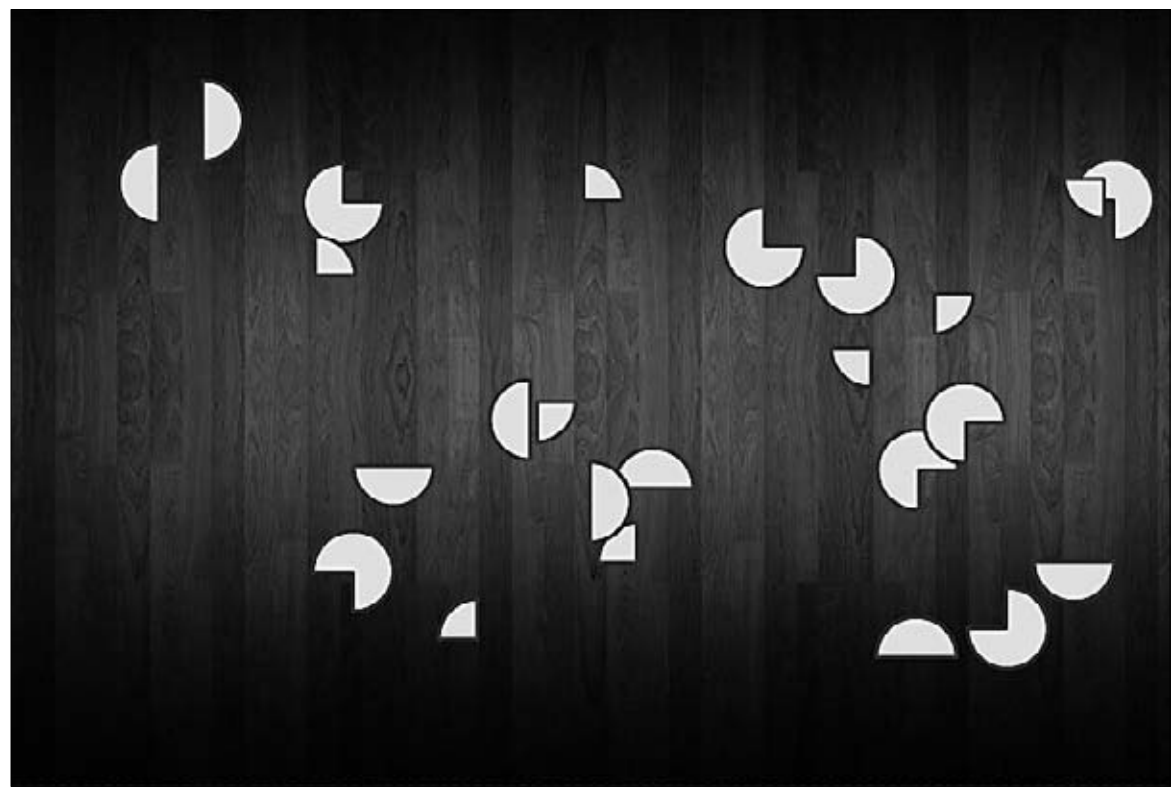
INSIDE A CHILD'S MIND



A Bangalore-based learning and assessment solutions company has developed a series of neuropsychology-based tests for schools to assess students' non-scholastic skills under the CBSE's new Continuous and Comprehensive Evaluation framework. That's not all. Coming soon is a career guidance tool based on a behaviour prediction engine that uses an innovative algorithm to emulate the decision pathways in the human brain

V SHOBA

IN 2008, when Karteek Addanki, a student at BITS-Pilani and now a researcher at the Human Language Technology Center of the Hong Kong University of Science and Technology, tried out a behaviour simulation engine developed by Vita Beans Neural Solutions, a Bangalore-based learning and assessment solutions company incubated at BITS-Pilani, he was blown away by the accuracy of the predictions it made about him.

