CONTEXT-DEPENDENT SPEECH PERCEPTION IN SCHIZOPHRENIA & SCHIZOAFFECTIVE DISORDER

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Why study language in schizophrenia?

PSYCHIATRIC SYMPTOMS
e.g. auditory verbal hallucinations, thought disorder[1]

LANGUAGE

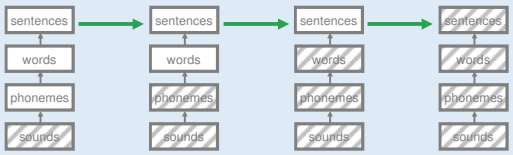
COGNITIVE SEQUELAE
verbal abilities particularly compromised, particularly early on (or even prior to dx)[2-5]

PSYCHOSOCIAL DIFFICULTIES
e.g. relations with friends & family, employment, self-care[6,7]

What leads to abnormalities in language understanding in schizophrenia?

ABNORMAL PERCEPTION HYPOTHESIS

Abnormalities in low-level perception[8-14] in schizophrenia may trickle up to higher-level language representations and processes



Prediction: Patients' ability to perceive and learn new information about speech sounds in context should be **less** compromised than their ability to perceive speech sounds in isolation

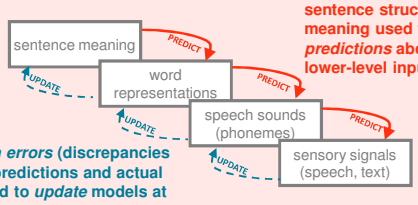
ABNORMAL GENERATIVE MODELS HYPOTHESIS

Abnormalities in hierarchical generative models of language[15-18] may disrupt both higher-level language understanding and lower-level speech perception[19-22] via a **self-reinforcing cycle of abnormal inference and abnormal prediction error signaling**

Hierarchical generative models of language in healthy adults:

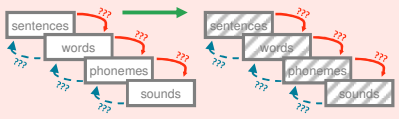
Goal: Optimal inference of intended message, given available information

Inferences **about higher-level sentence structure & meaning used to** ***generate predictions*** **about upcoming lower-level input**



Prediction errors **(discrepancies between predictions and actual input) used to** ***update*** **models at successively higher levels**

Hypothesized breakdown of generative models in patients:



Abnormal predictions and prediction error signals disrupt the links between higher- and lower-level representations

Prediction: Patients' ability to perceive and learn new information about speech sounds in context should be **more** compromised than their ability to perceive speech sounds in isolation

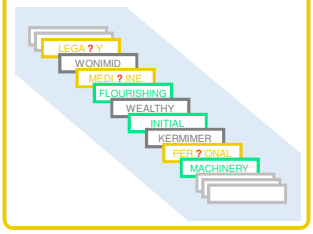
Task 1: Speech adaptation in word context

Approach: Expose listeners to words with systematically mispronounced speech sounds, then assess whether they categorize these sounds differently in isolation

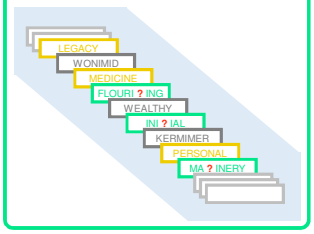
Patient population: Outpatients from McLean Hospital Schizophrenia and Bipolar Disorder Program meeting DSM-5 criteria for schizophrenia or schizoaffective disorder (assessed using SCID), all on stable medication regime, age 22-56

Exposure phase: Lexical decision for words in which either /s/ or /sh/ has been systematically replaced with a /s/-/sh/ blend (/?/)[23,24]

?S condition
All /s/ sounds replaced by /?/
7 patients, 11 controls

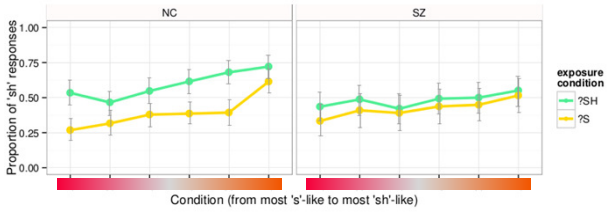


?SH condition
All /sh/ sounds replaced by /?/
7 patients, 9 controls



Test phase: All participants categorize same set of sounds as /asi/ or /ashi/

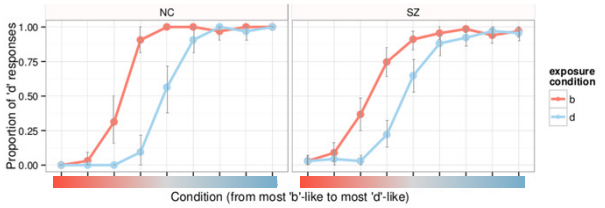
Preliminary results: Healthy adults, but not patients, are more likely to categorize /?/ as whichever sound had been replaced in the exposure words that they heard



Task 2: Adaptation of isolated speech sounds

Approach: Expose listeners to many prototypical instances of /ba/, then assess the extent to which they are more likely to categorize ambiguous sounds as /da/[25,26]

Preliminary results: Similar adaptation effects across groups (see also [10])



Task 3: Tone perception adaptation

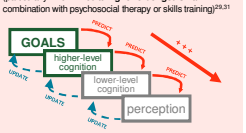
Approach: Measure tone perception thresholds with and without a fixed reference[27]

Preliminary results: Fixed reference in fact has a stronger effect on SZ thresholds (NC: **42** vs. **38**; SZ: **98** vs. **57**)

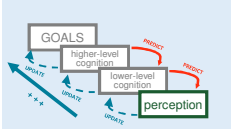
Conclusions & implications

- Patients' percepts readily adapt to lower-level context, such as surrounding speech sounds (**Task 2**) and tones (**Task 3**), but *not* to higher-level word context (**Task 1**)
- Suggests that patients are *specifically* less able to use higher-level word context to dynamically adjust their representations of speech sounds
- Supports **abnormal generative models hypothesis** over **abnormal perception hypothesis**
- Potential implications for understanding why current cognitive remediation programs are **consistently somewhat successful** despite quite different approaches[28-30]

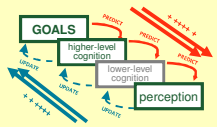
approaches focusing on high-level cognition[30] rebuild generative models via **predictive pathways**
(particularly when linked to **higher-order goals** via combination with psychosocial therapy or skills training)[29,31]



perception-based approaches[32-33] rebuild generative models via **model updating pathways**



possible that an **integrated approach** would have **synergistic benefits**



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