

## BACKGROUND

Both positive and negative feedback can modulate human behaviour

- Social and non-social feedback can be positive or negative in valence
- Our sensitivity to different types of feedback may developmentally shape how we interact with our environment

Autism spectrum disorder (ASD) is characterised by difficulties in social functioning

- Decreased sensitivity to positive social feedback (social reward) has been implicated in the aetiology of ASD
- Individuals with ASD display attenuated behavioural responsiveness to a range of social rewards
- ERP studies reveal decreased neural response (lower P3 amplitude) to social (smiling faces) and non-social (monetary) rewards in individuals with ASD. P3 amplitudes correlate negatively with social symptom severity (Kohls et al., 2011)
- P3 is thought to reflect allocation of attentional resources to reward stimuli

Sensitivity to negative social feedback in individuals with ASD is less well-studied than social reward

- Atypical neural response is found in response to negative social feedback (social exclusion) in individuals with ASD (McPartland et al., 2011)
- However, typical neural response (FRN amplitude) is found in individuals with ASD to non-social negative feedback (sub-optimal monetary outcomes) (McPartland et al., 2012)
- FRN is thought to reflect motivational salience (Yeung, Holroyd & Cohen, 2005)

The behavioural phenotype of ASD may be in part due to decreased neural sensitivity to social but not non-social feedback.

### Aims of the current study

- *Experiment 1*: To investigate the association between autistic traits and neural sensitivity to **positive** social, non-social and non feedback
- *Experiment 2*: To investigate the association between autistic traits, and neural sensitivity to **negative** social, non-social and non feedback

### Hypothesis

- Those with high levels of autistic traits will demonstrate a selective decreased neural response to both positive and negative social feedback but not non-social or non feedback

## METHOD

### Participants (Table 1)

- 69 typical adults (Assigned to “high” and “low” autistic trait groups based upon a median split on the SRS-A)

### Behavioural measures

- **SRS-A** - 65 item questionnaire measure of social functioning

Table 1. Participant Demographics

	Experiment 1 (N=36)		Experiment 2 (N=33)	
	Low SRS-A (n=18)	High SRS-A (n=18)	Low SRS-A (n=17)	High SRS-A (n=16)
Mean SRS-A Total (SD)	26.61 (8.02)	65.06 (20.56)	27.47 (10.39)	55.19 (13.41)
Age	24.11	23.94	24.36	21.96
Sex (M:F)	7:11	10:8	11:6	10:6

### ERP Components of Interest

- *Experiment 1*: Peak amplitude and latency for the P3 (200-400ms) extracted at Pz, electrode 62 (Figure 1)
- *Experiment 2*: Minimum amplitude and latency for the FRN (200-300ms) extracted at electrodes 5, 6, 11, 12 (Figure 2)

### ERP data acquisition and extraction

- ERP recorded continuously at 500 Hz.
- Electrical Geodesics 128 Hydrocel Sensor net

