Culture is a group thing

A STUDY HAS SHOWN THE LARGER NUMBERS ARE BETTER AT PRESERVING CULTURAL IDENTITY, SAYS **S ANANTHANARAYAN**

Language skills and intelligence have made humans better at cultural evolution than chimpanzees, ants, bees or microbes. But does the number of individuals in a group also matter? There are intuitive and analytical answers to this question. Now there is also an experimental verification. Maxime Derex, Marie-Pauline Beugin, Bernard Godelle1 and Michel Raymond, social scientists at Monpellier, France, described in the journal *Nature* last week their trials with 366 people engaged, in groups, in a dual-task computer game that tested the effect of group size on cultural transmission. The trial showed that simpler cultural traits were better conserved than complex ones and that expanding the group size increased the survival chances of the complex trait

The accumulation of socially learned information over many generations has enabled humans to develop powerful technologies that no individual could have invented alone, the authors note in the paper. That evolving and transmitting culture is unlikely outside humans is explained as being due to human specific mechanisms, like teaching, language or imitation. But this is not a complete answer, as transmission is not always exact and information loss is expected, particularly when there is greater complexity. Cultural loss, or the opposite of improvement, has also been documented and regression is found to be associated with reduction of group size.

The work of Joseph Henrich, Professor of Psychology and Economics at the University of British Columbia, has delved into adaptive learning and culture transmission and it outlines a mechanism of how information is passed on, a mechanism that is similar to the preferred transmission of beneficial genetic traits.

Maxime Derex and Joseph Henrich.

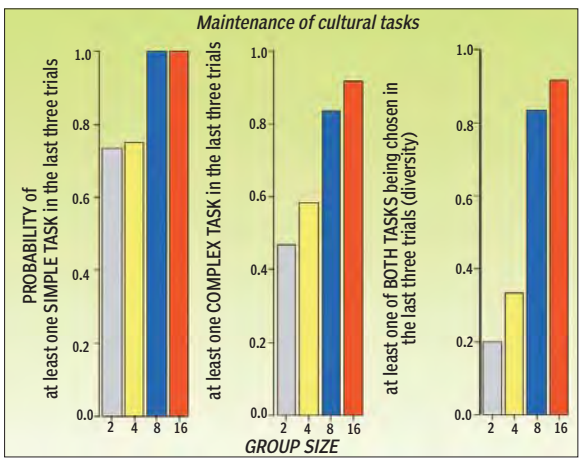
Learners are thus considered to be likely to imitate model persons who are successful or knowledgeable or endowed with prestige. As imitation is not exact copy, faithful transmission, and improvement, would presuppose a good number of transmission events, which would happen in a large population. But with a low population, there may be regression, with imperfect learners becoming demonstrators, as a low number would imply less successful models to follow.

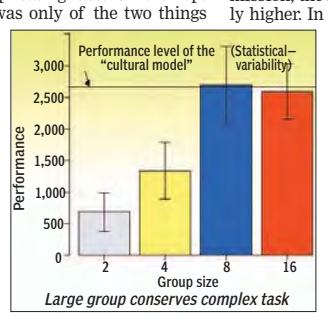
But the mechanism is complex. There is the effect, for instance, of a model who is known to excel in one area gaining prestige and being imitated in his/her behaviour in another domain. – like followers copying the hut-building technique of one who is successful in fishing. This is a behaviour pattern that advertisers use when they announce the preference for shaving cream of a tennis champion. And again, the factors that help the creation of complex culture may also be the factors that lead to a large population. It may hence be misleading to take the correlation of cultural complexity with a large population and conclude that one was caused by the other. The experimenters hence devised a model where complicating factors were kept out and the test was only of the two things that the work of Henrich suggested — first, that for a given group size, there should be a greater loss of information for a complex task, as compared to a simple task, and, second, that the loss should come down when the group was larger.

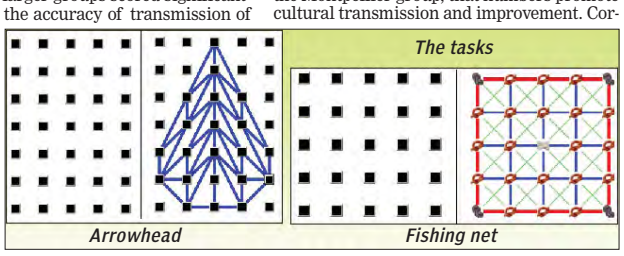
Naresh Fernandes and Charles Correa.

