



# Atypical visuo-temporal processing in Schizophrenia and Autism Spectrum Disorders revealed by the continuous Wagon Wheel Illusion



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## Background

1. Continuous wagon wheel illusion (cWWI) is a bistable perceptual phenomenon in which observers sometimes perceive motion reversal while viewing a continuous, periodically moving stimulus (e.g., Kline et al., 2008; Kline et al., 2004; VanRullen, 2007; VanRullen et al., 2005).
2. Several studies suggest that cWWI at least partially rely on discrete perceptual sampling of visual information (e.g., VanRullen, 2007; VanRullen et al., 2005). In particular, the high probability of seeing cWWI when a wheel rotates at ~10 Hz seems to correlate well with power fluctuations of human EEG oscillation at ~ 13 Hz over the parietal scalp region (VanRullen et al., 2006).
3. More and more studies have suggested that abnormal patterns of neuronal oscillation may play an important role underlying the psychopathology of certain mental disorders (e.g., schizophrenia and autism spectrum disorder [ASD]) (e.g., Uhlhaas et al., 2006; Uhlhaas et al., 2010).
4. In the current study, we explored to use cWWI as a behavioral probe to investigate the potential temporal-processing-related abnormality in schizophrenia and ASD with the hope to unravel the underlying abnormal neuronal oscillation of these mental disorders.

## Methods

### Participants

#### 1. Schizophrenia:

N= 11 (3 males, 8 females), mean age  $31.81 \pm 9.0$  y/o.  
Positive and Negative Syndrome Scale (PANSS): total score  $54.78 \pm 13.3$  (positive:  $12.89 \pm 3.7$ ; negative:  $14.22 \pm 4.3$ ; general:  $24 \pm 5.7$ ).

#### Age-gender matched healthy controls:

N= 11 (3 males, 8 females), mean age  $32.63 \pm 9.2$  y/o.

#### 2. ASD:

N= 10 (10 males), mean age of  $19.2 \pm 6.5$  y/o.

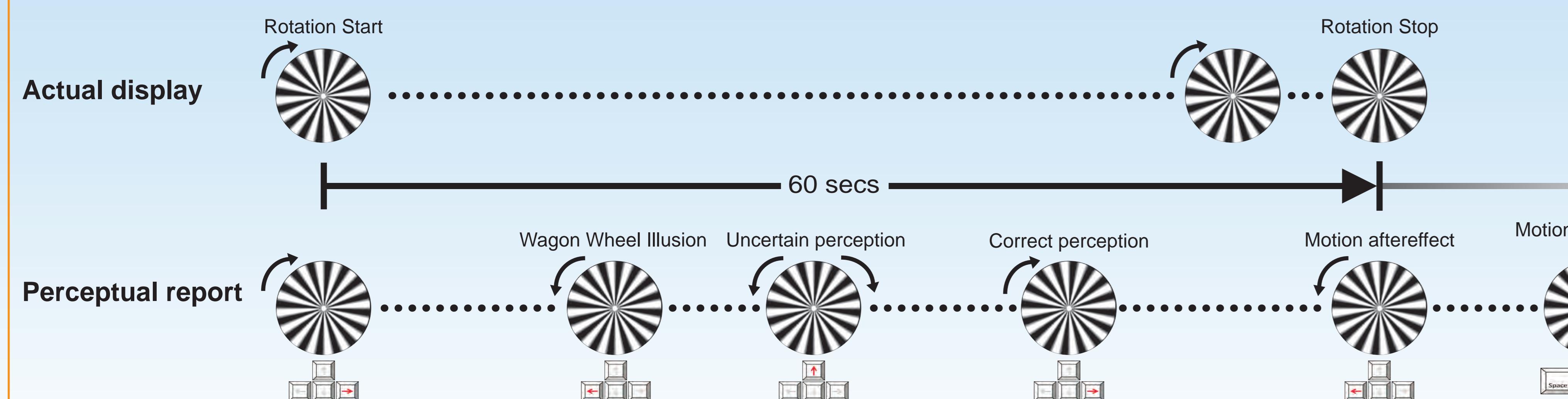
#### Healthy controls:

N= 8 (8 males), mean age  $21.50 \pm 3.3$  y/o.

