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# Processes of Auditory Hallucinations (AH) in a non-clinical and clinical sample



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## INTRODUCTION

Auditory Hallucinations (AH) are sensorial experiences occurring without corresponding external stimuli (Bentall, 1990) that lie on a continuum and therefore can be found in both clinical (e.g., schizophrenia) and non-clinical samples (Toh et al., 2022). Although studying AH in non-clinical samples have the advantage of bypassing clinical limitations (i.e. medication, hospitalization), different cognitive mechanisms might underly AH in clinical and non-clinical samples (Moseley et al., 2022), highlighting the need to include both samples.

AH supposedly arises from the interaction of both top-down and bottom-up processes (Waters et al., 2012). At the bottom-up level, neural hyperactivity might trigger AH. At the top-down level, a liberal decision bias and high expectations are proposed as potential mechanisms linked to AH and has been often studied with the auditory Signal Detection Task (aSDT). In this study, we want to further explore the role of perceptual decision making in AH by manipulating the frequencies that composed the noise used in the aSDT (Laloyaux et al., 2019). Moreover, we aim to explore the association between basic auditory processing and AH (Dondé et al., 2019).

We hypothesized

- (1) that patients with schizophrenia will have a poorer ability to discriminate pure tones compared to the general population, and even more if they have AH,
- (2) that individuals with AH will do more false alarms (FA) and have a more liberal response bias, compared to individuals without AH, and even more in the human-noise condition.

## METHOD

### Sample characteristics:

Clinical: 20 patients with a diagnosis of schizophrenia or schizo-affective disorder (mean age = 33.8, 5 females). 13 with AH, 7 without.

Non-clinical: 82 participants from the general population (mean age = 30.8, 58 females). 52 with a proneness of AH, 30 without a proneness to AH.

### Auditory Signal Detection Task (aSDT)

The task consists of 144 trials of noise (half the trials with human speech frequencies – human noise; and half without those frequencies – non-human noise). For 72 trials, an English speech was embedded in noise. The voice was presented at different thresholds to ensure ambiguity during the task. Participants indicated whether they heard a voice and how confident they were.

### Tone Matching Task (TMT)

The TMT is a test that elicits discrimination of basic auditory features and, behaviourally, assesses early auditory processes. Participants had to listen to the pairs of tones and indicate whether they were different or identical.

### Questionnaires:

- Launay and Slade Hallucination Scale – Extended modified (Larøi et al., 2004; McCarthy-Jones & Fernyhough, 2011)
- Hamilton Program for Schizophrenia Voices Questionnaire (van Lieshout & Goldberg, 2007)
- Creative Experience Questionnaire (Merckelbach et al., 2001)

