Multiparametric statistics to identify recovery beneficial brain activity in recovery from aphasia

Weiller C.a*, Kümmerer D.a, Umarova R.a, Musso C.a, Hören M.a, KLöppel S.b, Saur D.c

a Neurology Freiburg
b Neurology and Psychiatry Freiburg
c Neurology Leipzig

An exact prediction of system-specific recovery after stroke is necessary to provide rehabilitation therapy based on the individual needs. (Individualised rehabilitation in recovery from aphasia requires reliable prediction.) Prediction from lesion sites/anatomy is difficult as functions as language emerge from an interaction in networks and, reorganisation is a highly dynamic process, which influences activation patterns as well as white matter integrity throughout the brain. Recovery and treatment success depends on individual poststroke anatomy. Functional scales have very different metrics and the relation to brain function is essentially unknown. Multiparametric statistics are needed to extract information from their high dimensional data. In a previous study (Saur et al 2010) we used classification with applied support vector machines (SVM) to predict individual language recovery in 21 aphasic stroke patients. fMRI data activation pattern early after stroke enabled a correct prediction in 76% of patients. When age and functional scales (language recovery score derived from a principal component analysis of subtests from the AAT or AABT) were included/added correct assignments improved up to 86%. Thus, the application of multivariate machine learning techniques to early fMRI and clinical and demographical data has a high potential to improve individual prediction. Using SVM it is also possible to identify “recovery beneficial activity” in individual subjects, thus providing a tool for a targeted intervention for stimulation techniques.

References