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Identifying Brain Deficits

Toronto's Arrowsmith School treats a wide range of the learning dysfunctions that affects our children

Part two of a two-part series

By Norman Doidge

Last week's article described a new technique developed by Barbara Arrowsmith Young, director of Arrowsmith School in Toronto, for assessing and treating learning disorders. Using the work of Dr. Alexander Luria, a Russian physician and neuropsychologist, Arrowsmith Young found that many people with learning disorders actually have deficits that are like milder forms of certain known brain lesions.

Thus, to take a simple example, physicians are familiar with lesions in the left frontal area leading to Broca's speech deficit in stroke patients. Arrowsmith Young postulated-and recent brain scan studies have shown-that people who have milder difficulties pronouncing words have weakened Broca's area. But she also found numerous other interesting deficits, and has developed treatments for them.

What follows are some common clinical presentations of learning dysfunctions. Arrowsmith Young distinguishes between learning dysfunctions, which are problems stemming from deficits in particular areas of the brain, and learning disorders. A learning disorder might be "reading difficulty." But several different kinds of dysfunctions might contribute to it (such as motor symbol sequencing, problems with auditory speech discrimination or troubles with comprehension).

- **Symbol relations:** Arrowsmith Young has pioneered the treatment of difficulties in this area. Dr. Luria discovered that there is a part of the brain where the parietal, occipital and temporal lobes meet that is responsible for allowing us to understand the relations between symbols, hence Arrowsmith Young called this function "symbol relations." People with problems in this area present with a funny conglomeration of difficulties, which seem unconnected but are not. They often have trouble learning how to read an analog clock because they can't understand the relationships between the hands. They have trouble with grammar. Prepositions, which are about relationships (in, out, with, without) are difficult to understand. Logic, which is also about relationships (if A, then B) is compromised. So is mathematics, which is often about symbolic relationships (such as fractions, correlations or percentages). While other parts of their reasoning might be quite effective, when people who have problems in this area must think about relationships, particularly a lot of relationships, they are easily overloaded. This can lead to difficulty learning to read as well. The angular gyrus in the left hemisphere has been implicated in this, and the Arrowsmith School developed a specific exercise to strengthen this area to above the normal range. Children who complete the exercise find they can much more easily begin to understand math and grammar.
- **Artifactual thinking problems:** This describes difficulties in reading non-verbal emotional cues, which are crucial for understanding how people behave. It is hard to "read people" if this area is compromised. Not picking up on cues, people with artifactual thinking problems may speak on and on about a subject, when others would know to stop. Environmental deprivation or defences are not the sole cause of a lack of empathy. The right frontal cortex, devoted to processing non-verbal cues such as facial expressions and body language, makes an important contribution to empathy. In testing, these people often fail to consistently observe visual details. They often stop looking before taking in the overall picture, and come to the wrong conclusion about the situation. A deficit here also leads to limitations in the co-ordination, modulation and interpretation of one's own emotions. Consequently, emotions are less refined, differentiated or modulated. Unmodulated emotions can easily overwhelm one, and these people are prone to impulsive reactions. Being "out of it" they are prone to misunderstanding, anger or acting in odd or frustrated ways.
- **Symbol recognition difficulties:** This capacity, dependent on the left occipital area, allows people to recognize and remember a word or symbol visually that they have seen before. People with a deficit in this area have to study a word many more times than average before they can visually memorize it. In severe cases they might not recognize a simple word such as "house" even though this is a word they have seen many times before. Reading is slowed, and people with difficulty in this area may fall back on trying to sound out the words, if the part of the brain that processes the sound of words is working well. Needless to say, learning foreign alphabets is especially hard. The capacity to recognize symbols is different from the capacity to recognize "real" things such as landmarks or real objects-a right occipital function. (People with those deficits have object recognition difficulties, involving a right occipital deficit.)
- **Broca's area:** As stated, people with weakness in this area frequently mispronounce words. Interestingly, people with a mild weakness in this area can pronounce words, but require mental effort to do so, making it hard for them to talk and think at the same time.
- **Auditory speech discrimination:** Broca's area is an expressive area; this area is a receptive one, and people with difficulty here have trouble distinguishing similar sounding words, like "hear" and "fear" for instance.
- **Lexical memory difficulties:** Though once it was imagined that the mind had separate areas for reasoning, perception, emotion and memory, Arrowsmith Young has found that many important cognitive brain areas have their own memory systems. There is a separate area, behind Wernicke's area (described in the first article in this series), devoted to remembering the sound of words, and people with problems here have difficulty expanding their vocabularies.
- **Spatial reasoning:** Spatial reasoning depends on right premotor areas. It is the capacity to imagine a series of moves through space inside one's head, before executing them. If weak, the person not only gets lost easily, but can't work out a map inside his or her head before doing things such as going places or moving about in sports. A dentist planning how to drill a tooth, a surgeon planning an operation, or even a driver changing lanes requires skill in this area. Some people with this deficit find they forget where they have left objects, have trouble organizing their workspace, and interestingly, find, if they put something away in a filing cabinet, they have trouble imagining where it is.
- **Kinesthetic perception:** This is the capacity for perceiving where both sides of the body are in space. Those with this problem are clumsy, often cut themselves and can have trouble writing if the problem is on the affected side. At times this problem can affect speech articulation as well.

Arrowsmith Young has sorted out other areas, including helping children with narrow visual span, or trouble with math facts or mechanical reasoning, and even poor muscle tone.

A followup study at Arrowsmith School involving interviews with parents, students and teachers, and assessment of student records showed that 80% achieved their educational goals. Though some entered Arrowsmith School as many as seven grade levels behind in reading, math and other activities, they caught up to their peers. Arrowsmith School tests for 19 learning dysfunctions. More information, and individual's cases and their progress are available on the Web site: **www.arrowsmithschool.org**

Straining weak areas

So just what kind of exercises does the Arrowsmith School use to improve children's capacity in an area where they have a learning disorder?

Brain exercises for a weakened function require finding a way to isolate that function, then exercising it until it is strained, over a significant period, so that the child achieves perfection at that level. Tests determine the child's level of competence. The level is gradually increased.

Thus, children with trouble visually recognizing symbols (which can slow learning to read by making it hard to decode letters) are flashed all sorts of symbols on a computer screen which they must learn to recognize. English words are not used because then the children might be able to remember the words by meaning or might remember them by their sound. Rather, Persian, Chinese, Hebrew, Urdu, Sinhalese, Burmese, Armenian, Mongol and other characters that the child is unfamiliar with are used.

For symbol relations improvement, children are asked to tell the time. The trick is that though they may start with clocks that only have an hour hand, they go all the way up to 10-handed clocks on the computer. First minute, then second, then 60th of a second hands are added, then centuries, and so on are added. They have to be more than 90% correct on 25 consecutive clocks in a predetermined time.

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