What does the Turing test really mean? And how many human beings (including Turing) could pass?

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Alan Turing's short 1950 paper in *Mind*, "Computing Machinery and Intelligence," has influenced philosophic discourse, research in artificial intelligence, and even Hollywood cinema, as evidenced by movies such as *Blade Runner*. It's arguably one of the seminal papers of the twentieth century, regardless of academic discipline.

The so-called Turing test, as it is usually interpreted, sets a benchmark standard for determining when we might call a machine intelligent. We can call a machine intelligent if the following is satisfied: if a group of wise observers were conversing with a machine through an exchange of typed messages, those observers could not tell whether they were talking to a human being or to a machine. To pass the test, the machine has to be intelligent but it also should be responsive in a manner which cannot be distinguished from a human being. This standard interpretation presents the Turing test as a criterion for demarcating intelligent from non-intelligent entities. For a long time proponents of artificial intelligence have taken the Turing test as a goalpost for measuring progress.[2]

To give one readily available example of the standard interpretation, Wikipedia (accessed 4/28/09) summarizes the Turing test as follows:

"The **Turing test** is a proposal for a test of a machine's ability to demonstrate intelligence. It proceeds as follows: a human judge engages in a natural language conversation with one human and one machine, each of which tries to appear human. All

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participants are placed in isolated locations. If the judge cannot reliably tell the machine from the human, the machine is said to have passed the test. In order to test the machine's intelligence rather than its ability to render words into audio, the conversation is limited to a text-only channel such as a computer keyboard and screen."

Turing's paper is rich and multi-faceted and we are not seeking to overturn all of the extant interpretations. We do wish to suggest that a potent and indeed subversive perspective in the paper has been underemphasized. Some of the message of Turing's paper is encouraging us to take a broader perspective on intelligence and some of his points are *ethical* in nature. Turing's paper is about the possibility of unusual forms of intelligence, our inability to recognize those intelligences, and the limitations of indistinguishability as a standard for defining intelligence. "Inability to imitate does not rule out intelligence" is an alternative way of reading many parts of his argument. Turing was issuing the warning that we should not dismiss or persecute entities which we cannot easily categorize or understand.

Our interpretation fits the broad outlines of Turing's life. Turing was gay and he was persecuted for this difference in a manner which led to his eventual suicide. In mainstream British society of that time, he proved unable to consistently "pass" for straight. Interestingly, the second paragraph of his paper starts with the question of whether a male or female can pass for a member of the other gender in a typed conversation. The notion of "passing" was of direct personal concern to Turing and surely in more personal settings Turing did not view "passing" as synonymous with actually being a particular way.[3]

It also has been speculated that Turing was autistic or Asperger's, which suggests his mind was of a very different nature, compared to most of the people he knew. Turing probably was not aware of these neurodevelopmental concepts as such (they had not yet entered standard English-language discourse), but surely he knew, growing up, that he

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[3] Hodges (2000) is the most comprehensive biography of Turing and it includes a discussion of his sexuality.

was in some ways very different from others. In public school he was judged to be "ludicrously behind" with "the worst" writing ever encountered, and he was singled out as "bound to be a problem for any school or community."[4] While we cannot be sure whether Turing was autistic, it is clear from published accounts that other people noticed he thought and acted in highly atypical ways. Again, Turing himself could not pass a test of imitation, namely that of imitating the people he met in mainstream British society, and for most of his life he was acutely aware that he was failing imitation tests in a variety of ways.

Keeping in mind this biographical background, let's turn to the text for a look at the depth of Turing's thought.

Who is human?

Turing never uses the phrase "Turing test" in his paper, but instead refers to the "imitation game." Also he never postulates a clear conceptual distinction between a man and a machine. Indeed it is striking throughout his essay how frequently he makes a point of refusing to define this distinction. He writes (section 3): "…we wish to exclude from the machines men born in the usual manner. It is difficult to frame the definitions so as to satisfy these…conditions."[5] In an earlier paper Turing had written of the cerebral cortex as an example of an (at birth) "unorganised machine."[6] Although this description does not accord with the best scientific knowledge (even in Turing's time), it does show that he never took the man-machine distinction for granted.

