

# Virtual reality training could reduce gender gap in some spatial tasks

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Credit: Nick Seagrave / Unsplash

Finding out why men and women perform differently in some tasks is a matter of controversy with no scientific consensus. One of the areas under study is that of visuospatial abilities, where a number of studies have shown that men are better at certain tasks, such as mental rotation or egocentric spatial cognition, which involves locating elements in space by reference to one's own body rather than other objects.

However, the reasons for this are still unknown. According to an editorial that was recently published in the journal [\*Frontiers in Virtual Reality\*](#), the difference is not solely biological in origin and can be influenced by applying strategies to eliminate it.

The ability to form visuospatial images is a cognitive skill that we need in order to move around a space or perceive depth and distance. Its uses include drawing, buttoning up a shirt and making a bed.

We also use it for planning a route and traveling through a space to our destination, using "a procedure based on sensorimotor information about a person's position in space, the distances between the person and the object and self-movement, which provides a sequence of points of reference, turns and changes of direction that must be acquired by that person, as well as a set of place-action associations that have to be memorized," said Pierre Bourdin, a researcher and professor of the Faculty of Computer Science, Multimedia and Telecommunications of the Universitat Oberta de Catalunya (UOC).

Together with researchers from the universities of Barcelona and Zaragoza, the Aragon Institute of Health Research (IISA) and the Behavioral Addiction Care and Research Center (Centro de Atención e Investigación de Socioadicciones) of the Public Network for Mental Health and Addictions (Red Pública de Salud Mental y Adicciones) of the Government of Catalonia, Bourdin concluded that the gender differences in visuospatial abilities are not set in stone.

Significant improvements have been achieved by appropriate interventions ranging from training programs for [primary school children](#) to spatial visualization courses for engineering students. In some cases, these actions reduce or even remove the gender gap completely in many spatial tasks.

"When the first studies highlighting the differences between men's and women's spatial abilities came out, the [academic world](#), which is not free from biases, tried to find biological and evolutionary explanations," said Bourdin, who coordinates the XR Lab for [immersive technologies](#) (virtual, augmented and mixed reality) at the UOC.

"But if you look at it more closely, it is more complicated than it would seem on the surface. The differences can be altered to a great extent. This is why it's important to find out what the causes are and whether they can be eliminated, as this could lead to greater equality and possibly improve certain cognitive decline processes."

## **Virtual reality as a tool to reduce the gender gap**

One of the most astounding aspects highlighted in the editorial is the role of virtual reality in the improvement of spatial abilities. The studies presented show how this technology provides an immersive environment in which people's mental representation of cognitive maps and spatial orientation can be assessed and improved.

Furthermore, [virtual reality](#) can be helpful in studying the biases that widen this gap. Some studies have used male and female avatars, or avatars of different ages—representing children, [young people](#), adults or elderly people—to explore the importance of stereotypes in the performance of tasks, and the results are surprising. Taking on a gender, even if only in a virtual world, seems to have an impact on a person's responsiveness.

"Unlike reading comprehension, visuospatial skills are more closely linked to the types of technical tasks carried out in the fields of engineering or architecture, which have a strong logical and mathematical component; and, as most people in these fields are men, they're assumed to be the ones with these skills," said Milagros Sáinz,

lead researcher of the Gender and ICT (GenTIC) group of the Internet Interdisciplinary Institute (IN3) at the UOC.

"Such beliefs and social expectations about boys' and girls' intellectual skills are often unconscious and provide fertile ground for differences in [academic performance](#), school failure and drop-out, and choice of academic studies and career, as well as different leisure and spare time activities, among many other things. And we mustn't forget the influence of other sociocultural and contextual aspects that also affect whether these differences actually emerge," said Sáinz.

## **A research project that benefits society**

The authors of the editorial published in *Frontiers in Virtual Reality* have called for more research in this field in order to clarify the many questions that still remain unanswered. In the field of biology, a number of studies (some of which looked at differences between male and female rats in the laboratory) have found differences in the performance of certain spatial tasks, but the specific causes could not be pinpointed. As for the sociocultural facet, we must also gain a better understanding of the aspects that foster these inequalities and the tools that can help reduce them.

The research carried out in this field reveals the intricate nature of spatial abilities and their potential malleability. In spite of the [gender differences](#) found in the past, it may now be possible to modify them. The various technologies at our disposal may soon enable us to achieve the goal of reducing or even completely eliminating the gender disparities that cause girls and women to perform worse than men in spatial tasks. Furthermore, any discoveries for the improvement of spatial abilities may also be useful for treating some of the cognitive impairment seen in diseases such as Alzheimer's. All these advances will benefit society as a whole.

**More information:** Victoria D. Chamizo et al, Editorial: From paper and pencil tasks to virtual reality interventions: improving spatial abilities in girls and women, *Frontiers in Virtual Reality* (2023). [DOI: 10.3389/frvir.2023.1286689](https://doi.org/10.3389/frvir.2023.1286689)

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