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## Neuromagic: The neuroscience behind magic tricks

Magicians are very protective of their secrets. To join a professional organization of magicians, initiates must swear an oath not to reveal any illusion secrets to a non-magician. Yet, a few years ago neuroscientists [Stephen L. Macknik](#) and [Susana Martinez-Conde](#) convinced several well-known magicians to work with them on their study of neuromagic, or the neuroscience behind magic.

On Thursday, Nov. 18, Macknik and Martinez-Conde spoke about what they learned to a packed audience at the New York Academy of Sciences, as part of the Academy's popular [Science and the City](#) program. The talk, based on their book, [Sleights of Mind](#), focused on illusions, defined as "a subjective perception that does not match the real world," which they believe are critical to understanding how our brains construct visual experience.

Illusions can be divided into optical and visual, explained Martinez-Conde. The difference is that optical illusions happen in the real world, while visual illusions occur in the sensory/visual areas of the brain. The example she gave of a visual illusion is the waterfall illusion; after staring at a waterfall for about a minute and then shifting your gaze to stationary objects nearby, such as rocks, they appear to flow upwards.

The explanation, according to Martinez-Conde, is that neurons that detect downward motion become adapted to the movement of the water and therefore become less active. At the same time, the neurons that detect upward motion remain active. The balance of the two sets of neurons is then thrown off, resulting in your brain's conclusion that something is moving upwards.

The second half of the talk was largely devoted to change blindness, an issue of attention where people don't notice a change in a scene. Macknik showed the audience [a video](#) of a basketball game, asking the audience to count the number of passes between the team in the white uniform. While many audience members (myself included) correctly counted the number of passes, what we didn't see is the entrance of an unexpected character into the game (you'll have to watch the video).



This inability to see something so seemingly obvious, explained Macknik, is because the brain has a spotlight of attention. In *Sleights of Mind*, Macknik and Martinez-Conde describe how the spotlight can affect the visual system, as well as the other sensory systems and cognitive functions.

"Your spotlight is directed to a region of your cortex and enhances the activity carried out in that region...It not only increases the neural signals at the center of your spotlight, it also suppresses the activity in the surrounding region."

It's easy to see how this spotlight helps a magician in performing illusions and other feats of wonder. Misdirection, paired with other tactics, such as timing, social cues, and humor allow magicians to control what we see and experience. This also helps to explain why people, in general, are not good at multi-tasking.

To view [several videos](#) (sponsored by *Scientific American*) of magicians working their wonders, please visit the *Sleights of Mind* Web site.

--Ann L. Whitman

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