stream of them to the receiver (who is known as Bob). These photons will have one of two modes. In the first, a photon is polarised either vertically or horizontally. In the second, it is polarised diagonally—plus or minus 45°. In the first mode, a photon polarised vertically represents a "0" and one polarised horizontally represents a "1". Similarly, in the second mode polarisation at +45° represents "0" and at -45°, "1".

Bob's receiver can be set to only one mode at a time, so if Alice sends him a vertically polarised photon and his equipment is in the first mode, then he will record a "0". If his equipment is in the second mode, he will have an equal chance of recording a "0" or a "1". After a short time, Alice tells Bob that the photon she sent should have been measured in mode one; she does not tell him what value it should have been. Bob now knows whether he made a correct measurement. If he did, he keeps the result and tells Alice that they have a match. If not, he junks it and tells Alice to do likewise—a process that takes a few millionths of a second.

It is at this point that Eve may show up. Eve is the name that cryptographers give to an eavesdropper. Should Eve intercept the transmission, the laws of quantum mechanics mean that she cannot read it without altering the photon in some way. By recording each photon, she actually destroys what she is measuring. She must therefore generate some new photons and send these to Bob, in the hope that he doesn't twig what is going on. But her equipment, too, must be set to one mode or the other, and she cannot be certain that the polarity of the photon she sends to Bob is correct.

This means that if Eve is involved, when Alice and Bob come to compare their data there will be many more mistakes than would otherwise be expected. Eve's presence will thus quickly be revealed and appropriate countermeasures can be taken. And the system works not only when there is an intelligent eavesdropper on the line, but also when data become corrupted accidentally.

For a truly secure system, the message will be encrypted in a way that requires a mathematical key to unlock it. In fact, both key and message can be transmitted this way: if the key is sent first, any interception will be detected and the key discarded. Only when the key has been safely transmitted need the message itself be sent.

This being Switzerland, it is unlikely that anyone will try a bit of electronic ballot-stuffing in this particular election, so it is the anti-accidental-corruption feature that is of most interest to Geneva's returning officers. And in truth, this is as much a piece of advertising as a real application. The firm behind the efforts, ID Quantique, is Swiss. The other two companies developing quantum cryptography for commercial use, MagiQ and BBN Technologies, are American. Employing quantum cryptography to transmit the vote from polling stations to central counting house is thus a bit of a publicity stunt.

Still, this will be the first time the technology has been deployed for real, so whether the system succeeds or fails will be of great importance to ID Quantique. Like the other two firms, it has its eyes on banks, insurance companies and other businesses that have to move a lot of sensitive data around. Whether the government of Florida will be interested is a different question. ■

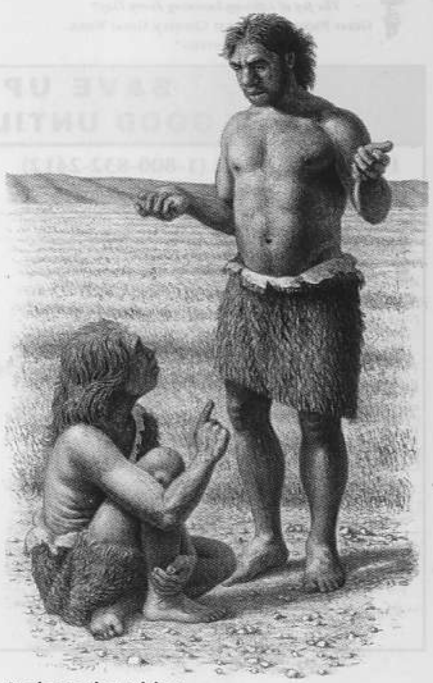
Evolution

The origin of speakies

More evidence that Neanderthals could talk to each other

IF YOU found yourself in a cocktail bar with a Neanderthal man, what would he say? A good conversation is one of the great joys of being human, but it is not clear just how far back in the hominid lineage the ability to use language stretches. The question of when grunts and yelps turned into words and phrases is a tricky one. One way of trying to answer it is to look in the fossil record for evidence about what modern humanity's closest relatives could do.

Svante Pääbo, of the Max Planck Institute for Evolutionary Anthropology in Leipzig, and his colleagues have done just that. Dr Pääbo is an expert in extracting and interpreting the DNA of fossils. As he reports in the latest issue of *Current Biology*, he and his team have worked their magic on a gene called FOXP2 found in Neanderthal remains from northern Spain.



And another thing...

The reason for picking this particular gene is that it is the only one known so far to have a direct connection with speech. In 1990, a family with an inherited speech disorder known as verbal dyspraxia drew the attention of genetics researchers. Those researchers identified a mutation in FOXP2 as the cause of the dyspraxia.

Since then FOXP2 has been the subject of intensive study. It has been linked to the production of birdsong and the ultrasonic musings of mice. It is a conservative type, not changing much from species to species. But it has undergone two changes since humans split from chimpanzees 6m years ago, and some researchers believe these changes played a crucial role in the development of speech and language.

If these changes are common to modern humans and Neanderthals, they must predate the separation of the line leading to *Homo sapiens* from the one leading to *Homo neanderthalensis*. Dr Pääbo's research suggests precisely that: the FOXP2 genes from modern humans and Neanderthals are essentially the same. To the extent that the gene enables language, it enables (or enabled) it in both species.

There has been much speculation about Neanderthals' ability to speak. They were endowed with a hyoid bone, which anchors the tongue and allows a wide variety of movements of the larynx. Neanderthal skulls also show evidence of a large hypoglossal canal. This is the route taken by the nerves that supply the tongue. As such, it is a requisite for the exquisitely complex movements of speech. Moreover, the inner-ear structure of *Homo heidelbergensis*, an ancestor of Neanderthals, shows that this species was highly sensitive to the frequencies of sound that are associated with speech.

That Neanderthals also shared with moderns the single known genetic component of speech is another clue that they possessed the necessary apparatus for having a good natter. But suggestive as that is, the question remains open. FOXP2 is almost certainly not "the language gene". Without doubt, it is involved in the control and regulation of the motions of speech, but whether it plays a role in the cognitive processes that must precede talking remains unclear—jokes about engaging brain before putting mouth in gear notwithstanding.

The idea that the forebears of modern humans could talk would scupper the notion that language was the force that created modern human culture—otherwise, why would they not have built civilisations? But it would make that chat with a Neanderthal much more interesting. ■