

# 783: Predicting Autistic Traits Using Eye Movement during Visual Perspective Taking and Facial Emotion Identification

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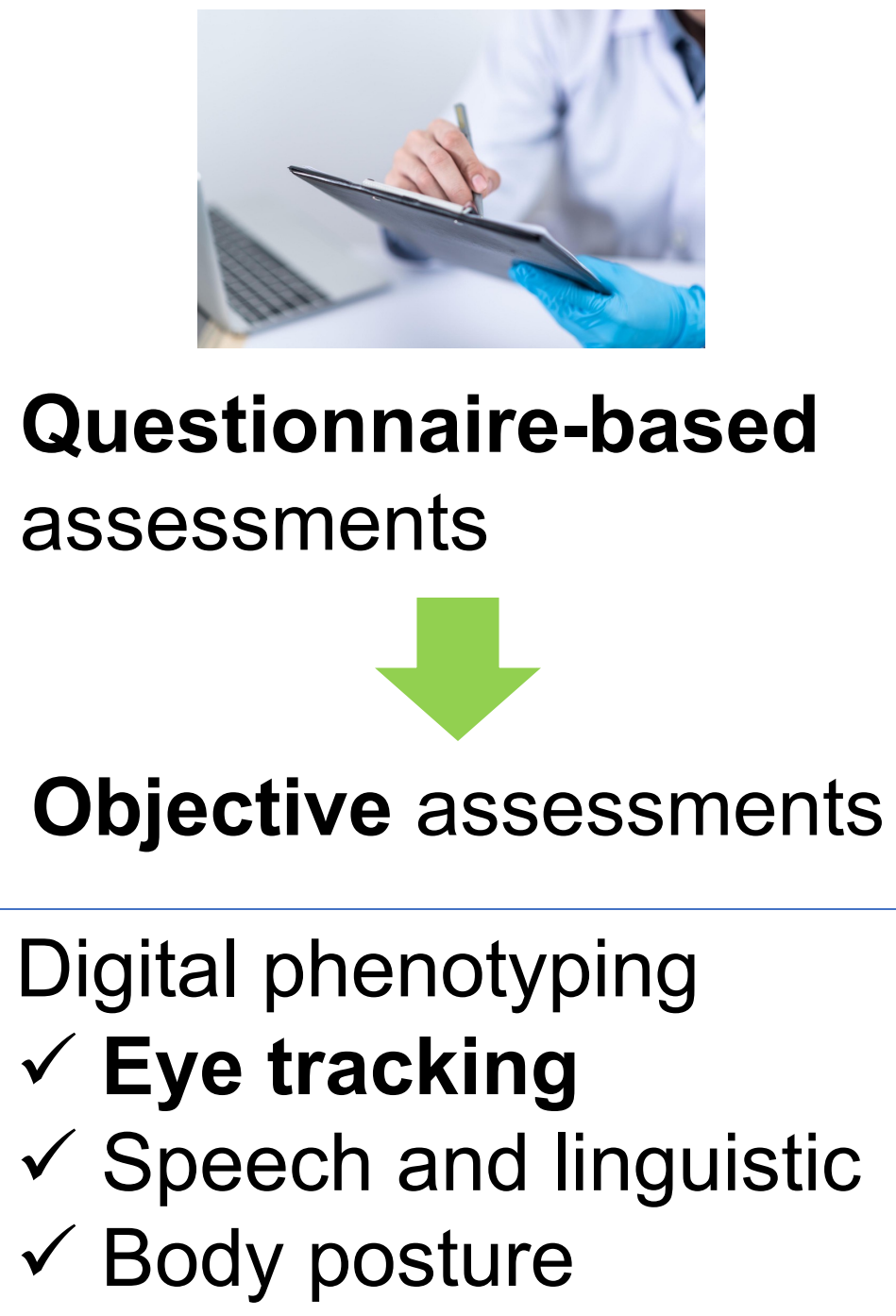
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- The development of **eye-tracking technology** has made it easier to understand autistic traits
- Proposed to use a combination of **facial emotion identification task** and **visual perspective taking task**
- Extracted area of interests features of each task and partial least squares regression to predict Social Responsiveness Scale-2 score, which is a measure of autistic traits
- Results showed that the Social Responsiveness Scale-2 score was predicted at **0.414** in Spearman’s correlation coefficient by using eye movements obtained from the two tasks

