How our Senses Combine to Give us a Better View of the World

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From a young age we are taught about the five senses and how they help us to explore our world. Although each sense seems to be its own entity, recent studies have indicated that there is actually a lot of overlap and blending of the senses occurring in the brain to help us better perceive our environment.

Researchers J.E. Lugo, R. Doti and Jocelyn Flaubert from the University of Montreal, along with Walter Wittich from McGill University, wanted to know if a feeling from an electrical stimulation of a body part (such as the leg) which normally would not be perceived, would be felt if it was simultaneously accompanied by a visual or auditory signal. The researchers studied this by applying slight electrical stimulation to the right calf of volunteers—the stimulation was so slight that it was not detected by the participants. The researchers then paired that electrical stimulation simultaneously with a visual signal, a distinct noise or a progressively louder white noise signal. The volunteers reported when they felt anything in their leg and the electrical response of the calf muscle activation was measured.

The results, reported in *Psychological Science,* a journal of the Association for Psychological Science, reveal that if an electrical stimulation of the leg is not initially detected, this sensation may be perceived by the addition of a visual or auditory signal with a corresponding electrical activation increase. The results described in this study indicate that the brain not only constantly processes information received from the senses, but also acts on that information to change what is happening in the peripheral system, and thus changing what we actually detect.

The results of the last experiment are characteristic of stochastic resonance. This is an interesting phenomenon where as noise is added to a system, the system's performance improves until, at a certain point, the performance begins to deteriorate. This is exactly what the researchers found in this study—as they increased the signal, participants reported more feeling in their leg, but this eventually decreased, even as the signal continued to get louder. They found this resonance signature even if the stimulus they used in this experiment was not noise but a pulse. These results show that a tactile stimulus combined with a specific level of auditory stimulation results in optimal detection of that sensation. However, too much signal energy will limit the response. It also shows that these dynamics represent a fundamental principle of multisensory integration.

This study gives us more insight into multisensory integration, which the authors argue, will result in increased knowledge of how the brain normally interacts with the peripheral system. In addition, learning more about multisensory integration will lead to a better understanding of disorders such as autism, in which altered sensory processing often occurs.