The Master Mediator

Looking My Way: The Brain Is Not a Computer

BY ROBERT A. CREO

Twice in 2012, I found myself motionless in an MRI machine at a top university research center with electromagnetic forces bombarding my body . . . with nary a flinch from me!

Now I am the proud owner of dozens of computer images of my portions of my very own brain. I am pleased to be able to share one with you at right.

At two Master Mediator Institute Immersion Courses held at Duke University and taught primarily by Duke faculty, the participants were able to watch a dissection of a human brain, and a demonstration of how an "fMRI"—a functional MRI—is used for research.

Since I was not pregnant and my body contained no metal inserts, I was able to volunteer to be the subject last May. Once all metal is removed from your clothes, then you lie flat on a table that slides you into the MRI.

Baseline measurements are conducted, and then you are presented with information on a computer screen above your face. As data moves across the screen you respond by pressing buttons with your hands. The equipment then takes readings that show the specific areas of the brain that are activated ("light-up" in scientific terms) while performing specific tasks.

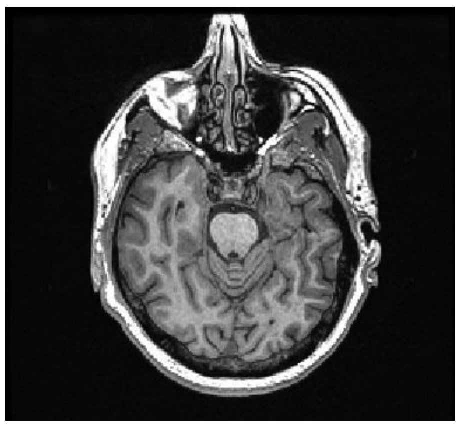
I was shown a series of letters which either made up a word in English, or was gibberish. These were read only to myself and not aloud. The MRI recorded the activity and any differences in processing by the neurons' circuits.

This month's column is the first of two parts on neuroscience and mediation.

The author is a Pittsburgh attorney neutral who is co-founder of the Master Mediator Institute, which conducts courses on negotiation behavior that focus on neuroscience and the study of decision making. He is author of "Alternative Dispute Resolution: Law, Procedure and Commentary for the Pennsylvania Practitioner" (George T. Bisel Co. 2006). He is a member of this newsletter's editorial board and of the CPR Institute's Panels of Distinguished Neutrals.

This data is transformed into usable information by processing far too complex for me to comprehend. Viola! The result is neuroscience related to decision making!

I was surprised to be able to go back into an MRI a few months later when I was asked to participate in a study being conducted by the University of Pittsburgh Medical Center



Columnist Robert Creo's brain, via MRI.

("UPMC") and Carnegie Mellon University involving memory, weight and age.

For more than 10 years, I have participated in a weight loss study at UPMC and always volunteered whenever asked to join related studies. This new study consisted of taking a memory test at UPMC, presumably to establish individual and group baselines, and then spending an hour in Carnegie Mellon's MRI.

The MRI portion consisted of letters being flashed across the screen, and my having to remember if the current letter was the same or different than the previous one or two letters. I was also flashed images of flowers—a control baseline—and then classes of food, such as vegetables, fruits, meats, fried foods and sweets, and rated my hunger when shown them on a scale of one to four. The study is continuing, and the graduate student promised to send me any papers generated from the final results.

Besides the fMRI, and earlier techniques such as SPECT and PET, which image three-dimensional changes in blood flow, scientists also measure brain activity using methods such as elecroencephalography, better known as an EEG, which involves placing electrodes on the scalp to record electrical activity. This was also demonstrated at the Duke Master Mediator Institute course. Another tool is magnetoencephalography, or MEG, which also involves placing electrodes over the head to measure the magnetic field generated by brain activity.

REGIONS AND SYSTEMS

Mammal brains all have the same basic structure, with the human brain being the largest in relationship to body mass. Most human brains weigh about three pounds; the texture is soft, with the cortex being pinkish-beige on the outside and off-white on the inside.

Scientists have divided the brain into regions and systems. The cerebral cortex is the venue of vision, and the frontal lobes are the locale of executive functions such as language, reasoning, planning, abstract thought and self-control.

There are about 100 billion nerve cells, called neurons, in the brain, with perhaps 10 billion of them residing in the sub-region known as the cerebellum, referred to as granule cells. The cerebral cortex is commonly divided into the frontal, parietal, temporal and occipital lobes. The neural tissue is layered or folded, which increases the amount of tissue that can fit into the skull cavity. The brain and spinal cord contain ventricles, which are vessels filled with cerebrospinal fluid, or CFS.

The CFS provides protection from the brain hitting the cranium. The CFS also gives buoyancy against gravity, which allows the brain to "float" and obtain its mass without resting on the base of the cranium. CFS is also considered to provide chemical stability. The brain and spinal cord are covered by a series of membranes called meninges which protect it from rubbing against bones of the skull and spine.

