Finding your way: Williams Syndrome and Navigation

What do we mean by navigation?

Research into navigation has suggested that whenever we learn our way around a new environment (e.g. a new town or a new school), there are three types of knowledge that we might gain.

1. **Landmark Knowledge**
   Landmarks are objects in the environment. We select landmarks that stand out to us, so that we can later recognise them and use them to help us to find our way. Landmarks can be *proximal* (close to you, e.g. a postbox on the street you are walking down) or *distal* (further away, e.g. a tall building in the distance). Useful landmarks are objects that are unique, permanent and don't move.
2. **Route Knowledge**
   Route knowledge describes the knowledge needed to learn a fixed route from A to B. That is, you learn a sequence of turns and associated landmarks, for example, you may think to yourself "I turn left at the bakery, and then I turn right at the bank."
3. **Configural Knowledge**
   The most sophisticated level of navigation draws on configural knowledge. This can be descibed as the relationship between landmarks and places within your environment. It is like having a map inside your head, and is sometimes referred to as a cognitive map. With this cognitive map, you can work out how to get from A to B, and, importantly, you are now able to adapt the route you take. For example, you can make short cuts, re-orient yourself if you become lost, and change your route if you encounter an obstacle (for example, a street may have access blocked because of road works).

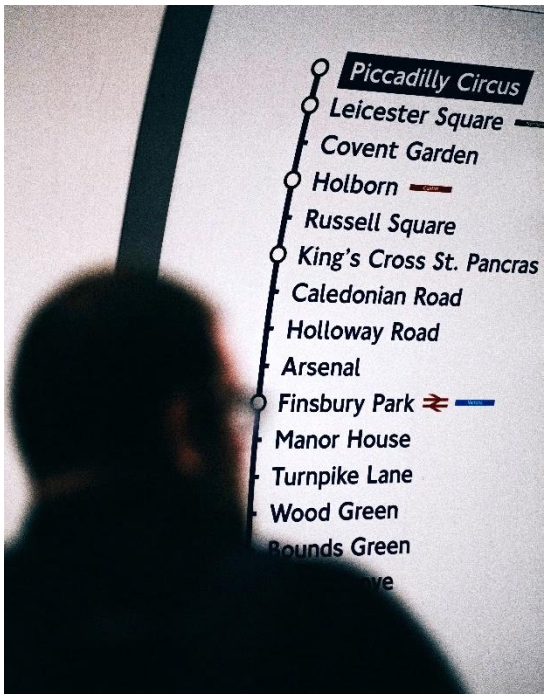
Another navigation concept is referred to as a **spatial frame of reference**. Route knowledge uses an **egocentric** frame of reference – which means that the location of landmarks are considered in relation to the self. Configural knowledge, however, requires the use of an **allocentric** frame of reference, which is when the mental representation of each landmark is considered in relation to other landmarks or parts of the environment, rather than your own body. You are able to understand the spatial relationships between external objects, independently of your own viewpoint.

Of course, in a practical sense, navigation involves more than just learning a route. For example, knowing which bus stop to get off at, knowing how to buy a train ticket, and being able to keep track of the time are all important skills for navigation. It is important to appreciate that many factors affect the ability to independently navigate. Being able to successfully navigate around an environment is essential for an indvidual's independence, confidence, and self-esteem.

Williams Syndrome and navigation

We have found in our research that individuals with WS are able to develop landmark knowledge and route knowledge provided they are given sufficient practice, but commonly have limited configural knowledge [3, 7]. This means that individuals with WS are able to learn fixed routes in a new environment. Research indicates that individuals with WS need significantly more practice to learn a new route than typically developing 5-year-old children [2]. This ability to use route knowledge is encouraging as it indicates that individuals with WS are able to find their way, even if the learning process is relatively time consuming. Remember though, as stated above, route knowledge has limited flexibility, and so individuals with WS find it hard to adapt learnt routes should they need to (e.g. finding alternative routes in response to obstacles). This reliance on fixed routes means that individuals with WS are vunerable to getting lost, as without configural knowledge, they cannot easily re-orient themselves.

Our research has also demonstrated that individuals with WS, like young children, have a strong reliance on using landmarks during route learning [2]. Compounding this, individuals with WS can also find it difficult to choose the most useful landmarks to pay attention to, sometimes paying attention to landmarks that are not particularly helpful for navigation, such as a non-unique streetlight (i.e. there might be many streetlights that look exactly alike throughout the route, thus causing confusion when relying on landmarks to determine which way to go) [5].



We have also shown that individuals with WS find it difficult to use maps, due to difficulties with linking the spatial relationships between objects on the map with the corresponding real-life objects [3].

