



Autism and the Simultaneous Tilt Illusion: Systemizing, Orientation Sensitivity, and Susceptibility to Context Effects

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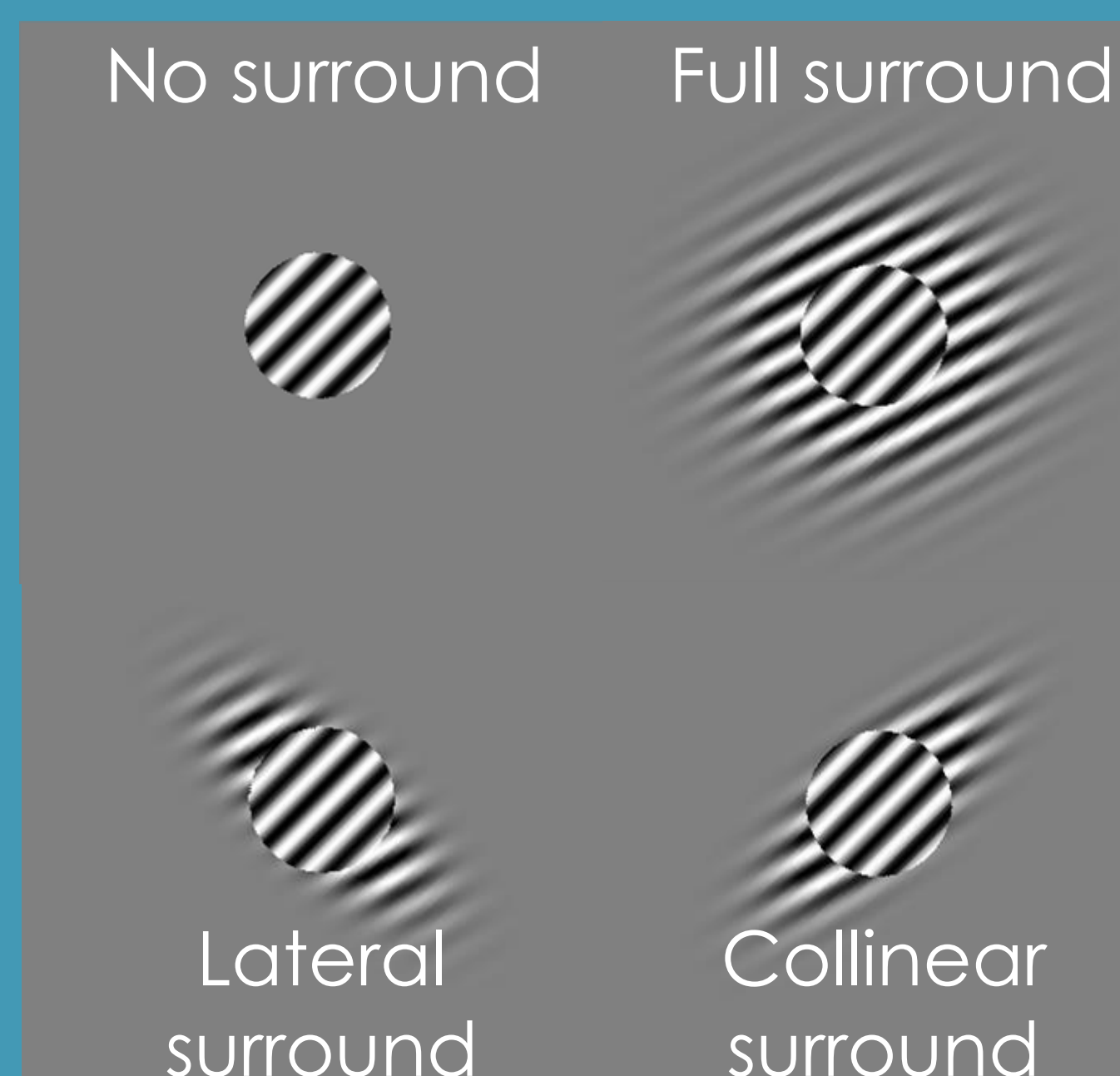
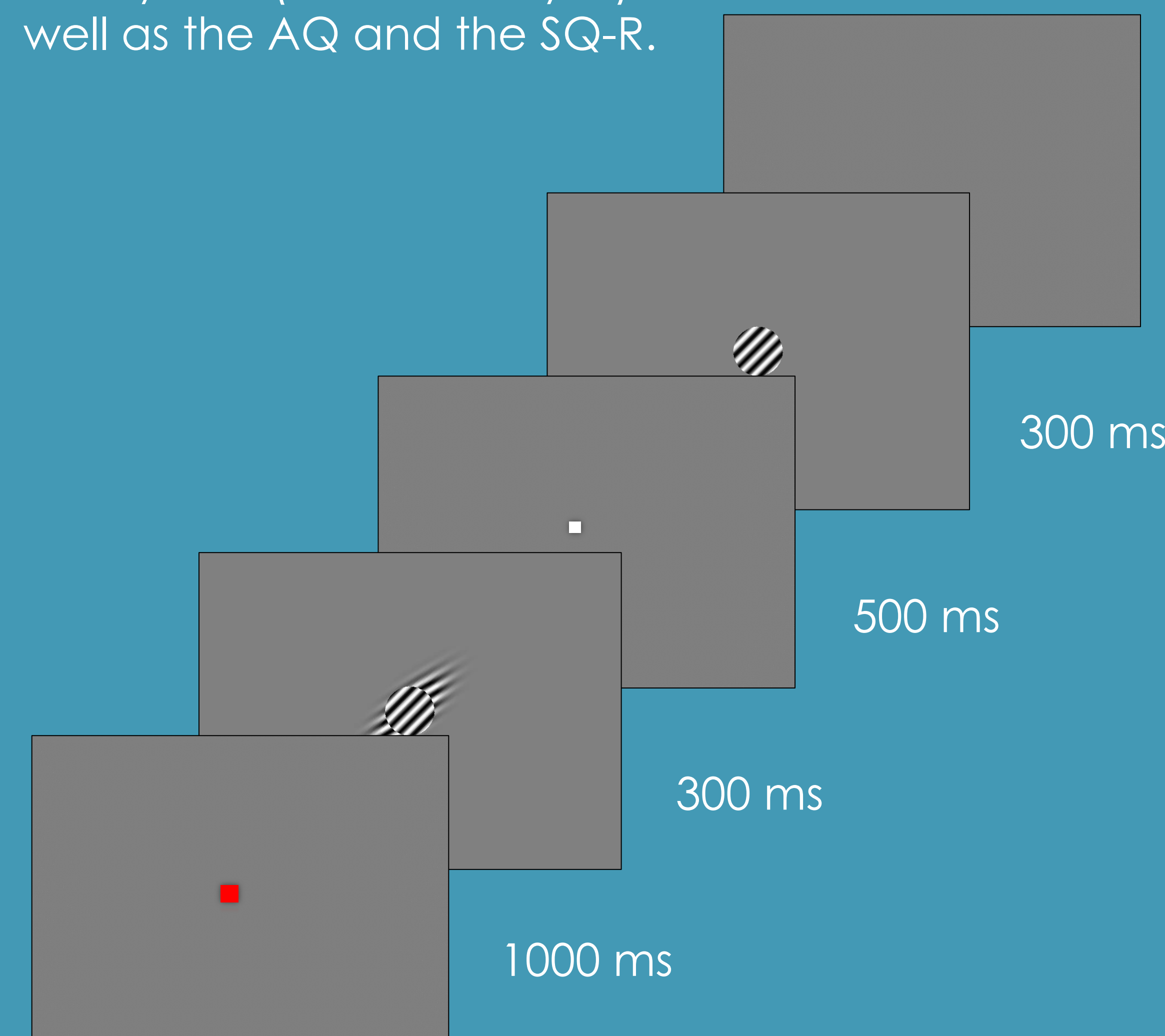
BACKGROUND

