



BP – Hemispheres

Understanding left-right hemispheric specialization is crucial because it helps reframe problems in education and mental health to understand key contributing factors and solutions in a whole new way.

Here are a dozen+ bytes of research and science reporting on hemispheric specialization, plus one compelling first-hand account from a brain scientist whose left hemisphere shut down, and excerpts from notable voices including best-selling author, Dan Pink (*Whole New Mind*, and *Drive*). And there's always more 😊

It is important to note upfront that 1) after a brain injury, some parts can compensate to varying degrees for other parts, and 2) many regions of the brain are all activated and networked for many daily, routine tasks, HOWEVER neither 1) nor 2) disproves or precludes hemispheric specialization.

It's not either/or. That's old mechanistic paradigm thinking. Quantum thinking is both/and.

Also, 3) though many different areas of the brain may be activated, there are varying degrees and qualities of "activation". There are more settings than just on or off.

Continuum Center has been advocating for malleability and plasticity of the brain for decades while conventional science held that the brain is fixed and cannot generate new cells or rewire. Well, 40 years later...

*"the brain is far more malleable than we once thought. After a hemisphere is forced to manage on its own, it can rewire itself to handle all the tasks of a full brain. In fact, two hemispheres can cause more trouble than one if they cannot talk clearly to each other. **Neuroscientists have linked some mental disorders, including dyslexia and Alzheimer's, with a breakdown in left-right communication.**" Discover 2009 May Carl Zimmer*

We'll start the "formal" presentation of 12 points for hemisphere specialization and the implications for education, with a "debunker's" attempt to disprove it.

1) From Dirk Van Damme's "debunking" article" <http://www.oecd.org/edu/ceri/neuromyth6.htm> :

"Other experiments with split brain patients investigated the role of the right hemisphere. The results of these



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experiments were that the right hemisphere is specialised in processing complex visual and spatial conditions. A video by Sperry and Gazzaniga about the split-brain patient W.J. shows one of the most impressive demonstrations of the superiority of the right hemisphere for visuo-spatial tasks...This role of the right hemisphere is further corroborated with clinical case studies."

Even a debunker says "specialized", and "most impressive demonstrations of superiority".

"Furthermore, clinical studies let researchers postulate that the right hemisphere is specialised in emotion processing. Emotional expression, as well as emotional recognition and discrimination, are impaired after lesions to the right brain hemisphere...These clinical findings are supported by behavioural studies...Furthermore, stimuli presented to the left visual field (right hemisphere) are judged to be more emotional and even to elicit stronger responses from the autonomic nervous system"

"Specialized", and "more/stronger emotional responses."

Mr. Van Damme says does not see any evidence that engagement/development of right hemisphere capacities is lacking in the classroom.

2) Human Memory, Cerebral Hemispheres, and the Limbic System: A New Approach. Genetic, Social, and General Psychology Monographs February 1, 1999 | [ROTENBERG, VADIM S.](#); [WEINBERG, IGOR](#) :

"In recent years, there has been increasing evidence suggesting that the limbic system and the right hemisphere are interrelated and that they function in close cooperation. In particular, they are closely associated in the processing and storage of memories (see review by Nadel & Moscovitch, 1997; Markowitsch, 1995). In line with that suggestion, Tranel and Hyman (1990) reported that in a 23-year-old patient, there was a significant defect in visual, nonverbal memory following bilateral amygdala damage. Evidence suggests that there is a greater interconnection between the limbic system and the right hemisphere than between the limbic system and the left hemisphere (Joseph, 1982; Liotti & Tucker, 1995; Tucker, 1991)... Emotions are closely associated with the right hemisphere (Joseph, 1982, 1988; Liotti & Tucker, 1995; Rotenberg, 1993)."

"...greater interconnection between limbic system and right hemisphere," and "Emotions are closely associated with right hemisphere"

3) KEVIN BOEHM Yale Scientific April 2012:

*"When children were shown images and asked to tell a story about them, function was lateralized strongly in the left hemisphere for over 90 percent of participating children. However, when asked to listen to an emotional story, both hemispheres of the brain were activated to a similar degree as planning and articulation require more processing involving more regions on both sides of the brain. **The stories the***



children listened to, unlike the pictures, were emotional, which may indicate that the observed involvement of the right hemisphere is linked to emotional regulation."

