Marko Nardini **Merging familiar and new senses to perceive and act in space**

Our experience of the world seems to unfold seamlessly in a unitary 3D space. For this to be possible, the brain has to merge many disparate cognitive representations and sensory inputs. How does it do so? I discuss work on two key combination problems: coordinating multiple frames of reference (e.g. egocentric and allocentric), and coordinating multiple sensory signals (e.g. visual and proprioceptive). I focus on two populations whose spatial processing we can observe at a crucial stage of being configured and optimised: children, whose spatial abilities are still developing significantly, and naïve adults learning new spatial skills, such as sensing distance using auditory cues. The work uses a model-based approach to compare participants’ behaviour with the predictions of alternative information processing models. This lets us see when and how - during development, and with experience – the perceptual-cognitive computations underpinning our experiences in space change. I discuss progress on understanding the limits of effective spatial computation for perception and action, and how lessons from the developing spatial cognitive system can inform approaches to augmenting human abilities with new sensory signals provided by technology.