The perceived tilt of an oriented array of lines is altered when surrounded by lines with a different tilt, as in the simultaneous tilt illusion (STI). This effect of context has been shown to be negatively correlated with orientation sensitivity (Song et al., 2013), suggesting that the mechanisms that modulate sensitivity and contextual effects are interrelated. Further, these mechanisms are also affected by changes in brain processing brought about by autism, with sensitivity correlated with a broad measure of autistic traits in the general population (the Autism Quotient, AQ; Dickenson et al., 2014), and context effects correlated with both AQ (Flevaris & Murray, 2015) and a more specific measure of the systemizing trait (the Systemizing Quotient, SQ-R; Walter et al., 2009) and its subscales (Reed & Dassonville, in preparation).

Contextual effects at the single neuron level in primary visual cortex are known to be dependent on the location of the context with respect to the neuron's preferred orientation, with flanking lines in collinear locations having different effects than those in lateral locations (e.g., Kapadia et al., 2000). Here, we test whether the relationships between contextual effects and sensitivity, and their modulations with autistic traits, are similarly dependent on the location of the context.

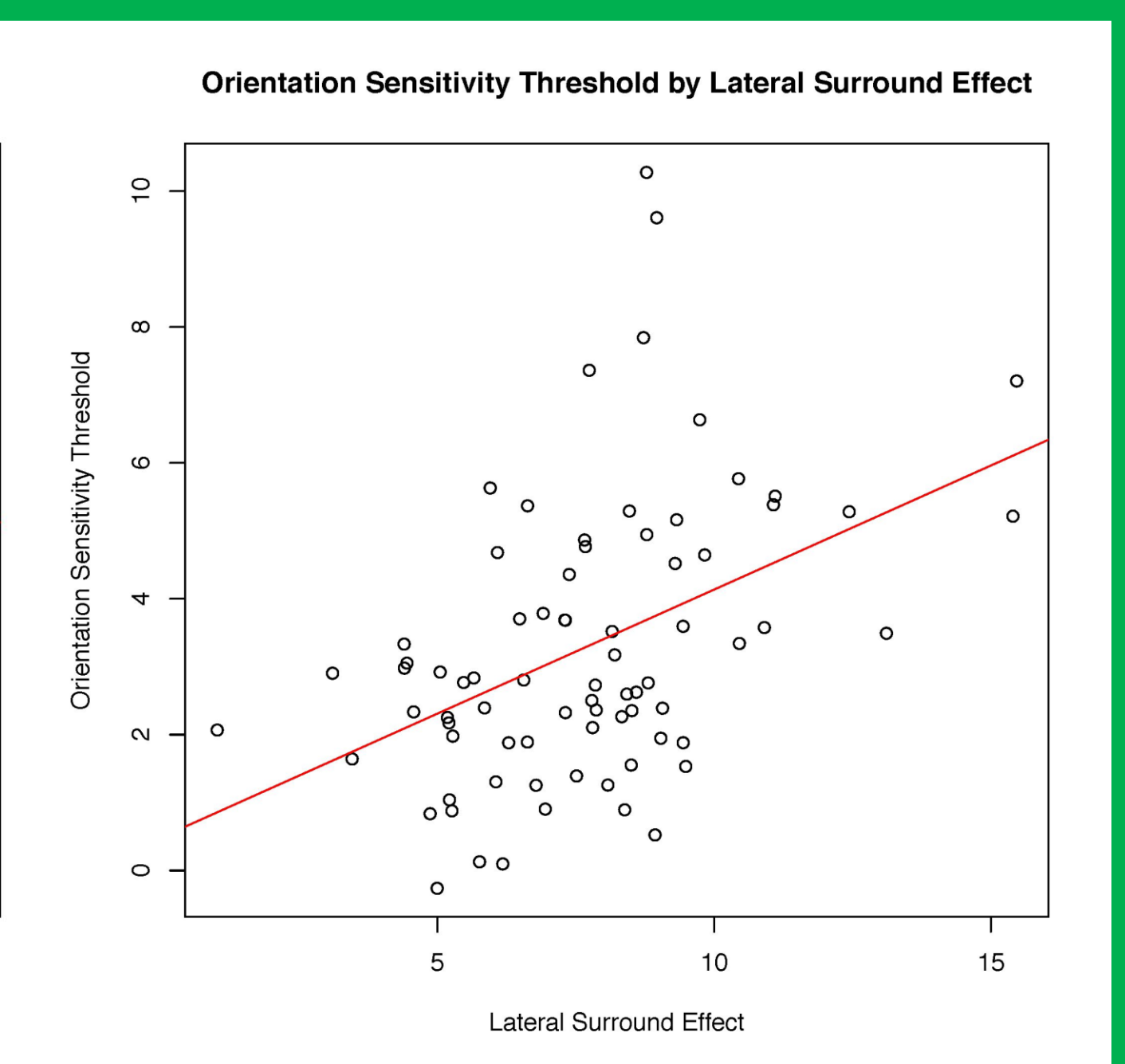
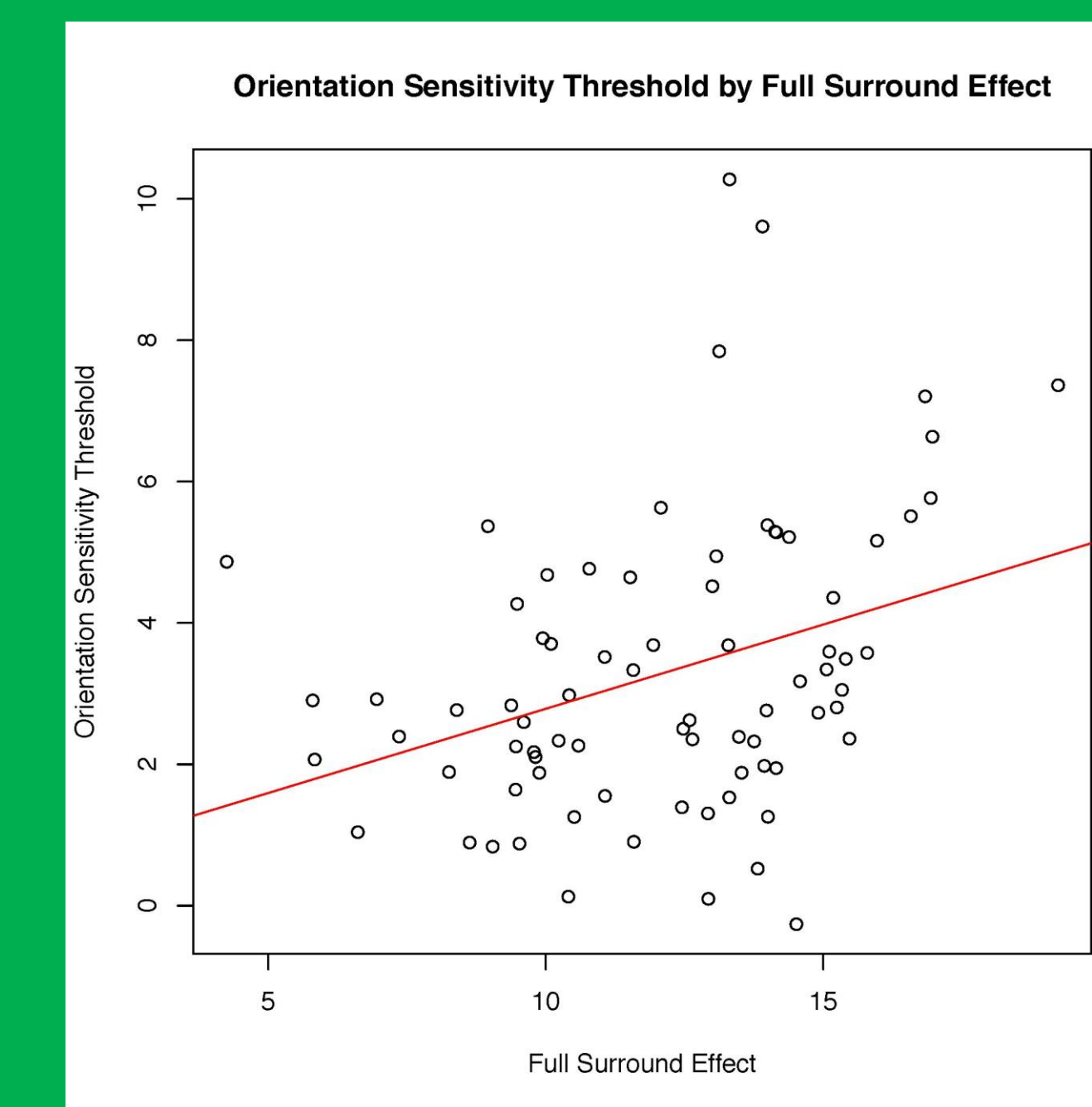
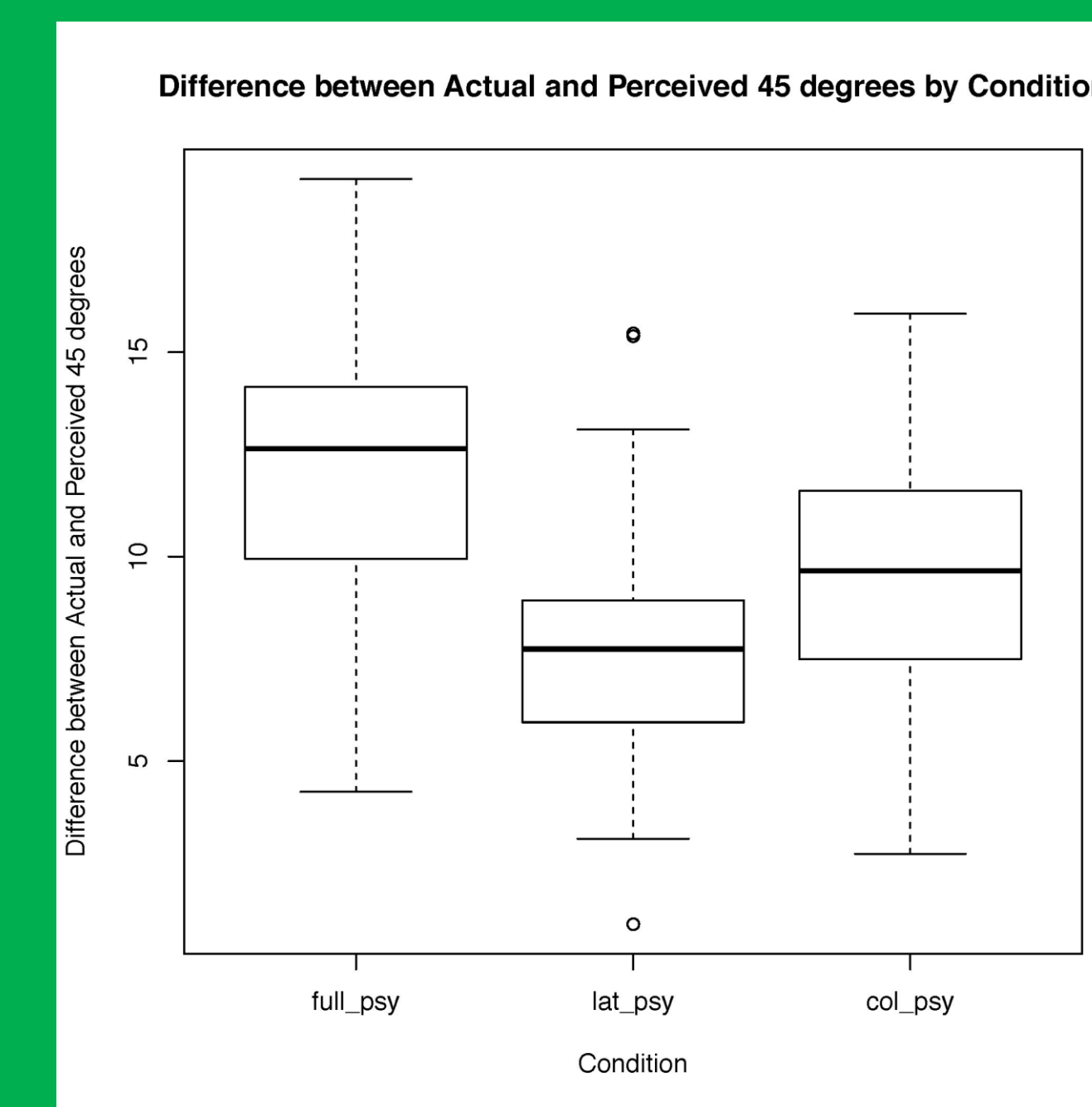
METHODS

