

Do you get lost?

Many people get lost in unfamiliar surroundings, and many others have problems to find their car in large parking lots. However, certain individuals get lost in places that they are supposed to know intimately, such as their neighborhood, their workplace, and even their own house; these people have suffered from severe topographical disorientation from childhood, despite having no other complaints and otherwise normal cognitive skills. This lifelong and devastating condition is known as *Developmental Topographical Disorientation* (DTD).

Most DTD cases documented so far point to a consistent inability to create and maintain a stable mental representation of the surrounding including the spatial relationships between landmarks available within it (i.e. a cognitive map). Cognitive maps are normally formed while people become familiar with their surroundings, and are known to be critical for orientation since they allow individuals to reach any target location from anywhere else within the environment. The inability to form and maintain a reliable cognitive map of the surroundings leaves individuals affected by DTD with a sense of unfamiliarity that triggers spatial disorientation each time they attempt to reach a destination that is beyond their immediate visual space.

To date, studies have failed to report any abnormalities in the volume and anatomical organization of the brain of individuals affected by DTD; no damages or congenital malformation have been reported either. However, as documented by independent studies, individuals with DTD are reported to have a decreased functional connectivity between brain regions that are known to be critical for spatial orientation and navigation (i.e., hippocampus and parahippocampal, retrosplenial and prefrontal cortex). The functional connectivity between different brain regions refers to the degree to which activation patterns in different regions are correlated in time, resulting in synchronized neural activity that supports a given cognitive function, in this specific case spatial orientation. A decreased in functional connectivity between brain regions, as opposed to an issue related to selective regions, is consistent with the presence of such a devastating disability despite well-preserved independent cognitive functions such as memory, attention, and perception. Therefore, the lifelong spatial orientation issues experienced by individuals with DTD seems to be related to a compromised functional connection between components of an extended complex neural network responsible for topographical orientation in humans.

As it is the case for other cognitive skills, there seems to be a hereditary basis for the lifelong inability to orient in individuals affected by DTD. A recent study investigating the presence of DTD in some large families has shown that an affected family member was present in each generation only when one of the parents was affected. These findings suggest that the DTD trait may be consistent with an autosomal or X-linked dominant inheritance, which indicates a significant genetic component to the development of the condition.

The behavioural, neurological, and potential genetic mechanisms underlying the presence of DTD may help scientists to better define the complex cognitive phenomenon of spatial orientation in

humans. This, in turn, will provide a unique opportunity for creating training programs that may help healthy individuals to develop better orientation skills, as well as individuals whose topographical orientation skills have been affected by clinical conditions such as stroke and dementia. To learn more about DTD please visit www.gettinglost.ca.

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