What Babies Know, and Noises Parents Make

Newborn babies can learn more abstract concepts than has been realized and, surprisingly, they seem to respond exclusively to certain sounds that parents normally make

BABIES come into the world capable of making logical inferences, of extracting cause-and-effect relationships, according to a group of behavioral scientists. Moreover, babies are born sensitive to certain sounds that parents intuitively make. Once again, seemingly helpless babies are turning out to be more sophisticated than anyone expected.

These recent findings on human infant behavior were reported by Elliott Blass of Johns Hopkins University at a workshop held at the National Institutes of Health.* Blass says that he began with "a conviction we all share that there are vital behavioral phenomena that are tied in with vital physiological systems and we don't know that much about them." So he started to investigate links between behavior and physiology by asking how baby rats learn to find their mother's nipple. From there, he went on to humans.

Because newborn rats are blind and deaf, it is not so clear what they recognize about their mothers. Blass and his associates discovered that the baby rats are searching for a familiar odor when they attach to the nipple. If the mother's nipple is washed, the rats will not attach. Moreover, the rats learn the mother's odor when they are still in the womb. Blass found that he could inject citral, a tasteless, lemon-scented compound, into the mother's amniotic fluid before the rat pups are born. After birth, those baby rats will attach to their mother's nipples only if the scent of citral is in the air. It makes no difference if the mother's nipples are washed. The crucial factor for these rat pups is the lemon smell.

In another set of experiments, Blass and his colleagues established that the newborn rats seek out an odor that they associate with a pleasurable sensation. Before the rats ever suckle, the rat mother spends a great deal of time licking the anal-genital area of her young, thereby sitmulating them and, at the same time, exposing them to her odor.

To test the effects of stimulation, Blass either stroked newborn rat pups in the presence of citral or he gave the animals amphetamine in the presence of citral. In both cases, the pups, which were not exposed to citral in the womb, subsequently approached and sucked citral-coated nipples. But the rats can only learn to like the citral scent during the first 8 days of life. "After day 8, the infant can't be moved. The behavior is locked," Blass says.

Finally, Blass found that the rats retain what they learned in infancy and that it affects their behavior as adults. Rats exposed to citral in the womb or stimulated in the presence of citral as infants will, as adults, prefer citral-scented sexual partners. "We believe we have found something here that ends up being translated into later sexual behavior," Blass remarks. "An infant that is reared in a certain scent will preferentially mate with a partner of the same scent."

Next, Blass and his colleagues decided to study human infant behavior. "What we saw as the critical thing was what the mothers did prior to nursing and their behavior during nursing," Blass says. "So we asked, Is there some way to provide an infant with order and engage the suckling system?"

The researchers began by teaching infants, who were 2 to 48 hours old, to anticipate a taste of sucrose. When they put a few drops of sucrose in a baby's mouth, the baby responds by extending his tongue and becoming calm. Blass and his colleagues found that they could teach the infants to anticipate sucrose. They showed that if they stroked a baby's forehead and then gave the child sucrose, the baby would quickly learn to turn its head in the direction in which the sucrose was delivered—in this case, the baby's left side. "Even a 2-hour-old infant is capable of extracting the predictive relationship between events that precede the presentation of sucrose and the presentation itself," Blass concludes.

When the investigators then extinguished this behavioral response—when they failed to present sucrose after stroking the babies' foreheads—the babies showed their displeasure. Seven out of eight babies cried when the sucrose failed to appear. In contrast, only 1 out of 16 controls who had not been conditioned to expect sucrose after a forehead stroke cried under the same circumstances. Blass interprets the crying response as indicating that the babies felt that there was "a violation of the relationship we had established."

Next, Blass and his associates attempted to determine if the babies could learn to anticipate sucrose in response to certain sounds—an auditory rather than a tactile stimulus. In this case, the babies' behavior was a complete surprise.

Blass selected four sounds to be paired with the delivery of sucrose solution—a click sound made by a castinet, a ting made by a triangle, a psst sound, and a shhh sound. He presented each sound to babies twice per second for 10 seconds preceding the delivery of sucrose. To his astonishment, the only infants who learned to associate the sound with the sucrose were those who heard the click. The babies who heard the psst or the triangle never stopped what they were doing to anticipate the sucrose and those presented with the shhh sound actually stopped behaving. "They didn't fall asleep but they stopped their gross behavior patterns," Blass says. In other words, the babies were made attentive by a click, were calmed by a shhh, and ignored the psst and triangle sounds.

"I chose the click sound because when my children were infants and it was my turn to feed them, I instinctively tried to awaken them with a click," Blass says. Now he is realizing that he is far from the only parent to click to his child. "One day, I was walking on the maternity ward to get the babies for our experiment and I heard this wonderful symphony of clicks that the mothers and the nurses were making. So we did a sound spectrogram. The clicks, kisses, and clucks that the parents were making were very similar to the sound of the castinet."

When Blass consulted Arnold Gould, who is curator of mammals at the Smithsonian Institution, Gould told him that all mammals click to their young, that clicking is the primary mode of communication between mammals and their infants. "If you're a mammal, you click," Gould told Blass.

In addition to demonstrating that parents somehow know what they are doing when they click to and shush their babies, Blass thinks he has shown something more about what babies know. "What we are showing is that babies can extract relations between related events. It is the way babies start to build up their knowledge of the world." ■

GINA KOLATA

* The workshop was sponsored by the National Institute of Child Health and Human Development and was held at the National Institutes of Health on 30 June and 1 July.