New moves: The condor may get additional protection in the new Californian state park, but it may acquire some worrying new neighbours. (Photo: Rick and Nora Bowers/Alamy.)

including the potential acquisition of 49,000 acres for a state park, this deal contains numerous 'poison pill' provisions, including the development of Tejon Mountain Village in the heart of condor critical habitat and Centennial, the largest single development ever to be proposed in California."

The Tejon Mountain Village project will result in the building of 3,400 homes in the Tehachapi mountains, while Centennial is a planned community of 23,000 homes slated to occupy the southern edge of the ranch. These real-estate projects aside, the dissenters argue that most of the land pledged for conservation is not in any case suitable for development, a fact that seems to diminish the apparent value of the deal. In addition, there is concern that funds necessary to purchase the 62,000 acres of optional property will never materialize. The signatories have alluded to the use of state bonds to pay for the land, but this hinges on the uncertain budgetary priorities of the state of California in the coming years.

With regard to the California Condor, potential threats to habitat, such as those imposed by the developments at Tejon Ranch, are cause for concern given the resources invested in saving this species and its still precarious future. In 1987, the 22 remaining wild California Condors were captured and bred in captivity, followed by a progressive release back into the wild that has resulted in the current population of 299 birds. All told, the effort to save the condor has cost over 35 million dollars and represents the most expensive Conservation Program ever undertaken by the US. In the light of this effort, and the uncertain future of the condor, as well as the other endangered species, it is clear why some have viewed the Tejon Ranch deal with a sceptical eye.

Q & A

Uta Frith

Uta Frith is Emeritus Professor of Cognitive Development at University College London and visiting professor at Aarhus University, where she participates jointly with Chris Frith in a Niels Bohr Project called 'Interacting minds – a biological basis'. She studied first in Germany and later at London University. From 1968 to 2006 she was based at UCL as an MRC scientist. From 1998 to 2006 she was Deputy Director of UCL's Institute of Cognitive Neuroscience. Her work has been concerned with neuro-developmental disorders, mainly autism and dyslexia. She has contributed some of the major cognitive theories explaining the signs and symptoms of these disorders. By studying the processes that might underlie specific cognitive deficits, she has been able to link cognitive mechanisms to behaviour on the one hand, and to brain function on the other. Uta Frith is a fellow of the British Academy, the Academy of Medical Sciences and the Royal Society. She recently obtained a Woman of Outstanding Achievement in SET award marked by the portrait on this page.

What turned you on to biology in the first place? Actually I am an impostor. I slid into biological sciences only dimly aware that I was doing so. It started by trying to have a look at 'everything' my university offered. I was registered as a student of History of Art, but this subject soon disillusioned me. It seemed to me that you had to go over well-trodden ground and find one small obscure corner for your doctorate. But, did I really want to be the specialist for the charming glass windows of a little chapel on the French border? It was no better in my other subject, Old Bulgarian. I had chosen this because I had loved ancient Greek and because an inspiring teacher suggested that I should take up this esoteric subject as a route to studying the structure of languages. This seemed like a serious scholarly thing to do, but it was really hard, and the vowel shifts in Slavonic languages did not really excite me after all. I looked around

Photo: Robert Taylor

for other things and stumbled across psychology. I had no idea what this was; it seemed that it might be something frivolous for those who were curious about themselves and other people.

What did you find so exciting about psychology? I embarked initially on psychology for the curious, rather than the earnestly interested. And something immediately captured me. As part of the entrance procedure I was tested on an extensive battery of IQ tests and I loved it. It intrigued me that somebody could assess my short-term memory by giving me increasing series of numbers to recall and that there was a surprisingly low limit of seven. I had hoped that I could learn to read people's personality through their handwriting, or be given psychoanalysis. Actually, handwriting analysis was not offered, nor was psychoanalysis. Instead I attended lectures on statistics, starting with analysis of variance and factorial design. Statistics made me feel that psychology was a respectable subject, important reassurance given that the library had lots of books with titles that seemed to me to be a bit on the fluffy side. The lectures were impressive, and to my surprise not that difficult to follow. Actually, it was great to learn something useful, something that would allow one to assess how people learn, and how to set up appropriate experimental designs. Soon enough I carried out miniature experiments in the lab class.

