vous system cancer was 2.01 — meaning that exposed children were 2.01 times as likely as unexposed to develop cancer — with a 95 per cent confidence interval of [1.44, 2.82]. (That is, although the 'true' risk ratio is not known, it is 95 per cent certain that it falls between 1.44 and 2.82.) The risk ratio for lymphoma was 1.52, with a 95 per cent confidence interval of [1.08, 2.12].

Washburn's group also calculated risk ratios of 1.51 for childhood lymphoma, 1.20 for leukaemia and 1.26 for childhood leukaemia, although none of these were statistically significant.

These results slightly strengthen the case for an EMF-cancer connection, but they still suffer from the weaknesses of all of the epidemiological data so far. Researchers have not been able completely to rule out the presence of 'confounders' — factors that appear concurrently with the EMF exposure and that may themselves cause cancer, such as carcinogenic pesticides used to clear the right of way underneath power lines. And, for some mysterious reason, the cancer risk seems to correlate better with the types of power lines than with the actual measured EMF fields inside the subjects' homes (see *Nature* **349**, 554; 14 February 1991). The meta-analyses can point to these weaknesses in the original studies, but they cannot fix them.

■ Don't trust this headline

DECEPTION is rife in the world. Men lie to women, and vice versa. Predators try to fool their prey, and the prey return the favour. Even bacteria and viruses get into the act, with elaborate molecular mechanisms designed to distract, confuse and deceive the immune systems of their unwilling hosts.

Why all the deception? The short answer is that, in an evolutionary sense, it works. The long answer was the subject of a AAAS session on "The evolution of deception: A biocultural approach".

"We are not defining deception as a conscious, nefarious act", said session organizer Loyal Rue, a professor of religion and philosophy at Luther College in Decorah, Iowa. And given that "nature provides niches for deceivers at every level of life", he argued that it might be necessary to rethink our natural bias against it — even in some cases of human deception.

Examples of deception in nature are common. Viceroy butterflies, which are a tasty treat for birds, mimic the markings of the foul-tasting Monarch butterfly to trick birds into not eating them. Some male blue-gill sunfish mimic both the appearance and the courting behaviour of females so that they can enter the territories of dominant males and fertilize the eggs laid there by the females. Cuckoos fool other birds by laying eggs in their nests. All of these tactics provide some evolutionary advantage and so developed through natural selection.

The more complex deceptive practices, however, are the behavioural ones, especially those that are learned instead of innate. Robert Sussman, an anthropologist at Washington University in St Louis, described deceptive behaviour in primates which, he said, seem to be the only animals that engage in 'voluntary deception'. He described one experiment in which a single female chimpanzee was shown the location of food in a cage. When the female and other members of her group were let into the cage, she went excitedly to the food — at which point the other chimpanzees took it away from her. After a few repetitions, she got the hint. When next the group was let into the cage, the female did nothing at first. Then, once the others were all settled down and looking the other way, she grabbed the food for herself. "Deception", Sussman said, "seems to have evolved along with intelligence." That leaves humans in the position of being the earthly creatures most able to deceive others, as well as themselves. How humans have dealt with that ability is one of the fundamental issues underlying Western religion and philosophy, Rue said.

Despite the presumption that deception is wrong, the ability to deceive and to be deceived seem to be adaptive traits, he noted. The value of being able to lie convincingly is obvious, but being vulnerable to deception, particularly self-deception, can also be valuable. Studies have shown, for instance, that people with positive self-images — including those that involve a certain amount of self-deception — are usually happier and healthier than those with low self-esteem.

The advantage of deception does not stop with individuals, Rue argued. The health and even existence of human cultures has historically depended on what he calls 'noble lies' — myths, or self-deceptions, that are shared among the people of a culture and which define a common way of viewing the world. As long as the vision is left unexamined, it can provide a framework on which to build a society.

Barbara J. Culliton and Robert Pool

Hope for the musically mediocre?

FOR everyone who dreams of making beautiful music but whose fingers just cannot seem to find the right notes, there is hope. In a presentation at the AAAS meeting, Max Mathews of the department of music at Stanford University described a new computerized system that gives a person creative control over music without the necessity of first perfecting his or her technique.

A musical performance, Mathews explained, consists of two parts: the score, a predetermined sequence of notes fixed by the composer; and the expressive factors, such as tempo, subtle changes in the duration of notes and the loudness or softness of different passages, which the individual performer controls. But the score provides a difficult hurdle for some would-be performers because it takes many tedious years of practice to develop the necessary manual skills to reproduce the notes as they were written.

"We can remove this load from the performer by letting the computer provide the correct sequence of pitches", Mathews said, "but at the same time we zealously guard the expressive parts of the music and give complete control to the performer." This is possible, he said, through the use of a computer system consisting of software called a conductor program and a piece of hardware called a 'radio baton'. The conductor program 'reads' a score and instructs a synthesizer to play the correct notes, but the performance is controlled by a human performer wielding the radio baton. This is a stick-like device with a radio transmitter at one end, which is waved over a detecting surface. The surface detects the radio waves emitted by the baton, determines the baton's position in three dimensions to within a fraction of an inch and directs the conductor program to modify the music in response to the movement of the baton.

The performer controls the tempo of the synthesizer-generated music through the beats of his baton, much as a conductor directs the tempo of an orchestra.

And by varying the position of the baton over the detecting surface, the performer can modify the quality of the notes. The effect, Mathews said, is similar to that which a violinist achieves with his bow or a woodwind player with his breath.

To demonstrate the effectiveness of the device, Mathews played a tape recording of a Vivaldi concerto in which two human flautists were accompanied by a synthesized orchestra which Mathews had directed with the radio baton. To an untutored ear, the sound was practically indistinguishable from a recording of a full human orchestra.

This device could open the world of music to a new type of performer, Mathews said — one who does not have to divide his energy and attention between technical performance and the expressive factors. Mathews admitted, however, that he does not know how good these performers are likely to be. "Can we teach the expressive facilities quickly and simply with this new instrument? Or does a performer need the years of practice on technique [before he can develop these expressive powers]?" R.P.

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