**Investigating structural connectivity in congenital prosopagnosia with**

**diffusion tensor imaging**

**Abstract**

Congenital prosopagnosia is a subtle deficit of visual perception that has only been widely recognised in the last ten to fifteen years. It characterised by impaired recognition of familiar faces and thought to be genetic and perhaps also developmental in origin. A recent study used diffusion tensor imaging to identify significant reductions in structural connectivity in some of the long association tracts of middle-aged congenital prosopagnosic subjects. New developments in the analysis of diffusion-weighted data, particularly in the field of tractography, now offer an opportunity to refine and extend these findings. The proposed experiment would seek to prove that the old study’s findings apply across the adult lifespan of prosopagnosics and are therefore not an effect of lifelong perceptual habits. It would localise differences in microstructure to particular subregions of the tracts of interest, providing novel ideas about their potential role in such a disorder. Finally, by employing more robust measures, it would tackle an unexplained result of the former study and provide a significantly more accurate quantification of white matter abnormalities.

**Introduction**

Diffusion tensor imaging (DTI) is an MRI type that allows us to non-invasively examine white matter structures in the human brain (Basser and Pierpaoli, 1996). In the past fifteen years it has widely been used to explore correlations between white matter integrity measures and differences in cognitive ability (van Eimeran et al., 2008; Yeatman et al., 2012), psychiatric profile (Kubicki et al., 2002; Steele et al., 2005), genetics (Sprooten et al. 2009; Dietsche et al., 2014) and task-specific training (Bengtsson et al., 2005; Scholtz et al., 2009). Over the same period, there have been substantial developments in the analysis of diffusion-weighted data. Tractography algorithms have been modified to take into account uncertainties in the diffusion tensor model (Behrens et al., 2003; 2007; Tournier et al., 2004; 2007) and prior knowledge about tract location (Catani et al., 2002; Clayden et al., 2007). Rigorous frameworks for voxelwise comparisons of multi-subject data were established (Smith et al., 2006; 2007). More recently, protocols for detailed within-tract analysis have been suggested (Colby et al., 2012). The pace of these developments means that many relatively recent studies of white matter and cognition do not take account of the full range of analytical tools now available. Revisiting their findings using more a sophisticated approach to data analysis is an efficient and reliable way to generate new insights.