How did psychology change your way of thinking? At that point — it was the early 1960s — I did not realise that brain and mind are two sides of the same coin. I had no idea that the two are connected, and thought that culture and art were somehow the antithesis to biology and brain. But my beliefs and attitudes were changing, not through lectures, but through practicals. Being drawn ever deeper into psychology, I found myself signing up for courses in anatomy and physiology, shared with the medical students. I heard that these courses had replaced the requirement for philosophy courses, and I was glad, because I had listened to some philosophy lectures in my quest to find my subject, and found them just as obscure and rarefied as the other arts subjects I tried. So, I joined the 'frog-killers'. It took some nerve, but I was rewarded with seeing traces of electrical nerve impulses on a smoke drum, made from scratch. What finally clinched my unexpected transition into science were the grand rounds at the psychiatry department. The case presentations of patients with schizophrenia or obsessive compulsive disorder were mind-expanding. I found that instead of reading people's personality from their handwriting, the really exciting thing to do was to find out how their minds could be so changed by events in their life and/or in their brain.

What made you a researcher? Although many of my fellow students were aspiring to be clinical, educational or occupational psychologists, for me psychology was about being a researcher. Unlike history of art, you did not have to search long for a topic that was not yet well explored. It was more like walking around a busy Wild West mining town, where nuggets of gold were lying around for the picking. I found my first golden nugget with dyslexia. Everyone believed at that time that dyslexia was socio-cultural, that is, not a real disorder. I was puzzled, because it seemed to me that some perfectly bright children had real difficulty learning to read and write — for no reason. Of course there must be a reason! I took on a project, which involved training children systematically in basic perceptual skills, for example, drawing lines and recognising shapes. The training had little effect, and the differences between children remained.

What were the first steps in your career? After the 'Vor-diplom' I went to London's Institute of Psychiatry and was lucky enough to get a place on a course in abnormal psychology. I continued my interest in dyslexia with a project, which investigated why children reverse letters. The simple idea was that the brain/mind must acquire a representation of the proper orientation of letters, so that this orientation became the norm. Perhaps this took much longer in dyslexic children. I was intrigued by the question of how such representations might arise also by personal observation. For example, I noticed that unbeknown to myself my mind had stored knowledge about the standard A4 size of a sheet of paper. This knowledge was revealed only because the then typical foolscap sheet of paper looked to me too long, and a typical letter from the US too short. How did my mind represent the size of a sheet of paper? Well, if you can feel intrigued by this sort of question, then you are probably a cognitive neuroscientist. This question led me to do a number of experiments on the representation of letters and lines.

Why dyslexia? My interest in dyslexia was enormously boosted when I found that my English husband asked me how to spell words. Shouldn't it have been *me* asking *him*? But the spellings of the words I learned daily just stuck in my head without trying. This gave me the impetus to study atrocious spellers who were at the same time good readers, and led me to edit a book on '*Cognitive Processes in Spelling*'.

Do you have a favourite paper? I have more than one! One particularly elegant experiment by my mentors Beate Hermelin and Neil O'Connor probably had the most far reaching influence on my career. Briefly, the paper suggested that autistic children were remarkably good at recalling random word strings, while all other children were miles better at recalling sentences relative to random strings. This paper was key to my later obsession with the theory that there is a weak drive for meaning in autism, known as the theory of weak central coherence. The next most influential papers for me were '*Does the chimpanzee have a theory of mind?*' by David Premack and Guy Woodruff and '*Beliefs about Beliefs*' by Heinz Wimmer and Josef Perner. These papers were key to the development of the hypothesis that autistic children lack the ability to attribute mental states to others and themselves, sometimes referred to as a mentalising deficit or mindblindness.

