But thinking makes it so

Overconfidence may be a strategic tool, says s ananthanarayanan

THAT bragging is a short cut to the poorhouse is good advice and being realistic is surely the tested path to progress. But extensive surveys conducted by Professor Mark D Alicke of Ohio University show that the advice is not generally followed – 70 per cent of over a million high school students who were surveyed considered themselves "above average leaders". And they were in good company as 94 per cent of college professors considered themselves to have "above average teaching ability".

This, of course, does not amount to a new definition of the word "average" – the reason for the overestimation is that each one applied a different standard of what was right and what was average, explained their own poor scores with personally valid reasons, just as the better scores of others were not wholly deserved, and so on. Of course, a whole lot of these confident people are wrong and deluded, but this is really the average — that mentally healthy and well-adjusted people overestimate their capability, at least moderately, and they underestimate risks and dangers – but still they blunder through and the world gets on. Which raises the question: how does this tendency persist under natural selection — can being overconfident be an adaptation to the environment? Having a higher opinion than justified, should it not lead to poor decisions and get selected out?

One explanation for persistent overestimation of one's own ability is the documented improved

	A	B
X	Win	Lose
Y	Lose	Win

performance of confident persons. And with the esteem of others that comes to those who believe in themselves, there could be a spiral of overconfidence! Dominic Johnson of the University of Edinburgh, UK, and James Fowler at San Diego, in a paper in *Nature*, propose a different mechanism that explains the tendency based on game theory and model where biased estimates, in the real world, can lead to optimisation.

The model considers a place where two persons compete for the same valuable resource. If they both stake a claim, then there will be conflict — great loss to the loser and erosion of the benefit to the victor. If both decide not to claim it, then it goes to neither. The question is: how can one decide to make a claim and the other decide to pass? If both persons had an accurate estimate of the other's strength, the decision is easy — fight if you are stronger, save your powder if you are not. But the problem in the real world is that we do not have such a correct estimate of strength — compounded by the deception the other would employ to pass off as stronger!

Game theory

The classic game theory problem is what strategy to use, or what resource to stake, when there is a choice in the face of an uncertain strategy by the opponent. In a typical game situation, one player's move, "A", leads to victory if the other player moves "X", but to defeat if he/she plays "Y". On the other hand, player "B" would win when he/she plays "Y", but lose if "X" is played.

The problem is what move should the first player make. Mathematics fortunately points out the way — the relative value of a "win" or a "lose" and the probability of the opponent playing one or the other move generate an optimal strategy for the first player. If there is no known tendency of the opponent, then there is a specific, random way in which the first player should select his/her moves for the optimal result — if the opponent does not select his/her own best strategy, then the first player will get "better than optimal" results.

Johnson and Fowler's model uses the same principles to consider the case where a player has to fight or surrender a claim. The issues involved are the cost of fighting and the value of the resource to be gained. Even if the player does not think he/she is stronger, a low cost of fighting and high value of reward may make the fight worthwhile, as the assessment of relative strength is uncertain.

This amounts to increasing the estimate of one's own worth to cash in on the chance of winning the prize. But if the cost of fighting is high, then it may be more prudent to moderate the estimate and stay out of the fight.

The model is, of course, more complex than this simplified description, as the randomising of response is often attained by creating a population that consists of a mix of daring and diffident people. But the effect is that the population would optimise returns through overall higher estimation of self-worth. This may then be one of the ways that the game theory strategy is implemented — the simple strategy is to fight when you are stronger, but wire the brain to always show you as a little better than you are. The other way would be to be honest in assessment, but follow a policy of fighting those even a little stronger, the least stronger most often, and so on.

Working out which description is most accurate or what part is biological and what part is cultural is still somewhat intractable. Doing this would need a study that controls separately for the large number of variables. And then there are other factors, like the finding that having higher expectations actually improves the performance of an organism, physical or social! But, to quote Matthijs van Veelen and Martin Nowak, who have commented on the paper in *Nature*, "Given that 94 per cent of college professors rate themselves as above average, there should be enough overconfidence around to tackle all the natural follow-up questions."

