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"The standard definition of an enriched environment is "a combination of complex inanimate and social stimulation". This definition implies that the relevance of single contributing factors cannot be easily isolated but there are good reasons to assume that it is the interaction of factors that is an essential element of an enriched environment, not any single element that is hidden in the complexity."

Van Praag H, Kempermann G, & Gage F. Neural consequences of environmental enrichment. *Neuroscience 2000*; 1:191-198.

Stroke Educator, Inc. is committed to educating the wider public about stroke and the 50 state "Aim High for Aphasia!" Aphasia Awareness campaign.

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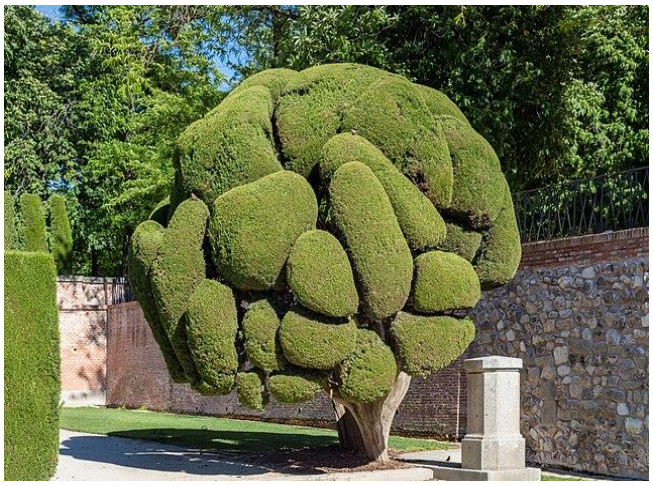
Aphasia Insights!

Aphasia Recovery and Brain Topiary: Shaping the Networks of the Brain.

By Tom Broussard, Ph.D.

I had a stroke and aphasia on September 26, 2011. I was an associate dean at The Heller School at Brandeis University when I fell down on Main Street, Waltham, MA. I lost my language and could not read, write or speak well.



As I got better, I began to read articles and books about the brain and how it works. (Of course, I didn't know that I was getting better *because* I was reading more!) It was the first time I had read about "pruning" the neurons (cells) of the brain.

I began to realize that "experience-dependent neuroplasticity" creates a brain topiary that shapes and trims the brain's neural networks. Cognitive activities (reading, writing, speaking) provide the stimulation that enhances and sculpts the learning field.

Topiary is the art of sculpting, clipping, shaping, and trimming shrubs, plants and trees into ornamental and fanciful shapes in indoor or outdoor landscaping. Topiary is living sculpture and is not unlike how the brain grows and shapes neural matter.

However, the raw material needed for (real) topiary grows as a result of photosynthesis, converting sunlight into plant materials such as branches and leaves.

The raw material needed to create the landscape of the brain grows as a result of neuroplasticity, converting thoughts and cognitive activities into dendrites and synapses (the metaphorical equivalent of branches and leaves).

Experience-dependent neuroplasticity is the lifelong process of creating, organizing, and shaping the neural connections that occur as a result of a person's life experiences. Differing life situations and circumstances influence (and therefore trim) how certain areas of the brain develop and continue to grow in certain directions.

Research has shown that animals (mice) raised in an artificially enriched environment have more dendrite development and overall synapses than do other animals who are raised in an impoverished environment with no stimulating or engaging features. This has been shown in human brains as well with increased cortical development as a result of novel, complex, stimulating, and engaging activities (Van Praag et al, 2000).

But unlike mice, our natural environment is already enriched by definition. We already have the tools we need to learn in an enriched environment. The problem is that there are different levels of enrichment whether damaged (by stroke) or degraded (by fewer enrichment tools) but in either case, learning is more difficult and requires more effort, motivation and persistent practice.

A stroke destroys a random set of neurons and the associated dendrites and synapses. As a result, the effect of the damage is also random across many different neural networks. The remaining neurons spread across those networks can still produce more dendrites and synapses based on similar experiences used by previous habits and well-established experience-dependent neuroplasticity-inducing activities.

The brain is *built* to shape and repair the living environment by using the same tools, the same activities, and the same habits (similar to shaped steel wire frames for topiary) that had been used the first time the links were established in an enriched environment. The activities induce plasticity and create the dendrites and synapses that are needed to rebuild the learning (synaptic) field.

Persistent and repetitive language activities *themselves* are the active ingredients that induce experience-dependent plasticity and the resultant brain changes.

An enriched environment (*living* by any other name) is both the cause *and* effect of aphasia recovery. The brain repairs the damaged networks using the remaining cells to grow the learning field.

Being *aware* of one's deficits is necessary but not sufficient. It is not enough to go through the motions (of learning) without understanding the underlying brain processes that support the work.

We can be *better* therapists and patients (or teachers and students) if we become more conscious and aware of how the brain's "topiary" works. As a result, people with aphasia can become *master* gardeners, woven into the mazes of their own recovery.

Signed: *The Johnny Appleseed of Aphasia Awareness*

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