Scale Errors:
Why youngsters try to do impossible things

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When you see a small child try to fit into or on top of a doll-sized toy, you're likely to laugh. That's exactly what three co-investigators of a new study initially did when their own toddlers attempted to fit into a toy car, a miniature room and a doll's crib.

This 21-month-old child has committed a scale error by attempting to slide down a miniature slide.

Based on those personal observations, as well as their research as developmental psychologists interested in how young children understand symbols, the researchers from the University of Virginia, Northwestern University and the University of Illinois at Urbana-Champaign set out to understand why youngsters, who actually know better, make such dramatic mistakes about scale.

Not to worry, moms and dads. The study of 18- to 30-month-old children, published in the May 14 journal Science, found these kinds of errors – scale errors – to be common in this age group. Videotapes show many participants in the research seriously trying to slide down miniature slides, squeeze into tiny toy cars and sit in dollhouse chairs.

"Even infants can discriminate the size of objects, so the question is why children sometimes ignore the fact that the objects are so small," said David Uttal, associate professor of psychology at Northwestern and study co-investigator

The provocative part of the answer to that question fits with theories that implicate two neurally and functionally distinct brain systems underlying the use of visual information. One brain area is involved in the visual recognition and categorization of objects ("That's a chair.") and with planning what to do with them ("I'm going to sit down."). A different area is involved in the perception of object size and in the use of visual information to control actions on objects.

The children's dramatic failures to use size when interacting with familiar objects may reflect immaturity in the interaction of these two brain systems, said Judy DeLoache, Kenan Professor of Psychology, University of Virginia, and lead author of the study.

"In scale errors, the usual seamless integration between the two systems in the brain momentarily breaks down, and the size of an object is not incorporated into a child's decision to act on it," she said. "However, once the action begins, children do use size information to adjust their motor behavior."

In deciding to get into the miniature car, children ignore how small it is, but then they accurately open its tiny door and aim their foot directly at its impossibly small opening. "There's a dissociation between the use of size for planning actions versus controlling those actions."

"One reason this is so interesting is that similar kinds of dissociations occur in various neurological impairments in adults, but they have rarely been studied in healthy young children," said Karl S. Rosengren, professor of psychology at the University of Illinois at Urbana-Champaign and study co-investigator.

The study also suggests a failure of inhibitory control, implicating immaturity of the prefrontal cortex. It is well established that infants and young children have great difficulty inhibiting inappropriate responses. In the case of scale errors, an action appropriate for one object is inappropriately directed to its replica.

The Science study's implications are important for understanding both the perception-action dissociation in behavior of normally developing young children and the early development of inhibitory control. The precise nature of the breakdowns and factors that influence their occurrence will be the focus of future research.

The study of 54 children, 18 to 30 months old, was conducted at the University of Virginia's Child Study Center (go to http://www.faculty.Virginia.edu/childstudycenter/ and click on "Current Projects" to find video clips of the children in the study).

The youngsters were given experience in a playroom with three large objects followed by exposure to miniature replicas that were identical except for size. They were observed interacting with an indoor slide they could walk up and slide down, a child-sized chair they could sit in and a car they could get inside and, with their feet, propel around the room.

The children were then taken for a walk, and when they returned to the room, they found the miniature replicas in place of the larger objects. If they did not spontaneously interact with the replicas, the experimenters drew their attention to them without commenting on their size. From videotapes of the sessions, the investigators identified a total of 40 scale errors committed by 25 of the 54 children.

Scale errors were coded whenever a child made a serious attempt to perform on a miniature object the same actions they had done with the large one. Persistence in trying to carry out the impossible action, such as trying repeatedly to squeeze a foot through a tiny car door, was a particularly clear sign of serious intent. Scale errors were clearly distinguishable from pretend play with the objects.

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