## RESULTS

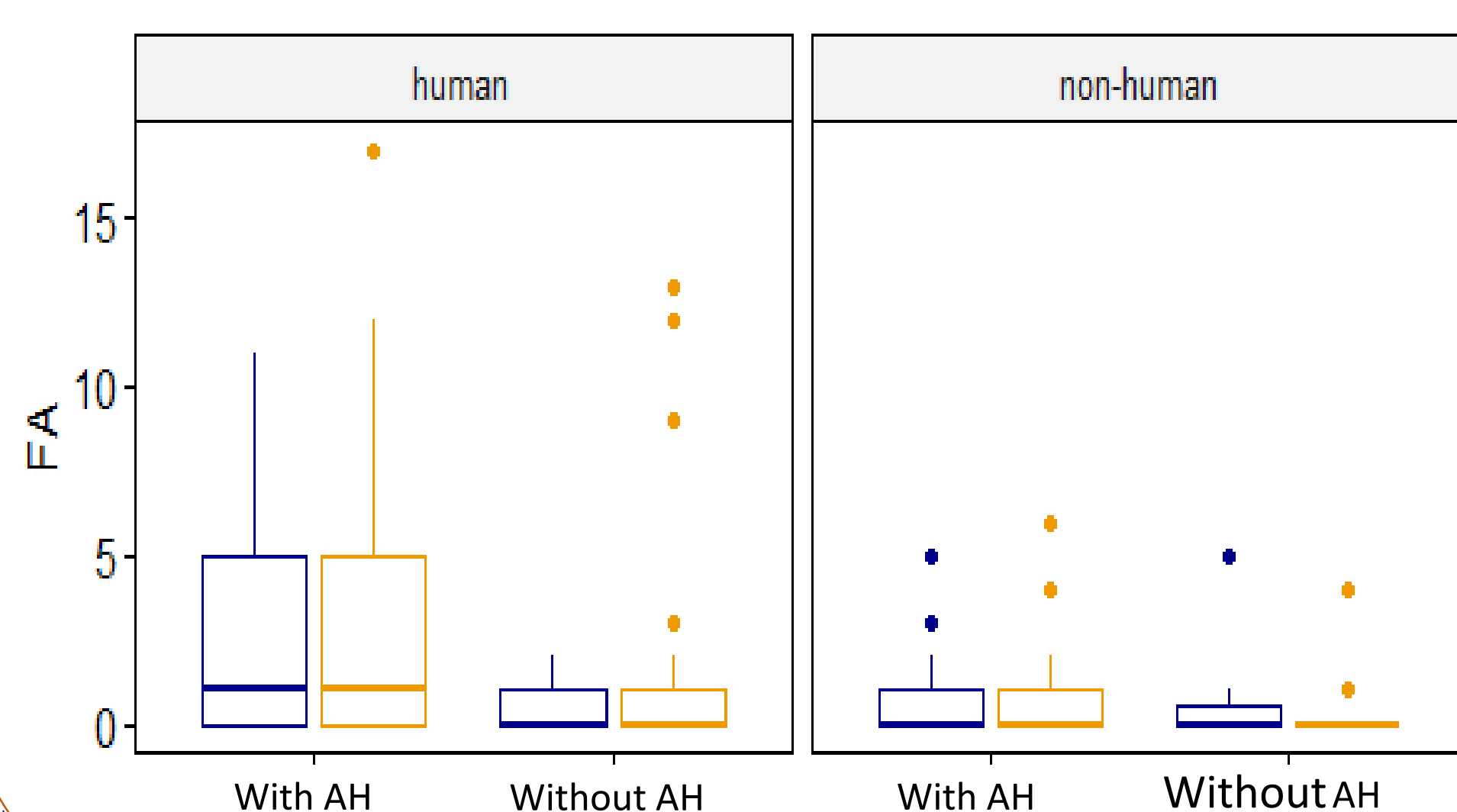
### aSDT

There is a significant effect of noise type on False Alarms (FA) ( $F(1, 98) = 8.617, p = .004, \eta^2 = 0.034$ ) and response bias ( $F(1, 98) = 76.727, p < .001, \eta^2 = 0.275$ ). However, there is no significant effect of proneness to AH on the FA ( $F(1, 98) = 3.303, p = .072, \eta^2 = 0.020$ ) and response bias ( $F(1, 98) = 2.469, p = .119, \eta^2 = 0.013$ ) neither of the clinical status on the number of FA ( $F(1, 98) = 0.038, p = .845, \eta^2 < 0.001$ ) and response bias ( $F(1, 98) = 0.219, p = .641, \eta^2 = 0.001$ ). The interaction effect was also not significant (FA:  $F(1, 98) = 0.589, p = .445, \eta^2 = 0.002$ ; response bias:  $F(1, 98) = 0.085, p = .771, \eta^2 < 0.001$ ).

