

## **The Bravo Evolution Report**

In the summer of 2006 I was commissioned by Bravo Television to write an essay on the future of human evolution. The essay was intended as a 'science fiction' way of illustrating some aspects of evolutionary theory.

Bravo then sent out a press release on the essay, but did not release the essay itself. As a result, a wildly distorted version of what I had written ended up being reported as 'science fact' in the media. I do not endorse the content of these media reports.

To read the original essay, please see below.

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### **Introduction**

What course will human evolution take in the future? What will humans be like after a thousand years? Ten thousand? One hundred thousand? A million? It's impossible to say for sure – but we can make some educated guesses.

Let's begin by making sure that we understand what evolution is and how it works.

### **What is evolution?**

Evolution refers to gradual change in the appearance and behaviour of organisms, brought about by changes in their genes. Genes can be thought of as instructions for building organisms. Occasionally, random copying errors – mutations – give rise to novel genes, and hence novel instructions, which build slightly different organisms. Most mutations are harmful; but some constitute improvements and succeed in getting more copies of themselves into the next

generation than do other genes. For example, suppose that, in a population of deer, a mutant gene for building a longer neck appears. And suppose that deer with this gene for longer necks can eat more leaves, and consequently have more offspring – which inherit genes for longer necks – than do deer with shorter necks. Over time, the gene for longer necks will spread, until all the deer have longer necks. This is evolution in action. It's that simple.

The first thing to realise about evolution is that it takes a very long time. To put things in perspective: life began about four billion years ago; mammals evolved about 200 million years ago; primates evolved about 50 million years ago; humans and chimpanzees split about 6 million years ago; and humans have been around in their present form for about 100,000 years. So we shouldn't expect any dramatic evolutionary changes in humans any time soon. Changes in humans over the past century – their becoming taller, healthier, more intelligent – are due not to biological evolution, but to changes in their living conditions in the wake of the industrial revolution. Similarly, most of the changes that we will see in the next millennia will be the products not of natural selection, but of genetic modification and artificial selection for the traits that we find desirable.

The second thing to realise about evolution is that there is no guarantee that things will continue to get 'better' – that humans will continue to get more attractive, more intelligent or more long-lived. The value of investments can go up as well as down. If uglier, stupider, short-lived humans have more offspring, and these traits are inherited, then humans will get uglier, stupider, and shorter lived. That's how evolution works. And of course, there is no guarantee that humans will be around at all in the future – we may go extinct. We may blow ourselves up, get hit by an asteroid, or be eaten by an alien race.

In order to predict the course of evolution, we need to know two things: Which mutations will arise? And: What conditions will humans will be living under in the future? It is not possible in principle to predict either of these things: mutations are inherently random; and our living conditions will depend in large part on what technology gets invented (and you cannot know what will be

discovered in the future). Nevertheless, we can use some of the basic principles of the theory of evolution to sketch some plausible scenarios for humans over the next thousand, ten thousand, one hundred thousand, and one million years.

### **One thousand years**

A thousand years time will mark the peak of human 'enhancement'. People of the year 3,000 will lead the longest, healthiest, most accomplished lives ever. This will be the result of advances in our understanding of human nature – our evolved biology and psychology. We will we have the potential to create the ideal conditions in which humans can flourish – the right diets, the most effective means of education, the best habitats and so on. Improved diets and nutrition will see people grow taller. Men will be between 6-7ft on average. We will also be living longer: up to around 120 years old.

We will also be able to provide technological enhancements to human nature – through genetic engineering, cybernetic implants, and so on. Body upgrades and enhancements will be driven largely by our evolved mate preferences. Fashions may come and go, but our evolved, hard-wired sense of beauty remains constant. Men everywhere find the following physical cues of youth, health and fertility attractive in women: a 0.7 waste-to-hip ratio, lighter-than-average skin colour, smooth hairless skin, glossy hair, symmetry, large clear eyes, low testosterone (eg, small chin), pert breasts and nulliparity. In the future we can expect to see women 'modifying' themselves to fit in with these preferences. (They already do to some extent – that's what make-up, cosmetic surgery, corsets, and hair conditioner are for. But in the future, technology will allow them to do so more easily and effectively.) And we can expect to see men modifying themselves to fit in with the physical cues of health and status that women everywhere find attractive: a 0.9 waste-to-hip ratio, taller-than-average, symmetry, cues of high testosterone (for example, square jaw, deep voice, bigger penis), and athleticism.