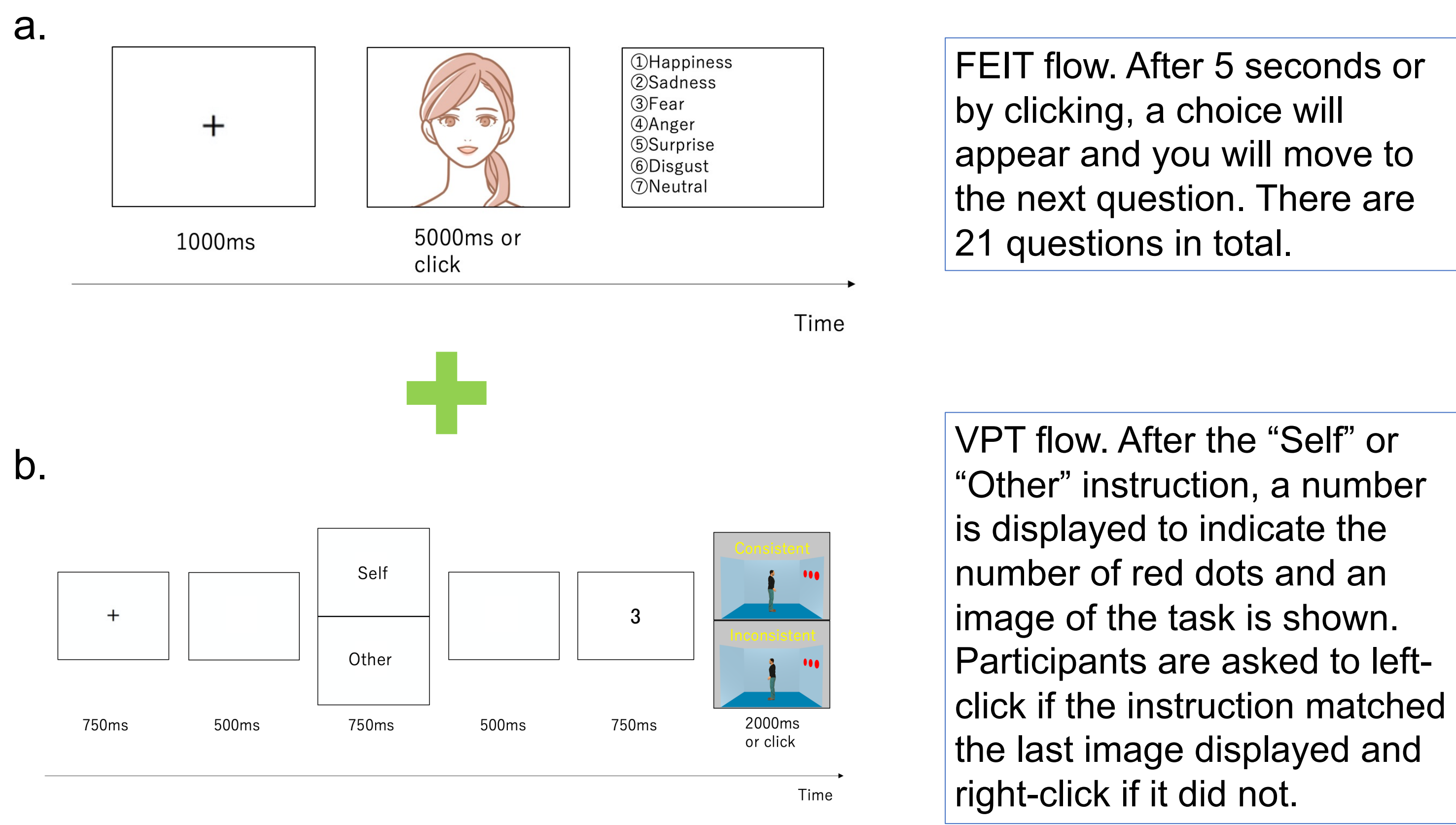
## Introduction

- Autistic traits are broad in severity and difficult to measure **objectively**
- Our prior study has used eye movement during facial emotion identification to predict autistic traits [Iwauchi+2023]
- We propose to predict autistic traits using eye movement during facial emotion identification task (FEIT) and **visual perspective taking (VPT)**, which is associated with theory of mind



## Methodology

- Participants
  - 28 participants (11 males and 17 females) between the ages of 22 and 35
  - Questionnaires: **Social Responsiveness Scale (SRS)-2**, Kikuchi Scale of Social Skills:18 (KISS:18), the State-Trait Anxiety Inventory (STAI)
- Tasks



- Eye movement and feature extraction procedure
  - Eye-tracker: Tobii Pro Fusion
  - Areas of interest:
    - a. The eyes, mouth, and face (FEIT images)
    - b. The person standing in the center, the right side where the red dot appears, and the left side of the wall (VPT images)
  - Features: the number of fixations and the number of saccades

List of features acquired for each task. We obtained a total of 55 features.