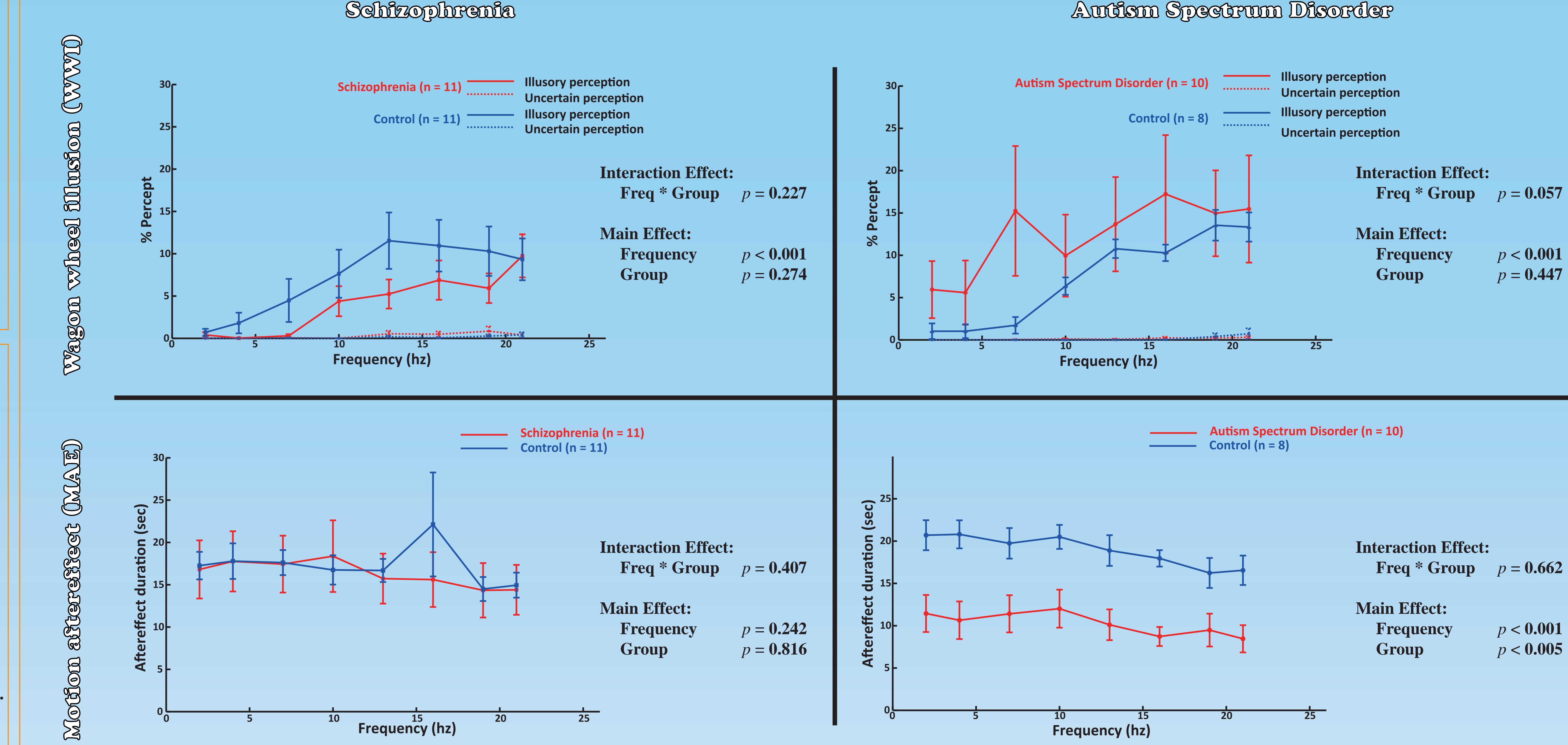
### Experiment Procedure

1. The stimuli were rotating wheels with 10 cycles of a sinusoidally modulated luminance pattern at 100% contrast. The wheels occupied  $6.6^\circ$  of visual angle and were displayed on a computer monitor with a refresh rate of 144 Hz.
2. There were 32 one-minute trials for each participant. There were 4 trials for each 8 frequency: 2, 4, 7, 10, 13, 16, 19 and 21 Hz. The wheels rotated at the different frequency were randomly presented.

### A typical trial



## Results



## Conclusion

1. Schizophrenia seems to suffer less in general from cWWI as compared to the corresponding controls, whereas ASD group seems to show different frequency preference for cWWI as compared to corresponding controls.
2. Results from MAE implicate the potential characteristic difference of low level visual motion perception between ASD group and control group (in addition to the difference that has been reported in biological motion or face adaptation effects).
3. Our results so far suggest that the cWWI could be a powerful tool to non-invasively probe the relationship between temporal processing and neuronal oscillations in mental disorders.

## References

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