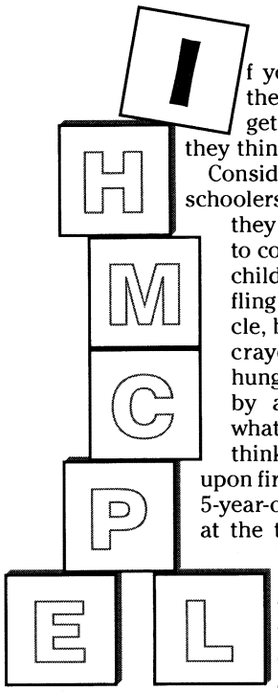
A Child's Theory of Mind

Mental life may change radically around age 4

By BRUCE BOWER



If you think kids say the darnedest things, get a load of what they think.

Consider a group of preschoolers shown a box that they all agree appears to contain candy. Each child gets a chance to fling open the receptacle, but only a stash of crayons greets their hungry glares. If asked by an experimenter what someone else will think the box contains upon first seeing it, 4- and 5-year-olds typically grin at the trick and exclaim "Candy!"

They realize, in their devilish way, that the shape and design of the box at first create a false belief.

Yet most 3-year-olds react entirely differently to the trick box. After falling for the sweet deception, they insist that a newcomer will assume crayons lie within the container. If an adult enters the room, peers into the box, and does an obvious double take, 3-year-olds still maintain that the grown-up expected to find crayons. What's more, the same youngsters confidently assert that they, too, initially thought the box held crayons.

Of course, 3-year-olds cherish cantankerous and contrary remarks, but further experiments indicate that a deeper process orchestrates their explanations of the world.

Observe, for instance, preschoolers given some toys purchased at a novelty store: a large sponge shaped and painted to look like a rock, a "sucker" egg made of chalk, and a green cardboard cat covered by a removable red filter that makes it appear black. Give them plenty of time to examine the objects. Most 4- and 5-year-olds separate each object's real qualities from its apparent attributes; they note, for instance, that the sponge only looks like a rock.

But those obstinate 3-year-olds find such subtleties about as appealing as going to bed early. In their minds, an object possesses either real or apparent characteristics, but not both at the same time. For instance, some assert that the phony rock looks like a sponge and really is a sponge, while the cat looks black and really is black.

These findings emerge from research conducted over the past decade to examine how children reach an understanding of the mind's trappings, such as beliefs, desires, intentions, and emotions. Some investigators contend that this hybrid of developmental and cognitive psychology explores the ways in which children construct "theories of mind." Others argue that the research illuminates the origins of "folk psychology," or people's shared assumptions about how the mind works.

Whatever terminology they use, scientists generally agree that knowledge about mental states and attitudes changes substantially throughout childhood. Debate revolves around a number of clashing explanations of how and why that change takes place.

"There's a genuine argument now over whether a fundamental shift occurs in children's understanding of their own and others' minds between ages 3 and 5," says John H. Flavell, a psychologist at Stanford University and an early explorer of how preschoolers understand thinking.

The March BEHAVIORAL AND BRAIN SCIENCES contains two opposing reviews of research on children's understanding of the mind, as well as 60 written comments from an international group of investigators.

Swiss psychologist Jean Piaget launched the study of how youngsters conceptualize mental life more than 50 years ago. He argued that infants use a few basic reflexes, such as sucking objects that enter their mouths and following moving objects with their eyes, but extract no other meaning from the environment. Preschoolers make themselves the center of the universe, in Piaget's theory; they fail to grasp that other people have different viewpoints and different sources of knowledge. A full appreciation of mental states as experienced by oneself and others blooms in later childhood and adolescence, Piaget held.

Today, researchers contend that more goes on in the heads of babies and young children than Piaget imagined. "Theory of mind" advocates argue that infants possess a primitive sense of being like others; soon thereafter, children assemble a succession of progressively more sophisticated predictions about the types of thought that coordinate behavior in particular situations. This process resembles the accumulation of knowledge through theory testing in science, they propose.

In 1978, investigations into children's theories of mind got a major boost from a controversial article in which two researchers suggested that chimpanzees theorize about mental states. To test this assertion, scientists began to look at whether chimps and children attribute false beliefs to others. Chimps showed little talent for viewing the world from another's misleading perspective, but children at different ages yielded intriguing results that spurred continued research.

