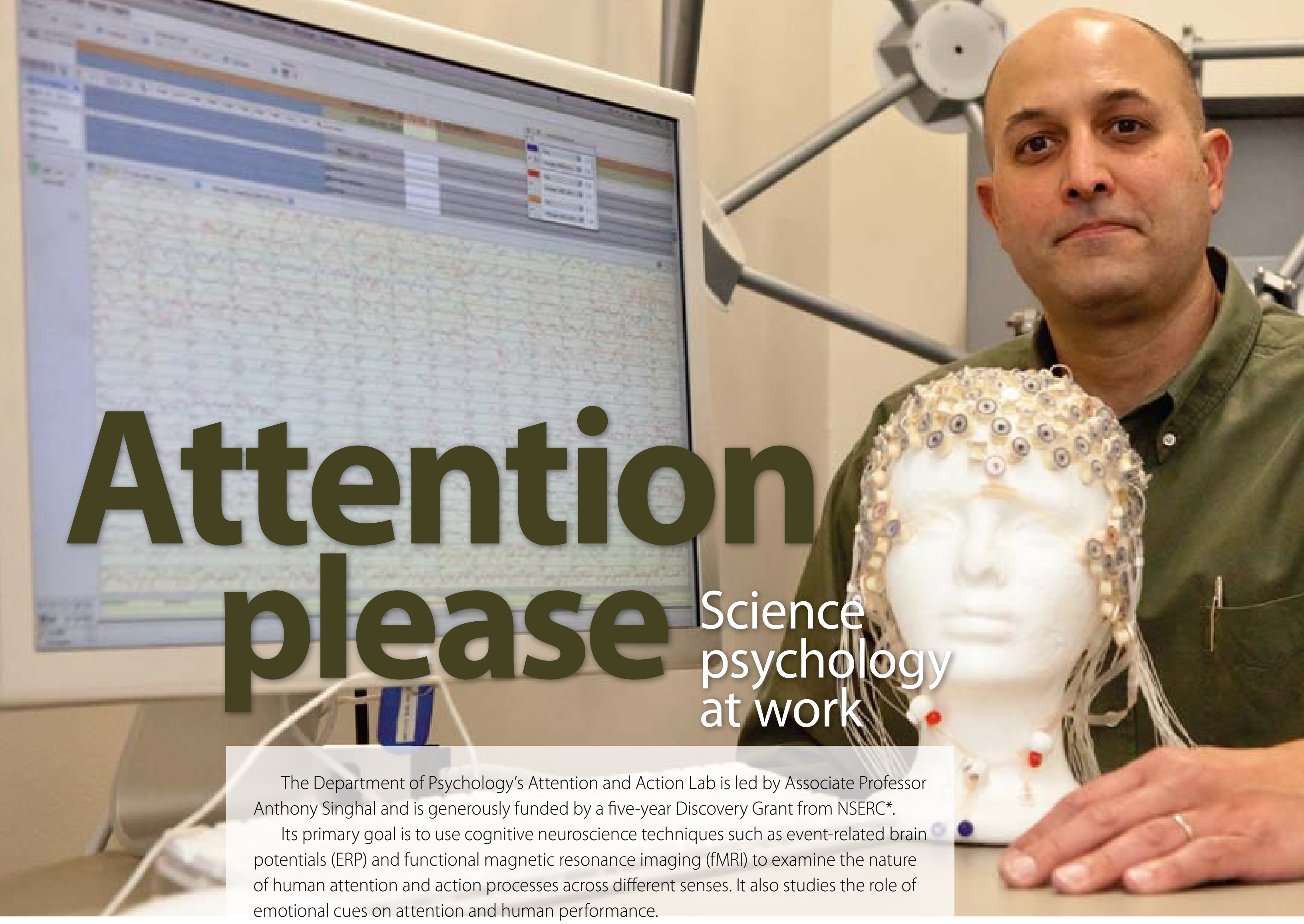

Attention please

Science psychology at work

The Department of Psychology's Attention and Action Lab is led by Associate Professor Anthony Singhal and is generously funded by a five-year Discovery Grant from NSERC*.

Its primary goal is to use cognitive neuroscience techniques such as event-related brain potentials (ERP) and functional magnetic resonance imaging (fMRI) to examine the nature of human attention and action processes across different senses. It also studies the role of emotional cues on attention and human performance.

The following articles explore some of the work being done by this research group.

Natural Sciences and Engineering Research Council of Canada

ATTENTION AND ACTION

Science hasn't even begun to cross the threshold when it comes to understanding the human brain. But U of A neuroscientist Anthony Singhal is excited to be among those tentatively knocking at the door.

Singhal leads the Attention and Action lab, where a team of scientists has been using the best current technologies—such as ERP (event-related potentials, or "brain waves") and fMRI ("brain scans")—to examine how our brains deal with competing stimuli processed by the attention, action, memory, and emotion systems.

"On an everyday basis, our brains integrate all kinds of information," says Singhal. "We know that some of the integration happens in specific parts of the brain, but we don't know much about the mechanisms of that integration. That's really the basis of my work for the past number of years."

