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## *Making Space*

*How the Brain Knows Where Things Are*

**Jennifer M. Groh**

*“A terrific book; very imaginative, yet based on solid science.”*

—Michael Gazzaniga, author of *Who’s in Charge?*

*“Making Space is written with a light touch, but with impeccable scholarship. It is extremely readable.”*

—Randy Gallistel, Rutgers University

Knowing where things are seems effortless. Yet our brains devote tremendous computational power to figuring out the simplest details about spatial relationships. Going to the grocery store or finding our cell phone requires sleuthing and coordination across different sensory and motor domains. *Making Space* traces this mental detective work to explain how the brain creates our sense of location. But it goes further, to make the case that spatial processing permeates all our cognitive abilities, and that the brain’s systems for thinking about space may be the systems of thought itself.

Our senses measure energy in the form of light, sound, and pressure on the skin, and our brains evaluate these measurements to make inferences about objects and boundaries. Jennifer Groh describes how eyes detect electromagnetic radiation, how the brain can locate sounds by measuring differences of less than one one-thousandth of a second in how long they take to reach each ear, and how the ear’s balance organs help us monitor body posture and movement. The brain synthesizes all this neural information so that we can navigate three-dimensional space.

But the brain’s work doesn’t end there. Spatial representations do double duty in aiding memory and reasoning. This is why it is harder to remember how to get somewhere if someone else is driving, and why, if we set out to do something and forget what it was, returning to the place we started can jog our memory. In making space the brain uses powers we did not know we have.

**Jennifer M. Groh** is Professor in the Department of Psychology and Neuroscience and the Department of Neurobiology at the Center for Cognitive Neuroscience at Duke University.