

Male/Female Brain Differences

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You've heard the saying more than once. "Men are from Mars, women are from Venus." It's always been obvious that differences exist between men and women. The theory that brains differ, however, was not so clear. Now research is confirming that the brains of men and women are subtly different.

Male/Female brain differences (part 1):

Studies that have looked at differences in the brains of males and females have focused on: (1) Total brain size: In adults, the average brain weight in men is about 11-12% MORE than the average brain weight in women. Men's heads are also about 2% bigger than women's. This is due to the larger physical stature of men. Male's larger muscle mass, and larger body size require more neurons to control them. This does not suggest that due to the larger brain, males are smarter than females.(2) Cell number: men have 4% more brain cells than women, and about 100 grams more of brain tissue. this may explain why women are more prone to dementia (such as Alzheimer's disease) than men, because although both may lose the same number of neurons due to the disease, "in males, the functional reserve may be greater as a larger number of nerve cells are present, which could prevent some of the functional losses."(3) Cellular connections: while men have more neurons in the cerebral cortex, women have a more developed neuropil, or the space between cell bodies, which contains synapses, dendrites and axons, and allows for communication among neurons.(4) Corpus callosum: it is reported that a woman's brain has a larger corpus collusum, which means women can transfer data between the right and left hemisphere faster than men. Men tend to be more left brained, while women have greater access to both sides.(however other studies have told a different story).(5) Hypothalamus: LeVay discovered that the volume of a specific nucleus in the hypothalamus (third cell group of the interstitial nuclei of the anterior hypothalamus) is twice as large in heterosexual men than in women and homosexual men, thus prompting a heated debate whether there is a biological basis for homosexuality.(6) Language: two areas in the frontal and temporal lobes related to language (the areas of Broca and Wernicke) were significantly larger in women, thus providing a biological reason for women's notorious superiority in language-associated thoughts. For men, language is most often just in the dominant hemisphere (usually the left side), but a larger number of women seem to be able to use both sides for language. This gives them a distinct advantage. If a woman has a stroke in the left front side of the brain, she may still retain some language from the right front side. Men who have the same left sided damage are less likely to recover as fully. Curiously, oriental people which use pictographic (or ideographic) written languages tend also to use both sides of the brain, regardless of gender.(7) Inferior parietal lobule (IPL): it is a brain region in the cortex, which is significantly larger in men than in women. This area is bilateral and is located just above the level of the ears (parietal cortex). Furthermore, the left side IPL is larger in men than the right side. In women, this asymmetry is reversed, although the difference between left and right sides is not so large as in men. This is the same area which was shown to be larger in the brain of Albert Einstein, as well as in other physicists and mathematicians. So, it seems that IPL's size correlates highly with mental mathematical abilities. Studies have linked the right IPL with the memory involved in understanding and manipulating spatial relationships and the ability to sense relationships between body parts. It is also related to the perception of our own affects or feelings. The left IPL is involved with perception of time and speed, and the ability of mentally rotate 3-D figures.(8) Orbitofrontal to amygdale ratio (OAR): In one project, they measured the size of the orbitofrontal cortex, a region involved in regulating emotions, and compared it with the size of the amygdala, implicated more in producing emotional reactions. The investigators found that women possess a significantly larger orbitofrontal-to-amygdala ratio (OAR) than men do. One can speculate from these findings that women might on average prove more capable of controlling their emotional reactions.(9) Limbic size: females, on average, have a larger deep limbic system than males. This gives females several advantages and disadvantages. Due to the larger deep limbic brain women are more in touch with their feelings, they are generally better able to express their feelings than men. They have an increased ability to bond and be connected to others. Females have a more acute sense of smell, which is likely to have developed from an evolutionary need for the mother to recognize her young. Having a larger deep limbic system leaves a female somewhat more susceptible to depression, especially at times of significant hormonal changes such as the onset of puberty, before menses, after the birth of a child and at menopause. Women attempt suicide three times more than men. Yet, men kill themselves three times more than women, in part, because they use more violent means of killing themselves (women tend to use overdoses with pills while men tend to either shoot or hang themselves) and men are generally less connected to others than are women. Disconnection from others increases the risk of completed suicides.

