The shine-through paradigm and the schizophrenia spectrum: a summary

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Introduction

Schizophrenia is a heterogenous disease strongly influenced by genetics.

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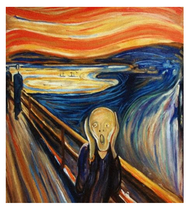


wikipedia.org/the_scream

Different symptoms, same diagnosis. APA, 2013

Unable to predict which medication will work for a patient.

Single-nucleotide polymorphism explains only a small variance of the risk for the disorder.

Visscher et al., 2012

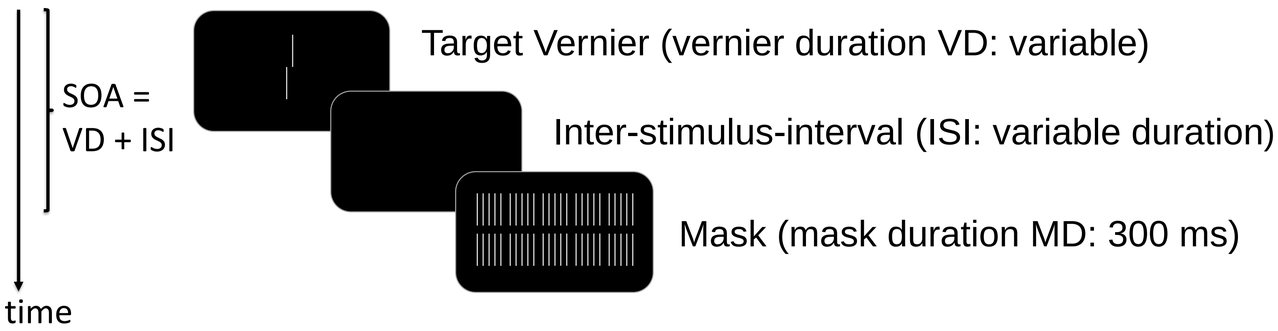
→ Endophenotypes

Gottesman & Goud, 2003
Turetsky et al., 2007

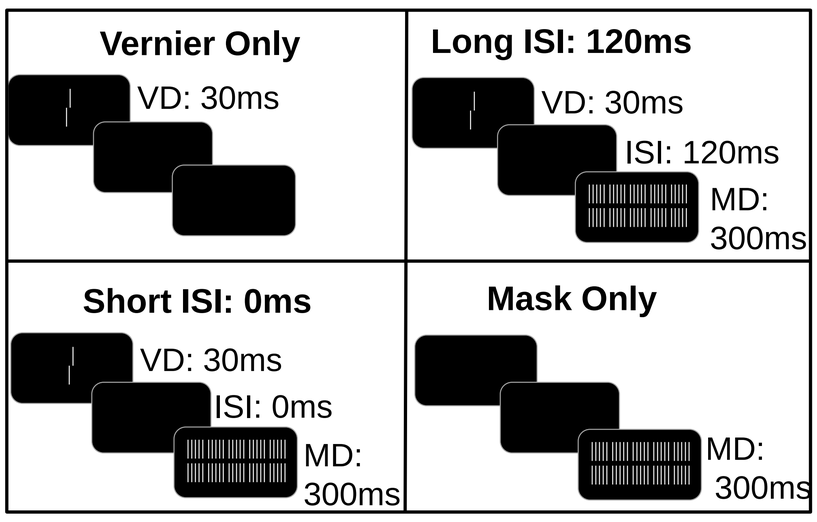
1. Associated with the disorder
2. Heritable and present at a higher rate in unaffected relatives
3. Independent of clinical state
4. Good test-retest reliability
5. Be practical
6. Reflect a neurobiological mechanism

Methods

Shine-through paradigm: behavioral experiment. Participants need to discriminate whether the lower bar of the Vernier is offset to the left or to the right compared to the upper bar. The Stimulus Onset Asynchrony (SOA) to reach 75% of correct responses is determined by an adaptive procedure.



Neural correlates of the shine-through paradigm: EEG experiment

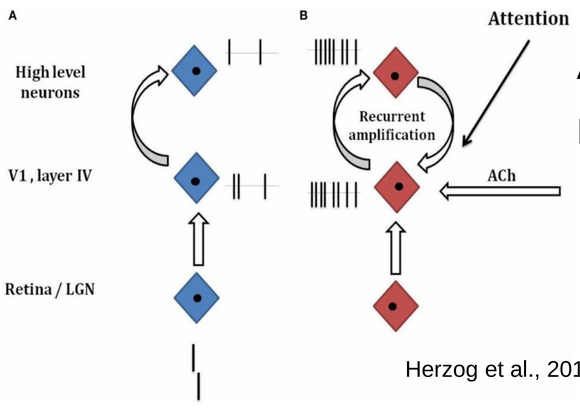


- Constant stimuli
- 30ms VD: mean SZ VD
- 150ms SOA: mean SZ SOA
- 30ms SOA: mean controls
- Mask Only: control condition

