Winter 2013

GAMBLING RESEARCH REVEALS

ALBERTA GAMBLING RESEARCH INSTITUTE

CONFERENCE 2013: "Research to Practice in Gambling Disorders"

RESEARCH 2013 PRACTICE
IN GAMBLING DISORDERS

The Institute and the University of Calgary are pleased to announce that they are co-sponsoring the Institute's twelfth conference on gambling research to take place on **Friday, April 5 & Saturday, April 6, 2013 at the Banff Centre in Banff, Alberta**. Conference organizer Dr. David Hodgins has arranged a roster of distinguished speakers from Canada, United States, Australia and Great Britain to discuss topics related to the theme ***"Research to Practice in Gambling Disorders."***

Confirmed speakers include Nerilee Hing (Southern Cross, Australia), Michael Wohl (Carleton), John Cunningham (CAMH), David Hodgins (Calgary), Nicki Dowling (Melbourne, Australia), Sherry Stewart (Dalhousie), Rob Williams (Lethbridge), Clayton Neighbors (Houston, USA), Carlos Blanco (Columbia, USA), David Ledgerwood (Wayne State, USA), Henrietta Bowden-Jones (National Problem Gambling Clinic, UK), and Rachel Volberg (Gemini Research, USA). Additional details regarding the conference program will be posted on the Institute's conference 2013 web page as they become available.

Conference registration is now open and can be accessed online from the Institute's home page. Early registration is available until **Wednesday, February 13, 2013**.

Appointment of New AGRI Research Director

The Alberta Gambling Research Institute is pleased to announce the appointment of **Dr. Nady el-Guebaly** to its new position of Research Director. Dr. el-Guebaly has had extensive research experience, including in the field of gambling, and previously served on the Institute Board for a number of years including as Board Chair. In this new capacity, Dr. el-Guebaly will work closely with the Board and researchers to identify and promote collaborative research opportunities, provincially, nationally and internationally, as well as to further develop research capacity in Alberta.

Researchers, scholarship recipients, and interested others will have an opportunity to meet with Dr. el-Guebaly at a series of open meetings being planned for mid-January at the Partner Universities (U of Alberta, U of Calgary, and U of Lethbridge). The exact dates and times will be posted on the Institute website as they are confirmed.

The primary aim of the Alberta Gambling Research Institute, a consortium of the Universities of Alberta, Calgary, and Lethbridge, is to support academic research related to gambling.

MISSION

To facilitate evidence-based broad research that informs gambling public policy and educates Albertans and the wider audience about the effects of gambling.

Lethbridge Graduate Students Informing Our Understanding of the Neural Mechanisms Associated with Behavioural Addiction

Past neuroscience investigations have revealed that there are regions within the brain that are highly associated with decision-making abilities. In fact, a seminal study of decision-making tasks involving a gambling element determined that brain function was markedly poorer for individuals with damage to the brain's prefrontal cortex versus healthy control subjects (Bechara, Damasio, Damasio, & Anderson, 1994). These people exhibited an inability to decide advantageously in situations where an exact calculation of the future outcomes was not possible and choices must be based on approximations. Similarly, problem gamblers tend to perform poorly on this same decision-making task – known as the Iowa Gambling Task – when their scores are compared with those of healthy individuals.

Unlike substance-related addictions, a problem gambler's brain isn't affected by an introduced drug, which means that there must be something else that accounts for differences exhibited as compared to non-problem gamblers. To further understand these factors, University of Lethbridge graduate students Scott Oberg and Catherine Laskowski have been involved in the development of brain-related research investigations on both human and animal subjects.

Scott Oberg Discusses His Recently Published Journal Article on Reward Hypersensitivity During Gambling

Q: How did you become interested in gambling-related research?

Before settling on pursuing academia, I spent some time working in a casino. I was struck by the peculiarities in people's behaviour when they gambled. In particular, I spent a lot of time observing and contemplating people's interactions with slot machines. It seemed odd to me that something that seemed rather simple could have such a pronounced effect on behaviour. Several years later, while doing my undergraduate degree, my interest in gambling was reignited when I realized its usefulness as a tool for understanding the broader topic of human decision making. I joined the lab of Dr. Tata where I began to investigate gambling behaviour from the perspective of cognitive neuroscience.

Q: Why are neuroimaging experiments useful in furthering our understanding of addiction and problem gambling?

Neuroimaging techniques, such as electroencephalography (EEG), allow us to better understand how the brain responds to potentially addictive stimuli and how these responses differ from those in healthy individuals. We are at a stage where neuroimaging is critical for determining whether gambling problems are a result of similar processes to those in substance addiction.

Q: The gambling games used in your experiment were modeled on the Iowa Gambling Task (IGT). Can you briefly explain the IGT?

The Iowa Gambling Task (IGT) is a decision making paradigm wherein a subject chooses between high value bets with a negative long-run expected value (EV), and low value bets with a positive long-run EV. Individuals with frontal cortex damage fail the task due to a perseveration on the high value deck. It was for this function (identifying frontal cortex damage) that the IGT was originally developed but, since its inception, it has been shown to distinguish individuals with several other disorders, including problem gambling. This connection suggested that some variety of frontal cortex dysfunction existed in problem gamblers that could be investigated using neuroimaging techniques.

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Q: Your findings indicate that gamblers are hypersensitive to valence. What might this be telling us?

Valence refers to the outcome of a behaviour that can be classified as positive or negative (wins vs. losses). Within the context of our study, a hypersensitivity to valence refers to our finding that the brain electrical signals associated with valence differentiation occurred sooner in gamblers than in controls. Gamblers seem to be processing feedback from their bets with abnormal rapidity. Parallels can be drawn between this finding and the hypersensitivity observed in the brains of substance abusers with the use of a physical drug being analogous to feedback from a bet.

