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DID you hear the one about the computer with a sense of humour? Didn't think so. Computers can do many things, but stand-up comedy is not one of them. Yet the idea that computers can be witty might not be all that far-fetched. Perhaps machines need not be conscious to understand humour, and even to invent and tell jokes. Physicist Igor Suslov of the Kapitza Institute for Physical Problems in Moscow, Russia, has designed a computer model which he says explains the evolution of humour. Our ability to experience humour, he suggests, ultimately depends on quirks in how the brain handles information. As a student, Suslov performed in the university theatre. "We didn't have much time to write our plays," he recalls. "I began to wonder if it might be possible to create jokes more or less automatically." He didn't work out how back then, but he never forgot the problem. Now he thinks he sees at least the broad outline of how humour works and why it evolved in the first place. Verbal jokes, Suslov suggests, work by drawing the mind into error. It first settles on one meaning, and then has to correct itself and see another. Take this joke, for example: Father (reprovingly): "Do you know what happens to liars when they die?" Johnny: "Yes sir, they lie still." The wit of the line comes from the way the brain pirouettes to interpret "lie" in two different ways. This kind of error, Suslov argues, is at the root of most humour, and stems from a fundamental difficulty the brain faces when trying to interpret incoming data. Whether it's words, sounds or visual images, the brain has to link incoming information to patterns it knows from experience. Much of this process takes place unconsciously. Only when the brain settles on an interpretation for a chunk of data does it send that interpretation into consciousness, where it might prompt action. As Suslov points out, however, to make rapid decisions, the brain often has to settle quickly on an interpretation without enough information to be sure it is the correct one. Yet it must also remain ready to take advantage of further data streaming in, which may lead to a better interpretation. Consequently, he says, there's just no way a wellfunctioning brain can entirely avoid making these errors of interpretation. "The nature of the processing algorithm makes mistakes inevitable." And that, he claims, also makes humour inevitable. He argues that humour is the brain's way of dealing with such errors: a rapid emotional response makes us aware of a mistake, and brings new information into consciousness especially swiftly. "Its biological function," says Suslov, "is to make brain operations more efficient." We laugh as the brain squirms its way out of a contradictory state. Suslov hasn't yet made a computer that laughs, but he has proposed a specific computational model, based on a neural network, that would mimic the information processing he describes, and necessarily be prone to the same recognition errors (www.arxiv.org/abs/0711.2058). Ultimately, he suggests, there may be no reason why we won't be able to program computers to tell and understand jokes (See "Joke in a box"). The idea is consistent with what we know about the brain, says neuroscientist Peter Latham of University College London, but it is not clear from Suslov's work why it should be humour that is linked to the processing difficulty he describes. "There are lots of positive emotions that might play the required role," he says. And why, he wonders, if humour evolved to solve an internal processing problem, does it involve an outward physical display, such as laughter, that others can see?

That characteristic of the humour response, according to biologist David Sloan Wilson of Binghamton University in New York, suggests it probably evolved in connection with social interactions. Human laughter, he points out, appears to be closely

On the origin of laughter: Humour isn't just about social bonding, it helps our brains work better too "Humour is the brain's way of dealing with errors - a rapid emotional response makes us aware of a mistake"

linked to similar behaviour that has important social roles for our primate relatives. During social play, such as tickling and chasing, many primate species display a particular facial expression, a "play face", and often produce a panting vocalisation that many biologists see as akin to laughter. There's also evidence that something very similar to humour and laughter exists in non-primate species. Over the past decade, for example, Jaak Panksepp of Washington State University in Pullman and colleagues have shown that rats make frequent ultrasonic noises similar to laughter during positive social interactions. Researchers can even make rats laugh by tickling them on the nape of the neck, an area to which rats themselves direct their playful activities. Panksepp suggests that the rat's behaviour is closely related to laughter in babies (Behavioural Brain Research, vol 182, p 231). Laughter, Wilson points out,

is also famously contagious. "People are roughly 30 times more likely to laugh in the presence of others than when they are by themselves," he says. All this evidence, Wilson suggests, makes a strong case that humour evolved in association with social activity. This doesn't mean that Suslov's idea is necessarily wrong, he says. "It could be that humour evolved for one function, and was later co-opted for another." For example, the emotional response involved in humour might have arisen first as an aid to social organisation and bond-forming among our distant ancestors, and then later, when the brain evolved higher cerebral functions, such as language processing, evolution may have hijacked the pre-existing emotional pathway linked to humour. If so, humour could sometimes play a role much as Suslov suggests, with the outward sounds we make, such as laughter, merely a by-product of earlier evolution. Yet Suslov has some other problems to work out too. After all, we don't always laugh when we misread a sentence, or misinterpret an image.

"This is the first real theoretical model I've seen proposed for humour," says psychologist Daniel Levine of the University of Texas, Arlington. "It's laudable for that. What is lacking is an explanation of what is or isn't humourproducing. It's not the case that every phrase that tricks the mind into an error is funny."

On the other hand, Suslov argues, the idea does explain quite a lot about jokes, including why hackneyed jokes don't work, and why the timing of a joke's delivery is so important. Both situations fail to lure the brain into making the required decision error, either because the brain recognises the joke, or because it has enough time to correct the misinterpretation before sending the correction into consciousness. So perhaps a computer that can understand and tell at least simple jokes may not be too far away. The humour we see in other primates and rats may only be a beginning. "Some people still regard laughter as a uniquely human trait," says Panksepp, "but the joke's on them." l joke in a box Computers already play chess and compose music. Igor Suslov of the Kapitza Institute for Physical Problems in Moscow, Russia, thinks one day they may also understand emotions. As a first step, he is working towards a computer that can react to humour - at least to simple jokes in which individual words switch their meanings as the joke is understood. A computational system capable of understanding such jokes, he suggests, has to be able to recognise meanings. It also requires a mechanism enabling a subsequent improved recognition to supersede the first. To accomplish this, Suslov envisions a neural network of artificial elements, similar to biological neurons. A network capable of reacting to humour requires a sensory system that gathers information from outside and sends it to a memory system, which can recognise patterns. When it does, this system would send its result to a third network, representing the computer's "consciousness". This network would then also link into a subnetwork of neurons corresponding to the motor cortex. Improved recognition of an incoming stimulus would trigger this cortex to kick off the humour response, a mechanical reaction expunging the incorrect interpretation and replacing it with the improved version - while making some funny noises perhaps. Building such a system, Suslov suggests, should be possible in a few years (www.arxiv.org/abs/0711.2061).

"This is a brave attempt to make a computer model of humour," says Leonid Perlovsky, an expert in artificial intelligence at Harvard University. "It is interesting to see even a first step toward understanding humour in a mathematical way."

-You've gotta laugh- "Human laughter seems to be closely linked to similar behaviour that is important among our primate relatives"