RESEARCH FOCUS

photo by Sally McCay

LOOKING AT LEARNING

Psychology's Mark Bouton explores mesh of memory and behavior
by Lee Ann Cox

The journal Nature recently published an article referencing phenomena that psychology professor Mark Bouton discovered—principles of extinction of fear or unwanted behaviors—without crediting his past work or publications. Far from a slight, it said a lot about him, more than twenty years at the vanguard of his field, doing research that's followed closely by other experimentalists, clinical psychologists, and neuroscientists. His findings are fact. "I think now everybody accepts these phenomena as the truth," says Bouton. "It's almost cool not to be cited."

Bouton's pioneering work, connecting neural events and human behavior, has made him an in-demand speaker and contributor to journals where he translates basic experiments into insights that may lead to better treatment for issues like anxiety disorders and drug addiction. But his message isn't always what clinicians hope to hear. Blame it on Pavlov.

The quest to understand the basic mechanisms of learning, memory, and emotion is grounded in classical conditioning, the theory made famous by the Russian physician Ivan Pavlov and his work with dogs, bells, and food.

Far from being consigned to psychological history, Pavlov's work has direct, and vexing, implications for modern treatments like exposure therapy. The Russian scientist discovered that extinction, the process of teaching those dogs that a bell no longer means food, is a way of inhibiting the original learning, not erasing it as the word seems to imply. Bouton's leading

contribution was the discovery that extinction learning is dependent on the context or environment in which it is learned. Leave the therapist's office or rehab clinic and the lurking habit, fear, addiction becomes the default, explaining the prevalence of relapse. And context, Bouton warns, is far more complex than just physical space; it encompasses drug state and even time.

The latter two elements, in fact, with a five-year, $1.3 million grant from the National Institutes of Health, are now the focus of Bouton's lab. Timing is the more abstract piece—and the one that excites Bouton the most as an experimentalist. Using rats, he spaces exposure trials at different intervals, teaching them a rhythm of sorts. At a particular spacing, they may achieve extinction. But present the extinction cue at another interval and the rat discriminates between the intervals ("This is not what I learned," the rat thinks) and will show spontaneous recovery of the old learning.

"The wrinkle is, animals, and I think people are probably the same, tend to generalize extinction from a long interval to a short interval but not from a short interval to a long interval," Bouton says. "So if you get exposure therapy with closely spaced trials, when there's a long interval to the next trial you might see a relapse."

Drug state is a hotter, more controversial piece of Bouton's findings. Clinicians have embraced D-cyclo-serine, a drug (and there are potentially many more to come) that facilitates a receptor in the brain associated with learning processes including extinction. It's already being studied in people with fear of heights, social phobias, and obsessive-compulsive disorder. Bouton has used D-cycloserine in rats and his results, some of which were published as early as 2006, have shown that it can facilitate the rate of extinction learning but not in all cases and when it does, others have shown, subjects quickly become tolerant to it.

The more crucial point is that the drug does not eradicate the essential truth about extinction: new learning is still context specific and therefore just as subject to renewal. "(Drugs) might facilitate the rate you learn something," says Bouton, "but it doesn't mean that what we know about learning from a behavioral perspective goes out the window."

Despite the fact that Bouton's work might be cautionary for clinical psychologists, many have gotten the message and started to work on ways to help patients bring a new learning context into the places where their problems actually occur. Thomas Brandon, director of the Tobacco Research and Intervention Program at the H. Lee Moffitt Cancer Center & Research Institute at the University of South Florida, heard Bouton speak more than a decade ago:

"Mark was doing more basic research that most addiction researchers weren't paying attention to," says Brandon, explaining that many were stymied by the fact that cue exposure therapy—exposing addicts repeatedly to the stimuli that make them crave drugs (again, think Pavlov ringing the bell)—worked in the clinic but not elsewhere.

Now Brandon and others are using an idea of Bouton's to extend extinction outside of the clinical setting: an "extinction-memory retrieval cue," a tangible reminder that could be taken anywhere. A researcher at Duke, for instance, initiates exposure through a highly realistic virtual reality experience of a crack house, then, as he reduces patients' cravings plays a series of tones. He then gives them a cell phone—they get calls playing the tones and can call in to hear them. Early findings indicate self-reported cravings for cocaine are reduced on hearing the tone.

Bouton's deepest interests lie in answering fundamental questions but he also believes his work can be a bridge to the life-changing work clinicians seek. "I think it's an obligation of

basic scientists, frankly," he says. "I tell my graduate students: it's nice to be testing all these cool theories, but it has a bigger meaning."

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