Some investigators now suggest that an innate brain mechanism allows even very young children to begin theorizing about mental states. Others view the child's emerging understanding of the mind as a by-product of a maturing brain that manipulates many types of information in increasingly complex ways.

Another school of thought regards commonsense notions about mental life as socially and culturally learned tools for dealing with others rather than as theories for making predictions about people.

And a final account emphasizes intuition as the driving force behind children's take on the mind. In this view, preschoolers first imagine having the desires or beliefs of another person and then mentally simulate what that person would do and feel.

Alison Gopnik, a psychologist at the University of California, Berkeley, champions an influential version of the theory of mind approach known as the "theory theory." Individuals gradually construct commonsense psychological beliefs as a way of explaining themselves and others, according to Gopnik. On the basis of their experience, children theorize that invisible mental entities, such as beliefs and desires, exist and operate in lawful ways, she contends. Youngsters modify or discard a favored theory if it encounters too many difficulties or continually leads them astray in social situations, just as scientists drop or modify a theory that cannot account for or predict key phenomena, the Berkeley psychologist posits.

"The same mental capacities that children use to understand the mind have been applied to science by adults. It's not that children are little scientists, but scientists are big children," she says, chuckling at the implication.

However, the nature of these proposed psychological launching pads for abstract thought remains hazy. Gopnik presents a rough outline of what researchers know about the development of an understanding of the mind.

Even infants display a vague notion of internal psychological states, she asserts. For example, studies find that babies deftly mimic adult facial expressions and gaze in the direction they see others looking.

From around 18 months to 3 years, children learn to distinguish between mental and physical events, Gopnik notes. They know the difference between, say, an imagined dog and a real dog, and begin to engage in pretense and make-believe games. Their talk includes words for perceptions, such as "see," "look," and "taste," and emotions, such as "happy," "love," and "want." By age 3, most also use words such as "know," "think," and "remember."

In Gopnik's opinion, 3-year-olds retain a fascination with "silly" states that stand apart from the real world, such as dreams and make-believe. They also assume that beliefs and other mental states apprehend the world directly, just as their eyes see whatever lies in front of them. They do not assume that a person holds a belief about the contents of a box; in the 3-year-old's theory, the person's belief corresponds to what the box holds. Thus, the typical youngster says the box contains candy when assessing its appearance. But the same child sheds that assumption upon seeing its contents and acquires a belief that the box has always held crayons and other people share that knowledge.

A theory of mental states as direct conduits to reality, rather than as representations of what may or may not exist, also sometimes causes children to confuse appearance with reality, as in encounters with spongy rocks and chalky eggs.

Further evidence suggests that 3-year-olds assign either total knowledge or absolute ignorance to mental states, Gopnik says. In other words, they fail to appreciate that belief comes in degrees. For instance, in contrast to 4-year-olds, 3-year-olds show no preference for information offered by people who express certainty about what a box contains versus people citing doubts about what the box holds.

Some investigators argue that 3-year-olds know enough about false beliefs to attempt to deceive others. A child at that age who breaks an expensive lamp may, when asked by his mother if he touched the lamp, quickly utter "No." But Gopnik maintains that researchers cannot yet say whether the denial signals a conscious attempt to manipulate mother's beliefs or a learned strategy for avoiding punishment, devoid of any deeper understanding of why it might work.

By age 4 or 5, at least in Western cultures, children come to the conclusion that people form beliefs and other mental states *about* the world, Gopnik holds. These youngsters entertain notions of false belief, distinguish between real and apparent qualities of the same object, and recognize changes in their own beliefs, she says.

Moreover, 5-year-olds usually understand that individuals may perceive an object in different ways depending on their line of sight. They also recognize that beliefs dictate a person's emotional reactions to particular situations, such as an adult's expression of surprise at discovering crayons in a candy box.

"By 5 years of age, children have acquired a remarkable understanding of the mind, in many ways quite like that of adults, and certainly very different from that of 2- or even 3-year-olds," Gopnik contends.

Although adults generally believe that each person uses direct knowledge of his or her own mental states to make educated guesses about how others think, research with children suggests otherwise, she adds. At any given stage of development, children make the same inferences about their own minds and those of other people, Gopnik argues.

When confronting false beliefs, she points out, 3-year-olds make errors about their own immediately past beliefs, such as saying they thought the box contained crayons all along, and commit a similar blunder in claiming that a newcomer believes the box holds crayons.