The 366 participants of the experiment were randomly assigned to groups of two, four, six, eight or 16 players. Two tasks were assigned — a simple task of drawing an arrowhead, and a complex task of building a fishing net, both on the computer screen, and the objective was to get the best evaluation. The arrowhead was evaluated based only on the shape, while the fishing net was evaluated, at a higher level, based both on the shape and the steps followed to build it. The players could choose either task at each try and had to go through 15 trials. At each trial, the player could choose to take the help of either a "cultural model" demonstration (this was for the first three trials) or the method of a fellow group member. The evaluation of all members of the group was there to make the choice.

The results of the trials, which can be seen in the diaigrams, demonstrate that simple tasks were generally conserved, and nearly always in the larger groups. Next, the complex tasks were clearly better conserved in the larger groups. And as for conservation of both tasks, or the diversity of cultural transmission, the larger groups scored significantly higher. In the accuracy of transmission of the complex task, again the larger groups had the clear advantage.







The results thus support Henrich's hypothesis that changes in group size can affect both adaptive cultural evolution, when the group is large, as well as deficiency in adaptation and loss of community skills, when the group is smaller. "In our evolutionary past, group-size reduction may have exposed human societies to notable risks, as humans live in many habitats to which they are ill-suited without specific cultural adaptations. Indeed, the more that we depend for our survival on large bodies of culturally transmitted knowledge, the more we rely on living in large groups. Under such conditions, group-size reduction could have triggered important loss of skills, leading to societal collapse," the authors say in the paper.

Life in cities

In the same week that this paper was published by *Nature*, there was an event in Mumbai where Charles Correa, noted architect and town planner, released *City Adrift*, a biography by Naresh Fernandes of Mumbai city that covers its many decades of dealing with land use and the demands of a growing population. Now, "middle-class Bombay shops in access-restricted malls, exercises in parks operated by private developers, trades public transport for airconditioned cars and aspires to live in gated communities… A city can flourish only if it has common ground to make common cause…" says the book, at the end of the account of the city's many strengths.

Correa explained that what made cities great was not land use or building skill; it was providing places for people to come in contact with others. He cited a model where people in a village were represented by red dots on a computer screen. Interspersed among the red dots were green dots, indicating enlightened individuals, or "role models", which exist in all groups. When the model of a village of 50 inhabitants was scaled up to 1,000 people, there were similarly more red dots and distributed green dots. But when the model was of a city with 25,000 people, there was a peculiar grouping together of green dots — they had reached a critical number, at which the city facilitated the best in its environs coming together to grow.

Correa had unwittingly put his finger on the hypothesis of Henrich and the findings of the Montpellier group, that numbers promote cultural transmission and improvement. Correa went on to dwell on how Mumbai, once a group of 14 islands, built causeways and connected the land and the people. But deficient city planning in recent times was encouraging the growth of "gated communities", which was to divide the city into islands again. If group size is important to maintain cultural, and this includes scientific, heritage, the new islands may find themselves short of the critical numbers!

THE WRITER CAN BE CONTACTED AT simplescience@gmail.com

PLUS POINTS

How clean is green?

More than 80 per cent of India's energy needs are met from non-renewable energy sources — fossil fuels – with coal providing a little more than 50 per cent of the energy supplied from non-renewable sources, followed by oil and natural gas. Such an energy regime leads to high carbon emissions. Not surprisingly, nearly 40 per cent of India's carbon emissions are from the power sector. The overdependence on fossil fuels also has much bearing on the country's energy security, given the fluctuating global oil prices and sustainability of coal. Imports cater to over 80 per cent of India's oil needs and around 20 per cent of our coal needs.

