Affiliate Lab Interview

Amir Raz

Amir Raz, an affiliate of the CCSN, investigates attention, placebos, and altered states of consciousness such as hypnosis. He is Director of the Cognitive Neuroscience Laboratory and Professor of Psychiatry at McGill University in Montreal, Canada.

What research projects are you currently exploring?

By training, I am a cognitive neuroscientist, but I am very interested in many social psychological questions. My research tends to marry these two approaches. One study I recently conducted looked at how people might be influenced by technology. At the beginning of a semester, I asked an advanced class of 160 students studying neuroimaging techniques to participate in a study of new technology for extra credit. The participants walked into a room and were asked to sit in a chair attached to a coiled device that resembled a salon hairdryer. They were told this was a new type of brain scanner. A screen nearby displayed rotating, three-dimensional brain renderings. This whole set up was simply for show. In order to maintain the illusion in the age of Google, we told the participants this technology was based on spintronics, a real system used by physicists-- if they investigated, it may have seemed legitimate.

ABOVE: The Montreal Neurological Institute at McGill University in Montreal

During the experimental task, we asked the participants to think of a two-digit number and keep it secret, just as audience members might do in a magic show. They were then asked to think of their number while our machine completed their brain "scan." Following the procedure, a computer screen displayed the number they were thinking of during the scan, allegedly based on their neural activations. This is patently impossible today. However, there are many standard magicians' tricks employed for this kind of guessing.

Because I employed these sorts of tricks in guessing their numbers, I was almost always able to guess the participant's number correctly. A majority of the participants believed that the brain scanner was reading their thoughts simply because I got the number right.

Two months later, I invited the same participants back for another task, this time in my office. I asked them to think of a two-digit number, and I wrote down a two-digit number on a piece of paper. Because I used the same magician's tricks in guessing their number, invariably, they were the same. Once again, they were surprised. I then asked them how they thought I was able to do this, and they offered many different explanations, ranging in credulity. At the end, I offered an explanation of the trick, using familiar psychological terms like priming, subliminal activation, and contamination. This explanation was inaccurate, but familiar to students of neuroscience and psychology. Just as with the technical devices, the students believed the scientific explanations delivered by an expert, without skepticism. I found similar results when performing similar experiments with my colleagues and graduate students.

EXPERT KNOWLEDGE DOES NOT SEEM TO LIMIT OUR CAPACITY TO BELIEVE WHAT TECHNOLOGY TELLS US.

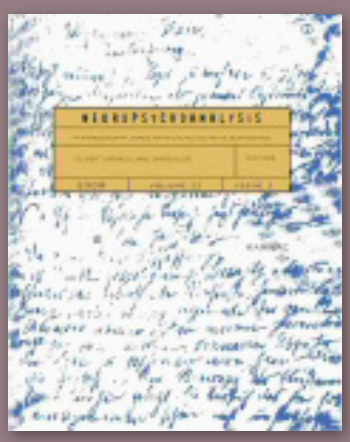
AMIR RAZ

People really believe in technology, particularly when it comes to neuroimaging techniques like fMRI (functional magnetic resonance imaging) or TMS (transcranial magnetic stimulation). We may not always have good reasons to do so, and we must be aware of this bias. The results of these studies were disturbing. Expert knowledge does not seem to limit our capacity to believe what technology tells us.

How does this relate to your research employing hypnosis?

Other experiments look at the neural correlates of agency using hypnosis. Hypnosis is an unusual plane of attention that allows us to create situations where people are unsure whether they are taking actions or things are happening to them. Around 15% of adults are very susceptible to hypnosis. With hypnosis, you can tell a person there is a helium balloon attached to their wrist, and their arm will slowly rise in the air. Of course, there is no balloon, but the atypical attention pattern makes the person raise his or her arm. This effortless effort is very compelling. If you ask someone to raise his or her arm deliberately in the same fashion, and look at brain imaging for

AMIR RAZ: FEATURED PUBLICATION



Raz, A. & Wolfson, J. B. (2010). From dynamic lesions to brain imaging of behavioral lesions: Alloying the gold of psychoanalysis with the copper of suggestion. *Neuropsychoanalysis,* Vol 12(1): 5-18.

Contemporary studies in the cognitive neuroscience of attention and suggestion shed new light on psychoanalytic concepts of yore. Findings from neuroimaging studies, for example, seem to revive the notion of dynamic lesions—focal brain changes undetectable by anatomical scrutiny. With technologies such as brain imaging and reversible brain lesion, some findings from modern biological psychiatry seem to converge with nineteenth-century psychiatry, reminiscent of the old masters. In particular, suggestion has been shown to modulate specific neural activity in the human brain. Here we show that "behavioral lesions"—the influence that words exert on focal brain activity—may constitute the twenty-first-century appellation of "dynamic lesions." While recent research results involving suggestion seem to partially support Freudian notions, correlating psychoanalysis with its brain substrates remains difficult. We elucidate the incipient role of cognitive neuroscience, including the relative merits and inherent limitations of imaging the living human brain, in explaining psychoanalytic concepts.

WE ARE JUST BEGINNING TO UNDERSTAND THE POWER OF THESE EFFECTS, BUT THE PROMISE THEY HOLD COULD BE EXTRAORDINARY.

AMIR RAZ

each situation, the activation is completely different. You can generate different neural patterns and neural correlates of the same movement, even with very simple paradigms.