REFERENCES:(1) <http://www.tarleton.edu/~sanderson/Male%20Female%20Differences.doc>(2) faculty.washington.edu/chudler/heshe.html(3) www.doctorhugo.org/brain4.html(4) cnri.edu/DRwilson/brain-differences.htm(5) sciam.com/print_version.cfm?articleID=000363E3-1806-1264-980683414B(6) <http://www.sfn.org/content/Publications/BrainBriefings/gender.brain.html> Male/Female brain differences (part 2):

Men and women are different, everyone knows that. But, aside from external anatomical and primary and secondary sexual differences, scientists know also that there are many other subtle differences in the way the brains from men and women process language, information, emotion, cognition, etc. Many behavioral differences have been reported for men and women. These differences appear in the way men and women : (1) Estimate time, (2) Judge speed of things, (3) Carry out mental mathematical calculations, (4) Orient in space, (5) Visualize objects in three dimensions (6) The way their brains process language. The "father" of sociobiology, Edward O. Wilson, said that human females tend to be higher than males in empathy, verbal skills, social skills and security-seeking, among other things, while men tend to be higher in independence, dominance, spatial and mathematical skills, rank-related aggression, and other characteristics. This may account, scientists say, for the fact that there are many more male mathematicians, airplane pilots, bush guides, mechanical engineers, architects and race car drivers than female ones. Another interesting information is that, male brains separate language, in the left, and emotions in the right, while the female's emotions are in both hemispheres. This helps explain why the male brain has a hard time expressing its feelings. Tests show that women generally can recall lists of words or paragraphs of text better than men. On the other hand, men usually perform better on tests that require the ability to mentally rotate an image in order to solve a problem. Mental rotation is thought to help people find their way, according to researchers. Does that leave the majority of women lost? Obviously not. Scientists believe that women may rely on their memory advantage and recall landmarks to find a destination. i.e. men are more likely to navigate by estimating distance in space and orientation, whereas women are more likely to navigate by monitoring landmarks. References : (1) [sciam.com/print_version.cfm?articleID=000363E3-1806-1264-980683414B](http://www.sciam.com/print_version.cfm?articleID=000363E3-1806-1264-980683414B) (2) <http://www.sfn.org/content/Publications/BrainBriefings/gender.brain.html> (3) <http://www.tarleton.edu/~sanderson/Male%20Female%20Differences.doc> (4) cnri.edu/DRwilson/brain-differences.htm

Male/Female brain differences (part 3):

When investigations about male/female brain differences began, scientists were skeptical about the role of genes and of biological differences, because cultural learning is very powerful and influential among humans. Are girls more prone to play with dolls and cooperate among themselves than boys, because they are taught to be so by parents, teachers and social peers, or is it the reverse order? But now, after many careful controlled studies where environment and social learning were ruled out, scientists learned that there may exist a great deal of neurophysiological and anatomical differences between the brains of males and females. Role of evolution: According to the Society for Neuroscience, the largest professional organization in this area, evolution is what gives sense to these gender differences. "In ancient times, each sex had a very defined role that helped ensure the survival of the species. Cave men hunted. Cave women gathered food near the home and cared for the children. Brain areas may have been sharpened to enable each sex to carry out their jobs". The advantage of women regarding verbal skills also make evolutionary sense. While men have the bodily strength to compete with other men, women use language to gain social advantage, such as by argumentation and persuasion. Interestingly, when we deliberately change sex-role behavior -- say, men become more nurturing or women more aggressive -- our hormones and even our brains respond by changing, too. Role of hormones: During the development of the embryo in the womb, circulating hormones have a very important role in the sexual differentiation of the brain. The presence of androgens in early life produces a "male" brain. In contrast, the female brain is thought to develop via a hormonal default mechanism, in the absence of androgen. However, recent findings have shown that ovarian hormones also play a significant role in sexual differentiation. Evidences: (1) Girls who were exposed to high levels of testosterone because their pregnant mothers had congenital adrenal hyperplasia seem to have better spatial awareness than other girls and are more likely to show turbulent and aggressive behaviour as kids, very similar to boys'. (2) There was a time when women were prescribed a synthetic female hormone (diethylstilbestrol), in an attempt to prevent repeated spontaneous miscarriages. Boys born to such women are likely to show more female-typical, empathising behaviours, such as caring for dolls. (3) Male babies born with IHH (idiopathic hypogonadotropic hypogonadism) have very small testes (and therefore low levels of testosterone) and they are worse at spatial aspects of systemising, relative to normal males. (4) Other male babies born with androgen insensitivity (AI) syndrome (testosterone is an androgen) are also worse at systemising. Interestingly, the brain areas that were found to differ between men and women are ones that in animals contain the highest number of sex hormone receptors during development. After all, males and females differ only by one Y chromosome, but this makes a real impact upon the way we think, feel, behave and react to so many things.