This enhancement is not, strictly speaking, evolution; rather, it reflects the fact that we will know how to get the most from our existing biology. We will be

pushing the limits of what's possible with our current DNA. There will, however, be at least one genetic change in near future: in a thousand years, differences in skin colour will be a distant memory. Biology tells us that 'race' is only skin deep. Superficial regional variation in skin colour masks the fact that we are all members of the same species, we share a universal human nature, we even share the same great-great-great-...-grandparent perhaps as recently as 3,500 years ago. In the future, advances in communications and transport mean that the human gene pool – which started out united, but has spent the past few thousand years divided – will flow back together again. And so we can expect existing regional variation in skin colour to get smoothed out and averaged, and our descendants to have coffee-coloured skin.

### **Ten thousand years**

It is often assumed that 'cultural evolution' goes hand in hand with biological evolution, and that advances in technology will help humans to evolve faster and better. But this is not necessarily the case; in fact, the opposite may be true. The more we rely on technology, the more our genes are off the hook. This is great in the short term: individuals with genes that, for example, predispose them to skin cancer can use sunblock. But this is not so good in the long-term: genes for skin cancer are no longer weeded out of the gene pool. Multiply this across every domain in which humans get a technological helping hand, and you can see how we may be storing up trouble for the future.

For example, advances in fertility treatments allow people who would otherwise not have had offspring to do so. This means that, in the future, infertility will rise. As a result, we will be increasingly reliant on transfer of nuclear DNA into thriving donor gametes, artificial insemination, surrogate mothers, and perhaps artificial wombs. And, because the size of infants will continue to rise, natural mothers will also have to resort more to caesarian sections.

Reliance on technology might also lead us to lose some of our natural abilities. Our obsession with hygiene, and increased reliance on medicine, will allow our immune systems to atrophy; we will perhaps be reduced to walking around in

hermetically-sealed bubbles, breathing through filtering respirators.

Advances in computing might allow us to communicate with others using only our thoughts. This might allow our vocal chords – and the brain areas and muscles that control them – to atrophy. (Thus, men would lose their Adam's Apple.) Women might increasingly find men attractive not for their deep voices or large vocabulary, but for their deep thoughts and colourful imagination.

More alarmingly, the more we rely on technology to help us, the less we will rely on other people. And, because humans evolved their moral instincts in order to get along with others, perhaps our moral sentiments will evaporate. Emotions such as love, sympathy, trust and respect – which currently motivate us to care for families, to be a good team-player, to trade favours, and to resolve conflicts – may fade away, leaving humans much more selfish and self-centred than they are now.

Genetic engineering may allow us to replace faulty stretches of DNA. If these stretches of DNA come 'off the shelf' of a central repository – a future NHS? – then we might all end up with more similar genes, and become more homogenous. We would look and think the same way.

And so, in ten thousand years' time, humanity may adopt some of the characteristics of domesticated animals: enfeebled, ineffectual, pampered, homogenous, spoilt, and juvenile.

### **One hundred thousand years**

Evolution is not just about survival: it is also about reproduction. And competition for mates is one of the most potent forces driving the evolution of new kinds of features and creatures. It has given rise to some of the most dramatic adaptations in the natural world – the peacock's tail, the nightingale's song, and the stag's antlers.

In humans, it has been argued that the competition for mates is responsible for many of our most superlative features – our extra-large brains, for example.

Our ancestors used their brains as multi-media entertainment systems to amuse and seduce the opposite sex; those who could tell the funniest stories, paint the most evocative pictures, or use the longest words, succeeded in attracting more (or higher quality) mates, and having more offspring. Competition for mates has also been used to explain our unusual penises and breasts: human males have the largest penises of all primates, and human females the largest breasts. For thousands of generations, women have been choosing as partners men whose penises – especially if and when erect – demonstrated their health and vigour. And men have been choosing women whose full, symmetrical breasts signalled their youth, fertility, and underlying genetic health.

