

The Abstract: Little children do not seem to think the way adults. The task in studies of cognitive development is three-fold:

- 1) Describe the starting point: What capabilities is the baby born with?
- 2) Describe the end point: What is the adult behavior that needs explanation?
- 3) Describe the developmental course: How did we get from start to end?

In this lecture, we will look at three specific examples:

- 1) Numerical ability: Where does math come from?
- 2) Animism: Why do children say the clouds are alive? How do concepts develop?
- 3) Egocentrism: How and when can children appreciate the contents of another mind?

In each case we will see that there are (probably) innate building blocks and a progression toward an adult state that is not fixed.

Lecture Notes:

If you get a new computer off the shelf, it "thinks" like an adult computer. This is not true of an off-the-shelf baby.

Three classic demonstrations come from the work of Jean Piaget.

- 1) Failure to conserve number
- 2) Childhood animism
- 3) Egocentric behavior

NUMBER:

Three aspects of number

- 1) Numerosity – the difference between more and less for big amounts
- 2) Subitizing - instant appreciation of from one to about four items
- 3) Counting – on to infinity

Numerosity

Infants can discriminate between 8 & 16 (for example)

Xu F, Spelke ES. 2000. Large number discrimination in 6-month-old infants. *Cognition* 74: B1-B11

Subitizing

Karen Wynn's great experiment

Wynn, K. (1992). Addition and subtraction by human infants. *Nature*, 358, 749-750.

Baby math in the subitizing range.

How do we know that babies know that $1+1 = 2$?

Counting to infinity

Waits for language

How does counting develop?

Step 1: Counting without meaning

Step 2: Counting a small number of countable things

Step 2.5: 6 is lots but "six" is not the same as "lots"

Step 3: Induction

But not for everyone, apparently

Gordon P. 2004. Numerical Cognition Without Words: Evidence from Amazonia.

ScienceExpress / www.scienceexpress.org / 19 August 2004 / 10.1126/science.1094492

ANIMISM - The problem of concepts

Who is alive?

Problems with the concept of "alive"
(Can you define it?)

Asking more carefully

Does the sun breath?
Does the sun have babies?

Teaching a new property

Sue Carey teaches kids about the omentum.

Conclude: Children have categories even if not the adult categories

What are the foundations of these categories?

Two examples

- 1) a concept of object
- 2) a concept of the "essence" of an object

OBJECT

Elizabeth Spelke and the (probably) innate understanding of objecthood

Why was that duck going into that tube?

ESSENCE

Gelman, Susan. A. (2004). Psychological essentialism in children. *Trends Cogn Sci*, 8(9), 404-409.

Suppose we took a skunk and changed his skin into raccoon skin so that he looked just like a raccoon: Would he be a raccoon?

Is essence learned?

Suppose we took a kangaroo baby and had it raised by goats: Would it have a pouch? Would it be a hopper or climber?

EGOCENTRISM & the problem of mind reading

The three mountain problem

Simplify to Grover in his car.

Simplify to mommy her sunglasses and even a 2 yr old knows what mommy sees.

And adults have problems, too: The "curse of knowledge"
Birch, S. A., & Bloom, P. (2004). Understanding children's and adults' limitations in mental state reasoning. *Trends Cogn Sci*, 8(6), 255-260.

The false belief task

The basic task:

Bug Bird puts candy in cupboard.
Grover moves it to drawer. (with child watching)
Bug Bird comes back.
Ask the child: Where should Big Bird look?

Variation 1: Guessing is easier than seeing

Sort of Variation 2: When is a banana a telephone?

Variation 3: What if Big Bird takes a picture?

What is going on?

Some possible connections to
the Loftus false memory experiment with the stop sign.

the capacity of working memory

SUMMARY:

For number:

An innate endowment for small numbers and for quantity
Counting relies on language
All those pieces, combine synergistically to make adult abilities

For animism (or concepts more generally)

An innate endowment for objects and their essences
But understanding is "wrong" in important ways and so you need to learn the true meaning of concepts like "alive"

For egocentrism (and mind reading, more generally)

Maybe an innate ability to know something of the contents of another mind.
But, even as an adult, you have a bias toward the contents of your own mind.
And adult mind reading might require something like adult working memory capacity