"...function lateralized strongly in left" until "when asked to listen to emotional story both hemispheres were activated to similar degree." (This is also evidence that regions can indeed be less or more activated depending on attention. We are not using all the brain all the time.)

4) Japanese research team, led by Prof Ryuichi Shigemoto in National Institute for Physiological Sciences, "Dr Yoshiaki Shinohara and his colleagues found that synaptic size and shape in the center of the spatial memory (i.e. hippocampus) were asymmetrical between synapses receiving input from the left and right hemisphere...They investigated the electron microscopic structure of synapses in left and right hippocampus, and found synapses made by terminals from the right hippocampus are large, complex in shape, and rich in the GluR1 subunit of AMPA-type glutamate receptors. In contrast, synapses receiving input from the left hippocampus are small and rich in the NR2B subunit of NMDA receptors. **That means, both synaptic structure and synaptic molecules differ between synapses with left and right inputs. "Long-term potentiation (LTP), that is known as the cellular mechanism of learning and memory, depends on the allocation of glutamate receptors in hippocampus". **This report is published in Proceedings of National Academy of Sciences in the week of Nov 17, 2008.****

"...both synaptic structures and synaptic molecules [including glutamate receptors] differ between synapses with left and right inputs...learning and memory depends on allocation of glutamate receptors..."

The right hemisphere is more tied to emotions and therefore very important for learning, given all the research on emotions and learning. Look at the way/what we currently teach, and look at all the myriad, epidemic signs of emotional distress and dysfunction in our youth, and society generally.

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In addition, Van Damme admits:

5) "Sperry's experiments yielded an amazing result: when split brain patients processed an object with their right hand, i.e. with their left hemisphere, they could easily name the object. In contrast, when an object was touched with the left hand, i.e. processed by the right hemisphere, they could not name it! This finding put an end to the century long discussion on language lateralisation. **It affirmed that the left hemisphere is unequivocally the seat of the major language functions in most individuals."**

He says, "left hemisphere is unequivocally the seat of the major language functions in most individuals." Well, because education is primarily verbal, there is the language reading/writing connection. Language names and differentiates things – which is analysis. L hem is more calculating...facts, figures, names, dates, places. Logic is about tabulating data ..less connection to **emotional brain.**



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Story-telling and imagery, introspection and emotional sensing are much more R hem, music too, but not much of any of that in schools today.

He goes on to say:

"There is no direct scientific evidence that supports an analytical, logical thinking style for the left hemisphere, which predetermines the left hemisphere for mathematical tasks, or reading and writing. In contrast, Stanislas Dehaene found that both the right and left hemisphere are active in the identification of Arabic numerals (e.g. "1", "2"). Similarly, other data showed that subsystems in both hemispheres are activated for parts of the reading process, e.g. decoding written words or recognising speech sounds."

It does not automatically follow that because identifying Arabic numerals, and parts of the reading process, use subsystems in both hemispheres, that is evidence there is NO hemispheric specialization relevant to education? Maybe there's something about working with Arabic numbers that is more visually and creatively engaging. Almost like an art project. Hard to take one study of a non-representative subject and generalize to broader conclusions about hemispheres and education.

There are more specifically designed studies that come to very different conclusions.

6) July 12, 2011 by **Martha Burns, Ph.D, The Science of Learning** (which would relate to education):

*"...Several neuroscientists have accordingly revised and expanded the early right-left dichotomy to see **the right hemisphere as preferential in processing form, structure, and perhaps, direct links to emotion, [vii] while the left hemisphere handles complex, rapidly changing stimuli, in which discerning the specific sequential order is critical to perception** (as in speech perception, for example, where one must discern and order very rapidly changing complex acoustic events very quickly.)*

*Another revision to the older view of right versus left hemisphere complements the view that the right hemisphere is preferential for pattern analysis, and comes from **developmental neuroscience which has reported research that supports the contention that for most cognitive skills the right hemisphere matures before the left.**"*

"Preferential in processing," "matures first," right has perhaps "direct links" to emotion ("in here"), and left handles rapidly changing stimuli ("out there")

Do you think "handles stimuli" is just a yes or no or are there degrees of activation/engagement and capacity development? Do you think with an education system hyper focused on math, science and linear verbal skills system - all L hem specialties, that the right hemisphere is going to be as



engaged and developed as it could be?

