

## How space binds objects and words

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The real world contexts in which children learn object names is one in which multiple objects compete for attention, in which attention is often shifted from one object to another in rapid succession, and in which objects often move in and out of sight. Yet children seem to keep track of individual objects and intended referents. This paper presents evidence that young word learners (15 month olds) keep track of objects through a system of implicit deictic reference whereby attention to particular locations in space is used to define and index individual objects.

Our task is borrowed from a prior study by Baldwin. In our version, the child is first presented with a novel object at the A location (e.g., on the left) and attention is directed to that object without naming. The child is then presented with a different object at B (e.g., to the right) and attention is directed to that object. Each object is then hidden: the A object in a bucket at location A and the B object in a bucket at location B. A delay period (3 to 5 sec) then intervenes. The experimenter then directs attention to one bucket (e.g., A) and offers a name (e.g., “There is a dax “). In Experiment 1 (as in Baldwin’s study), the experimenter then immediately shifts attention to the other bucket (at location B) and pulls object B from the bucket and into view such that the naming event is most closely linked by space to one object (A) but by time to the other (B). Children were subsequently presented with both objects in a neutral location and asked to get one by name. They consistently chose the object most closely linked to the name by location, not by time. Four subsequent experiments using a similar procedure (except children were never shown which objects had been hidden in which buckets) showed that location is a strong force binding objects and intended referents: Without a spatial link, that is attention to the same location in space, 15 month olds cannot map names to objects. Moreover, children take the name as referring to any (and all) objects coherently linked to the attended location to which the name is offered. Finally, children can track an object (an intended referent) over multiple locations if the path of motion is spatially and temporally coherent. The structure of the task and children’s interpreted referents are highly reminiscent of infants perseverative errors in the A not-B task. However, here, spatial coherence organizes intended referents (rather than generating errors). In the discussion, we note that the use of space to bind objects to intended referents is characteristic of gestures and also American Sign Language. We suggest that this is because *attention* provides a momentary reference to an object and a location (or path) in space and in so doing binds individual objects to cognitive processes.