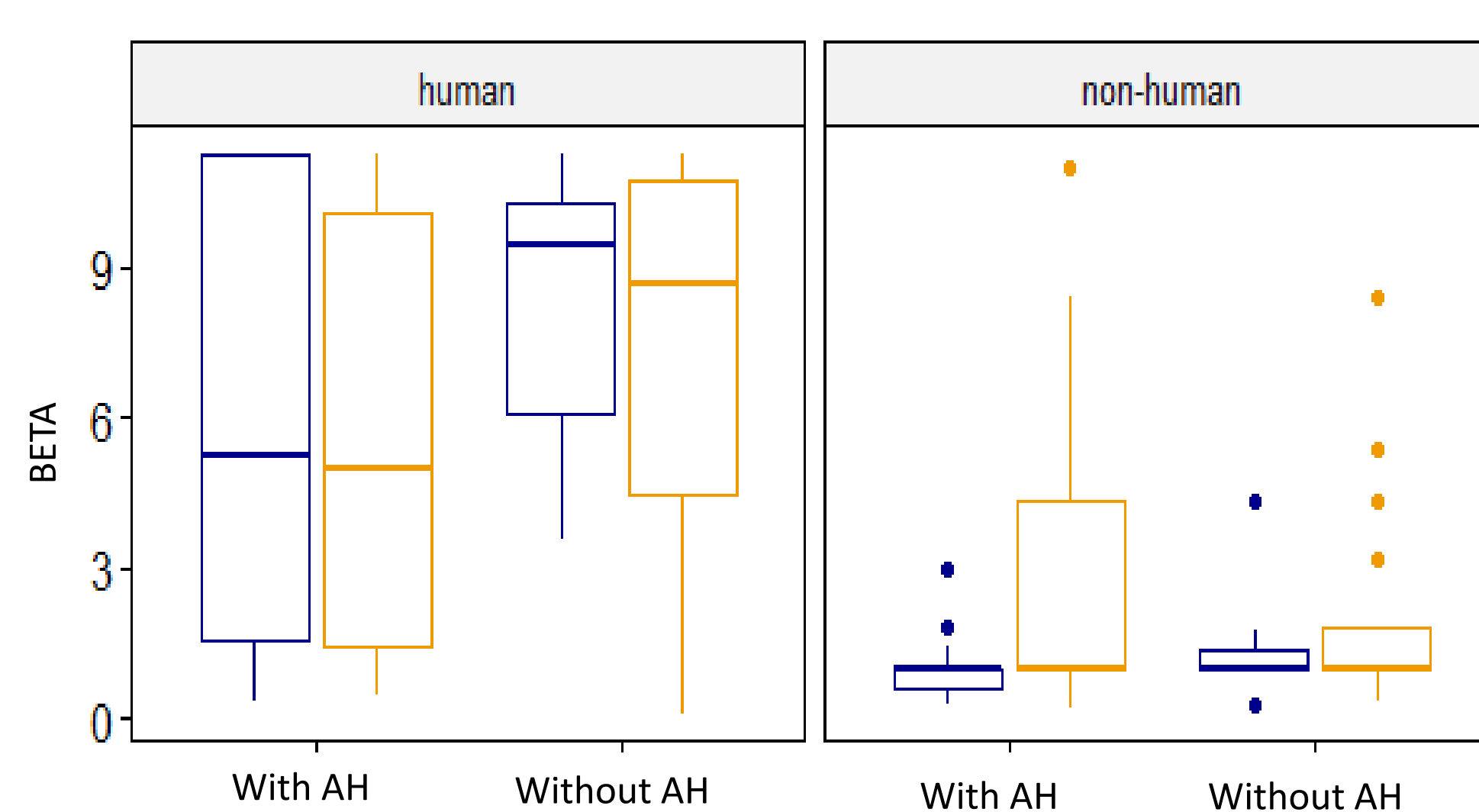
### TMT

There is a significant difference between patients and healthy volunteers ( $F(1, 98) = 21.174, p < .001, \eta^2 = 0.178$ ) in their performance in the TMT. However, no significant difference exists between individuals with or without a proneness to AH ( $F(1, 98) = 0.493, p = .484, \eta^2 = 0.005$ ). Likewise, no interaction is seen between the presence or absence of diagnosis and proneness to AH ( $F(1, 98) = 0.378, p = .540, \eta^2 = 0.004$ ) on TMT scores.