It makes sense to shift to renewable energy. But what about the enviromental costs of such energy? Let us take small hydropower first. In 1997, the Central Electricity Authority estimated a potential of 5,519 MW from small hydropower projects, including those producing 3-15 MW. Since 2000, several small hydropower projects have been mooted, many of which are in the geologically and ecologically sensitive Himalayan and Western Ghats region. Dams are under construction in the ecologically fragile North-east region. Critics have said these dams will lead to flash floods in the tributaries of the Brahmaputra. Questions are also being raised on their stability and long-term viability.

India is the fifth-largest producer of wind energy with an installed capacity of 19 GW and an estimated potential of 48 GW. Tamil Nadu, Gujarat, Karnataka and Maharashtra are leading producers. But wind energy does not come without associated impacts. In undertaking renewable energy projects, we can learn from other countries. China, for example, has faced global criticism for hydropower projects that have high environmental costs and Spain's large wind farms are under criticism for causing high bird mortality and disturbing avian migration.

The option of having solar panels on rooftops of commercial and residential buildings is becoming popular. The Union ministry of new and renewable energy offers up to 30 per cent capital subsidy on implementing rooftop solar panels. States like Gujarat also offer subsidies. Solar energy, then, appears to be the safest form of renewable energy from an environmental standpoint. This is not to say the country should discard wind energy projects. They should be carried out after proper assessment of their environmental impacts.

G DHANAPAL/CSE-DOWN TO EARTH FEATURE SERVICE

THAT EUREKA MOMENT

TAPAN KUMAR MAITRA RECOUNTS FRANCIS CRICK AND JAMES WATSON'S DISCOVERY OF THE DOUBLE HELIX

'I have never seen Francis Crick in a modest mood. Perhaps in other company he is that way, but I have never had reason so to judge him." With this typically irreverent observation as an introduction, James Watson goes on to describe, in a very personal and highly entertaining way, the events that eventually led to the discovery of the structure of DNA. The account, published in 1968 under the title, *The Double Helix*, is still fascinating reading for the personal, unvarnished insights it provides into how an immense scientific discovery came about.

Commenting on his reasons for writing the book, Watson observes in the preface that "there remains general ignorance about how science is 'done'. That is not to say that all science is done in the manner described here. This is far from the case, for styles of scientific research vary almost as much as human personalities. On the other hand, I do not believe that the way DNA came out constitutes an odd exception to a scientific world complicated by the contradictory pulls of ambition and the sense of fair play".

James Watson (left) and Francis Crick at work with their DNA model

As portrayed in Watson's account, he and Crick were about as different from each other in nature and background as they could be. But there was one thing they shared, and that was an unconventional but highly productive way of "doing" science. They did little actual experimentation on DNA, choosing instead to draw heavily on the research findings of others and to bring their own considerable ingenuities to bear building models and exercising astute insights and hunches. Out of it all emerged, in a relatively short time, an understanding of the double-helical structure of DNA that has come to rank as one of the major scientific events of the 20th century.

To appreciate their findings and their brilliance, we must first understand the setting in which Watson and Crick worked. The early 1950s was an exciting time in biology. It had been only a few years since Oswald Avery, Colin MacLeod and Maclyn McCarty had published evidence on the genetic transformation of bacteria, but the work of Alfred Hershey and Martha Chase that confirmed DNA as the genetic material had not yet appeared in print.

Meanwhile, at Columbia University, Erwin Chargaff's careful chemical analyses had revealed that although the relative proportions of the four bases — A, T, C, and G — varied greatly from one species to the next, it was always the same for all members of a single species. Even more puzzling and portentous was Chargaff's second finding: for a given species, A and T always occurred in the same proportions, and so did G and C (ie, A==T and C=G).

The most important clues came from the work of Maurice Wilkins and Rosalind Franklin at King's College in London. They were using the technique of X-ray diffraction to study DNA structure and they took a rather dim view of Watson and Crick's strategy of model building. X-ray diffraction is a useful tool for detecting regularly occurring structural elements in a crystalline substance, because any structural feature that repeats at some fixed interval in the crystal contributes in a characteristic way to the diffraction pattern that is obtained. From Franklin's painstaking analysis of the diffraction pattern of DNA, it became clear that the molecule was long and thin, with some structural element being repeated every 0.34 nm and another being repeated every 3.4 nm. Even more intriguing, the molecule appeared to be some sort of helix.