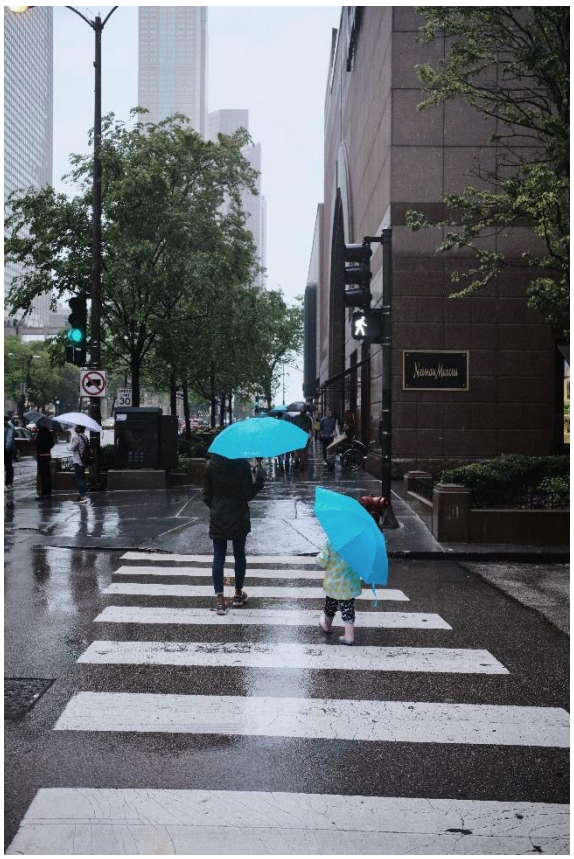
Additionally, recent research shows that the high prevalence of anxiety in WS [9] has implications for independent navigation [6]. For example, the reliance on fixed routes means that individuals may become distressed if something goes wrong with their route. Specifically, it has been shown that individuals with WS may experience anxiety about navigating independently, which has a significant impact on their navigation abilities[6]. This anxiety can affect many other aspects of navigation, such as using public transport, crossing the road, exploring new environments, or reacting to a change when they are traveling, such as a route being blocked.

Furthermore, parents and guardians of those with WS may also feel anxiety about their child's ability to navigate independently, as well as their safety and increased vulnerability in social situations [6]. These worries may limit the opportunities that the individual has to practice independent navigation. Therefore, the impact of anxiety should be appreciated when helping the individual to develop their navigation skills.

Practical Tips for navigating with individuals with Williams Syndrome

- When learning a new route, it is essential for the individual with WS to practice it many times.
  Why? *Our research shows that individuals with WS need significantly more practice than typically developing children when learning a route* [1, 2, 3, 4].

- When practicing the route, ask the individual with WS to actively lead you from point A to point B, correcting their errors as you walk along.
  Why? *This active engagement helps the individual to concentrate on learning the route* [4].



- During route learning, encourage the individual to point out and verbalise useful landmarks. For example, "There is a post-box at this corner"
  Why? *Verbally labelling useful landmarks makes it easier for the individual to learn the route* [3, 4].

- Teach the individual about which landmarks are most useful, and why.
  Why? *As individuals with WS show a strong reliance on landmarks* [2]*, it is important that they know how to select useful ones.*
  - Unique landmarks are more useful than repetitive landmarks. For example, a distinct tree or building that stands out in its environment would be a unique landmark, while a streetlamp would be a repetitive landmark, as there are many other streetlamps along most routes that look alike.
  - Useful landmarks should not move. For example, a building would be more useful than a parked car as a building will remain in the same location, while a car is likely to be moved.
  - Proximal landmarks near junctions are also more useful than proximal landmarks along path sections. This is because landmarks near decision points can be paired in memory with the direction that you need to turn.
  - Distal landmarks are generally not very useful for route learning but are still vital for developing configural knowledge.

- Make sure the individual has strategies to use if they should become lost, or if their usual route is unavailable.
  Why? *Knowing what to do in such situations can help the individual to stay calm and may reduce anxiety.*
  Such strategies could include:
    - Make sure the individual has someone that they can phone or text for help
    - Store pictures of landmarks along the route on the individual's phone (in the correct order). If the individual gets lost, they can look at the pictures to guide them.
    - Asking a safe person to help – for example, an employee in a nearby shop.

- Be aware that the return route should be learned as well, as the visual environment is different when travelling back. For example, one strategy could be to make the time to learn the sequence of landmarks for the original route in reverse order.
  Why? *The return route will look different, so the individual may not be able to visually match the environment to the one they learnt for the outgoing route* [1].

- Be aware of the impact of anxiety on navigation and provide a safe and supportive environment in which the individual can practice and develop their skills.
  Why? *Heightened anxiety, which is often present in WS, can negatively impact navigation skills. This impact is often aggravated by the presence of social phobia which is highly likely to occur given the outdoor setting of most navigation situations. As a result, anxiety when navigating is common [6], but being aware of this can prevent inadvertently making the individual more anxious.*

- Use pedestrian crossings wherever possible.
  Why? *Issues with depth perception are common in WS* [8]*, and so judging the speed of oncoming traffic is difficult.*

- Using a virtual environment could be a safe way to practice exploration and navigation skills before the child attempts to navigate alone. This can be as simple as walking the route using a streetview app on a desktop computer.
  Why? *Potential hazards such as traffic, uneven ground, etc are not present in a virtual environment. Furthermore, learning in a virtual environment can improve real-world performance* [4].

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