Traditionally, emotion and cognition have been thought to be at opposite ends of the spectrum—think Kirk versus Spock. "We now know that there's some reciprocity between the parts of the brain that control our cognition and the parts that control our emotions," Singhal observes.

As a grad student at York University, Singhal looked at the basic effects of distractions, using a flight simulator. Expert pilots adjusted nimbly to complicated scenarios and multiple distractions, whereas novice pilots were thrown off much more easily. "Just little beeps here and there could cause them to miss the runway, or crash," says Singhal. "We found some clear markers in the brain associated with those deficits in their performance."

While still working toward his doctorate, Singhal was the lead project-scientist of a study involving astronauts on the International Space Station—to measure their multitasking skills, and to see how well they could adapt over time to the effects of working in microgravity. "I got to travel down to NASA in Houston, quite a bit, to the Johnson Space Centre," he says. "That was a very cool project for a PhD student."

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Anthony Singhal

ATTENTION AND EMOTION

In the basement of the Mazankowski Institute, twelve-year-old "Darren" has found an unusual way to get out of school for the afternoon. He's lying in an fMRI machine viewing a series of images while neuroscientists record his brain activity.

As a healthy control subject, he's also helping provide a set of baseline data for a U of A study into the potential of mindfulness-based stress reduction (MBSR) to treat mood disorders in troubled adolescents.

In the fMRI control room, neuroscientist Andrea Shafer explains some of the basics of MBSR. "If an individual can be more mindful of how they feel in the moment, that may help them handle that moment, especially if it's stressful or emotional," she says.

Pediatrics professor Sunita Vohra, who leads the MBSR project, says it will fill a significant research gap. "There's lovely adult data that suggest that MBSR may be quite helpful with a variety of conditions—anxiety, depression, stress, or coping. But we really don't have a lot of pediatric data right now."

Three U of A teams are working together to generate that data. Vohra's team is focusing on the quantitative side—comparing the behaviour of children in a regular program against those who also receive training in MBSR. "These children are already receiving the best of what our health-care system has to offer in terms of drug therapy, non-drug therapy, etc.," Vohra says. "We're adding an adjunct, MBSR, to see if it can help with their coping and resilience, to help decrease anxiety, and to promote feelings of self-capacity."

A second team, led by Jessica Van Vliet, is looking at the qualitative aspects of the treatment—not just if MBSR works, but why and how it works.

The third team is the neuroscientists—Shafer, along with Anthony Singhal and Florin Dolcos. "It's a wonderful opportunity," says Vohra, "to not only look at MBSR's effects through surveys and other measures, but to actually see the way people's brains light up in an fMRI."

In the end, Darren's somewhat tedious afternoon might help improve countless lives. "We're starting with a high-risk group that we think could benefit the most from MBSR," says Vohra, "but the overall population that could benefit is enormous. All children face stress in their lives—all people face stress in their lives. So how can we help them cope better?"

These days, the research in Singhal's lab is a bit more down-to-earth. One project looks at the potential for troubled teens to use cognitive strategies to help alleviate their emotional problems—a technique called mindfulness-based stress reduction (MBSR). Another examines the neural markers associated with the distractions we encounter while driving—a project we could all learn from. "I never use my phone anymore when I drive," Singhal laughs.

Although his field is still in its infancy, even with all of our current advances, Singhal is thrilled to be paving the way for future neuroscientists. "We're at the level of understanding the human brain that they were 150 years ago in terms of understanding how the heart works.

HANG UP AND DRIVE


Michelle Chan

Scientists sometimes struggle to explain the real-world implications of their research. This is not a problem if your subject is distracted driving.

"We're talking about millions and millions of dollars in health care costs, and lost wages, and lawsuits, the substantial social cost," says Anthony Singhal, leader of the U of A's Attention and Action Lab. "The relationship between distraction and injury and death in automobiles is pretty high. It's not as high as alcohol, but it's still pretty high."

Although one particular form of distraction—cell phone use—tends to dominate the discussion these days, Singhal and his team are looking to measure the effects of a distraction at a more basic level, he says. "For example, one of my students, Michelle Chan, is doing a study to look at emotional information on billboards."

In Chan's experiment, people navigate a course on a driving simulator while passing billboards portraying single, emotionally laden words. Surprisingly, even such a simple stimulus can measurably affect people's driving performance, says Chan. "People actually drive faster when they're feeling positive emotional stimuli. For example, words like happy and love. And they drive more slowly when they see negative words, like reject, abuse, hate, crime, etc."

Singhal's researchers also study the underlying neurological mechanisms behind the distractions' outward effects (speeding and slowing down). "We worked out a scenario where they can actually do the simulation in the MRI, so we'll be able to see exactly where in the brain things are happening," says Singhal. "Ultimately, I'd like to get to the point where we can get an ambulatory brain-wave system. It would be nice to be able to put people in a car on a closed course, and monitor brain waves as they're driving."

Distracted driving laws are just one step in making the roads safer, says Singhal. "The research we're doing will be important to inform policy around things like roadway design, and even cockpit design for automobiles."