The writer can be contacted at simple-science@gmail.com

Believing you're better than you are may help you succeed. Outmatched but victorious, the biblical figure of David slaying Goliath in an artist's impression.

Professor Mark D Alicke

Dominic Johnson

Tower building

HIGHER expectations are found to increase performance. An exercise that is routine in the training of managers consists of asking a trainee to build a tower of blocks, using one-inch wooden cubes. But the trainee is blindfolded and he uses the non-dominant hand (ie, right-handed trainees use their left hands or vice-versa). The idea is to eliminate any "skill" or "experience" in block-building. While blindfolded, the trainee would be orally guided in the task by two helpers, who are called the "supervisor" and the "manager". The trainee is also told that the "national average" performance is a tower of 12 blocks, before the tower falls.

But just before the "game" starts, the three players are asked to make an "estimate" of how this tower is going to be. Usually, each of the three names something more than 12; say, 14 or 16. Occasionally, the estimate is ambitious, like 18, or "non-cooperative", like eight. After all three players have made and shared this estimate, the task is begun. A class of trainees is divided into groups, of three players and four-five observers, and there are a number of groups.

Whatever be the mechanism, the results are uniformly, exceptions omitted, enlightening — wherever there is a large estimate, there is a high performance. The "14s" may reach 16, the "16s" may cross 16, the "18s" may reach 17. The conclusion, which usually need not be articulated, is that if supervisors and managers, and the employee himself/herself, have high expectations, the worker is motivated and he/she does perform. In this exercise, it may be that the blindfolded trainee stays more alert till the target has been reached, or starts out more enthusiastic if the target is challenging. But the message for managers is that sincerely expecting more can increase output.

This is a psychological aspect which enters the domain of capability. Thus, apart from actual skills, the level of information with the subject and also the tendency to overestimate, there is the element of motivation by external opinion, which needs to be factored in while figuring out how the mind pictures capability or the prospects of a course of action.

Chromosomes & inheritance

tapan kumar maitra **traces the development of genetic research following the revolutionary theory of evolution**

THE Darwinian concept of evolution postulated that some of the variations observed among individuals in a population were heritable. Being heritable, and evidently having an influence on the reproductive potential of the individual, these variations permit natural selection to take place. A number of 19th-century biologists attempted to deal with variations in a concrete manner and there was by 1885, largely because of the vision of August Weismann, a general acceptance of the idea that the germ cells were the material basis of heredity and that the genetic contributions of egg and sperm — despite differences in size — were essentially equal. It remained, however, for Mendel to deal with variations in a quantitative manner, and to develop inheritance tests that would permit variations — singly or collectively — to be followed through a number of generations.

The Mendelian laws of inheritance, formulated in 1865, still form the basis of our understanding of heritable variation. Mendel ascribed variation to the inheritance of material entities or factors, whose nature he did not understand but which existed singly in gametes and doubly in zygotes and which could exist in differentiated states, or alleles, as we now know them. They determined, in some way, the character variations with which he worked and which were inherited in predictable fashion.

Mendel's genetic discoveries were ignored from 1865 to 1900, when they were disinterred and given due recognition. By this time, however, an understanding of the cell, nucleus and chromosomes was well advanced:

- The egg and sperm, despite obvious differences in shape and size, were recognised as cells, with each contributing a given and usually equal number of chromosomes to the zygote at the time of fertilisation.
- Species were characterised by a constant number of chromosomes.
- Longitudinal replication of chromosomes in mitosis provided a sound basis for the genetic equality of the daughter nuclei and for the conservative aspects of inheritance.
- Meiosis had been discovered (in Ascaris), the relation of meiosis to gamete formation in animals was appreciated and haploidy versus diploidy during the lifecycle was made clear.
- It had been shown that the chromosomes not only had physical continuity from one generation to another, but that those were qualitatively different from each other in as far as they influenced developmental processes.
- The cellular nature of growth and development was being explored.

By 1902, Garrod, through his study of human disease, took the first step toward an understanding of the biochemistry of inherited variation and the interrelations of chromosomes and chemical reactions.

