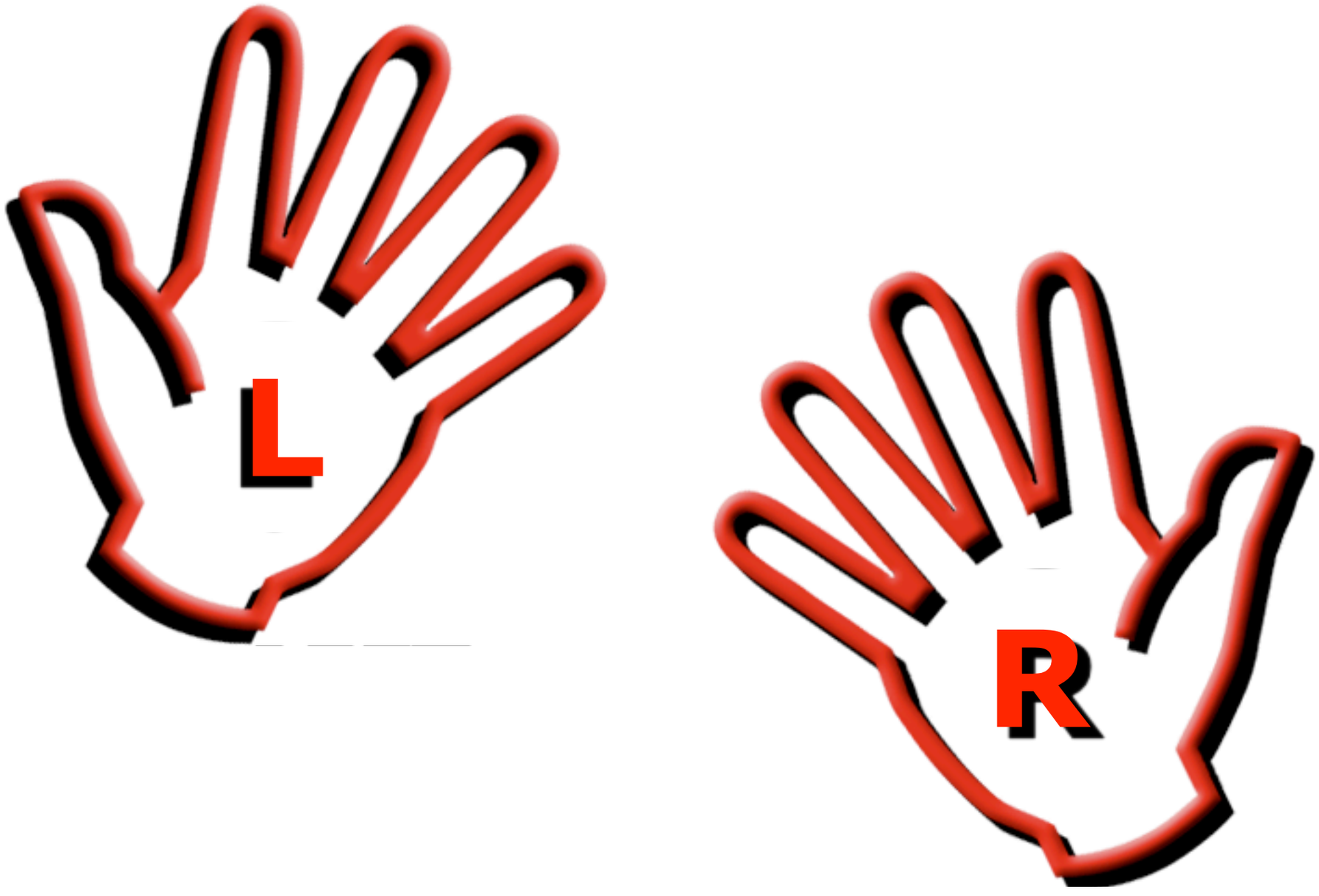