With hypnosis, the experimenter manipulates the subject, as opposed to manipulating the experiment. In experimental cognitive neuroscience or cognitive psychology, most researchers do experiment A and then do experiment A "with a twist" and call it experiment B. They then look at the differences between the results. With hypnosis, people can do the same thing twice, but the context changes via the power of suggestion. In these cases, I am relying on changing the person, not changing the experiment. This social manipulation has produced results different from other psychological experimental methods.

How might these studies be applied?

Harnessing some of this work in attention therapeutically would be very rewarding. One area where the power of suggestion can be applied is with Tourette's syndrome patients. Individuals with Tourette's syndrome suffer from vocal ticks and motor ticks-- sometimes very simple, sometimes fairly complex. These can be very difficult to control and disruptive to everyday life. However, many individuals with Tourette's can control their ticks for a short period of time, usually a matter of minutes, if given a significant incentive. After this short time, the ticks come back, often as a rebound effect, with many ticks occurring at once.

Some years ago, I noticed that when Tourette's patients engage in tasks they particularly enjoy, like playing a game, reading, or watching a movie, they tick less. It appeared there was an interesting correlation between attentional investment and ticks. I wanted to see if attentional training might help these patients.

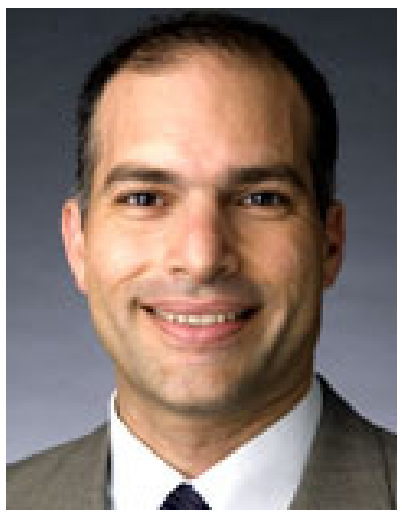
I decided to apply some of the work we had done with attention to Tourette's patients in the lab. I would bring out an elaborate machine: an old video camera on a tripod complete with many complicated lights, meters, and knobs. I tell the subjects, both adults and children, that this is a tick detector. I tell them that it can tell me when you are about to experience a tick. This is a tautology, because they tick very frequently. I tell the participants that the machine says they are going to tick very soon, and they do, seconds or minutes later, reinforcing what I have told them. I then tell them I am going to turn on the tick-deflector function of the machine. I tell them the deflector will be able to sense the oncoming ticks and deflect them, and if the deflector is able to deflect a tick, they will hear a beep. The machine can be interpreted different ways-- either more sensitive than the participant, sensing and dismissing ticks that they do not feel, or predictive of the participant's ticking behavior. Because they hear a tone, they learn to associate machine's beeping with control of their ticks, and they tick less. This sense of control can be very helpful, as it allows them to control their ticks for an extended period of time with no rebound effect. The therapeutic role that such a device could have could be very powerful.

What future directions do you see for this research?

More and more often, we are finding that expectations and mental state can have substantial effects in shaping and forming a person's physiology and creating certain measurable changes in neural circuitry. This is especially notable because this is a top-down effect. Traditionally, medicine and neuroscience have looked at bottom-up effects. Take, for example, the way our body responds to a mosquito bite. A mosquito bites us, and our body produces a histamine reaction, which communicates to peripheral nerves through our central nervous system to our brain. The field has been oriented to understanding these processes. Neuroscience is just beginning to examine a system that begins in the brain, with signals traveling through the nervous system, those messages changing the way the system is performing. In this regard, the social sciences have a lot to offer neuroscience and may help to push the field beyond its reductionist beginnings. This is an important step for any paradigm. We are just beginning to understand the power of these effects, but the promise they hold could be extraordinary. ■

BELOW: The "brain scanner" used in Raz's experiments

BELOW: Amir Raz, Professor of Psychiatry at McGill University



RECENT SELECT PUBLICATIONS FROM THE RAZ LAB

Raz, A., Schweizer, H. R., Zhu, H., & Bowles, E. N. (2010). Hypnotic dreams as a lens into hypnotic dynamics. *International Journal of Clinical and Experimental Hypnosis*, Vol 58(1): 69-81.

Raz, A., Packard, M. G., Alexander, G. M., Buhle, J. T., Zhu, H., Yu, S., & Peterson, B. S. (2009). A slice of *pi*: An exploratory neuroimaging study of digit encoding and retrieval in a superior memorist. *Neurocase*, Vol 15(5): 361-372.

Raz, A. (2009). Varieties of attention. In Berntson, G.G. (Ed.) & Cacioppo, J. T. (Ed.), *Handbook of neuroscience for the behavioral sciences, Vol. 1* (pp. 361-369). Hoboken, NJ, US: John Wiley & Sons Inc., xvi, 613 pp.

Greene, D. J., Barnea, A., Herzberg, K., Rassis, A., Neta, M., Raz, A., & Zaidel, E. (2008). Measuring attention in the hemispheres: The lateralized attention network test (LANT). *Brain and Cognition*, Vol 66(1): 21-31.

Raz, A. (2008). Genetics and neuroimaging of attention and hypnotizability may elucidate placebo. *International Journal of Clinical and Experimental Hypnosis*, Vol 56(1): 99-116.