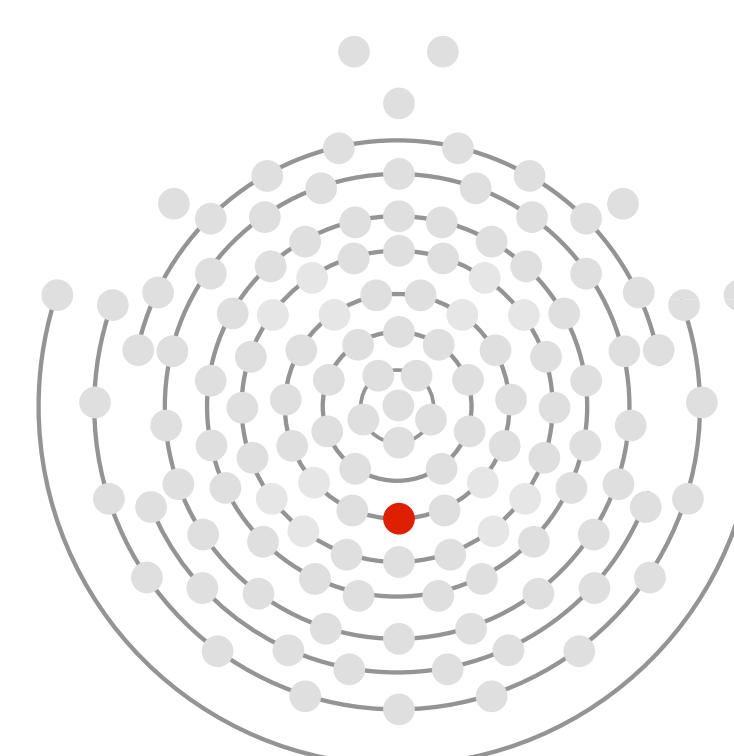


Figure 1. P3, electrode Pz

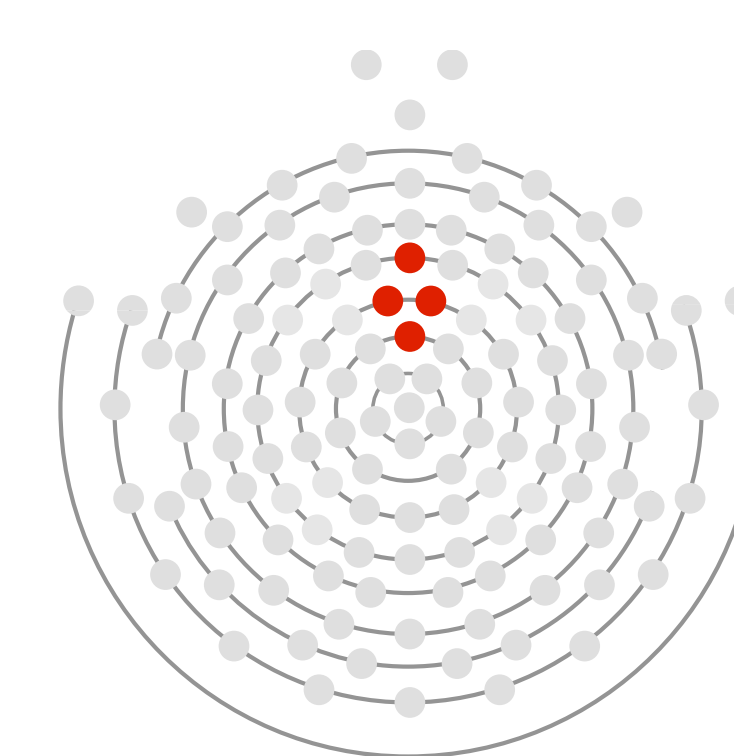


Figure 2. FRN Montage, electrodes 5, 6, 11, 12

## METHOD

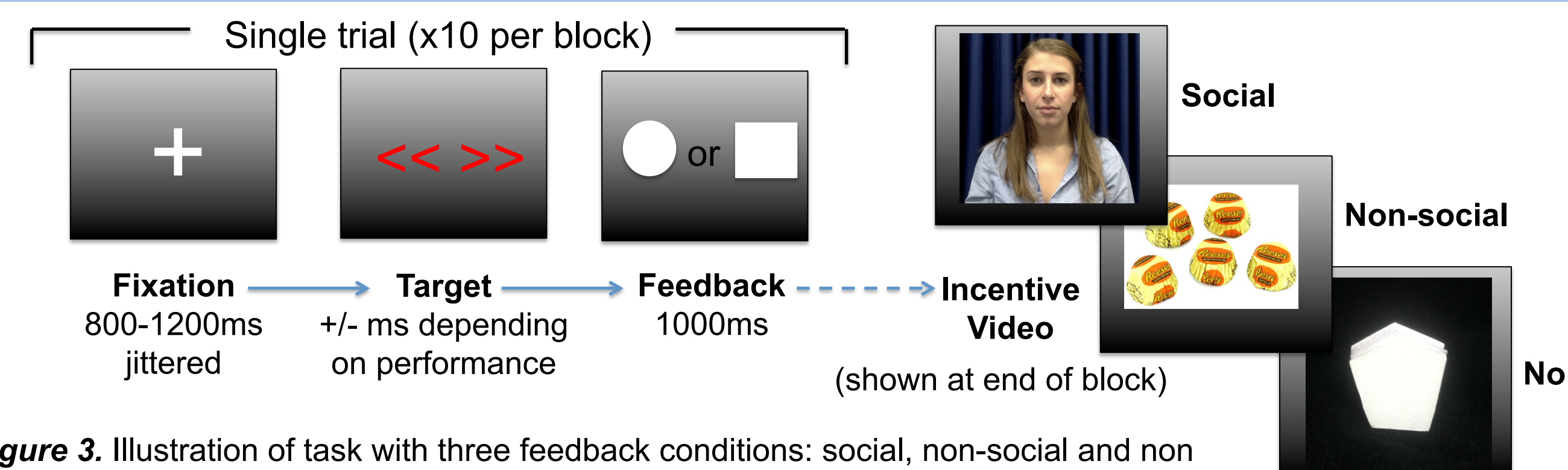


Figure 3. Illustration of task with three feedback conditions: social, non-social and non

### Experimental Paradigm

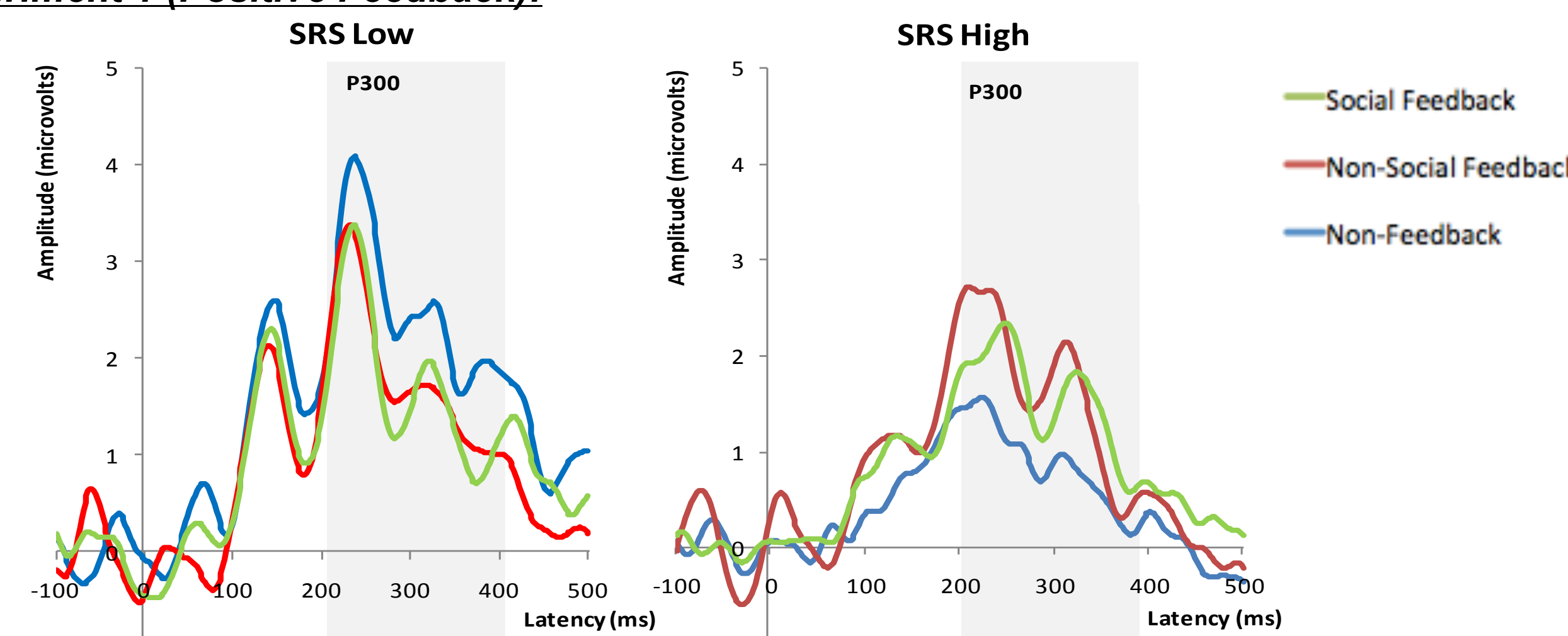
- **Social Reward/Feedback (SR/SF)** – videos displaying positive (*Exp. 1*) or negative (*Exp. 2*) feedback from a purportedly live (female) observer
- **Non-Social Reward/Feedback (CR/CF)** – videos of candy being dispensed (*Exp. 1*) or removed (*Exp. 2*)
- **Non-Reward/Feedback (NR/NF)** – videos of grey shapes (both *Exp. 1* and *2*)
- Task was to press button as quickly as possible when target appeared
- Video feedback reflected performance during preceding block
- Accuracy levels were set at 66% (*Exp. 1*) and 39% accuracy (*Exp. 2*) to ensure equal overall positive and negative feedback across conditions and subjects