Primary measure: global field power

Hypothetical mechanism

Performance = target enhancement x intrinsic effort



A. Only weak neural responses

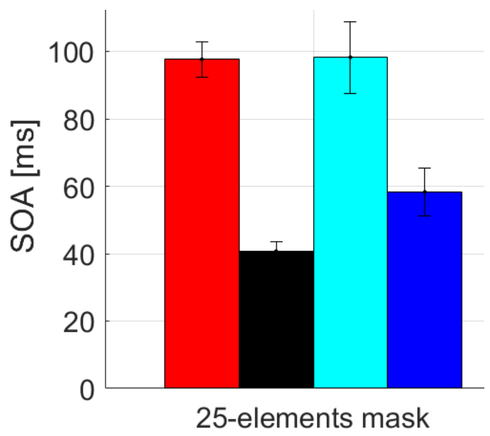
B. Recurrent processing, attention, neuromodulation: weak response of the Vernier is amplified

Herzog et al., 2013

- Schizophrenia spectrum: can't enhance the neural responses to the target vernier, making it more vulnerable to masking
- Depressive patients: can stabilize the neural representation of the vernier, but might put less effort in the task
- Siblings of schizophrenia patients: might put more effort to recruit more neural resources to partially compensate for their behavioral deficits

Results

Behavioral experiment



Schizophrenia patients (SZ) N = 121

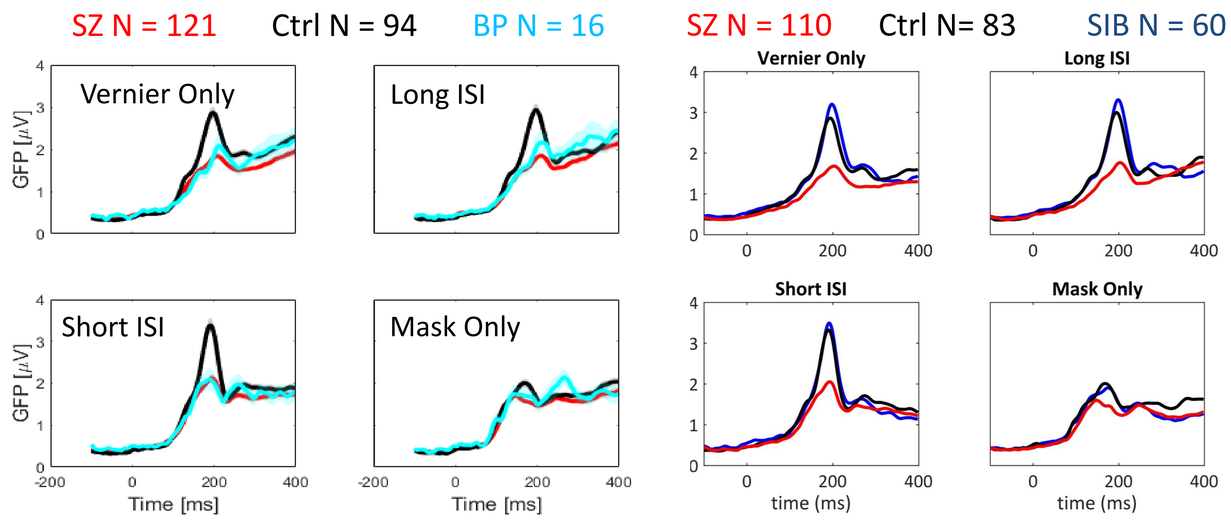
Controls (Ctrl) N = 94

Patients with bipolar disorder (BP) N = 16

Siblings of schizophrenia patients (Sib) N = 60

adapted with permission from Garobbio et al., 2021; da Cruz et al., 2020

EEG experiment



Garobbio et al., 2021

da Cruz et al., 2020

Deficits also for:

- Adolescents with psychosis N = 15 Holzer et al., 2009
- Schizoaffective patients N = 20 Chkonia et al., 2012
- Students scoring high in schizotypal traits N = 25 Favrod et al., 2017
- Patients with first-episode psychosis N = 20 Favrod et al., 2018

Related studies:

- Depressive patients (N = 39): no behavioral deficits, but GFP amplitude in between that of controls and SZ Favrod et al., 2019
- SZ taking atypical medications (N = 25) performed better than patients taking typical ones (N = 25) Fernandes et al., 2019

Genetic experiment: A SNP of the cholinergic nicotine receptor gene correlated with masking deficits in SZ. Cholinergic system plays a role in boosting faint sensory information, related to selective attention.

Bakanidze et al., 2013

Conclusion

- The shine-through paradigm is an endophenotype for schizophrenia.
- Potentially, SZ and BP show deficient target enhancement.
- Masking deficits are not visual deficits *per se* but are related to dysfunctions of attention and/or the cholinergic system.
- Results close the loop between genetics, neural processing and behavior.

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