



The American Association for the Advancement of Science

In the beginning was the word

CHICAGO

This year's meeting of the AAAS looked at winter weather, solar energy, smelly hyenas, the restoration of paintings and the importance of talking to babies

THE more parents talk to their children, the faster those children's vocabularies grow and the better their intelligence develops. That might seem blindingly obvious, but it took until 1995 for science to show just how early in life the difference begins to matter. In that year Betty Hart and Todd Risley of the University of Kansas published the results of a decade-long study in which they had looked at how, and how much, 42 families in Kansas City conversed at home. Dr Hart and Dr Risley found a close correlation between the number of words a child's parents had spoken to him by the time he was three and his academic success at the age of nine. At three, children born into professional families had heard 30m more words than those from a poorer background.

This observation has profound implications for policies about babies and their parents. It suggests that sending children to "pre-school" (nurseries or kindergartens) at the age of four—a favoured step among policymakers—comes too late to compensate for educational shortcomings at home. Happily, understanding of how children's vocabularies develop is growing, as several presentations at this year's meeting of the American Association for the Advancement of Science (AAAS) showed.

One of the most striking revelations came from Anne Fernald of Stanford University, who has found that the disparity

appears well before a child is three. Even at the tender age of 18 months, when most toddlers speak only a dozen words, those from disadvantaged families are several months behind other, more favoured children. Indeed, Dr Fernald thinks the differentiation starts at birth.

She measures how quickly toddlers process language by sitting them on their mothers' laps and showing them two images; a dog and a ball, say. A recorded voice tells the toddler to look at the ball while a camera records his reaction. This lets Dr Fernald note the moment the child's gaze begins shifting towards the correct image. At 18 months, toddlers from better-off backgrounds can identify the correct object in 750 milliseconds—200 milliseconds faster than those from poorer families. This, says Dr Fernald, is a huge difference.

Mind the gap

The problem seems to be cumulative. By the time children are two, there is a six-month disparity in the language-processing skills and vocabulary of the two groups. It is easy to see how this might happen. Toddlers learn new words from their context, so the faster a child understands the words he already knows, the easier it is for him to attend to those he does not.

It is also now clear from Dr Fernald's work that words spoken directly to a child, rather than those simply heard in the home, are what builds vocabulary. Plonk-

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ing children in front of the television does not have the same effect. Neither does letting them sit at the feet of academic parents while the grown-ups converse about Plato.

The effects can be seen directly in the brain. Kimberly Noble of Columbia University told the meeting how linguistic disparities are reflected in the structure of the parts of the brain involved in processing language. Although she cannot yet prove that hearing speech causes the brain to grow, it would fit with existing theories of how experience shapes the brain. Babies are born with about 100 billion neurons, and connections between these form at an exponentially rising rate in the first years of life. It is the pattern of these connections which determines how well the brain works, and what it learns. By the time a child is three there will be about 1,000 trillion connections in his brain, and that child's experiences continuously determine which are strengthened and which pruned. This process, gradual and more-or-less irreversible, shapes the trajectory of the child's life.

Fortunately, taciturnity can be easily fixed. Telling parents is the first step: many who volunteered themselves and their children for study did not know they could help their babies do well simply by speaking to them.

There are tools that can help, as well. One such is a Language Environment Analysis (LENA) device. It is like a pedometer, but keeps track of words, not steps, by analysing the speech children hear. It was originally developed as a prop for research, but parents kept asking for the data it recorded and researchers thus realised it could also serve as a spur. Parents use it to monitor, and improve, their patterns of speech, much as a pedometer-wearing couch potato might try to reach 10,000 steps a day, say. ▶▶

▶ A recent study by Dana Suskind shows how promising this approach is. Dr Suskind is a paediatric surgeon in Chicago. She got interested in the field while monitoring children whom she had fitted with artificial cochleas, to treat deafness.

Her new study shows that the use of a LENA device, combined with a one-off home visit to give parents advice, produces a 32% increase in the number of words a child hears per hour after six weeks. Dr Suskind's Thirty Million Words Initiative (named after Dr Hart's and Dr Risley's original finding) is now using LENA devices and weekly home visits to improve the linguistic diet of children in Chicago. Parents are taught to make the words they serve up more enriching. For example, instead of telling a child, "Put your shoes on," one might say instead, "It is time to go out. What do we have to do?"

Other groups are trying similar approaches. In Providence, Rhode Island, Angel Taveras, the mayor, has started a project that uses LENA devices to improve the vocabularies of children in pre-school. Mean-

while, in Chicago and several other places, nurses who visit mothers' homes to give them advice on health and nutrition also encourage them to chat to their children and read to them aloud. Such interventions are effective and not particularly expensive.

In January Barack Obama urged Congress and state governments to make high-quality pre-schools available to every four-year-old. He is knocking on an open door. This financial year 30 states and the District of Columbia have increased spending on pre-schools. Nationally, this amounts to an increase of 6.9%.

That is a good thing. Pre-school programmes are known to develop children's numeracy, social skills and (as the term "pre-school" suggests) readiness for school. But they do not deal with the gap in much earlier development that Dr Fernald, Dr Noble, Dr Suskind and others have identified. And it is this gap, more than a year's pre-schooling at the age of four, which seems to determine a child's chances for the rest of his life. ■