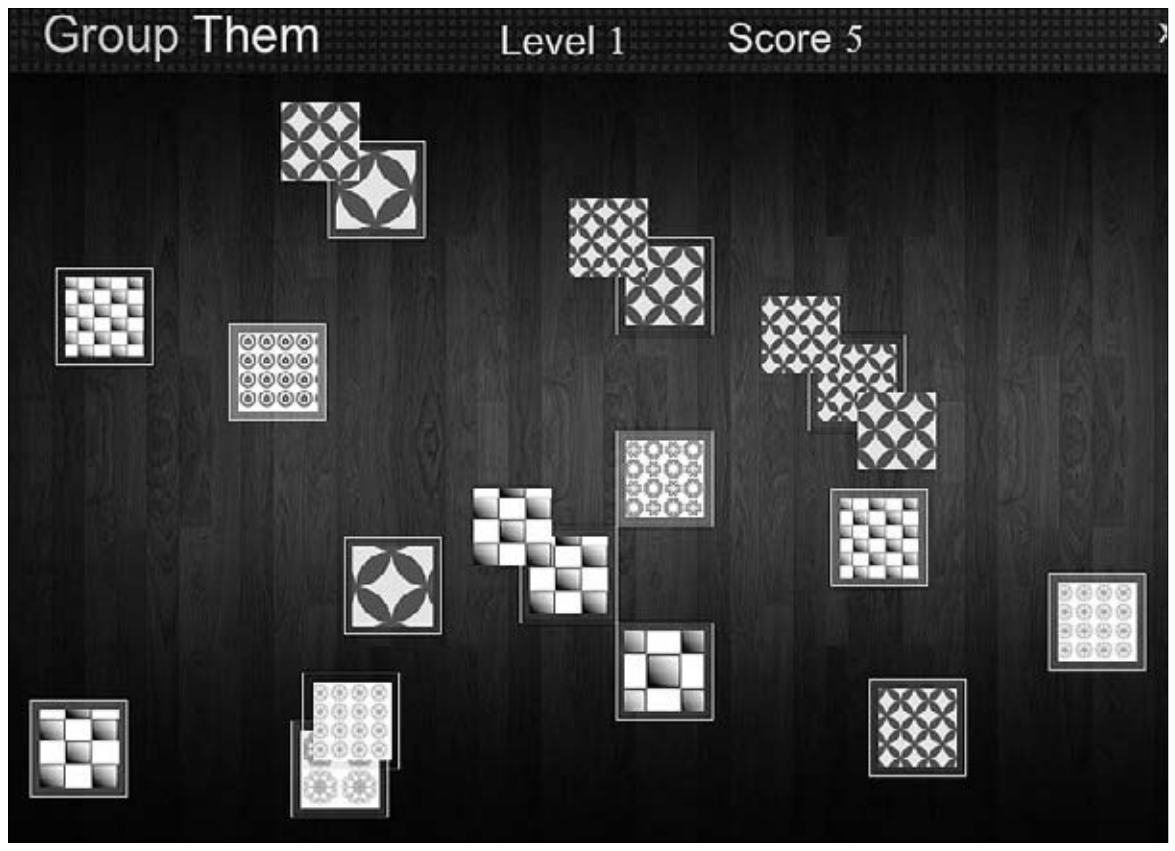
Using inputs received in the course of a set of four simple games—identifying how much he liked a picture on a computer screen, a chess-like strategy game and sorting of words—the engine predicted things like what he valued, such as job satisfaction over money, or the way he would react to a new idea. "These predictions were very accurate given the simplicity of the game," says Addanki.

