*Because of Alex....*In a Word

by Clarence E. Schutt, Ph.D.

In dreams our deepest wishes become true. Our unconscious brains work unceasingly to combine experiences from long ago with those of yesterday, and relay these illusions to a place where anxious thoughts dissolve. In my dreams, my son Alex speaks. His voice is clear, his thoughts and questions sharp and cleverly worded. His speech is so natural that the miracle of it dawns on me only slowly. My joyful cries wake me, returning me to a world where Alex still can't speak, but leaving me to wonder "does he talk in his dreams?" What a comfort it would be to know that for nine hours out of every twenty-four Alex can experience the gift of speech like nearly everyone else.

What exactly is a word? This question undoubtedly caused sleepless nights for some of the greatest of twentieth century philosophers: Russell, Wittgenstein, Putnam, Quine, and Rorty, who struggled to explain how words can represent the world, including the thoughts of others, to our minds. It is the deepest of questions because of the relationship words bear to thought itself. Can one think without words? Is moral behavior possible without language? In these heady realms, autism should easily be accorded the label of the "most philosophical of all human afflictions."

Physiologists have a simpler explanation. Words are the result of the controlled passage of air over the voice-box, across our tongues and teeth, and through our lips. Utterances are entirely the result of a beautifully orchestrated series of muscular contractions in the diaphragm, throat, and tongue, as air passes over them, all while our eyes are scanning text or face and our ears register the sounds to which we will respond. The muscles are set into motion by nerves that are controlled by various ganglia of nerve cells, linking conscious thought to autonomic movements. Like walking, we seem to do it effortlessly (once we learn how). It is all a matter of triggering what were once called "programs of the brain" to produce the nerve signals in the proper sequence to activate the muscles involved. Sensors on each muscle, which are themselves extended neuronal cells whose axons terminate at the surface of the muscles, report back instantaneously on the strength being exerted by each muscle. This information allows us to make fine adjustments in our performance. Some are better at it than others, and practice makes perfect.

What happens in my sleeping brain when words Alex can never have spoken appear so naturally on his lips in my dreams? Why doesn't endless repetition improve Alex's vocabulary? What are the causes of involuntary movements in our children's facial and bodily muscles?

Such questions no longer seem odd or impossible to comprehend. The robust new field of "cognitive neuroscience" is leading us closer to the secrets of language. Using PET scans that can map moment-by-moment changes in oxygen consumption in working brains, it is possible to see which areas of the brain are activated in response to specific cognitive challenges. Relatively easy linguistic tasks for normal subjects, like repeating a list of commonly used nouns, seem hardly to tax the brain. Little seems to happen between a prompt from the investigator and the production of the expected string of words from the subject. However, when subjects are asked to think of novel noun-verb combinations or to solve complicated puzzles, their brains appear to be active in several distinct areas in particular order.

Although the classical "language areas" of Broca and Wernicke (so beloved by popular writers on the brain) are clearly important, it is clear that many regions must work in concert, especially in complex social conversations. PET scans reveal, for instance, the close proximity of the "motor" areas responsible for speech production and the "cognitive" areas involved in processing sensory information. The "executive" and "memory" regions all seem to light up when responses to the spoken word are being sent down the line to the muscles that cause the noises we call words. It is beginning to make sense.

Social context changes the pattern of responses. A small brain structure called the amygdala swings into action. Every instant of social life is a moment of creation, during which our brains map the present onto our stored memories and associations to produce a combination of past and present never before seen. Each word, every facial expression, all uncomfortable shifts in gaze or posture result when webs of sensory field neurons combine with memory nets, where values and learned responses reside, and play a tune on the nerves that control our muscles. Our movements and responses change what others perceive in us. Our worlds meld and join.

Interpreting the science in this way leads to an optimistic view of human nature. We are all different. The impossibly large number of experiences we each have all register differently and combine in different ways in our minds. If we think of higher things and dream about a future without autism, the world might even get better.

And Alex may one day speak of his dreams with me. ◆

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