



## Contributions of the ACx to Fine Discriminations of Sound Lateralization

Mafalda Valente 1, Juan Castiñeiras 1, Raghavendra Kaushik Archak 1, Alfonso Renart 1

1. Champalimaud Foundation, Lisbon, PT

While the Auditory Cortex (ACx) is clearly involved in processing auditory stimuli, its necessity in simple auditory decisions—such as sound localization, based on interaural level differences (ILDs)—remains controversial. Lesion studies in rodents suggest minimal impairment in simple localization tasks after ACx damage[1-3]; however, deficits are often observed in finer perceptual decision-making tasks[4,5]. Therefore, ACx may play a modulatory role.

We used ibotenic acid lesions and transient optogenetic silencing of ACx neurons to directly examine their contribution to an ILD discrimination task. While lesioning the cortex yielded no substantial effects, optogenetic silencing significantly impaired decision accuracy and increased anticipatory behaviors, with higher rates of fixation aborts. Somewhat unexpectedly, reaction times (RTs) were shorter, contrary to our initial predictions that sensory disruption would slow decisions.

We used an adapted drift-diffusion model (DDM), incorporating two parallel processes: a proactive (anticipatory) process, and a reactive (stimulus-driven) process of evidence accumulation[6,7]. While simply increasing the anticipatory (proactive) drive can mimic the increase in anticipatory responses, it did not account for the reduced accuracy nor the decreased RTs. Reducing the firing rate of sensory neurons, and increasing noise within the evidence accumulation process, were required in the model to accurately reproduce the full pattern of behavioral changes. Thus, ACx silencing appears to simultaneously degrade the sensory evidence and increase anticipatory behaviors.

Our work demonstrates the strength of combining targeted neural manipulations with detailed computational modelling, providing deeper insight into how cortical areas modulate perceptual decisions, and these findings support a nuanced role for ACx in auditory decision-making.

**auditory cortex, drift-diffusion model, optogenetics, sound localization**