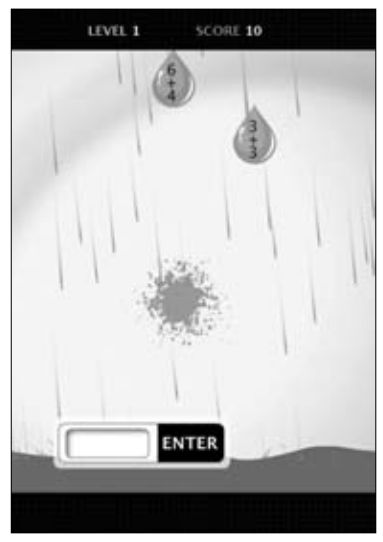
Earlier this year, Vita Beans designed and put together a series of such neuropsychology-based tests for schools to assess students' non-scholastic, or "life" skills, such as memory, attention span, logic and problem solving ability, quantitative ability, vocabulary and social behaviour, in terms of class percentiles. Launched in May, Vita Beans' assessment tool, consisting of five sets of short, engaging, game-based tests and a set of activities to capture the behavioural profile of the students, has now been adopted by 16 CBSE schools across the country to generate extra-curricular personality reports and evaluate students' thinking, social and emotional skills in accordance with the Board's new Continuous and Comprehensive Evaluation (CCE) framework for Classes IX and X.

Assessment, though, is not the whole story. Based on three or four CCE evaluations regularly administered over a year, Vita Beans can suggest an "improvement pathway for professional development" of students, rating their existing skills sets—and recommending improvements—under realistic, investigative, artistic, entrepreneurial, social and organisational professions based on Holland Codes, an internationally accepted framework to understand professional inclinations. Backed by the company's accurate and scientific prediction engine—refined and tested successfully in corporate pilots over the last two years—this advanced feature will be launched later this year.

Vita Beans is the brainchild of Amruth Ravindranath, who, during his student days, started experimenting with simulating human decision-making and found that most psychometric aptitude tests—based as they are on statistical frameworks and techniques developed over 60 years ago—suffer from abysmally low accuracy as you increase the specificity of the predictions that you want to extract from them. Vita Beans decided to build online interactive applications to profile functions of different areas of the human brain that are involved closely in decision making—like the amygdala, which is involved in attention and the medial and prefrontal cortex, which help process information about context and individual preferences. The inputs from these applications were used in an algorithm to emulate the decision pathways in the human brain to make predictions. The result was a robust behavioural simulation engine, which, when released for public testing among 500-plus users in 2008, predicted their decisions with a surprisingly high accuracy of 86 per cent based on their virtual profiles. Of the 1,207 specific predictions the engine made—such as, given four corporate incentives, which one you would choose—1,042 predictions were accurate.

Amruth, now in Canada after being selected as the youngest of 14 fellows to be supported by the Jeanne Sauvé Foundation earlier this year—he is working at the ATLAS (Advanced Technologies for Learning in Authentic Settings) Lab of McGill University to create a technology platform that automatically translates the medium and style of delivery of content based on the nature of the audience—says, "Since 2005, many research groups have come up with non-MRI-based testing techniques that measure the functional capabilities of different brain regions that are involved in human decision making and behaviour. Also, individual groups have developed simulation techniques to replicate specific behaviours of certain pathways in the human brain (like addiction, learning, etc). But much of it still remains in the realm of research labs and diagnostic science."





"We seek to bring in the latest advancements in neuroscience and neuropsychology into psychometric analysis to solve many of the problems inherent in traditional psychometric techniques," he says. Keerthi Kiran, director for business development and partnerships for Vita Beans, says there aren't any other such deductive and predictive engines available in the market today.

"Vita Beans essentially combines ideas from game theory, evolutionary biology, behavioural psychology, neuroscience and fuzzy logic to determine how an individual would respond in a particular situation. I am not aware of any other behaviour prediction services like this. There are a number of services that recommend what you might like—like Facebook, *Last.fm* and YouTube—but the technology behind them is much simpler and based on statistical methods," says Addanki, who interned with the company in the summer of 2009 after trying out their prediction engine.

Vita Beans combines ideas from game theory and fuzzy logic to determine how an individual would respond to a particular situation

Varun Anand, who was associated with Vita Beans in 2008, got impressive results when he viralled one of their tests at *makemytrip.com*, where he was employed at the time. "Fifty people had taken the test in the technology team there. They got an accuracy of about 85 per cent, with some of them getting a 100 per cent accurate set of predictions," he says.