Why autism? I came across autistic children for the first time at the Institute of Psychiatry. This was just as dramatically mind-changing for me as the presentations of patients with different kinds of mental disorders had been earlier. I was instantly captivated by these strange children, and my fascination has never diminished. They gave me riddles that just demanded to be confronted — though never to be solved. I still feel the sense of wonder and amazement at the paradoxical combination of strengths and weaknesses in the autistic mind. Nobody has explained the savant phenomenon yet, but the paper by Hermelin and O'Connor that made such a big difference to me is probably still as near as you can get to the processes underlying this phenomenon.

What advice would you offer someone wondering whether to start a career in biology? I would like to speak to women in particular, because there are still too few women in science. I would say: it is fine to start a career in biology even if you come with an arts background, because you can catch up if you really want to. Universities should recognise that it is a good idea to give a second chance to motivated students. I still believe that it is easier to find a fulfilling career in science than in the humanities. Also, I would like to stick up for psychology as a way into science. Even if you choose psychology, because you didn't have the qualifications in maths and biology that now you wished you had, go on and learn what you need in these subjects. For science-phobics psychology is the perfect medium to get introduced to scientific methods.

Here are some other things I would say to a woman starting a career in science: Show courage and resilience and aim high. Don't play on femininity, but don't get taken in by typical male power struggles; why waste the emotional energy when you can network with other women and go shopping instead? Be kind, generous and collaborate, but take the credit.

Do you have a scientific hero? My heroes come from fiction, like Mary Shelley's Frankenstein (not the monster — the scientist!), or Conan Doyle's Sherlock Holmes. Frankenstein is so incredibly courageous and ambitious as to want to find the secret of life. He works very hard and with great imagination, and he tragically fails. This is the intensely passionate and romantic side of science. It is often ignored and worse, derided. But perhaps without a dash of the romantic passion you can only be a good but not a brilliant scientist. Sherlock Holmes is the opposite of romantic, and he never fails. He shows the dash of autism that may be as vital for the genius detective as for the genius scientist. The hallmark of this style is keenly perceptive attention to what others consider minor details. Conan Doyle speaks of the 'significance of trifles', and made Holmes the author of a "little monograph on the ashes of 140 different varieties of pipe, cigar and cigarette tobacco". The deeply romantic and the obsessively pedantic are both part of my image of a scientific hero.

What do you think are the big questions to be answered next in your field? Developmental cognitive neuroscience could and should have an impact on education. The science of the mind/brain has huge potential for improving our mental capacities in all sorts of ways. Learning changes the brain for sure, but teaching enhances learning and is capable of changing the brain even more. Learning through others is what really sets humans apart from other species. Once improved education has made us cleverer and less ignorant, we might get wiser too. But this is another very big question — this is for the long term.

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Quick guides

Gaze following

Klaus Zuberbühler

What is gaze following? Gaze following occurs if an individual perceives another's gaze and, as a result, comes into contact with the object or event the other is attending to.

Why is this interesting? Trying to understand how other minds work, particularly those of non-human, non-linguistic animals, is not a trivial task. Researchers are limited to a small set of behaviours from which to interpret mental states, and 'gaze following' is one of particular interest. Gaze usually indicates attention, and one important question is how and why an individual is motivated to find the object of that attention. Is this due to a simple automated response, or is it the result of a mental calculation about the underlying cause?

How widespread is gaze following? Gaze following probably occurs in most primates, from prosimians to humans, but it is not a uniquely primate behaviour. The behaviour has been documented in some domesticated animals, for example dogs and goats, and has recently also been demonstrated in ravens. One hypothesis, therefore, is that gaze following is a general behavioural feature of social species, although empirical data are still lacking for most animal groups.

Why follow gaze? Monitoring another individual's gaze is adaptive for various reasons, particularly during foraging or for detecting predators. Individuals capable of gaze following enjoy a selective advantage over non-gaze-followers because they can benefit from discoveries made by others. For example, in chimpanzees and marmosets, gaze can signal possession, and animals avoid food that others are looking at, presumably to avoid competition. Gaze following also increases the probability of witnessing rare but important social interactions, such as rank reversals, thus helping animals