When it comes to constructing a machine to play the imitation game, Turing wishes to permit "every kind of engineering technique" but he realized that a truly open set of

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[4] See "The Alan Turing Internet Scrapbook, Empire of the Mind" at
http://www.turing.org.uk/turing/scrapbook/early.html
[5] Turing's essay is reprinted in Turing (2004) and also is available at several sites on the web. To make our points easier to follow, we will reference them by section number (the paper's sections are short) rather than page number.
[6] "Intelligent Machinery," reprinted in Turing (2004), p.424.

possibilities includes birthing and raising a child. This again challenges any categorical man-machine distinction. Yet raising a human child should hardly count as an advance in computer science or artificial intelligence. Turing jokes that perhaps the team of engineers will have to be all of one sex (another implicit reference to homosexuality), so as to rule out biologically conceived human children from belonging to the class of machines "produced" by engineers. This discussion reflects a mode of reasoning which is repeated throughout the essay. Turing postulates what a particular distinction might mean, such as that between man and machine, and then proceeds to subvert that distinction with his examples, his terminology, and his side comments.

Turing also realizes he should not remain stuck on definitional worries, so he proceeds under the simple assumption that "we only permit digital computers to take part in our game." The reader might think he has solved the demarcation problem – between man and machine – simply by assuming it away for pragmatic reasons. But again Turing wishes to subvert reader expectations of any simple solution. Shortly thereafter, in section 5, Turing refers to the "universality of digital computers" in such a way as to cover all methods of information processing including, in our view, all human methods. This follows the assertion in section 4 that "all digital computers are in a sense equivalent." Turing is in part referring back to his original work on the idea of a universal computer, but in this context he is also questioning the distinctions between man and machine, intelligent and non-intelligent. At that time, when Turing was pondering the nature and meaning of the imitation game, his most renowned scientific contribution was aimed at establishing the monistic result that all computation boils down to the same set of underlying processes.

It is also in section 4 that Turing starts referring to the notion of "a human computer," a recurring phrase in the rest of the article. As with his embrace of information processing regardless of method, this phrase again shows that he doesn't think we have good demarcation criteria. Later in the piece, he repeatedly mentions the notion of a "child-programme," arguably with the same rhetorical end in mind. For all the clumsiness of computers in Turing's day, he understood how difficult it is to produce a definition that

would make man and machine, as representing thinking and non-thinking or intelligent and non-intelligent, fundamentally different in description or principle.[7]

In section 2 of the paper, Turing goes so far as to ask whether imitation should be the standard of intelligence. He asks whether a man can imitate a machine, rather than vice versa. Of course the answer is no, especially in matters of arithmetic, yet obviously a man thinks. We are again warned that imitation cannot be the fundamental standard of intelligence. Turing is clear: "May not machines carry out something which ought to be described as thinking but which is very different from what a man does? This objection is a very strong one, but at least we can say that if, nevertheless, a machine can be constructed to play the imitation game satisfactorily, we need not be troubled by this objection." In other words, imitation might show that a machine can think, but a *lack* of imitative ability does not show an entity to be inferior, non-intelligent, or fundamentally deficient or disordered.

Who can pass?

Turing does not make this point but the reality is that many human beings, intelligent and of mature age, could not pass what we now call a Turing test. This includes many human beings who would do well on IQ tests or other traditional measures of intelligence. Some autistics provide examples, as would other individuals with non-standard neurodevelopmental paths. For instance, an autistic might not comply with the presumed or implied typical social context behind many of the proffered questions. Many answers from autistic individuals might seem "off" to the judging panel, so there is a good chance autistics' distinctly atypical information processing would fail to pass the imitation or Turing test.[8]

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[7] For further and more direct evidence on this point, see "The Alan Turing Internet Scrapbook, The Turing Test 1950" at
http://www.turing.org.uk/turing/scrapbook/test.html
[8] There is one interesting case in the literature of a woman, Cynthia Clay, who failed a Turing test because when asked about the plays of Shakespeare she demonstrated too much knowledge about the topic (Halpern, 2006). There are also reports of a restricted