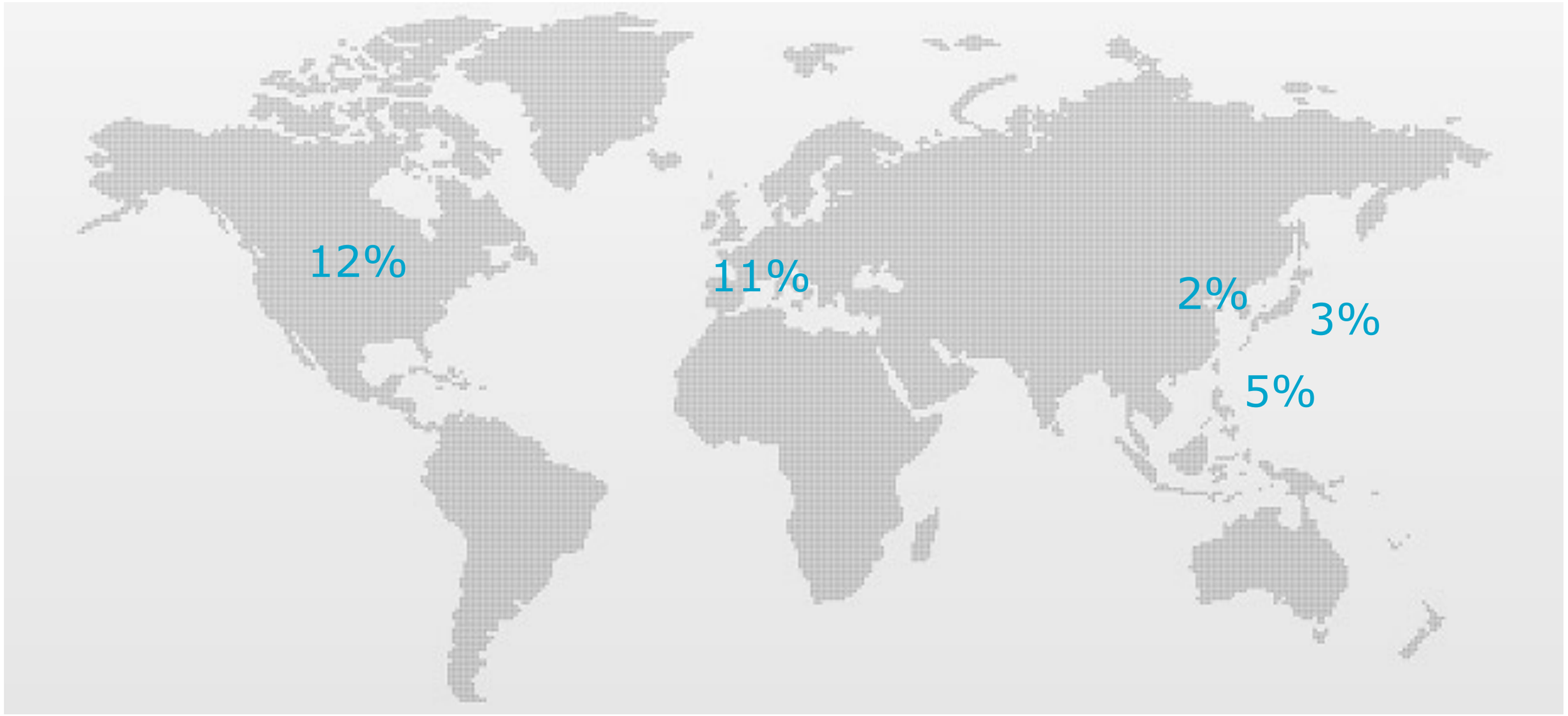
Evolutionary Genetics