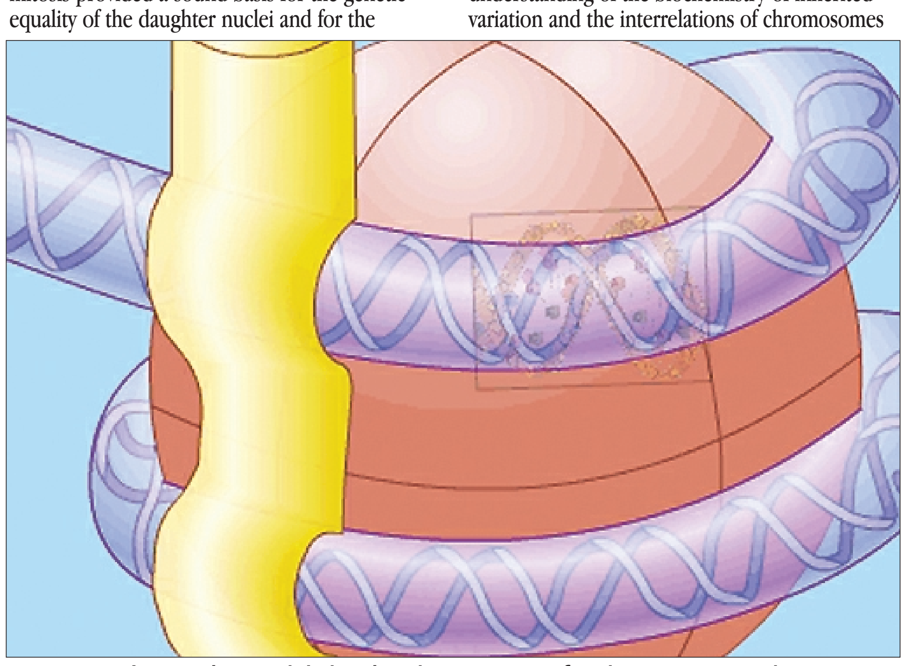
All these discoveries made it increasingly clear that the chromosomes were key elements whose behaviour in division and at fertilisation could account for the transmission of hereditary factors from one generation to another, whether of ceils or of individual organisms. The stage, therefore, was set for the union of the still unknown genetic factors of Mendel with the physical factors of cytology. The Sutton-Boveri chromosomal theory of inheritance, advanced in 1902-1903, provided this synthesis, just as earlier the concept of cell lineage merged the cell theory with the evolution theory. The science of cytogenetics was thus launched with the brilliant correlation of gene transmission and chromosome transmission.

The basis of the theory, as stated by Button, is as follows:

- In somatic cells, arising from a zygote. The chromosomes consist of two similar groups, one of maternal origin, inherited through the egg, the other of paternal origin, inherited through the sperm. Each somatic nucleus, therefore, contains pairs of like chromosomes, or homologues, the number of pairs being the same as the haploid number of chromosomes in a gamete.
- The chromosomes retain their structural individuality and their genetic continuity throughout the lifecycle of an organism.
- In meiosis, synapsis brings together pairs of homologous chromosomes and permits their subsequent segregation into different germ cells.
- Each chromosome, or chromosome pair, plays a definite role in the development of an individual.

Sutton visualised the chromosomes as the physical carriers of Mendelian factors and the segregation of a pair of chromosomes and the independent assortment of non-homologous chromosomes as the physical basis for the qualitative and quantitative aspects of Mendelian segregation. Sutton, together with Roux and Boveri, also anticipated the phenomenon of linkage, when he stated that all the factors in any one chromosome must be inherited together.

The writer is associate professor in botany, Anandamohan College, Kolkata



Interactive model showing the structure of a chromosome and its various magnifications.

Pigeon-guided missiles...

emily dugan **on some extraordinary ideas that didn't quite make it from prototype to production line**

ALBERT Einstein once said that if at first an idea is not absurd "then there is no hope for it". Indeed, some of the maddest notions of their time are now essential to modern living. But for every ingenious invention that changes the world, there are hundreds of equally imaginative ones that quietly fizzle out.

History is littered with these heroically daft ideas, from a plan to put a roof over New York City to giving London its own Eiffel Tower and a scheme for a house that cleans itself.