Other brain structures include the amygdale, hippocampus, thalamus, basal ganglia and the four lobes. The occidental lobe is involved in visual sense; auditory is in the temporal lobe and insular cortex. Motor functions are processed in other specific areas. Different areas of the cerebral cortex are active in different cognitive and behavior functions.

The cortex is also divided into the right and left hemisphere, which are similar, but some functions such as language are commonly found in the left sphere, while for spatiotemporal reasoning—the cognitive ability to recognize space and objects—the right sphere is usually dominant in most people.

Early use of MRIs, which weren't as accurate as later generations, were interpreted in such a way that a popular mythology of right- and left-brained people was created with certain characteristics, such as creativity and artistic talent, being attributed solely to the dominant use of one side of the brain. This is not true, although some functions may be localized in specific regions. The bottom line is that the brain is a vibrant and holistic organ.

CHIPS AND PROCESSING

Michael Platt, director of the Duke Institute for Brain Sciences' Center for Cognitive Neuroscience (see www.dibs.duke.edu/research/center-for-cognitive-neuroscience), made a presentation at the 2009 Master Mediator Institute Immersion Course titled, "The Brain is Not a Computer." Some scientists and laypeople analogized the human mind to a computer that processes information via neurons, like computer chips and circuits.

But unlike a computer, there is no central processing unit in the brain and no permanent hardwiring of circuit boards. Neuronal connections are interdependent, flexible and subject to revision depending on the content. The connection between neurons is called a synapse, which can be either electrical or chemical. Neurons connected together process stimuli as "evidence" and balance accuracy and urgency to formulate a decision, i.e., a choice of action.

There are complex electrical and chemical happenings in the brain. The power supply is energy from blood glucose, the simple sugar derived from foods. Brain metabolism consumes more than 20% of the total glucose, 20% of body oxygen and 15% of the human body's cardio output. Unlike muscles, the brain does not store any glucose in the form of glycogen, and in periods of low glucose may use ketone, or lactate during exercise.

Neurons are composed of a cell body, a stem called an axon, and another tube that ends in a complex web of branches called dendrites. Neurons pass electrical currents, the movement of ions along the neuronal membrane to another neuron.

Chemicals that pass signals from a neuron to another cell across a synapse are called neurotransmitters. These chemicals are clustered in the membrane beneath the axon terminal and after release they bind with specific receptors in the membrane on the other side of the synapse gateway to activate that receptor.

These neurotransmitters are easily synthesized from dietary components. These are usually divided into three main groups of amino acids: peptides (more than 50 have been identified), and monoamines, such as epinephrine (adrenaline), norepineephrine, dopamine, histamine, and serotonin.

Many neurotransmitters are classified as either "excitatory," depending on whether it increases the likelihood a cell will fire, or "inhibitory" which decreases action potential. Glutamate, for example, correlates fast excitatory synapses in the brain and spinal cord while GABA is inhibitory. Dopamine is critical in the reward system and is involved in addictions. Serotonin regulates appetite, sleep, memory, learning, mood, muscles, behavior and the cardiovascular and endocrine systems.

And oxytocin is a hormone released from the hypothalamus region that correlates with trust, loyalty, and love toward others. The Master Mediator Institute had the privilege of having Dr. Paul Zak, one of the foremost experts on oxytocin, present twice at Immersion Courses and to conduct an oxytocin experiment on mediators. See Monique McKay, "Exploring the Role of Oxytocin in Mediation," 30 *Alternatives* 123 (June 2012).

The brain is not static. Brain cells die and renew. Neural circuits are constantly rewiring and responding to new stimuli and chemical activity. The generation, regeneration and revision of neural circuits and synapses are referred to as "neuroplasticity." These processes are influenced by the individual's physical and mental experiences.

The common example is learning to ride a bike. These neurons form a circuit that can be reactivated after years of non-use. Some practices and repetitive patterns of neurons firing together create complex circuits that are then "hard-wired" into neural memory that can be retrieved automatically to perform certain tasks.

One of my summer jobs more than 45 years ago was taking apart armatures in car motor generators. After spending hundreds of hours in this repetitive task I could do it today as efficiently as when I was 16 years old. This is common to all human beings as activities are encoded in neural pathways and not in what we might commonly refer to as memory, which involves a conscious effort to reconstruct past events by accessing certain areas and functions of the brain.

Neuroplasticity is also a response to injury when significant changes—remapping—occurs to accommodate the damage in order to shift functions to other parts of the body. Neuroscience research and theory now support the concept that personal experience may change the brain's anatomy and functional organization—their psychology and their cognition.

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In Part Two next month, Master Mediator columnist Bob Creo applies this discussion of brain design and function to decision making and conflict resolution.

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Why Matter Matters in ADR

The task: Understanding how the brain functions—a back-to-school assignment, only deeper.

The relevance: People at the negotiating table are reacting for complex reasons. Familiarity with at least some of this will make you more productive.

Mediation application? More on that coming in Part 2.