LV 25600-01 | Lecture with exercises | 4KP

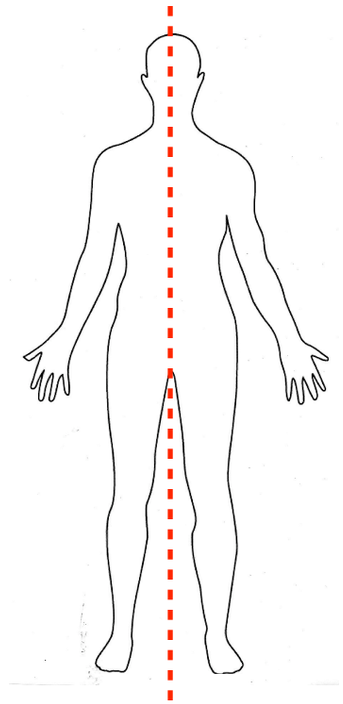


PopGen ▷ Handedness

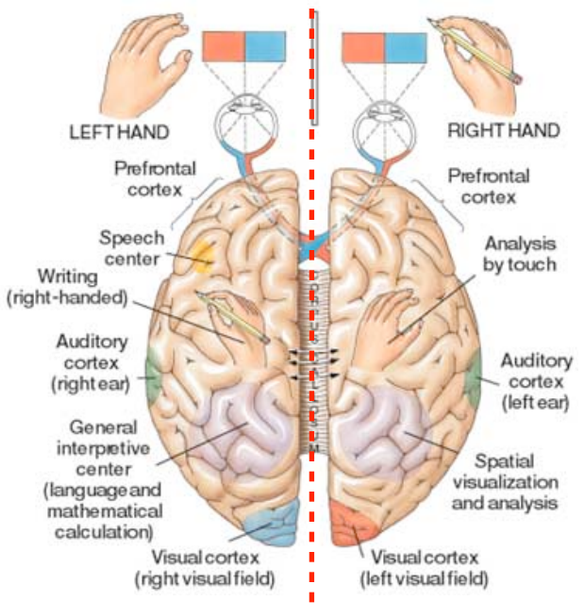
~10%



Source: http://www.rightleftrightwrong.com/



Our internal organs do not mirror the body's exterior, **bilateral symmetry.** The heart and spleen, for example, normally form on the body's left side, the liver on the right; each lung bears a distinctly different shape.



Although the two halves of our brain have broadly **similar anatomy**, certain tasks tend to be handled by one side of the brain more than the other. Scientists chalk this up to efficiency's sake, as performing duplicate, simultaneous actions on each side wastes energy and available brain power.

Whatever handedness' origin in humankind, it's clearly been around a long time. For example, **cave paintings** have shown the occasional lefty ancestor clutching a spear.

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What causes some people to be left-handed, and why are fewer people left-handed than right-handed?

Clare Porac, a professor of psychology at Pennsylvania State University who studies handedness, explains.

Researchers who study human hand preference agree that the side of the preferred hand (right versus left) is produced by biological and, most likely, genetic causes. The two most widely published genetic theories of human hand preference argue that evolutionary natural selection produced a majority of individuals with speech and language control in the left hemisphere of the brain. Because the left hemisphere also controls the movements of the right hand--and notably the movements needed to produce written language--millennia of evolutionary development resulted in a population of humans that is biased genetically toward individuals with left hemisphere speech/language and right-hand preference. **Approximately 85 percent of people are right-handed**. These theories also try to explain the persistent and continuing presence of a left-handed minority (about 15 percent of humans).

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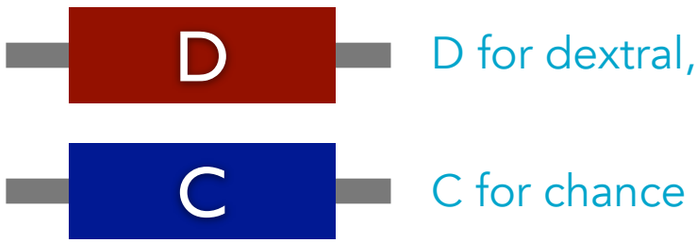

The **D gene is more frequent in the population** and is more likely to occur as part of the genetic heritage of an individual. It is the **D gene that promotes right-hand preference** in the majority of humans. The **C gene is less likely** to occur within the gene pool, but when it is present, the hand preference of the individual with the **C gene is determined randomly**. Individuals with the C gene will have a 50 percent chance of being right-handed and a 50 percent chance of being left-handed.

Right-handers rule the world, and they've been doing so since the Stone Age. How do we know this? Researchers found out by measuring the arm bones in ancient skeletons and studying the wear patterns on prehistoric tools. In Western countries, only about 10% of the population is left-handed. People who prefer different hands for different tasks (mixed-handed) or who use both hands with equal skill (ambidextrous) are rare.

Scientists have long known that handedness is partly shaped by genes. But it wasn’t until 2019 that they identified differences in parts of the DNA of left- and right-handers. The study, which also analyzed brain scans of 9,000 British subjects, found that in lefties, the parts of the right and left sides of the brain that process language work in better tandem. Whether that makes left-handers more fluent speakers is still to be investigated.

Fetuses start to move their arms around 9-10 weeks. By early in the second trimester, the babies show a clear preference for sucking one thumb over the other. So handedness is probably hardwired before birth. Still, most development experts say parents likely won’t get a good sense of their child’s dominant hand until age 2 or 3. Many kids continue to switch hands for different tasks during early childhood.

Source: WebMD - Kate Rope

Like most aspects of human characteristics, handedness is complex and appears to be influenced by many factors, including genetics and environment.

Handedness, or hand preference, is the tendency to be more skilled and comfortable using one hand rather than the other for tasks such as writing and throwing a ball. Although the percentage varies around the world, in Western countries 85 to 90 per cent of people are right-handed and 10 to 15 per cent are left-handed. Mixed-handedness (preferring different hands for different tasks) and ambidexterity (the ability to perform tasks equally well with both hands) are rare.