This stirred the imaginations of Watson and Crick, because they had heard only recently of Linus Pauling and Robert Corey's a-helical structure for proteins. Working with models of the bases cut from stiff cardboard, Watson and Crick came to the momentous insight that DNA was also a helix, but with an all-important difference: it was a double helix, with hydrogen-bonded pairing of purines and pyrimidines.

The rest is history. Shortly thereafter, the prestigious journal *Nature* carried an unpretentious two-page article entitled simply, "Molecular Structure of Nucleic Acids: A Structure for Deoxyribose Nucleic Acid", by James Watson and Francis Crick. Though modest in length, that paper has had far-reaching implications, for the double-stranded model that Watson and Crick worked out in 1953 has proved to be correct in all its essential details, unleashing a revolution in the field of biology.

THE WRITER IS ASSOCIATE PROFESSOR AND HEAD, DEPARTMENT OF BOTANY, ANANDA MOHAN COLLEGE, KOLKATA AND CAN BE CONTACED AT tapanmaitra59@yahoo.co.in

Cure for damaged skin

SCIENTISTS SAY HOUSEHOLD BLEACH COULD ALSO HEAL RADIATION DERMATITIS AND SUNBURN, WRITES **TOMAS JIVANDA**

According to tests carried out by scientists at Stanford University Medical Centre in California, old and fragile skin bathed in a solution of household bleach becomes thicker, with increased cell proliferation. The discovery was made by testing the use of diluted bleach on mice with radiation dermatitis. The team found that the animals bathed in the bleach solution experienced less severe skin damage and better healing and hair regrowth than animals bathed in water.

They then turned to elderly but healthy mice and found that by bathing them in the bleach solution, the effects of ageing were allayed and the animals' skin began to look younger.

The findings could help fight radiation dermatitis in humans, a painful sunburn-like side effect of radiation cancer therapy, preventing the need for the treatment of some patients to be interrupted to give time for skin to heal.

"An effective way to prevent and treat radiation dermatitis would be of tremendous benefit to many patients receiving radiation therapy," said Susan Knox, associate professor of radiation oncology and a co-author of the study.

The research was prompted by the fact that bleach has been used in the treatment of moderate to severe eczema in humans for decades, despite little being known about how the chemical is effective on skin.

Now, the new study has revealed for the first time that bleach works by blocking the process that causes inflammation when immune cells rush to the site of the injury to protect against infection.

"Originally it was thought that bleach may serve an antimicrobial function, killing bacteria and viruses on the skin," said Thomas Leung, an instructor in dermatology at Stanford and a pediatric dermatologist at Lucile Packard Children's Hospital.

"But the concentrations used in clinic are not high enough for this to be the sole reason. So we wondered if there could be something else going on. It's possible that, in addition to being beneficial to radiation dermatitis, it could also aid in healing wounds like diabetic ulcers," Leung said.

"This is exciting because there are so few side effects to dilute bleach. We may have identified other ways to use hypochlorite to really help patients. It could be easy, safe and inexpensive."

Plane truth

Noise pollution from aircraft could be a cause behind heart ailments in people living near airports, especially the elderly. A study says there is a

positive association between aircraft noise and hospitalisation for cardiovascular diseases.

A 2.9 per cent increase in hospital admission rates for cardiovascular diseases has been observed in areas that have a 10-decibel increase in noise (from 55 dB) due to aircraft. However, this increase was found to be 3.5 per cent due to the addition of pollutants like ozone and particulate matter. Researchers noted the most likely reasons for increased cardiovascular hospitalisations could be stress due to hormonal imbalances and increased blood pressure.

The study involved six million people above 65 years of age residing near 89 airports. Approximately 23 per cent of the participants were exposed to noise pollution of more than 55 decibels. Overall, 2.3 per cent of hospitalisations among older people living near airports were attributable to aircraft noise. Conducted by Francesca Dominici from?the Harvard School of Public Health, Boston, and colleagues, the study was published in the October issue of the *British Medical Journal*.?Dominici said, "It was surprising to observe adverse effects of noise on cardiovascular health, even beyond exposure to air pollution and traffic noise."

SMRITI SHARMA/CSE-DOWN TO EARTH FEATURE SERVICE