Non-Linear Dynamics of Voice in Mental Disorders

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**Introduction**

Mental disorders are often characterized as presenting odd speech patterns: monotone voices, lack of emotional tones, mechanical rhythms, etc \cite{1-4}. These symptoms are assessed qualitatively during the diagnostic process \cite{5}. We systematically quantify voice dynamics in schizophrenic, depressed and Asperger’s patients as well as matched controls during a semi-controlled experimental task. We employ Recurrence Quantification Analysis (RQA) and automatically discriminate between populations with >77% of accuracy, highlighting distinctive voice dynamics in each diagnoses.

**Materials & Methods:**

40 Danish participants (10 with Asperger’s, 10 with schizophrenia, 10 with depression and 10 controls) matched on gender (5 Female), age (\(M = 29.89, SD = 4.78\)) and years of education (\(M = 12.62, SD = 2.8\)) were recorded while freely describing the Frith-Happé videos \cite{6} for a total of 400 speech productions.

From each audio recorded description we extracted the raw speech signal at 44.1 KHz using Praat \cite{7}. We then extracted 100 samples/second of: i) fundamental frequency (fig. 2B), selecting human voice frequencies between 75-600 Hz, ii) speech/pause sequences (fig. 2C).

**Discussion:**

Voice dynamics are a promising index of mental disorders lending quantitative support to diagnosis and treatment monitoring in psychiatric practice. The methods developed in this proof-of-concept are now being validated on larger corpora of speech production.