It was originally thought that a single gene controlled handedness. However, more recent studies suggest that several genes, perhaps as many as 40, contribute to this trait. Each of these genes is likely to have a small effect on its own, but together they play a significant role in determining hand preference. Studies suggest that at least some of these genes help determine the overall right-left asymmetry of the body from the earliest stages of development. So far, researchers have only identified a few of the many genes thought to influence handedness. Studies suggest that other factors also contribute to handedness. The prenatal environment and cultural influences may play a role.

Like many complex traits, handedness does not have a simple pattern of inheritance. Children of left-handed parents are more likely to be left-handed than children of right-handed parents. However, because the overall chance of being left-handed is relatively low, most children of left-handed parents are right-handed. Identical twins are more likely than non-identical twins (or other siblings) to be both right-handed and left-handed, but many twins have opposite hand preferences.

Source: National Library of Medicine - MedlinePlus

HANDBOOK OF
NEUROPSYCHOLOGY

The genetics of handedness, cerebral dominance and lateralization

I.C. McManus[1] and M.P. Bryden[2]

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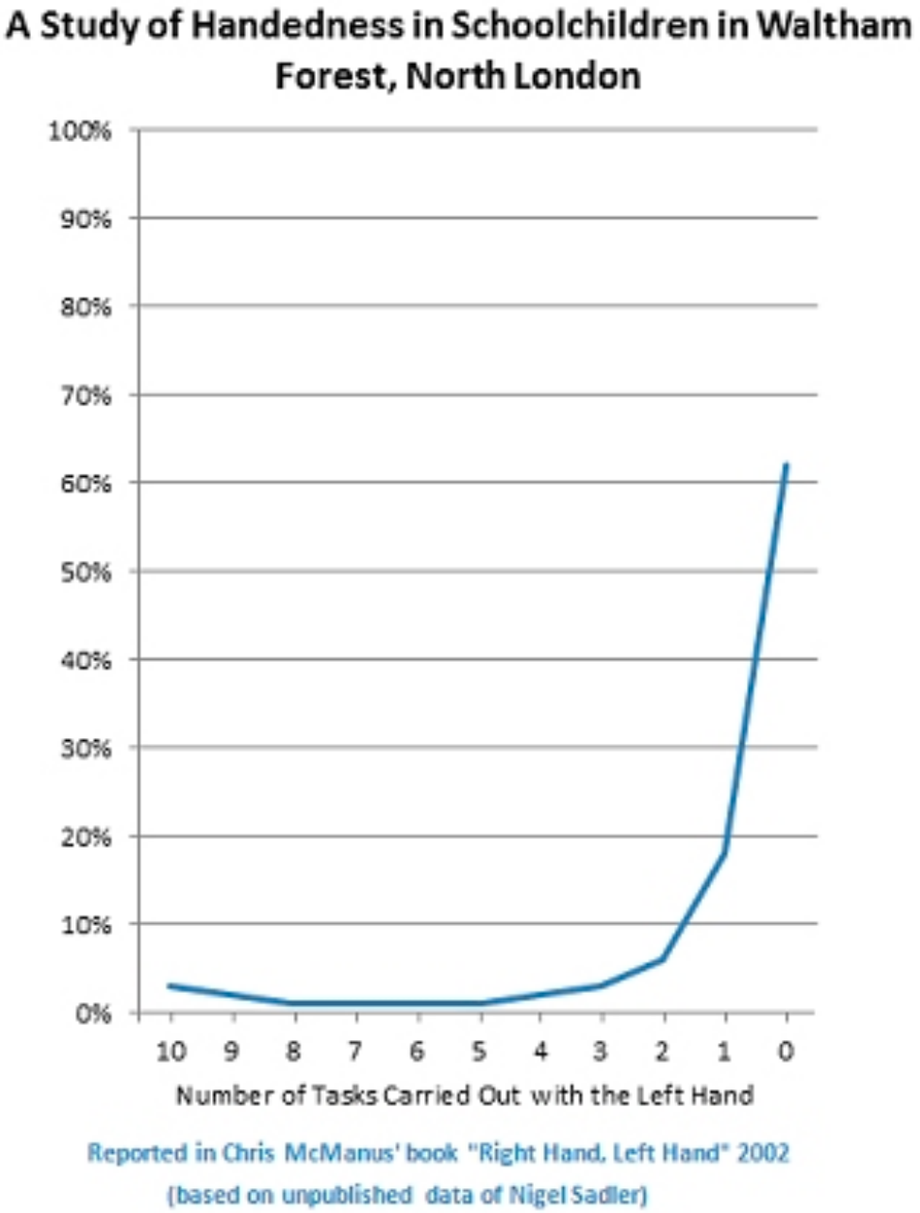
Handbook of Neuropsychology, Vol. 6: Child Neuropsychology
I. Rapin and S.J. Segalowitz (Vol. Eds)
F. Boller and J. Grafman (Series Eds)