James Moore, co-author of *Pigeon Guided Missiles And 49 Other Ideas That Never Took Off*, to be published next week says, "Behind all these ideas is one person that keeps going and going. If you look at successful entrepreneurs, they do the same thing. These ideas have ended up on the scrapheap of history, yet at the time they seemed like they could really happen."

Here are some wacky notions that, thankfully, play no part in life as we know it:

Pigeon-guided missiles: In 1941, American scientist BF Skinner believed pigeons were the answer to defeating Adolf Hitler. He showed that they could steer a missile towards a model ship by pecking at a target on a screen that moved its rudders. His pigeons continued to peck accurately even in rapid descent and with explosions going on, often making more than 10,000 pecks in 45 minutes. He planned to load three inside missile cones, but mass production was cancelled in 1944 because officials didn't want to put weapons in the hands – or claws – of birds.

The international "hot air" airline: Long before the jet engine carried millions around the world, William Henson and John Stringfellow decided steam power could fly a plane. Dubbed the Aeriel Steam Carriage, the 1841 invention was expected to carry a dozen passengers 1,000 miles. Grand posters picturing it in flight over the pyramids and China piqued people's interest, but the furthest this heavy beast ever flew was 30 feet – or what others described as a "short hop".

The diabolical death ray: Following HG Wells's fictional description of an all-powerful death ray in *The War of the Worlds*, inventors scrambled to create the real thing. Gloucestershire-born inventor Harry Grindell Matthews claimed to have made one in 1923, managing to con the British and French governments into a bidding war over it. Despite the media frenzy, his prototype only appeared to turn on a lightbulb and stop a small motor. A full-size version was never made.

Edison's concrete furniture: While the light bulb, the telegraph and the X-ray saw Thomas Edison hailed as a genius inventor, not all his ideas were winners. After buying a concrete factory he became convinced that furniture made from the hefty grey stuff was the answer to affordable living. Despite his faith that his idea was inspired, few concrete sofas and pianos were sold.

London's Eiffel Tower: When the Eiffel Tower was completed in 1889, Londoners got size envy. Patriotic Briton Sir Edward Watkin vowed, "Anything Paris can do, we can do bigger." The first level of his tower was completed and opened after being dubbed an "unfinished ugliness" by *Building News*, but the costly exercise made Watkin's company go bust and the construction was never finished. In 1907, the rusting stump was blown up.

Nelson's pyramid: Trafalgar Square might have looked very different if the front-runner had been chosen in a competition staged to commemorate Britain's seafaring hero Admiral Lord Horatio Nelson. A pyramid representing victory over the Nile was planned to stand in the Square on a scale that would dwarf St Paul's Cathedral. Its grotesque size and £1 million price tag — then a fortune — meant that building work instead started on Nelson's Column in 1840.

A roof over New York: In an attempt to avoid snow-clogged New York winters in the 1950s, inventor Richard Buckminster Fuller designed a geodesic dome to cover a two-mile wide stretch of central Manhattan. It would be pulled into place a mile above the city using 16 helicopters, creating an energy efficient microclimate. In the end, New Yorkers could not be persuaded that it was worth $200 million to be kept inside all day.

Exploding traffic lights: When John Peake Knight invented the world's first traffic lights in 1868 he proved it was possible to be too far ahead of your time. The gas-fired device exploded two weeks into a trial outside the Houses of Parliament in London, leaving the police officer operating it badly burned and putting off the use of traffic lights for another half century.

The flying car: In 1940, Henry Ford was convinced that airborne automobiles were the future. "Mark my word," he said, "a combination airplane and motor car is coming. You may smile. But it will come." In 1949, Waldo Dean Waterman even made a prototype "Aerocar" with removable wings. It did fly, but thanks to production costs it never took off.

The atomic car: The Ford Nucleon — the world's first nuclear powered car — promised to go 5,000 miles without ever needing to refuel. In 1958, scientists were convinced that atomic-powered automobiles carrying their own nuclear reactors would be a brilliant transport solution. Fortunately, someone realised a simple car accident could nuke a whole town, and the plan was dropped.

The Independent, London