mine for sex hormones, which younger children would lack.

But ancient child labour wasn't always so back-breaking. When Le Roy analysed a jumble of skeletal remains from prehistoric tombs in France, she found three baby teeth with cylindrical grooves. Such abrasions form when people use their teeth for repeated, forceful stretching and softening of animal tendon or plant material, Le Roy says. The material was probably used for sewing or making baskets, she adds (M. Le Roy *Ardèche Archéol.* **35**, 12–18; 2018).

The teeth belonged to two children between the ages of one and nine. They date to 2100–3500 BC, making them some of the oldest evidence that children were engaged in skilled labour. Le Roy is about to start surveying human remains from more than 30 French burial sites from the same time period, and expects to find more evidence of young children at work.

LEAVING THEIR MARK

Other researchers are looking to artefacts rather than skeletons for information on child labour. When archaeologist Steven Dorland at the University of Toronto, Canada, examined ceramic shards from a prehistoric village in what is now southern Canada, he saw minuscule fingernail marks in the fifteenth-century debris. The size of the indentations showed that kids aged six or younger were forming clay vessels (S. G. H. Dorland *J. Archaeol. Sci. Rep.* **21**, 298–304; 2018).

In some modern communities, only pots of a certain quality make it to the kiln. But at Dorland's site, youngsters' misshapen starter pots were also fired. "It shows children in those societies had a certain level of social value," he says.

Even after the advent of written records — which can document the presence of youngsters in the workforce — archaeological evidence can provide powerful illumination of the role of children. Bricks and roof tiles excavated from a Lithuanian castle, dated to between the thirteenth and seventeenth centuries, still bear the fingerprints of their young creators.

Analysis of the prints' ridges suggests that children between the ages of 8 and 13 made more than 10% of the recovered building materials, said archaeologist Povilas Blaževičius at the National Museum of the Palace of the Grand Dukes of Lithuania in Vilnius during his EAA presentation.

Lithuania lacks written sources about children in the historical workforce, Blaževičius says. That leaves physical traces as the only evidence of their efforts there centuries ago. "When we have fingerprints of a child inside a pot, we definitely show that a child formed it," he says. "For me as an archaeologist, it's another way to find children in past societies." ■

SCHRÖDINGER'S CAT

Quantum puzzle baffles physicists

New twist on thought experiment yields conflicting results.

BY DAVIDE CASTELVECCHI

In the world's most famous thought experiment, physicist Erwin Schrödinger described how a cat in a box could be in an uncertain predicament. The peculiar rules of quantum theory meant that it could be both dead and alive, until the box was opened and the cat's state measured. Now, two physicists have devised a modern version of the paradox — with shocking implications — by replacing the cat with a physicist doing experiments.

Quantum theory has a long history of thought experiments, and most are used to point to weaknesses in various interpretations of quantum mechanics. But the latest version is unusual: it shows that if the standard interpretation of quantum mechanics is correct, then different experimenters can reach opposite conclusions about what the physicist in the box has measured. This means that quantum theory contradicts itself.

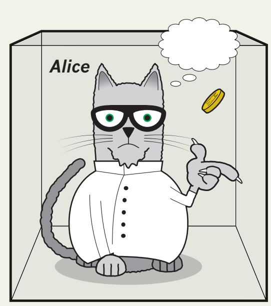
Physicists have debated this conceptual experiment with gusto for more than two years — and it has left most researchers stumped, even in a field accustomed to weird concepts. "I think this is a whole new level of weirdness," says Matthew Leifer, a theoretical physicist at Chapman University in Orange, California.

The authors, Daniela Frauchiger and Renato Renner of the Swiss Federal Institute of Technology in Zurich, first posted their argument online in April 2016, and published a paper on 18 September (D. Frauchiger and R. Renner *Nature Commun.* **9**, 3711; 2018). (Frauchiger has now left academia.)