Even without the prediction module, several schools have expressed interest in the basic CCE package and are hosting pilot runs. Ever since the CBSE did away with Class X board exams and instead suggested a holistic evaluation of learners—in scholastic and non-scholastic areas—last year, schools across the country have been grappling with training teachers in CCE. Shivananda Salgame, who runs iLearn International, a company that works in activity-based learning and has partnered with Vita Beans to take their tests to schools, says while the Board has issued guidelines, most teachers are simply not trained to rate students on non-scholastic grounds.

Krishna Sharma, principal of the Atomic Energy School in Mysore, where iLearn International conducted a small pilot, says it is next to impossible for schools to evaluate every student's life skills and values. "With not less than 35 students per class, it will be a herculean task," he says. "The computer game-like tests generate scores in non-scholastic skills as per CBSE requirements and have been well received by students. The module will be even more helpful if they added descriptive indicators in each section."

Vita Beans' fascination with human decision making has also led them to pursue the ambitious project of creating an Artificial Intelligence agent, which they call Adam, with algorithms to help understand and exhibit emotions and display rudimentary versions of creativity and discovery, among other abilities.

Gauging high-speed spin inside a Lilliputian world

Researchers have tuned a microscope to detail physical processes inside atoms at nanosecond scales and produce the equivalent of a high-resolution, high-speed movie of the atom's behaviour

JOHN MARKOFF

IBM scientists have modified a scanning-tunnelling microscope, making it possible to observe dynamic processes inside individual atoms on a time scale one million times faster than has previously been possible.

The researchers have perfected a measurement technique in which they use an extremely short voltage pulse to excite an individual atom and follow with a lower voltage to read the atom's magnetic state, or spin, shortly afterward. The resulting data produces the equivalent of a high-resolution, high-speed movie of the atom's behaviour.

The advance, reported in the journal *Science*, has potential applications in fields including solar energy technology, computer data storage and quantum computing.

The scanning-tunnelling microscope was invented by IBM researchers in 1981 in Switzerland. The systems are now in wide use, and make it possible to make images of individual atoms. While they have attained astounding spatial resolutions they have been less precise in detailing physical processes that occur so quickly that their duration is measured in nanoseconds. A nanosecond—a billionth of a second—is to a second as one second is to 30 years.

"This technique is really nice because it allows us to measure how things change in time," said Michael Crommie, a physicist at the University of California, Berkeley. "Obviously people have been doing this with other techniques but it has proven hard to do at very small time scales."

The researchers said that the actual rate of change in the magnetic orientation of the atoms they were able to measure is several orders of magnitude faster than the new technique. But they are able to slow down aspects of the process, which is described as "spin", so that they are able to observe it at the nanosecond scale.

Spin can be likened to the constantly changing orientation of an atomic-scale bar magnet, said Andreas J. Heinrich, a physicist at the IBM Almaden Research Center in San Jose, California. "Before we had the scanning-tunnelling microscope that allowed us to follow things down to the atomic scale," he said, but we did not have the ability to follow these fast processes. Now we can offer a combination of high time and spatial resolution; we're trying to speed up nanoscience."

He said that one of the questions the researchers are trying to answer is how many atoms are required to store a single bit of magnetic information. The new technique will allow scientists to peer into a Lilliputian world where magnetic ones and zeros are read and written by modern digital computers which should lead to a better understanding of the remarkably small structures at the heart of both magnetic and digital memory systems.

It will also give them a tool for building a generation of computers based on quantum mechanical effects. While the basic unit of today's digital computers is a bit—a one or a zero—researchers are now designing systems in which a quantum bit, or qubit, will be able to represent one and zero simultaneously.

"With quantum computing, the idea is to break out of the paradigm of normal computing, which uses ones and zeros to compute," said Sebastian Loth, an IBM scientist. "Quantum computing is interesting as it offers the ability to perform calculations not possible with any supercomputer that is around right now."

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