population Clinical Non-Clinical

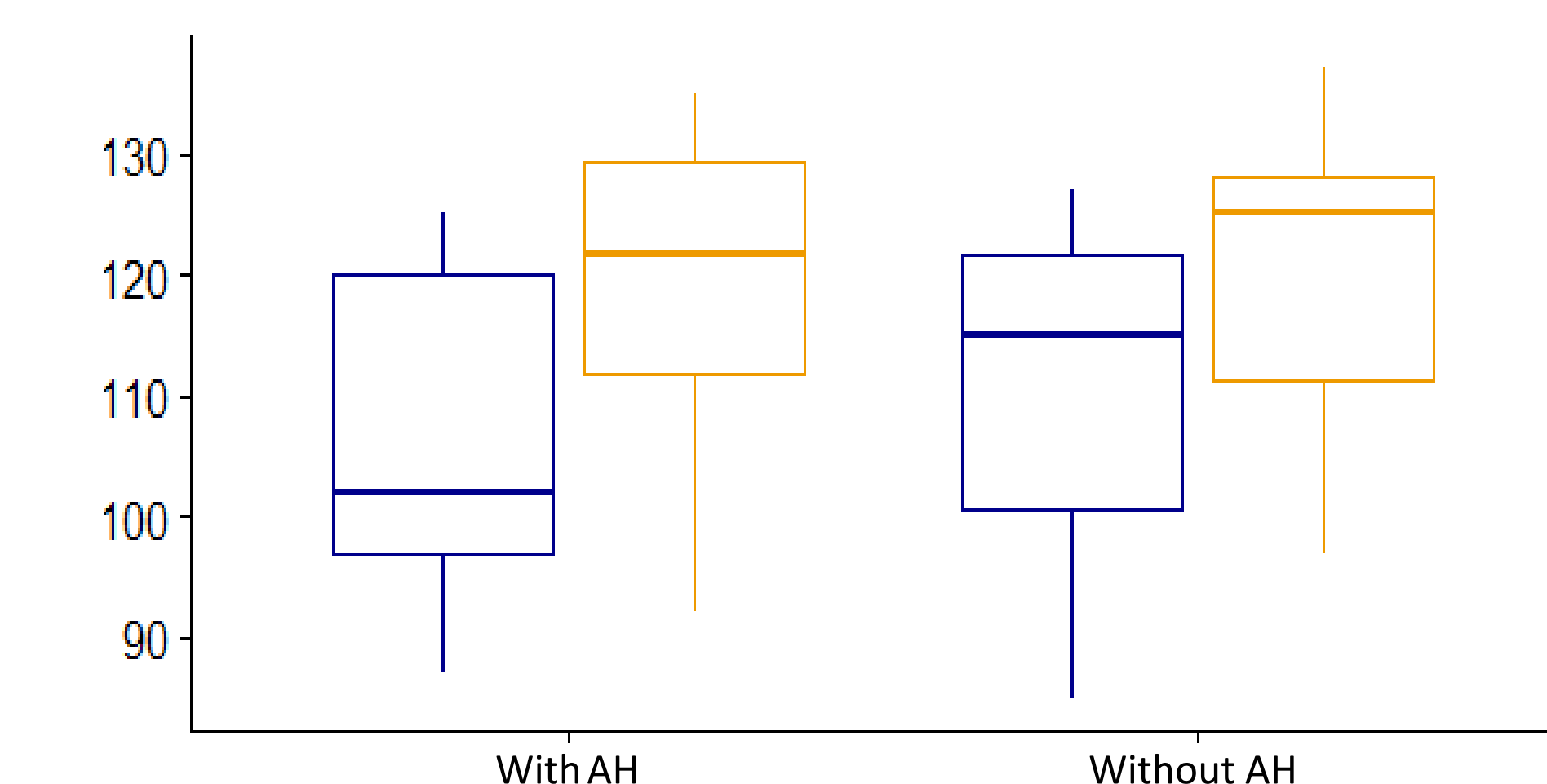


population Clinical Non-Clinical



TMT scores

population Clinical Non-Clinical



## DISCUSSION

Basic auditory processing seems to be different between clinical and non-clinical samples but doesn't seem to be linked to AH even if previous studies were showing a correlation with positive symptoms (Dondé et al., 2019).

Even if an interaction between top-down and bottom-up processes seems to take place here, it doesn't seem to be linked to AH contrary to the supposition of Waters and collaborators model (2012).

Limits: the number of participants is not equivalent from group to group and inclusions should be pursued. Moreover, normality assumptions are not respected for our TMT and aSDT variables. The preliminary results here should then be taken with caution.

A better understanding of the cognitive processes playing a role in the rise and maintenance of AH could improve interventions (Smailes et al., 2015).

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