

# Show your fingers to a neuroscientist

October 12 2016

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Researchers used a common photocopier to measure the lengths of the index and ring fingers of 42 women. Half of these women were asked to solve different mental tasks after they had been given a drop of testosterone on their tongue. The goal was to determine the differences in how men's and women's brains work, and the significance of finger length and testosterone levels. Credit: Carl Pintzka / Kolbjørn Skarpnes, NTNU

By comparing your index and ring fingers, a neuroscientist can tell if you are likely to be anxious, or if you are likely to be a good athlete.

It is well-known that adults whose [index finger](#) is shorter than their [ring finger](#) were exposed to greater amounts of testosterone when they were in the womb.

Both [women](#) and men with this characteristic are—on average—better equipped to solve mentally demanding 3-D rotation tasks as adults. As a group, they also have better physical and athletic abilities, but are more prone to having ADHD and Tourette's syndrome.

## **Why on earth is this the case?**

Both boys and girls are exposed to testosterone in the womb. Everyone has different levels of male and female sex hormones. Some men have a lot of testosterone, some have less, and the same applies to women. Women who have received a lot of prenatal testosterone don't need much testosterone as adults.

The level of testosterone in utero affects one's [finger length](#) as an adult.

## **24 women and a drop of testosterone**

"The relationship between the index finger and ring finger in particular indicates how much testosterone you have been exposed to in utero," says Carl Pintzka, a medical doctor and researcher at the National Competence Service for Functional MRI.

In his doctoral dissertation at NTNU, Pintzka investigated how the brain functions differently in women and men. As part of this study, he tested an established theory about the significance of finger length and how the brain works.

He measured the finger length of 42 women and gave half of them a

drop of testosterone. The other half were given a placebo. Afterwards, the women had to solve various mental tasks.

## **Short index finger, more testosterone**

"We could then look at how [testosterone levels](#) affect different abilities in healthy women both in the womb and in adulthood," says Pintzka.

An index finger that is relatively short compared to the ring finger indicates that one has been exposed to a lot of testosterone in utero, whereas a relatively long index finger suggests a lower exposure to testosterone in the womb.

"One mechanism behind this relationship is the difference in the receptor density for oestrogen and testosterone in the various fingers in utero. This relationship has also been shown to remain relatively stable after birth, which implies that it's strictly the foetal hormone balance that determines this ratio," says Pintzka.

## **More testosterone, better sense of place**

The relationship between the index finger and ring finger in humans is associated with a variety of abilities in adulthood.

"The greatest effect has been found for various physical and athletic measures, where high levels of prenatal testosterone are consistently linked with better capabilities," Pintzka says. "Beyond this we find a number of uncertain results, but a general feature is that high levels of testosterone generally correlate with superior abilities on tasks that men usually perform better, such as various spatial tasks like directional sense," he adds.

Conversely, low levels of testosterone are associated with better abilities in verbal memory tasks, such as remembering lists of words. Foetal hormonal balance also likely affects the risk of developing various brain-related diseases.

### **... but also more ADHD and autism**

Pintzka says studies show that high levels of testosterone in utero correlate with an increased risk of developing diseases that are more common in men, such as ADHD, Tourette's and autism. Low levels of testosterone are associated with an increased risk of developing diseases that are more common in women, like anxiety and depression.

His study primarily involved researching how testosterone affects different spatial abilities in women. The women were asked to navigate a virtual maze, and to mentally rotate different three-dimensional objects.

### **More study needed**

According to Pintzka, the study results indicate a trend towards a positive effect of high testosterone levels on spatial abilities in utero. He believes that a larger study would be able to show a significant correlation. Furthermore, the results suggest that these hormone levels are important both in utero and in adulthood.

In other words, no definite conclusions can be drawn quite yet. Pintzka found no prenatal hormonal effects on study participants' ability to navigate a virtual maze.

"The women who scored best on the mental rotation tasks had high levels of [testosterone](#) both prenatally and in their adult lives, while those who scored worst had low levels in both," says Pintzka.

**More information:** Carl W.S. Pintzka et al. Changes in spatial cognition and brain activity after a single dose of testosterone in healthy women, *Behavioural Brain Research* (2016). [DOI: 10.1016/j.bbr.2015.10.056](https://doi.org/10.1016/j.bbr.2015.10.056)

Provided by Norwegian University of Science and Technology

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