

HHMI Research - Summer 2013
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Behavioral Research in the Handedness and Imitation of *Cebus apella* Monkeys

Student researchers will be involved in several projects related to handedness and cerebral lateralization in *Cebus* monkeys. The research is based on theories about the evolution of cerebral lateralization and handedness in nonhuman primates. Monkeys have learned to perform a variety of tasks that involve different variables related to handedness, such as task complexity, familiarity, and whether the task is unimanual or bimanual. Degree of handedness is measured by a Handedness Index ($[(R - L) / (R + L)] \times 100$), and strength of handedness is reflected in binomial z-scores for each monkey for each task.

Two main projects are planned for Summer 2013. In the first task, monkeys will be trained on five different tasks that will be performed either alone or in a continuous sequence. A large body of research shows left-hemisphere dominance for language in humans, which has been related at least partly to the sequential nature of linguistic communication (spoken or written). We hypothesize that sequential tasks evoke left-hemisphere dominance, so that the monkeys will show a stronger right hand preference (left-hemisphere control) when the tasks are performed in a sequence than when each task is performed alone. We further hypothesize that a sequence of *novel* tasks will show stronger hemispheric effects than a sequence of *familiar* (more habitual) tasks.

In the second project, monkeys will be tested in a series of tasks to evoke imitation in the *Cebus* monkeys. Most research has suggested that monkeys (as opposed to some ape species, especially chimpanzees) do not show good imitative skills. But some recent research by Whiteman's group at Stirling University in Scotland, as well as the team of Dorothy Fragaszy (Georgia) and Visalberghi (Institute of Cognitive Sciences and Technologies, Rome) have shown that under some conditions, monkeys do show some signs of imitative behavior. Recent studies with the capuchin monkeys at the college have confirmed that monkeys' ability to imitate *spontaneously* is limited. Research during the summer of 2013 will test whether monkeys can be trained to attend to a human model and imitate the model's action. A large battery of simple tasks is planned, each of which involves two models performing two different but equally effective actions on some container to procure a small food reward. For example, one model will open a flap on the *top* of a small box to retrieve a treat, while the other model will open a flap on the *side* of the box. On each trial, only one of the models will open the box. Then a treat will be placed in the box, and we will record what kind of action a monkey uses to retrieve it – imitation or nonimitation of the model's behavior. Only ten trials per object will be presented, and then a new kind of container will be presented, with two new kinds of actions that the two models can perform. The objective is to train a "learning set" of imitative responses: over the series of tasks we hypothesize that the monkeys will become more likely to attend to the specific action performed by each model across a wide variety of tasks, and will therefore show more tendency to imitate the action of each model on a given trial. Further imitative studies are planned, contingent on the results of the experiment described here. For example, we plan to capitalize on some earlier handedness training we have done with the monkeys in which they retrieve a washer or poker chip and hand it back to us. In the imitative study, we will have the monkeys watch a model place a token (washer or chip) in one compartment of a multi-compartment box. Then the model will remove the token and hand it to the monkey. If the monkey puts the token in any compartment, it will receive a small, less-preferred reward (e.g., a Cheerio). But if the monkey places the token in the *same* compartment as the model has done previously, then the monkey will receive a larger, more-preferred reward (e.g., a grape). We predict that under these circumstances, the monkeys will be rewarded for attending to and imitating the model, and will become more successful at imitative behavior. If this is successful, we will test to see whether this learned capacity for imitation will *transfer* to novel tasks. If so, this will provide some of the first evidence that, with some training on the *concept* of imitation, monkeys *can* spontaneously imitate a model in a novel task.