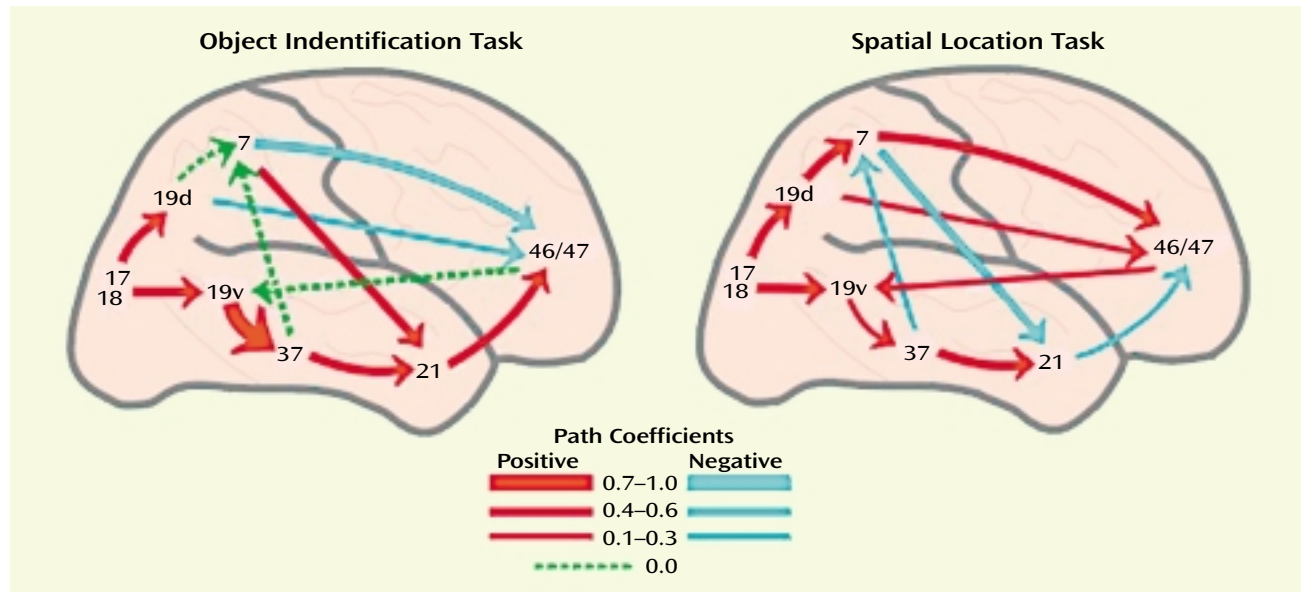


Neural Networks



Graphic representation of the object vision and spatial vision functional networks in the right hemisphere. Excitatory (positive) pathways are shown in red; inhibitory (negative) pathways are shown in blue. The width of the arrows reflects the strength of the pathway. Green paths are hypothesized connections that measured at or near zero when tested in this model.

Neural Systems I

Brain behaviors (cognitive, motor, and affective) are the direct result of the operations of distributed neuronal networks in the central nervous system (CNS). Although the analysis of functional imaging data is often restricted to the comparison of activity in distinct CNS regions, the overall behavior output depends on the interaction of related neural regions. New analytic techniques are emerging for application with functional mapping data to derive task-specific neural systems. The statistical technique, called structural equation mapping, is based on correlational analysis and employs the fundamental assumption that brain areas related to each other will have highly correlated, task-specific activity. Structural equation mapping furthermore assumes that the pattern of correlations between brain areas is mediated through direct and indirect anatomic influences.

Illustrated here are the results of a structural equation mapping analysis of a positron emission tomography regional study of cerebral blood flow in which subjects performed a visual perceptual matching task regarding either object identification or spatial location. Regions were selected for analysis on the basis of task-dependent changes in activity, interregional correlations, and known neuroanatomic pathways. In the object identifica-

tion task, interactions along the ventral pathway from Brodmann's area 19v (visual association cortex) through Brodmann's area 37 (inferior temporal cortex), extending to Brodmann's area 46 (frontal cortex), were dominant. In the spatial location task, interactions along the dorsal pathway from Brodmann's area 19 through Brodmann's area 7 (superior parietal cortex) to Brodmann's area 46 were increased relative to interactions during the object vision task. The inhibitory (negative) correlation influences on the frontal cortex during the object identification task came from the dorsal pathway, and they came from the ventral pathway during the spatial location task. The same visual signal is selectively passed on to the appropriate pathway on the basis of the specific requirements of the task (object identification versus spatial location). The brain regions that form the pathways from the visual association cortex to the frontal cortex are thought to provide specialized processing of the signal to facilitate performance of the specified task.

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