In contrast, 3-year-olds perform much better when dealing with "silly" mental states that bear no relation to the real world. For example, in one study directed by Gopnik, 3-year-olds knew they had first pretended that an imaginary glass contained hot chocolate and then had imagined that the same glass was full of lemonade. Children at this age also realize that other people may engage in

Don't just sit there, think something

Children know much about the mind by age 4, but their conception of how people think still diverges sharply from that of older children and adults, according to a report in the April CHILD DEVELOPMENT. Beginning around age 7, youngsters tend to conclude that mental activity goes on continuously in a waking mind. Younger children, in contrast, assume that the mind switches on when it has a job to do and switches off at the conclusion of a task, leaving the mental landscape blank.

A 4-year-old who attributes complex meaning to beliefs and other mental states, as proposed by "theory of mind" researchers, at the same time fails to realize that people lead continuous inner lives and experience a "stream of consciousness," contend John H. Flavell, a psychologist at Stanford University, and his colleagues.

In one trial conducted by Flavell's team, groups of 20 children at ages 3, 4, and 6 to 7 years, as well as 20 adults, stated whether they believed a female experimenter entertained any thoughts or ideas in three situations: waiting quietly in a chair facing a blank wall, looking at pictures on the wall, and attempting to explain how someone got a big pear into a small glass bottle. Participants indicated the absence of thought by selecting a drawing of a woman's head underneath an empty "thought bubble" (commonly used to indicate the thoughts of cartoon characters) and signaled the presence of thought by choosing a portrayal of a woman's head under a thought bubble containing three asterisks.

Warm-up tests established that all of the participants viewed the asterisks as representing ongoing thoughts or ideas.

Only one of the 3-year-olds attributed mental activity to a waiting person. That number increased to four in the 4-year-olds, 11 in the 6- to 7-year-olds, and 19 in the adults. In contrast, at least 13 members of each age group granted thoughts to a person looking at pictures or trying to explain the pear-bearing bottle.

In further trials with 4-year-olds, most of these youngsters contended that people can voluntarily empty their minds of all thoughts and ideas for a few minutes and that the mind of a waiting person "was not doing anything."

And in unpublished results, Flavell's group finds that not until about age 7 do children consistently recall thoughts they just had while contemplating a problem.

Preschoolers may seldom reflect on their own and others' thoughts and probably experience problems when they try, Flavell suggests. Prior studies directed by Flavell suggest that at around age 7 kids realize that one thought triggers another in a chain reaction, a person's facial expression may contradict inner thoughts, and some psychological states linger indefinitely, such as worries that a monster will emerge from the dark at night.

—B. Bower

pretense and change the details of an imagined situation.

Arriving at an adult-like, abstract account of thought requires a child to continually tinker with and sometimes replace theories about how the mind works, Gopnik says. Other psychologists, including Henry M. Wellman of the University of Michigan in Ann Arbor and Josef Perner of the University of Sussex in Brighton, England, currently direct investigations aimed at shedding further light on these theories.

In an ironic twist, relatively stable theories of mind rapidly become second nature after age 5 and foster the false impression that we directly experience our own mental states rather than making well-practiced inferences about what we believe, want, and feel, Gopnik asserts. Master chess players experience a similar warping of perception, she says. After years of practice, their consideration of numerous potential moves during a match occurs so quickly and effortlessly that they report only a sensation of reacting to the competing forces and powers on the chessboard rather than making a step-by-step analysis of the proper move.

Other researchers argue that a child's ability to theorize about mental life depends on a specialized brain mechanism that exerts its influence by around age 2, when children begin to use pretense. Contrary to Gopnik's proposal, 4-year-olds probably do not overhaul their assumptions about mental states, argues Alan M. Leslie, a psychologist at the University of London in England. Instead, he says, their new treatment of false belief and other psychological concepts reflects a maturing capacity to parcel out different sources of information in their minds.

For instance, unlike many 3-year-olds, 4-year-olds also realize that an out-of-date photograph – say, a picture of candy in a cupboard that is now bare – represents a past state of affairs that has changed.

Leslie and his colleagues propose that young children easily slip into and out of pretend play because the brain's "theory-of-mind mechanism" allows them to grasp that people hold invisible attitudes about the veracity of a fictional state of affairs. Hence, even 2-year-olds understand that if mother pretends a banana is a telephone, she won't serve the telephone for lunch and call up father on the banana.