### Statistical analysis

- Repeated measures ANOVA with autistic traits as between-subjects factor (high vs. low) and feedback type as within-group factor (SR/SF, CR/CF, NR/NF). Follow up *t*-tests to explore direction of interactions
- Correlations between autistic traits (SRS-A) and P3 peak and FRN minimum amplitude in SR/SF, CR/CF and NR/NF conditions

## RESULTS

### Experiment 1 (Positive Feedback):



### Experiment 2 (Negative Feedback):

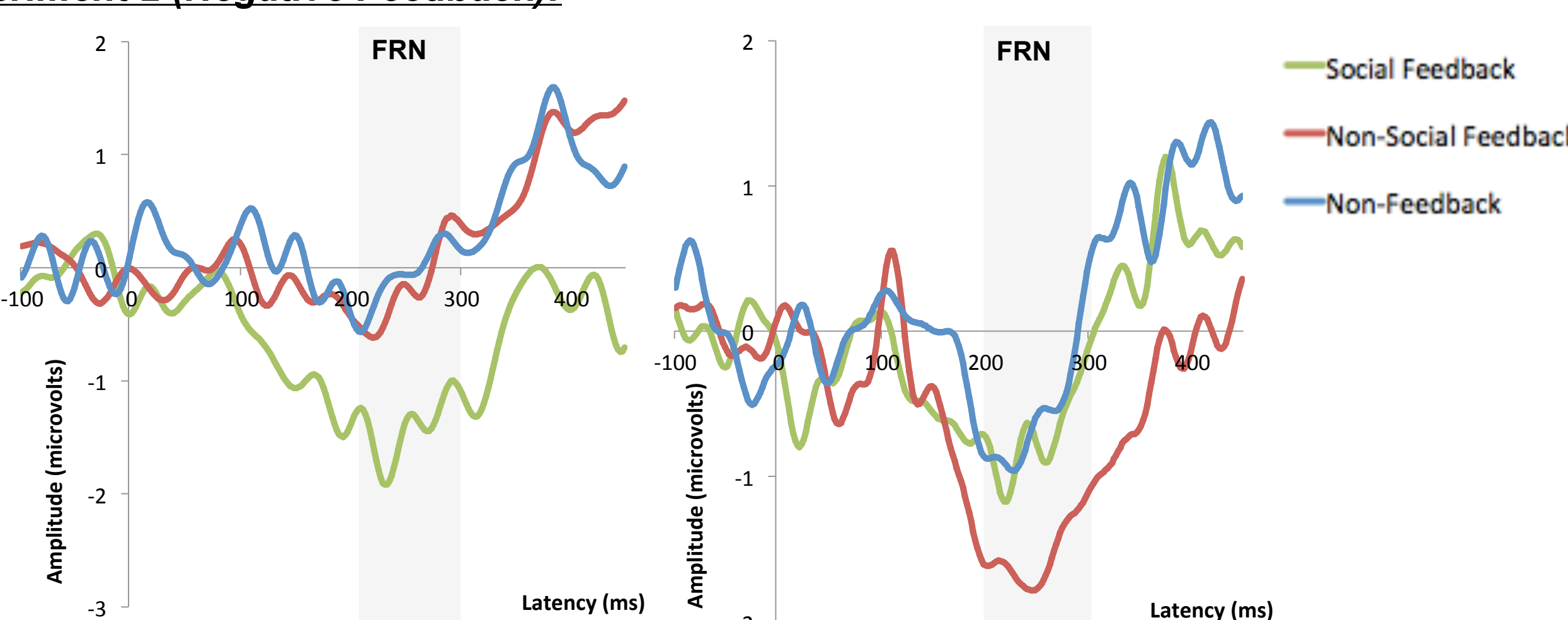


Figure 4. Grand mean waveforms for correct (top) and difference between incorrect and correct (bottom) trial outcomes shown separately for low and high levels of autistic traits as measured by the SRS-A. Gray bar indicates time window for statistical analysis of P3 and FRN components

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## RESULTS

### Experiment 1 (Positive Feedback):

#### Effect of reward type on P3 amplitude

- CR produced the highest P3 amplitudes at Pz ( $M=4.35$ ), followed by SR ( $M=4.21$ ), followed by NR ( $M=3.98$ ); [ $F(2,70)=.39, p>0.05$ ]

#### Reward x group interaction

- Significant reward x group interaction [ $F(2,68)=4.24, p<0.05$ ]
- Follow up *t*-tests revealed that high SRS-A displayed a significantly lower P3 amplitude to SR ( $M=2.98, SD=2.18$ ) than low SRS-A ( $M=5.43, SD=3.16$ ); [ $t(34)=2.70, p<0.05$ ]; figure 4. In contrast there were no significant between group differences for CR; [ $t(34)=.38, p<0.05$ ], or NR; [ $t(34)=.49, p>0.05$ ]

#### Correlations

- A significant negative correlation was found between SRS-A scores and P3 amplitude for SR; [ $r(36)=-.36, p<0.05$ ], but not CR or NF

#### P3 latency effects

- No significant differences were found for either reward or group

### Experiment 2 (Negative Feedback):

#### Effect of feedback and response on FRN amplitude

- Main effect of response, greater decrease in FRN amplitudes following incorrect ( $M=-1.75, SD=2.53$ ) compared to correct responses ( $M=-1.10, SD=2.53$ ); [ $F(1,32)=7.89, p<0.01$ ]
