

Winner of Researcher Category – National Brain Science Writing Prize 2008
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A job for monsters?

Computer games involving monsters with strange sounding names may not be the most obvious scientific tools for investigating how children learn vocabulary. But that's what my colleagues and I at the University of Bristol have been using to try to understand the complex processes going on in the brain when children learn new words. Our research using these computer games has recently thrown up some intriguing findings: children with Down syndrome, who suffer from a genetic condition involving a chromosomal abnormality and for whom vocabulary development is often delayed, appear to learn words in an unusual way.

The key to learning new words is verbal short-term memory, the ability to remember spoken information over very brief periods of time – seconds rather than minutes or hours. A child who can accurately remember a new word in this way has a much better chance of creating a permanent record of that word in their mind, and hence incorporating it into their vocabulary, than a child who finds remembering words over short periods of time relatively difficult.

Children with Down syndrome commonly find it hard to remember new words temporarily. Surprisingly though, while their vocabulary development is typically delayed, it is not as bad as might be expected, given their short-term memory problems.

Dr Chris Jarrold, a reader in developmental psychology at the University of Bristol, has researched the condition extensively. "In many studies we have found that even when allowance is made for hearing difficulties that children with Down syndrome often experience, they tend to find remembering verbal information accurately over brief periods of time difficult, so we would expect their vocabulary to be relatively poor," he explains. "The puzzle is that it certainly doesn't appear to be as bad as we'd predict on the basis of their very poor short-term memory skills."

Dr Jarrold and I suspected that children with Down syndrome might have an unusual way of learning new words, one that avoids heavy reliance on short-term memory skills. To find out if we were right, we broke the learning process down, and looked separately at two key components, learning what a word sounds like and learning what it means. Research suggests verbal short-term memory is needed for learning sound, but it is much less involved in learning meaning.

In our computer games, children were taught the names of a set of friendly monsters, and were then asked to either pick out the right names when shown pictures of the monsters (showing how well they had learnt the sound of each word), or to pick out the right monster when given the monsters' names (showing how well they had learnt meaning).

Strikingly, children with Down syndrome identified which monster was which well, but they found it much harder to tell us what the monsters' names were. In other words, they had particular difficulties learning what words sound like. "This suggests that children with Down syndrome probably rely on meaning quite heavily when learning new words," says Jarrold. "This strategy may compensate to some extent for their sound-learning difficulties and so help them achieve surprisingly good vocabularies despite their poor verbal short-term memory skills."

Of course, accurate learning of sound is still very important because it is essential for telling some words with very different meanings, like peg and pig, apart. When we changed how 'word-like' the monsters' names were, children with Down syndrome found words that sounded typically English much easier to learn than words that sounded more unusual. "Words that have been incorporated into the native language from other languages are therefore likely to be especially difficult for them to learn," says Jarrold. "But words that already sound relatively familiar should be easier to acquire."

More than simply helping us solve our scientific conundrum, this research ultimately offers hope of finding new methods of supporting vocabulary development for children with Down syndrome. Targeting their key weakness, relatively poor learning of sound, by familiarising them with less common sounding words in the language is one possibility for future intervention programmes to explore.

Another promising possibility is to capitalise on their key strength, good learning of meaning, and to help them to exploit this to their fullest advantage. A support programme involving word-learning exercises that embrace their unusual reliance on meaning for learning new words might just prove invaluable in helping children with Down syndrome improve their vocabulary. Now that sounds like a job for our monsters!