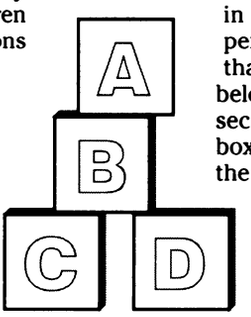
The same brain mechanism allows 3- to 4-year-olds to understand that a person behaves according to potentially misleading beliefs, hopes, or other attitudes held about people and objects, Leslie asserts.

Autistic children provide an example of what happens when apparent brain damage destroys the theory-of-mind mechanism, he contends. Studies conducted by Leslie and University of London coworkers Uta Frith and Simon Baron-Cohen indicate that autistic youngsters fail to develop any rules of thumb for understanding how mental states cause behavior. Autistic children cannot conceive that they or others hold false beliefs, and they find it difficult to understand deception, according to the British investigators.

As a result, symptoms of autism revolve around the absence of imagination, an inability to communicate with others, and a poverty of social skills, Leslie suggests.

Philip D. Zelazo of the University of Toronto and Douglas Frye of New York University, both psychologists, take a different approach. They hold that a 4-year-old's altered conception of mental states depends on the emergence of a general ability to reason first from one perspective and then from another, incompatible perspective.

One experiment conducted by Zelazo and Frye required children to place cards in various locations according to their colors and then sort the same cards according to their shapes. Three-year-olds succeeded at the first set of rules but could not immediately switch to the alternate rules; 4- and 5-year-olds performed well at sorting cards both by color and by shape.



Other investigators doubt that commonsense notions of the mind spring either from specific theories or a more general versatility at manipulating information.

Instead, children possess a powerful innate tendency to make sense of their own and other's actions by telling stories about those deeds, argues Jerome Bruner, a psychologist at New York University. Myths, oral stories, books, and other cultural influences on family and social life shape the ways in which children arrive at a personal understanding of belief, deception, and the rest of mental life, he asserts. Bruner expands on this notion in his book *Acts of Meaning* (1990, Harvard University Press).

If Bruner's argument is correct, children in the United States and Sri Lanka, or in other contrasting cultures, should report striking differences in their assumptions about the mind. To date, virtually all evidence regarding children's understanding of the mind comes from Western cultures, Gopnik points out.

Another explanation of folk psychology rests on a child's powers of imagination. Three-year-olds have trouble imagining mental states that contradict their own current mental states, and thus exhibit difficulty with false-belief tests, holds Alvin I. Goldman, a philosopher at the University of Arizona in Tucson. By age 4, children can imagine having the beliefs and desires of another person; they then mentally simulate that person's resulting feelings and behaviors, Goldman argues.

Paul L. Harris, a psychologist at the University of Oxford in England, agrees. In some studies, 3-year-olds accurately report their psychological experience and understand that mental states refer to the real world, according to Harris. When asked to visualize an imaginary object, 3-year-olds understand the direction to "make a picture in your head" and describe the mind as a container which at times displays pictures of nonexistent things, he notes.

Children apparently adopt such metaphors as a way of capturing their inner psychological experiences and improving their mental simulations of how others think, Harris asserts.

In addition, he says, 3-year-olds perform much better on false-belief tasks when an experimenter presents a situation in words rather than in actions. For instance, an experimenter may tell 3-year-olds that an object that apparently belongs in one box has been secretly transferred to another box, rather than showing them the transfer. The children then look in both boxes to verify the transfer. Compared with same-age counterparts who only observe the transfer, these youngsters are much more likely to realize that an uninformed newcomer will guess the object's location incorrectly.

A verbal description makes it easier for 3-year-olds to imagine the object in its initial location and to ignore the knowledge that they saw the object in an unexpected box, Harris holds.

Still, Gopnik argues, the presence of an underlying theory best accounts for the wide range of understanding about the mind achieved by children around age 4. What's more, considerable research already suggests that adults often remain unaware of the unconscious mental states that direct their attitudes and judgments (SN: 3/28/92, p.200), adding to the likelihood that children also lack direct access to their own mental states and must construct theories to explain mental life, she points out.

Unfortunately, much remains unclear about the origins of theories and the reasons for their change in childhood as well as in science, Gopnik acknowledges.

"The scientist's ability to learn about the world is still almost as mysterious as the child's," she maintains. "Nevertheless, reducing two mysteries to one is an important advance, and a great deal more than we usually achieve." □