The human brain has a remarkable capacity for reorganisation in early life. Deprivation such as congenital deafness or hand loss is the most prominent model we have for understanding this reorganisation. Yet paradoxically, existing evidence comes almost exclusively from studies with adults, which cannot retrospectively tell us how the reorganisation took place. A key possibility is that altered behaviour during childhood, which children develop in order to cope with their disability, is a driver for brain reorganisation. Therefore, to understand the extent to which behaviour shapes functional brain organisation, we will study the brain as new behaviour is being developed. We will measure functional adaptations that children born with one hand develop in order to compensate for the lost functionality of their missing hand, and how this adapted behaviour might impact cognitive development. We will study adults who have lost a hand at different stages of development, from infancy to childhood, to determine the extent to which experience of having a hand stabilises brain organisation. We will use sign language in novices and expert signers to determine how motor experiences are transformed by linguistic experience. To ascertain the bidirectional relationship between reorganisation observed in the sensorimotor cortex and these compensatory behaviours, we will fMRI (both standard and ultra-high field), MEG and behaviour, in combination with advanced multivariate pattern analyses.