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7) **Stroke Smart Magazine**

July/August 2007

AMAZING BRAIN

Right vs. Left: What Does It Mean? By Jay Schneiders, PhD:

"In the case of tasks such as talking, listening, reading and writing, both sides of the brain constantly communicate and work together no matter what we think, feel or do.

Still, the left side of the brain does process information differently from the right side. This is especially important to stroke survivors who have had a stroke on one side of the brain or the other.

The left side of the brain (again, in most, but not all of us) deals with putting information in order and analyzing things in a more sequential way. It handles details, is (in some ways) superior for reading and writing, and is probably more responsible for positive emotions such as joy. People with left-sided strokes may have trouble with skilled movements, depression and speech.

In contrast, the right side of the brain has a more big-picture, large-scale processing style. It pulls information together, seems better at handling new information, and is probably more responsible for negative feelings. People with right-sided strokes may have problems with music, melody in speech, confusion and anxiety reactions."

"Process information differently," (L) "handles details," and (R) "more big-picture, large-scale processing style." HighBeam Research

8) **The University of Arkansas Enhanced Learning Center Eric Jensen Brain-based Learning 2000:**

*"Researchers discovered that musicians process music to a greater degree in the left hemisphere, while non-musicians process it more in the right hemisphere. This paradox points to the complexity of our brain functions. In this case, **since musicians tend to analyze music more than the novice, their left brain is engaged to a greater degree.**"*

"analyze music" – "left brain is engaged to a greater degree"

"Greater degree" means there are degrees to which an area is activated...it is not just an on or off setting.

If we all already, every day, use all of our brain, why does certain brain training change brain waves and enlarge certain areas of activation? And there is lots of evidence for this. **Ancient yoga practices and psychology** are another source of challenge to conventional science views



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on human capacity...changing physiology in ways that materialist, behaviorist assumptions can't account for because it means **consciousness is a causal reality**

[MARC mindfulness research summary - UCLA Mindful ...](#)

marc.ucla.edu/workfiles/pdfs/MARC-mindfulness-research-summary.pdf

Brief Summary of **Mindfulness Research** ... **mindfulness** practice on the **brain**. ... **Mindfulness training** may affect an individual's ability to harbor successful social

Brief Summary of Mindfulness Research by Greg Flaxman and Lisa Flook, Ph.D.

"Researchers' interest in mindfulness practice has steadily increased as studies continue to reveal its beneficial effects. Current research looks at how the brain responds to mindfulness practice, how relationships benefit, and how physical and mental health improves, as well as other topics."

[Mindfulness Meditation Is Associated With Structural ...](#)

nccam.nih.gov/research/results/spotlight/012311.htm

Mindfulness meditation may increase gray matter ... **Mindfulness Meditation** Is Associated With Structural Changes in the **Brain** ... About **Research Training** and ...

The tide is slowly turning...the growing interest in and assimilation of so much that was thought to be "fringe" and "hippie" 50 years ago is now creating a wave. **The paradigm is shifting.** It started awhile ago.

"Prepare your craft. The verbal [left hemisphere] dam is collapsing." Timothy Leary

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9) **Science News** ... from universities, journals, and other research organizations

Is Our Left Brain Is Different From Our Right? Nov. 25, 2008:

"Since the historical discovery of the speech center in the left cortex in 150 years ago, functional differences between left and right hemisphere have been well known; language is mainly handled by left hemisphere, while spatial recognition is more specialized to the right hemisphere. However, the structural differences of synapses underlying left-right difference of the brain remained unknown."