Participants (n = 78) were asked to judge the relative orientation of two successive arrays of tilted lines (i.e., "Was the tilt of the second stimulus clockwise or counterclockwise from the first?"). Each trial included a reference array (no surround, tilted 45°) and a test array with or without a surround (full, lateral, or collinear surround of lines tilted 45±15°), with a tilt that varied according to an adaptive staircase. Participants also completed a visual acuity task (FrACT Acuity C), as well as the AQ and the SQ-R.



RESULTS

- Each frame condition caused a significant repulsion effect, with the test array perceived to be rotated in a direction opposite the tilt of the contextual surround ($p < 0.01$). Notably, the contextual effect of the collinear surround was greater than that of the lateral surround ($p = 0.001$).
- Orientation sensitivity was negatively correlated with susceptibility to context effects (that is, higher orientation thresholds were associated with greater context effects) induced by both full (Spearman $r = 0.37$, $p = 0.001$) and lateral surrounds (Spearman $r = 0.43$, $p = 0.0001$), but not a collinear surround.
- Orientation sensitivity and context effects were uncorrelated with AQ and SQ-R scores, and their subscales.



DISCUSSION

- The collinear surround caused a larger repulsive effect than the lateral surround, suggesting that the effect of the full surround in the STI may be driven predominantly by the collinear context.
- The correlation between sensitivity and context effects were replicated (Song et al., 2013), yielding further evidence of common underlying mechanisms. This relationship seemed to be driven most strongly by context in the lateral locations.
- Autistic traits as measured by the AQ and SQ-R (and their subscales) were uncorrelated with either orientation sensitivity or contextual effects, failing to replicate the previous work of Dickenson et al. (2014) and Reed & Dassonville (in preparation).
 - Although this failure to replicate may have been due to the previous results being less robust than indicated, it is also possible that the failure was due to an insufficient variability in AQ and SQ-R scores in the current study, or the use of different stimuli (Reed & Dassonville tested the effects of a small rod-and-frame illusion, instead of the STI).

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