The available evidence is sketchy but we do know that one BBC radio producer doubted Turing's ability to communicate and complained about the "definite hesitation" in his speech. There is also a transcript of a discussion between Turing and several other scientists; one commentator observed: "Reading the transcript is rather like reading the conversations generated by computers... Few of the discussions can stick to a point or actually address a question!" One of the scientists argues against Turing by implying that Turing's atypical way of processing information cannot be human.[9]

In further dismantling the idea that the appropriate metric for intelligence is imitation, Turing notes that an optimal cognitive strategy for a machine is probably to do something *other* than to imitate a man. He says he will dismiss this possibility because it violates the game's *assumption* of imitation as the goal, but the point gets made nonetheless. Imitation and intelligence are simply not the same and lack of imitation, or failure to be indistinguishable, does not mean lack of intelligence—or lack of humanity.

Section 5 of Turing's paper, titled "Arguments from Various Disabilities," is of particular interest for our perspective. Turing offers a list of "disabilities" that machines may suffer from:

> "Be kind, resourceful, beautiful, friendly, have initiative, have a sense of humor,
> tell right from wrong, make mistakes, fall in love, enjoy strawberries and cream,
> make some one fall in love with it, learn from experience, use words properly, be

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Turing test comparing diagnosed paranoid schizophrenics with the "PARRY" machine, designed to respond as such. The expert judges were professional psychiatrists but they did no better than chance, in part because the atypical humans involved do not respond in traditional ways (Shieber 1993). Yet surely this does not mean that computers are today "truly intelligent" in the paranoid sense. On issues of the specificity of the kind of intelligence required in a Turing test, see French (1990).

[9] See "The Alan Turing Internet Scrapbook, The Turing Test 1950" at http://www.turing.org.uk/turing/scrapbook/test.html; see the words of Jefferson and Turing's reply.

the subject of its own thought, have as much diversity of behaviour as a man, do something really new."

Turing still doesn't think these possible disabilities, which may or may not impair future machines, rule out the notion of intelligent (non-human) machines. He notes that many people haven't yet encountered a machine with these capabilities and so they underestimate machines. It's also interesting that most items on this list have in various ways been invoked as capabilities which autistic people cannot have, even when the scientific evidence indicates otherwise (e.g., while popularly presumed autistic social deficits predict an absence of moral understanding in autism, all available findings demonstrate this is not the case; Blair, 1996; Grant et al., 2005; Leslie et al., 2006). Under our reading of the paper, Turing is arguing that the appearance of a disability, and consequent failure to pass, should again not be taken as evidence against intelligence or evidence against the possibility of learning additional capabilities in the future.

Turing's future

So how does Turing close the paper and what does he see as the best path going forward? In Turing's penultimate paragraph he presents two paths. The first is to increase the computational abilities of current machines, as we might do by improving their abilities at chess. An alternative is to "provide the machine with the best sense organs that money can buy, and then teach it to understand and speak English. This process could follow the normal teaching of a child." Is Turing implicitly—and with dry British humor—referring to the "normal teaching" he received as a child, and its unforeseen and atypical outcome? Turing writes that both approaches are required and that much needs to be done, presumably in both computer education and in human education.

In other words, he closes with a call for pragmatism, a recognition and mobilization of many different forms of intelligence, and again he is warning us that imitation isn't everything. Equating indistinguishable with intelligence may be a serious error. We read Turing as offering an implicit ethical admonition. Turing himself could not "pass" as

"normal" in the world of his time and he wasn't so concerned that machines couldn't "pass" either. Intelligence will continue to pop up in surprising and indeed hard to recognize forms.

The history of the Turing test itself may illustrate how apparent cognitive deficits may in fact be entangled with underappreciated cognitive advantages. It is possible that Turing conceived of his imitation test precisely because he had so much difficulty "passing" and communicating himself. In social settings these facts were seen as disabilities but in the longer term they helped Turing produce this brilliant essay.

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