Neural correlates of vocal learning in songbirds and humans

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Glossary

Anterior Forebrain Pathway (AFP)
A network of nucleï in the songbird forebrain which is responsible for ”babbling” behavior in juvenile songbirds and plays an important role in birdsong learning.

Arcuate Fasciculus (AF)
White matter tract connecting frontal with parietal and temporal brain regions. Anatomical basis of dorsal language pathway.

Artificial Grammar Learning (AGL)
Paradigm used to study acquisition of grammatical rules. In AGL participants acquire grammatical rules from exposure to phrases generated by a grammar and are subsequently tested on their ability to generalize these rules to new phrases.

Bird's Own Song (BOS)
Individual song of a zebra finch, in good learners a subtly different copy of the adult song model.

Blood Oxygen Level Dependent (BOLD)
Signal on which fMRI measurements are based, representing the fraction of deoxygenized hemoglobin in a brain region. A higher level of deoxy hemoglobin results in BOLD signal loss, the increased BOLD signal associated with neural activation is caused by the increased supply of oxygenized blood to the activated region.

Broca's area
Region in the Inferior Frontal Gyrus which has been associated with both speech production and syntactic processing. Broca's area encompasses Brodmann's area's (BA) 44 and 45. In this thesis, Broca's area is seeded by selecting BA 45, because this area has most often been associated with grammar learning.

Conspecific song (CON)
The song of a bird of the same species, either familiar or unfamiliar

Diffusion Tensor Imaging (DTI)
Neuroimaging technique that uses the diffusion of water protons in the brain to visualize white matter tracts.

Fractional Anisotropy (FA)
Scalar value representing the anisotropy of diffusion, where relatively high FA levels are associated with diffusion along an axis, as happens in axonal bundles. Used as a measure of white matter integrity reflecting axonal diameter, fiber density and myelination.

functional Magnetic Resonance Imaging (fMRI)
Neuroimaging technique dependent on the BOLD signal, which is used to measure brain activation.

Heterospecific song (HET)
Song of a bird from another species. In this thesis, song of the European Starling is used as a heterospecific stimulus.

Language network
Set of regions which have been demonstrated to be implicated in language processing and which are functionally connected.

MLd
Dorsal part of the Lateral Mesencephalic nucleus, the primary auditory midbrain nucleus in the songbird brain. MLd is considered the homologue of the human Inferior Colliculus.

Non-adjacent dependencies (NAD)
Dependencies between non-adjacent linguistic elements, often at the level of constituents. In this thesis non-adjacent dependencies exist within three-word phrases which by participants might be interpreted as two constituents, resulting in an adjacent dependency according to linguistic theory. However, the contrast of interest is the presence vs. absence of a dependent rule.

Resting State Functional Connectivity
FMRI technique where the data are collected in the absence of stimulation (in this thesis: with eyes closed) and analyzed for correlations between the low-frequency BOLD signal in different regions. Regions are considered functionally connected when their BOLD signals are correlated under the assumption that "What fires together, wires together".

Song Control System (SCS)
Network of nucleï in the songbird brain which is responsible for the production of song.

Tutor's song (TUT)
: Adult song which is memorized by a juvenile bird and used as a model when learning its own song. In the natural environment this is usually the father's song. In this thesis, birds are tutored by other adult males of the same species.

Vocal learning
: In this thesis: process in which a juvenile learns its vocalizations by imitating an adult. A criterion for vocal learning is that vocalizations will not develop normally without exposure to adult vocalizations.