"Functional differences," "specialized," "underlying left-right difference"

10) ***"The two sides of the brain may be a legacy that we inherited from our wormlike ancestors. But their delicate balance of symmetry and***



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specialization is now woven into the very essence of human nature. Discover
2009 May Carl Zimmer

“Specialization”

11) James Iaccino, PhD, (1993) suggests that **although each hemisphere does have some clear-cut specialization, each side “still requires the other to complement its overall functioning.”**

“...clear cut specialization,” “complement” (there is no need to “complement” if they do the same things.)

12) In “Spheres of Influence,” a 2008 article for *Scientific American Mind*, Gazzaniga explained this concept of the left brain trying to explain behaviors about which it had no information...

So, [Michael] Gazzaniga said, it appears that each side of the brain does have “specialized” functions, as the left brain is now considered the “interpreter” or “problem solver” as well as the center for most language skills. Yet the right brain has importance as well, especially in terms of perceptual grouping, and in accurately identifying and later recalling groups of objects presented to it.”

Right brain - seeing how parts fit into a perceptual pattern...memory...

“The advantage of having a dual system is obvious,” Gazzaniga writes in the *Scientific American Mind* article. “The right hemisphere maintains an accurate record of events, leaving the left hemisphere free to elaborate and make inferences about the material presented. In an intact brain, the two systems complement each other, allowing elaborative processing without sacrificing veracity.”

In one experiment, “To the researchers’ amazement, the patient came up with a totally fabricated story of why he had pulled an apple from the bag. The “story” was an attempt to explain or interpret his behavior, to make sense out of what he didn’t know.”

Interesting. Left brain dominance at expense of right hemisphere capacities leads to making up explanations for things. ☺

In 1996 brain scientist **Jill Bolte Taylor** was on the fast track of her profession. Researching and teaching at Harvard Medical School by day, “Dr. Jill” filled her weekends and evenings educating audiences about what she calls the “tissue issue”—the value of brain donation for research. She was moving steadily toward her goal of understanding the chemical foundation of mental illnesses such as schizophrenia, from which her brother suffered. Two years earlier, at 35, the Harvard-trained neuroanatomist had become the youngest board member ever at the [National Alliance on Mental Illness](#) (NAMI).

But on December 10, 1996, the energetic brain scientist had a stroke: a golf-ball-sized hemorrhage and blood clot shut down the left hemisphere of her brain.



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“For eight years I did not exist as a solid; I existed as a fluid entity in a fluid environment. When I lost that perception of “solid” and that defined boundary of my body, I became at one with all that is. That is a very different way of perceiving yourself in relationship to your external world. This was a marvelous experience—to be that enormous in the absence of the distraction of language that has to label everything in my world.

Our academic system is designed to reward extreme left-hemisphere gifts and behavior. If you look at our level of aggression in society, it tells us what is going on in the left hemisphere. It gets stressed out; it is on a timetable, so it’s always urgent and always late and behind, and this results in a snappish attitude and behavior. To the left hemisphere, everything is either right or wrong; It is all about hierarchy, so I know where I sit on that ladder—what’s above me and what’s below me—and I have to behave accordingly to fit into my little box. Okay, that’s one way of being. But how happy are these people?”

She also speaks about the tremendous sense of interconnectedness and compassion she felt while operating in that right hemisphere mode, and goes on to clarify:

“At no time have I said that we should all grow up to just be pure right-hemisphere. The point is balance: I am a true advocate for developing both skills. Now we are out of balance with left-hemisphere dominance”. “

Bolte Taylor’s description of left and right distinctions fits perfectly with the interdisciplinary research we report. Ironically, in my 20’s I had a roommate whose right hemisphere was severely damaged and she was like a machine...very cold and calculating. A person in real-life fit the description of left brain dominance.

It’s time for a new paradigm and a new balance to create a new universe of possibility.

Our current paradigm will not get us to **optimism** – or to the positivity, empathy and compassion that everyone says/knows we need more of. **DoS Measurement tool.**

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Best-selling author Dan Pink in his book A Whole New Mind, and WIRED article Revenge of the Right Brain, states that we are entering a new right brain era which he calls the Conceptual Age. He most recently is known for his book about motivation called Drive.

