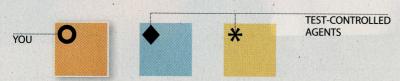# Spot the pattern

How might a test of universal intelligence work? This test, simplified here, aims to place both humans and machines on the same intelligence scale. It calculates the participant's ability to spot hidden patterns

A PARTICIPANT IS TOLD (OR PROGRAMMED) BEFOREHAND TO TRY TO GAIN MORE POSITIVE REWARDS THAN NEGATIVE ONES
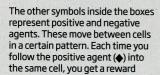
YOU

TEST-CONTROLLED AGENTS

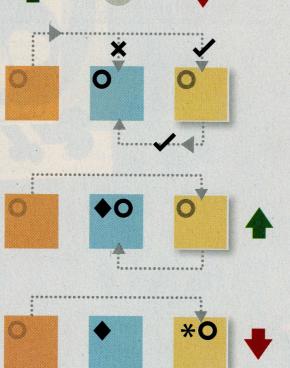**The test is an untimed interactive task on a computer screen**

When the test begins, you are presented with a row of boxes.
A little circle inside one of those boxes represents "you".
By clicking on the boxes, you can choose to move your circle between them, or stay put – other symbols also move between boxes

After each choice, a positive, neutral or negative reward is shown

At first, you discover that you cannot move from some boxes into certain others. That's because you must travel along certain "paths" linking the boxes. These paths are not visible, so you must identify them

The other symbols inside the boxes represent positive and negative agents. These move between cells in a certain pattern. Each time you follow the positive agent (◆) into the same cell, you get a reward

Each time you follow the negative one (✳), you get a penalty

EVENTUALLY, THE PARTICIPANT SHOULD NOTICE A PATTERN THAT LEADS TO MORE POSITIVE REWARDS

Orallo and Dowe are on the right track. "What I like most is that they succeeded in producing a test that appears to not prefer human agents over artificial ones or vice versa," he says. A formal, testable and completely general measure of intelligence is "crucial for the future of AI", he adds.

If it works, the implications and benefits of a truly universal test would be far-reaching. "Understanding what intelligence is can't be separated from the problem of how intelligence can be measured," says Hernández-Orallo, in the same way that energy, distance and velocity can only be understood through our ability to measure them quantitatively. He says that our current inability to quantify intelligence in a general sense outside of the human species is a major problem, relegating it to a philosophical idea, rather than a scientific one.

Smart slime

There's certainly potential for discovery if we can move beyond our human-centric view of intelligence. Researchers have already found intelligence in unexpected creatures, such as slime moulds that live in dung, which show a surprising ability to navigate mazes. Cephalopods, too – squids, octopuses and the like – have a mental prowess that has only recently been properly appreciated.

Who knows what other surprises we might find on Earth – not to mention in space – if we could design a test to assess other beings fairly? "Exploring intelligence through the special case of human intelligence is seriously mistaken," says Blay Whitby, a philosopher at the University of Sussex in Brighton, UK, specialising in AI. "If we relaxed the requirement that it has to be like us, we might see a lot more intelligence."

Perhaps we would also show a bit more appreciation for the AIs we have already created here on Earth, from the sophisticated search algorithms that let us navigate the web, to the programs that have so much influence over the stock markets. "Once you drop the anthropocentric requirement, AI looks a lot more impressive," Whitby says.

Thinking through all this, I recall my first stab at Hernández-Orallo's test: the truth is I found all those coloured boxes so confusing and frustrating that I simply gave up. I doubt a machine would do the same. Just how flawed human intelligence can be has never felt so apparent. ∎

Celeste Biever is *New Scientist*'s deputy news editor

and compare performance," says Douglas Detterman at Case Western Reserve University in Cleveland, Ohio. "The problem is that in order to show optimum performance, tasks have to be designed for each species. For example, since you cannot give written instructions, how do you make it so each animal approaches the test on an equal footing?

Hernández-Orallo has enlisted experts in animal cognition to help deal with these issues, but a similar problem could even occur with machines: different algorithms might respond differently to the same programmed instructions, which would not necessarily be down to their intelligence.

"I expect it to take quite some research effort until all the kinks are ironed out," says Tom Schaul, an AI researcher at the University of Lugano in Switzerland, who is working on a rival general test for machines. He believes you could design an algorithm that aces the test but performs abysmally on most other tasks. However, he also thinks Hernández-