REFERENCES: (1) cnri.edu/DRwilson/brain-differences.htm (2) [sciam.com/print_version.cfm?articleID=000363E3-1806-1264-980683414B](http://www.sciam.com/print_version.cfm?articleID=000363E3-1806-1264-980683414B)

(3) www.guardian.co.uk/life/feature/story/0,13026,937913,00.html

Male/Female brain differences (part 4):

This is an abstract of a very interesting article by Simon Baron-Cohen (director of the Autism Research Centre, Cambridge University), published in the Guardian on April 17, 2003. The empathising-systemising (E-S) theory. Empathising : is the drive to identify another person's emotions and thoughts, and to respond to these with an appropriate emotion. Systemising : is the drive to analyse and explore a system, to extract underlying rules that govern the behaviour of a system; and the drive to construct systems. There are three common brain types: The female brain (brain of type E) : for individuals where empathising is stronger than systemising. The male brain (brain of type S): for individuals where systemising is stronger than empathising. The balanced brain (brain of type B): for individuals who are equally strong in their systemising and empathising. N.B. There are now tests you can take to see which type (E, S, or B) you are. Not which type you'd like to be, but which you actually are. A key feature of this theory is that your sex cannot tell you which type of brain you have. Not all men have the male brain, and not all women have the female brain. The central claim of this new theory is only that on average, more males than females have a brain of type S, and more females than males have a brain of type E. The theory is saying that, on average, males and females differ in what they are drawn to and what they find easy, but that both sexes have their strengths and their weaknesses. Neither sex is superior overall. What are the potential new insights from a theory like this? It may help us understand the childhood neurological conditions of autism and Asperger syndrome, which appear to be an extreme of the male brain. Such individuals may have impairments in empathising alongside normal or even talented systemising. The theory also predicts the existence of the mirror-image of autism or Asperger syndrome, namely, the extreme female brain. Science has not even begun to investigate what such people are like, but we know they must have impairments in systemising, alongside normal or even talented empathising. Finally, the theory delineates two key dimensions of individual differences - empathising and systemising - that exist among any group of children, so that parents and educators can become more tolerant of difference. The explanation for autism? Two largest sub-groups of autism are: (1) classic autism (2) Asperger syndrome. Both share certain features: (1) a difficulty in developing social relationships; (2) a difficulty in communication; (3) the presence of unusually strong, narrow interests; (4) a strong adherence to routines. They differ in that: (1) In classic autism: the person might have an IQ at any point on the scale (even in the learning disabled range) and the person invariably had a language delay as a toddler. (2) In Asperger syndrome: the person is always at least average in IQ (and may be well above average), and talked on time as a toddler. Autism spectrum conditions affect about one child in every 200, with males being far more likely than to be diagnosed. What's interesting is that the obsessional interests that people with autism spectrum conditions show often focus on a system. It may be an intense preoccupation with: (1) light switches in the house, (2) running water from the taps in different sinks in the house. For their long-suffering parents, these "obsessions" can be very hard to cope. But according to the E-S theory the child may simply be focusing on the tiny details in the system using his intelligence to work out the underlying rules that govern that system : (1) how fast the water flows when the tap is turned to different angles,

(2) which lights go on when different switches are in the up or down position The characteristic approach they take home in on a topic or area of knowledge, and comb it for every detail, until they feel they've covered most if not all of the information available. The "obsession" might last weeks, months, or even years. And then typically, they move on to a new area to master. Some parents and teachers will indulge the child so that the child can follow their obsessional interests all the way. And just sometimes, this can lead to great achievement or the development of expertise. Other parents or teachers - with good reason - feel a need to interrupt the child's obsessional focus. But the E-S theory sees individuals with autism spectrum conditions as having a learning style that prefers depth over breadth, and accuracy or exactness over gist. So much for their strong systemising. What about their impaired empathising? This is the area that is likely to lead them into trouble, or to leave them disabled. Difficulty empathising translates into a whole set of hurdles. e.g.: (1) You might be last person to get the point of a joke, which can leave you feeling like an outsider. (2) You might end up saying something that another person finds hurtful or offensive, when that was the last thing you intended. (3) You might misinterpret other people's actions and motives. (4) And you might just not pick up how others see you, and hence not know how you come across as odd or different. (5) People's insincerity or subtle emotions may just go straight over your head. References: (1) www.guardian.co.uk/life/feature/story/0,13026,937913,00.html

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