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Microscopic Microeconomics

By JONAH LEHRER

In the last decade or so, the American economy has been undone by a series of bubbles. First there was the dot-com boom, in which start-ups without business models were suddenly worth billions of dollars. Then after a brief [recession](#), we began speculating about real [estate](#), so that Las Vegas tract homes tripled in value before they even had roofs. The latest suspect for a bubble is gold, which has doubled in price over the past three years.

Why are bubbles such a persistent feature of financial history? Economists argue that these speculative frenzies are caused in part by market failures like too much liquidity or lax regulation. Cognitive [psychologists](#), meanwhile, see bubbles as a case of pattern recognition gone awry, as people extrapolate the past into the future. In recent years, neuroscientists also have become interested in bubbles, if only because the financial manias seem to take advantage of deep-seated human flaws; the market fails only because the brain fails first. Read Montague, at Baylor College of Medicine, has spent the last few years trying to decipher the bits of brain behind our

irrational exuberance. It's microeconomics at its most microscopic.

Montague's experiments go like this: A subject is given \$100 and some basic information about the stock market. After choosing how much money to invest, the player watches as his investments either rise or fall in value. The game continues for 20 rounds, and the subject gets to keep the money. One interesting twist is that instead of using random simulations of the market, Montague relies on real data from past markets, so people unwittingly "play" the Dow of 1929, the S&P 500 of 1987 and the Nasdaq of 1999. While the subjects are making their investment decisions, Montague measures the activity of neurons in the brain.

At first, Montague's data confirmed the obvious: our brains crave reward. He watched as a cluster of **dopamine** neurons acted like greedy information processors, firing rapidly as the subjects tried to maximize their profits during the early phases of the bubble. When share prices kept going up, these brain cells poured dopamine into the caudate nucleus, which increased the subjects' excitement and led them to pour more money into the market. The bubble was building.

But then Montague discovered something strange. As the market continued to rise, these same neurons significantly reduced their rate of firing. "It's as if the cells were getting anxious," Montague says. "They knew something wasn't right." And then, just before the bubble burst, these neurons typically stopped firing altogether. In many respects, these dopamine neurons seem to be acting like an internal thermostat, shutting off when the market starts to overheat.

Unfortunately, the rest of the brain is too captivated by the profits to care: instead of heeding the warning, the brain obeys the urges of so-called higher regions, like the prefrontal cortex, which are busy coming up with all sorts of reasons that the market will never decline. In other words, our primal emotions are acting rationally, while those rational circuits are contributing to the mass irrationality.

This is a costly mental mistake. Montague notes that investors who listened to the prescient dopamine neurons would earn much more money than the typical subjects, largely because they would get out of the market before it was too late. “It’s crazy to think that there’s a signal in our head that’s so much smarter than we are,” Montague says.

While these data contain plenty of caveats, they nevertheless provide an important insight into how the brain makes sense of the marketplace and why we sometimes get swept away by speculation. The mind is not a single voice but an argument, a chamber of competing voices, and a bubble occurs when we listen to the wrong side.

Unfortunately this tendency is exacerbated by other people. Montague has also found, for instance, that subjects in the investment game are extremely vulnerable to what he calls “the country-club effect,” which occurs when we try to make more money than someone else. “This is what happens when you’re sitting around with your friends at the country club or watching cable TV, and everybody is talking about their huge profits,” he says. “Those

conversations are going to change the way you think about risk.”

Men seem especially vulnerable to this foible: When they competed against strangers, they were much more likely to get swept away by the financial speculation.

Montague says he hopes that someday the neuroscience of bubbles will help us stop the speculation before it spirals out of control. “The only way we’re going to avoid the next bubble is by understanding why people start bubbles in the first place,” he says. “The Fed should buy a brain scanner.”

Jonah Lehrer is the author, most recently, of “How We Decide.”