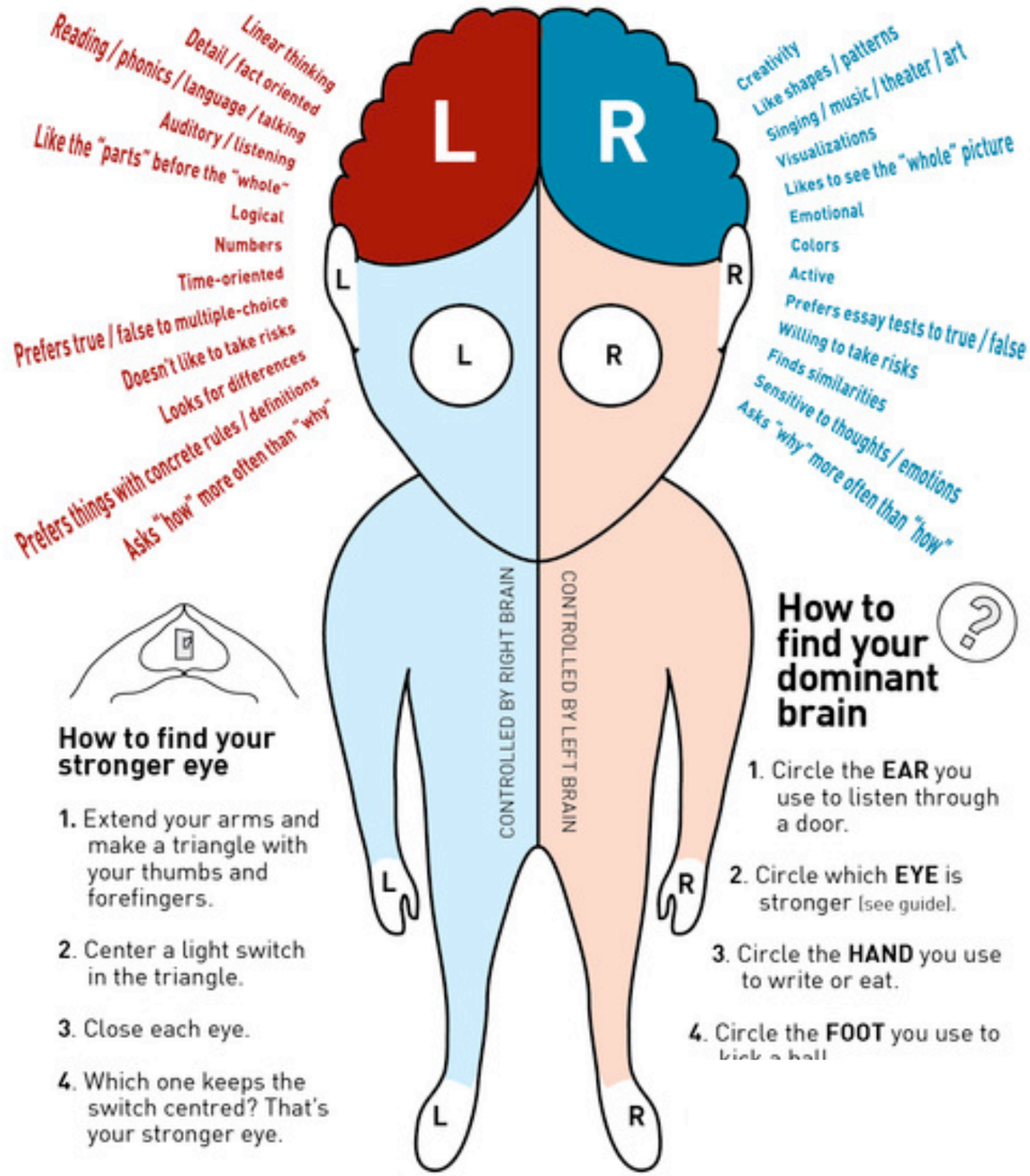
Parents		Offspring		
Father	Mother	Sons	Daughters	Total
Right	Right	10.4% (30,268)	8.5% (26,020)	**9.5%** (63,250)
Right	Left	22.1% (1,815)	21.7% (1,688)	**19.5%** (8,933)
Left	Right	18.2% (2,308)	15.3% (2,100)	
Left	Left	27.0% (215)	21.4% (168)	**26.1%** (417)