Mating is also the most likely candidate for driving human evolution over the next 100,000 years. This is especially so given that, in one big gene pool, extreme individuals can mate with other extreme individuals. So, once upon a time, the best male tennis player in the world would never have met the best female tennis player. But now, thanks to international tournaments and the like, players such as Andre Agassi and Steffi Graf can meet, mate, and produce super-tennis-playing offspring. Or Brad Pitt can meet Angelina Jolie and have super-attractive children.

One could imagine that this process, taking place over the next 100,000 years, will create more and more genetic inequality, and with it social and economic inequality – so much so that the circles in which the genetic elites move become ever more exclusive, until they lose contact altogether with the rest of society, and come to constitute their own 'celebrity' gene pool. At this point we may begin to see a parting of the ways between the genetic 'haves' and the genetic 'have-nots'. People with the best genes will have chosen to mate with each other, leaving the rest to mate amongst themselves. This "assortative mating" increases the degree of genetic inequality in the population, and creates the conditions for "sympatric speciation" – that is, the formation of new species in the same geographical location. This could lead to new varieties of human: the 'gracile' descendants of a genetic upper class and the 'robust' descendants of a genetic underclass. The genetic 'haves' will tend to be tall, thin, symmetrical, clean, healthy, intelligent and creative. The genetic 'have-

nots' will be short, stocky, asymmetrical, grubby, unhealthy and less intelligent. Much longer term, this could create a situation reminiscent of that portrayed in HG Wells' *The Time Machine*. In this classic work of science fiction, a Victorian time-traveller fast-forwards to the year 802,701 AD, and finds Earth inhabited by two species of human: the elfin Eloi and the brutish Morlocks.

### **One million years**

Let us suppose that, one million years into the future humans (or at least the Eloi) have reached and begun to colonise other planets in other solar systems; that these planets, though chosen because they resemble Earth, nevertheless vary in terms of their gravity, their day length, their eco-systems and climate; and that these planets are too far apart to permit any significant migration. This would create the classic conditions for full-blown speciation.

New species emerge when a gene-pool is divided, and the two newly separated gene pools evolve in different directions. Suppose, for example, that our population of deer ends up on two sides of a river, and only one side of the river has the tall trees that make it an advantage to have longer necks. We might imagine that only one population evolves longer necks. When members of the different populations can no longer breed with one another, a new species is said to have emerged – perhaps in this case, the giraffe.

Darwin's finches provide the classic real-world example of speciation. Here, an ancestral species of finch arrived and colonised the various different islands that make up the Galapagos. The different populations then proceeded to evolve into thirteen distinct species – each with a different shaped beak that had been designed by natural selection to exploit a particular type of food – nuts, seeds, insects, larvae, and so on.

Divided by oceans of empty space, our distant descendants would find themselves in a similar situation. We should expect to see different species of humans adapting to their local planetary environments. Descendants who end up on big, slow, heavy, dark cold planets might come to resemble modern day Inuits: short, stocky, with slow metabolisms, longer circadian rhythms, and pale

skin. Those who end up on small, fast, light, warm planets might come to resemble the fabled Nubians: tall, thin, with fast metabolisms, shorter circadian rhythms, and darker skin. In all cases, we should expect the different populations of humans to adapt their metabolism to the peculiarities of the local foodstuffs, and the local atmosphere; and to adapt their immune systems to local diseases.

Under these conditions we would see the evolution of new species of humans, perhaps named after their celestial location: perhaps *Homo andromeda*, *Homo betelgeuse*. Our own species, *Homo sapiens*, would be long gone.

### **The future**

So, these might be some of the highs and lows of human evolution over the next million years. But remember, that there is nothing inevitable about the evolutionary process. It is not aiming at anything, it has no goals, and no inertia. What evolves will be a product of the mutations that arise, and the circumstances in which they find themselves. To the extent that we will be able to invent new genes, and to create our own conditions, we have some control over our future. In this sense, the future is not a place that we will go to, it is a thing that we will build.

### **Further Reading**

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