Revenge of the Right Brain Logical and precise, left-brain thinking gave us the Information Age. Now Comes the Conceptual Age - ruled by artistry, empathy, and emotion.

WIRED magazine 2005 By Daniel H. Pink (former editor Yale Law Review, vice presidential speech writer and best-selling author)



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“Until recently, the abilities that led to success in school, work, and business were characteristic of the left hemisphere. They were the sorts of linear, logical, analytical talents measured by SATs and deployed by CPAs. Today, those capabilities are still necessary. But they're no longer sufficient. In a world upended by outsourcing, deluged with data, and choked with choices, the abilities that matter most are now closer in spirit to the specialties of the right hemisphere - artistry, empathy, seeing the big picture, and pursuing the transcendent.

Beneath the nervous clatter of our half-completed decade stirs a slow but seismic shift. The Information Age we all prepared for is ending. Rising in its place is what I call the Conceptual Age, an era in which mastery of abilities that we've often overlooked and undervalued marks the fault line between who gets ahead and who falls behind.”

“When I was a kid - growing up in a middle-class family, in the middle of America, in the middle of the 1970s - parents dished out a familiar plate of advice to their children: Get good grades, go to college, and pursue a profession that offers a decent standard of living and perhaps a dollop of prestige. If you were good at math and science, become a doctor. If you were better at English and history, become a lawyer. If blood gossed you out and your verbal skills needed work, become an accountant. Later, as computers appeared on desktops and CEOs on magazine covers, the youngsters who were really good at math and science chose high tech, while others flocked to business school, thinking that success was spelled MBA.

Tax attorneys. Radiologists. Financial analysts. Software engineers. Management guru Peter Drucker gave this cadre of professionals an enduring, if somewhat wonky, name: knowledge workers. These are, he wrote, “people who get paid for putting to work what one learns in school rather than for their physical strength or manual skill.” What distinguished members of this group and enabled them to reap society's greatest rewards, was their “ability to acquire and to apply theoretical and analytic knowledge.” And any of us could join their ranks. All we had to do was study hard and play by the rules of the meritocratic regime. That was the path to professional success and personal fulfillment.

But a funny thing happened while we were pressing our noses to the grindstone: The world changed. The future no longer belongs to people who can reason with computer-like logic, speed, and precision. It belongs to a different kind of person with a different kind of mind. Today - amid the uncertainties of an economy that has gone from boom to bust to blah - there's a metaphor that explains what's going on. And it's right inside our heads.



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Scientists have long known that a neurological Mason-Dixon line cleaves our brains into two regions - the left and right hemispheres. But in the last 10 years, thanks in part to advances in functional magnetic resonance imaging, researchers have begun to identify more precisely how the two sides divide responsibilities. The left hemisphere handles sequence, literalness, and analysis. The right hemisphere, meanwhile, takes care of context, emotional expression, and synthesis. Of course, the human brain, with its 100 billion cells forging 1 quadrillion connections, is breathtakingly complex. The two hemispheres work in concert, and we enlist both sides for nearly everything we do. But the structure of our brains can help explain the contours of our times.

To some of you, this shift - from an economy built on the logical, sequential abilities of the Information Age to an economy built on the inventive, empathic abilities of the Conceptual Age - sounds delightful. "You had me at hello!" I can hear the painters and nurses exulting. But to others, this sounds like a crock. "Prove it!" I hear the programmers and lawyers demanding.

OK. To convince you, I'll explain the reasons for this shift, using the mechanistic language of cause and effect.

The effect: the scales tilting in favor of right brain-style thinking. The causes: Asia, automation, and abundance."

Pink sees these additional contributing causes, they do not preclude deeper underlying causes, like the very mechanistic paradigm that so demands all those mechanistic proofs and outlooks...with a priori assumption that the inner subjective world is nothing more than material chemicals secreted and neurons firing.

Hemispheres and Education