Defining handedness, then, is clearly not as simple as noting **which hand a person writes with**, although this is probably the most obvious and visible display of handedness, and the one used most often in informal situations. However, the ambiguities and inconsistencies in arriving at workable definitions present a **major challenge** to serious researchers in the area. Many **studies and comparisons** (e.g. the association between handedness and schizophrenia, autism, developmental disorders, etc) are often based on different definitions of left-handedness, which makes the data very difficult to **interpret and compare**.

Source: http://www.rightleftrightwrong.com/

PopGen ▷ Handedness



Source: http://blog.enotes.com/author/jhgardner/

- **To Do lists** will work well for you, and you're probably already an expert at them!
- You might find that you're more partial to **non-fiction reading**
- You probably work **better alone than in a group**. If you must be in a group, volunteer as leader
- Take advantage of your **organizational skills** in taking notes and scheduling
- Push yourself to **take risks**! They can pay off

RRRR > left brained

RRRL

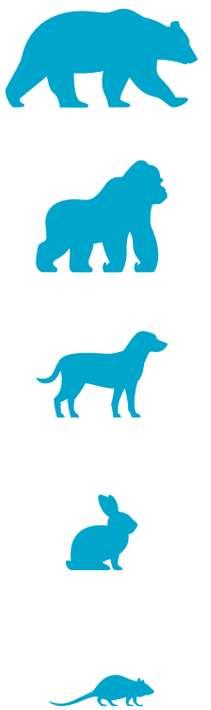
RRLL

RLLL

LLLL > right brained

- You will excel in **essays**, more so than on factual, T/F-type questions
- You probably **don't always read directions** carefully–make that a priority
- Use **images and charts** in your studies
- Use your **imagination and creativity** to its fullest on all projects
- **Organize your thoughts** by getting them down on paper

There is **little evidence** that other non-humans - even the higher apes, our **closest relatives** evolutionarily speaking - show any signs of **population-level handedness**. Although **individual animals** do tend to have a hand/paw preference (and indeed are remarkably reluctant to switch from their preferred hand in spite of the best efforts of animal experimenters), no preference has been observed at the species or population level, where it appears to remain close to **50% right and 50% left**. Researchers have even tried to breed animals according to their paw preference, but the resulting generations still exhibit a **random mix**. Thus, although the lower animals may show handedness, they do **not** show right-handedness or left-handedness.



In fact, the only other animal which has shown a distinct **population-level left-handedness** bias (and indeed the only animal exhibiting handedness at anything like the same level as humans) turns out to be the **parrot**, with **90%** of parrots favouring the left-foot for picking things up in one major study.

source: http://www.rightleftrightwrong.com

Handedness - whether someone is right-handed or left-handed - is thought to be influenced by a combination of genetic and environmental factors. Although the exact cause of handedness is not fully understood, researchers have identified several contributing factors:

Genetic factors: Studies have shown that handedness tends to run in families, suggesting a genetic component. However, the genetics of handedness are complex and specific genes responsible for determining handedness have not been definitively identified.

Brain structure: The brain plays a crucial role in determining handedness. In most right-handed people, language processing and motor control areas tend to be more lateralised in the left hemisphere of the brain. In contrast, left-handed individuals may have more symmetrical or right-hemisphere dominant brain structures, although there is considerable variation.

Environmental factors: The environment in which a person grows up may also play a role. For example, cultural and social factors can influence the development of handedness. Children often observe and imitate the handedness of their parents or caregivers.

The consequences of handedness are generally minimal and do not significantly affect a person's overall well-being. However, there are some notable effects:

Differences in brain activation: Left- and right-handed people may have differences in the way their brains process information, particularly language. For example, some left-handed people may have a more bilateral distribution of language functions in the brain.

Potential challenges: In a predominantly right-handed world, left-handed people may face some challenges when using tools and objects designed for right-handed people. These challenges may include using scissors, can openers or computer mice ergonomically designed for right-handed use.

Creativity and skill specialisation: Some studies have suggested that left-handed people may be more likely to excel in creative fields, although this is not a rule. There is also some evidence that left-handed people may have an advantage in certain sports where opponents are less accustomed to dealing with left-handed competitors.

International Left-Handers Day