Q: Your article mentions that gamblers performed significantly worse than controls on the IGT and also that they failed to differentiate high from low risk in their bet selections. Might this be related to sensation seeking?

These data support the notion that gamblers are risk seeking and thus are driven towards the higher value bet. By stating that gamblers did not differentiate risk, we mean that they were insensitive to the actual reward contingencies associated with the bet options. The gamblers behaviour suggests that they based their future actions on a desire for risk rather than on the actual outcomes of their bets. To state it slightly differently, the gamblers were less able to determine the actual probabilities of the game seemingly due to a predisposition towards risky behaviour.

Q: Do finding from your investigation support or differ from other neuroimaging studies of problem gambling?

Although the field is growing rapidly, the number of neuroimaging studies involving problem gambling is still limited. Our findings complement the studies currently out there and provide evidence (by demonstrating hypersensitivity to reward) that likens problem gambling to substance use disorders. The search for neurological evidence to explain the similarities between these two disorders has been a primary focus of the field thus far.

Q: Are you currently involved in a continuation of this research or other investigations?

Currently, my research is focused on how the structural characteristics of electronic gambling machines (EGMs), specifically the near miss, influences human decision making. To achieve this, our lab is investigating the neural mechanisms underlying a subject's evaluation of risk when they are presented with frequent near misses. EGMs that incorporate a high occurrence of near misses may be manipulating normal decision making processes by increasing the perception that inherently uninformative feedback is predictive of future reward.

For additional information:

Scott Oberg is a M.Sc. student in Neuroscience at the University of Lethbridge, in Lethbridge, Alberta. He was awarded an Institute scholarship in 2012-13. His research supervisor is Dr. Matthew Tata.

Bechara, A., Damásio, A. R., Damásio, H., Anderson, S. W. (1994). Insensitivity to future consequences following damage to human prefrontal cortex. ***Cognition, 50***, 7-15. http://dx.doi.org/10.1016/0010-0277(94)90018-3

Oberg, S., Christie, G.J., & Tata, M.S. (2011). Problem gamblers exhibit reward hypersensitivity in medial frontal cortex during gambling. ***Neuropsychologia, 49*** (13), 3768-3775. doi:10.1016/j.neuropsychologia.2011.09.037 http://dx.doi.org/10.1016/j.neuropsychologia.2011.09.037

Catherine Laskowski Developing a Decision-Making Task That Tests a Rodent's Ability to Inhibit Previously Rewarding Behaviour

The November 21st meeting of the University of Lethbridge Gambling Research Group featured a presentation by neuroscience graduate student Catherine Laskowski who discussed her research into the development of the N-Armed Bandit Task in Rats. It involves a paradigm of choices which are associated with differing levels of "reward" (food-based) and "punishment" (i.e., time-out).

In the task itself, a young adult Long-Evans rat is placed into the task-testing environment where it can explore several tunnel-like areas (i.e., "arms"). Each of the three separate arms contains a feeding lever that, when "nosed" by the rat, dispenses a reward. Rewards associated with a particular arm are considered high-, middle-, or low-value. To encourage participation, the rats are at 85% food deprivation.

After receiving a reward, the rat must rapidly return to its original starting position before it can re-initiate the task; if it had not previously selected the high-value arm, it is penalized with a time-out of 10 seconds for having chosen the middle-value arm or 20 seconds for the low-value arm. According to Laskowski, "The rats are punished with a time out if they choose either of the 2 lower-value arms which makes it much more important for them to choose carefully when selecting an arm to collect from… If a rat chooses the low-value arm, not only does he receive the smallest amount of food reward available, but he also loses a lot of time that could be used to collect better rewards." Once the rat has completed a pre-determined number of trials, the arm dispensing the greatest reward abruptly switches. This switch is of critical importance to the test and relates to idea of decision-making in an uncertain environment and the opposing demands of gathering and exploiting information (Daw et al., 2006).

"The N-Armed Bandit tests an individual's ability to disengage from something that was previously rewarding and explore other options when the previous behavior becomes disadvantageous or devalued," said Laskowski. She noted that her early experiments had found that, after a few "exploration" trials, a normal healthy rat is able to determine the arm with the greatest reward and "exploit" it rather than exploring other arms of its test environment. Plotting individual rat choice selections on a graph showed that healthy animals learned to alter their foraging strategies after a particular arm's reward level was diminished. Future stages of her research will involve testing rats with lesions (i.e., damage) to their medial prefrontal cortex. She hypothesized that those rats will perform poorly on the N-Armed Bandit and that the algorithm used to calculate their reinforcement learning scores will show significantly different values than the control group.

Improving our scientific understanding the effects of neurological impairment on the behavior of rats could have important applications for those people who suffer from neurological impairments associated with addiction (e.g., prefrontal hypoactivity). "I believe that it is more difficult for these people than for neurologically healthy individuals to disengage from behaviours related to that addiction even after it has caused significant harm in their lives," said Laskowski. Thanks to these types of investigations in rats, the brain's specific neurotransmitters related to addiction will one day be better understood which increases the likelihood of effective pharmacological treatments being developed.

For additional information:

Catherine Laskowski is a M.Sc. student in Neuroscience at the University of Lethbridge, in Lethbridge, Alberta. Her research supervisor is Dr. David Euston.

Daw, N., O'Doherty, J. P., Dayan, P., Seymour, B., & Dolan, R. J. (2006). Cortical substrates for exploratory decisions in humans. ***Nature, 441***, 876-879. http://dx.doi.org/10.1038/nature04766

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