Abstract

The thesis deals with the extension and validation of an already existing prediction model of human facial development. Within the main aims I also focused on comparing the new predictor with the original one and creating growth trajectories for boys, and girls. For the implementation longitudinal data from a database of 3D facial scans belonging to the 3D Imaging and Analytical Methods Laboratory in the Department of Human Anthropology and Genetics at Prf UK were used. We evaluated 693 3D facial scans of children of the Czech population in the age ranges 3–5 years, 7–12 years and 12–15 years, where we enriched these time series with new individuals and a total number consisted of 73 boys and 87 girls. Face scanning was performed once or twice a year using Vectra and 3dMd 3D optical scanners. For the follow-up analysis we used geometric morphometry methods (CPD–DCA, PCA…) which helped us to unify the created individual 3D models of faces and to calculate the mean prediction error, which is visualized by coloured maps.

The resulting mean prediction error between predicted and real face was obtained by linear modelling of the data for children aged 3 to 5 years, 7 to 12 years, and 12 to 15 years. In the youngest group of children, the smallest mean prediction error was achieved by boys at the age of 5, which equals 1.718 mm while in the remaining two age groups we observed the smallest mean prediction error in girls at the age of 12 was 1.726 mm and at the age of 15 was 1.798 mm. Compared to the previous studies, the difference we observe does not exceed the difference in the magnitude of the mean prediction error by more than 0.2 mm. Therefore, the results suggest that the extended prediction model is as reliable as the original one. Constructed growth trajectories showed that in the 3–5 years period, the growth rate is approximately the same for both sexes, but there is already sexual dimorphism in the face size. The largest differences were noted in the older category. For girls, the peak of growth occurs between 11 and 12 years of age and for boys between 11 and 13 years, where their growth is still continuing.

Key words

3D facial models, prediction model, age progression, mean prediction error, aging trajectories, geometric morfometry, coloured maps