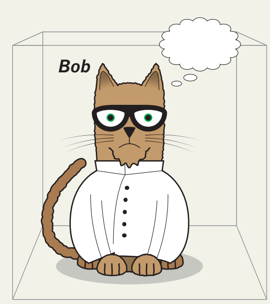
Quantum mechanics underlies nearly all of modern physics. But the answers it provides

NEW CATS IN TOWN

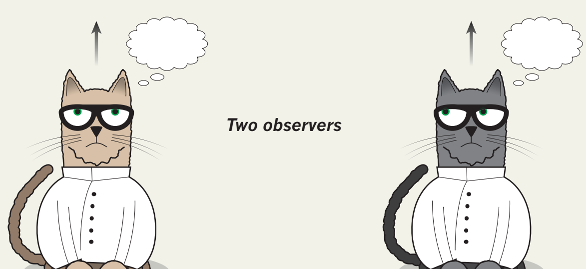
Physicists have devised a variation of the iconic Schrödinger's cat thought experiment that involves several players who understand quantum theory. But surprisingly, using the standard interpretation of quantum mechanics, the observers sometimes seem to come to different conclusions about a particular event — suggesting that the interpretation contradicts itself for complex systems.



Alice tosses a coin and, using her knowledge of quantum physics, sends a quantum message to Bob.



Using his knowledge of quantum theory, Bob can detect Alice's message and guess the result of her coin toss.



When the two observers open their boxes, in some situations they can conclude with certainty how the coin landed — but their conclusions are different. This means that the standard interpretation of quantum theory gives an inconsistent description of reality.

can be frustratingly limited. Its equations cannot predict the exact outcome of a measurement — for example, of the position of an electron — only the probabilities that it can yield particular values.

Quantum objects such as electrons therefore live in a cloud of uncertainty, mathematically encoded in a 'wavefunction' that changes shape smoothly. But when a property such as an electron's position is measured, it always yields one precise value (and yields the same value again if measured immediately after).

The 'Copenhagen interpretation', formulated in the 1920s by Niels Bohr and Werner Heisenberg, is the most common way of understanding this. It says that the act of observing a quantum system makes the wavefunction 'collapse' from a spread-out curve to a single data point. But it leaves open the question of why different rules should apply to the quantum world of the atom and the classical world of laboratory measurements (and of everyday experience). But it is also reassuring: although quantum objects live in uncertain states, experimental observation happens in the classical realm and gives unambiguous results.

Now, Frauchiger and Renner are shaking physicists out of this comforting position. Their theoretical reasoning says that the basic Copenhagen picture — as well as other interpretations that share some of its basic assumptions — is not internally consistent.

Their scenario is more involved than Schrödinger's cat — proposed in 1935 — in which the feline lived in a box with a mechanism that would release a poison on the basis of a random occurrence, such as the decay of an atomic nucleus. In that case, the state of the cat was uncertain until the experimenter opened the box and checked it.

"I think this is a whole new level of weirdness."

In 1967, the physicist Eugene Wigner proposed a version of the paradox in which a physicist friend lived inside a box with a measuring device that could return one of two results, such as a coin showing heads or tails. Does the wavefunction collapse when Wigner's friend becomes aware of the result? One school of thought says that it does, suggesting that consciousness is outside the quantum realm. But if quantum mechanics applies to the physicist, then she should be in an uncertain state that combines both outcomes until Wigner opens the box.

Frauchiger and Renner have two Wigners, each doing an experiment on a physicist friend whom they keep in a box (see 'New cats in town'). One of the two friends (call her Alice) can toss a coin and — using her knowledge of quantum physics — prepare a quantum message to send to the other friend (call him Bob). Using his knowledge of quantum theory, Bob can detect Alice's message and guess the result of her coin toss. When the two Wigners open their boxes, in some situations they can conclude with certainty which side the coin landed on, Renner says — but occasionally their conclusions are inconsistent.

The result has triggered heated responses from quantum theorists. "Some get emotional," Renner says. And different researchers tend to draw different conclusions. "Most people claim that the experiment shows that their interpretation is the only one that is correct."

For Leifer, producing inconsistent results should not necessarily be a deal breaker. Some interpretations of quantum mechanics already allow for views of reality that depend on perspective. Robert Spekkens, a theoretical physicist at the Perimeter Institute for Theoretical Physics in Waterloo, Canada, says that the way out of the paradox could hide in some subtle assumptions in the argument, in particular in the communication between Alice and Bob.

"To my mind, there's a lot of situations where taking somebody's knowledge on board involves some translation of their knowledge," he says: perhaps the inconsistency arises from Bob not interpreting Alice's message properly. But he admits that he has not found a solution yet. ■