- SF elicited the most negative FRN amplitudes ( $M=-1.89, SD=2.66$ ), followed by CF ( $M=-1.78, SD=2.86$ ), followed by NF ( $M=-1.58, SD=2.60$ ); [ $F(2,64)=.59, p>0.05$ ]

#### Feedback x response x group interaction:

- Significant feedback x response x group interaction [ $F(2, 62)=3.52, p<0.05, \eta^2=.102$ ]
- Follow up *t*-tests revealed those with low SRS-A scores showed a selective decrease in FRN amplitude to negative ( $M=-1.74, SD=2.42$ ) compared to positive ( $M=-.14, SD=2.43$ ) SF; [ $t(16)=-3.51, p<0.05$ ]; figure 4. No differences were found for CF or NF
- Those with high SRS-A scores did not show any difference between negative and positive feedback to SF or NF, but showed a selective decrease in FRN amplitude to negative ( $M=-2.13, SD=3.02$ ) compared to positive ( $M=-.83, SD=3.52$ ) CF; [ $t(15)=-4.21, p<0.01$ ]

#### Correlations

- A significant negative correlation was found between SRS-A scores and FRN amplitude for incorrect CF; [ $r(33)=-.37, p<0.05$ ], indicating greater neural response in those with higher SRS-A scores, but not for SF or NF

#### FRN latency effects

- No significant differences were found for either reward or group

## CONCLUSIONS

- Our study found decreased neural response to both **positive** and **negative** social feedback in individuals with high levels of autistic traits

- This supports, and extends, the social motivation hypothesis (Dawson, Webb & McPartland, 2005), which posits that decreased neural response to social reward may underlie the development of difficulties in social functioning seen in individuals with ASD

- Future studies should aim to investigate whether a) comparable findings are present in clinical populations and b) if attenuation of the P3 or FRN response is related to dissociable aspects of the ASD phenotype or to overall symptom severity

### REFERENCES

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