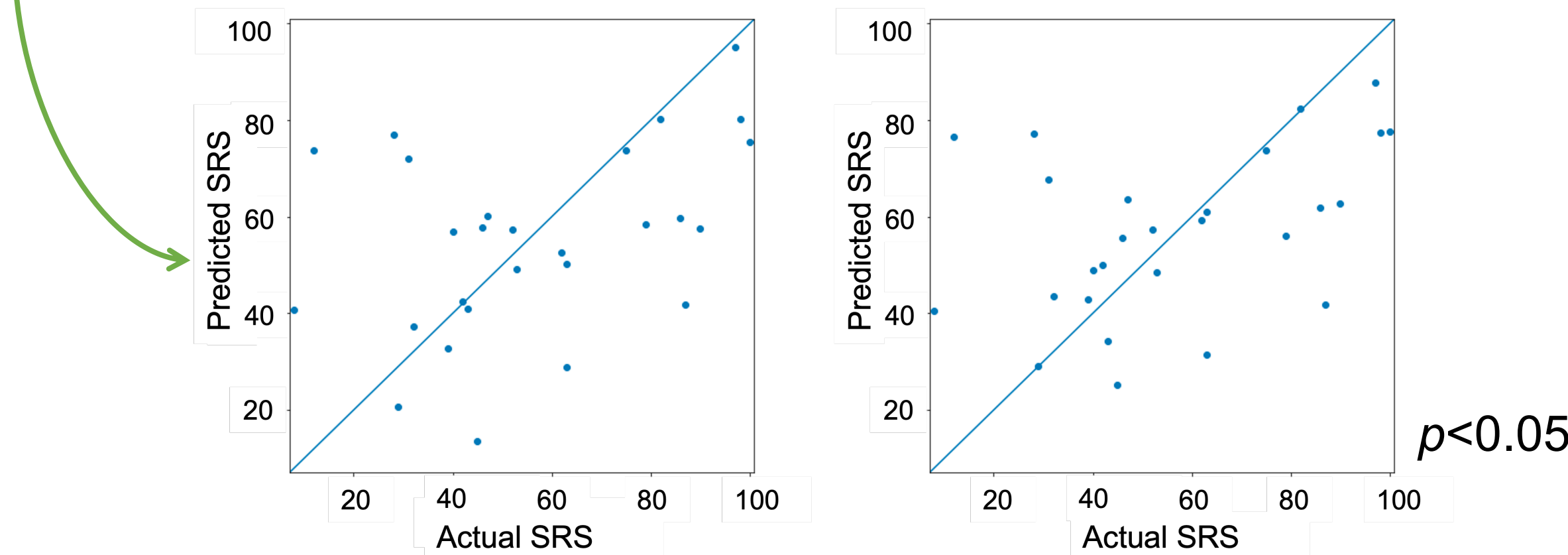
Task	Feature	Condition	Total features
a. FEIT	Number of Fixations at eyes	Happiness	35
	Number of Fixations at mouth	Sadness	
	Number of Fixations at face	Fear	
	Number of Saccades	Anger	
	Response Time	Surprise	
		Disgust	
		Neutral	
b. VPT	Number of Fixations at human	Self-Consistent	20
	Number of Fixations at right wall	Self-Inconsistent	
	Number of Fixations at left wall	Other-Consistent	
	Number of Saccades	Other-Inconsistent	
	Response Time		

## Results

- Modeling and evaluation
  - Models: Linear regression and Partial Least Squares (PLS) regression adopted for interpretability
  - Evaluation: nested leave-one-subject-out cross-validation
  - The models was compared under three conditions:
    - 1. Only FEIT features
    - 2. Only VPT features
    - 3. FEIT and VPT features

Results for each model predicting SRS-2. The best results for each metric are in bold.

Model	Feature set	$R^2$	RMSE	$\rho$
PLS regression	FEIT	0.053	25.32	0.400
	VPT	-1.11	37.83	-0.319
	FEIT+VPT	<b>0.121</b>	<b>24.40</b>	<b>0.414</b>
Linear regression	FEIT	-0.009	26.13	0.321
	VPT	-2.56	49.11	-0.440
	FEIT+VPT	<b>0.077</b>	<b>25.00</b>	<b>0.400</b>



Scatter plots of the true SRS-2 score and predicted SRS-2 score. The left side is the model that uses only the FEIT features. The right side is the model that uses the features of both the FEIT and VPT.

The best 5 regression coefficients of PLS regression for each feature.

Feature Set	Feature	Regression Coefficient
FEIT	Number of Saccades Sadness	-13.17
	Number of Saccades Surprise	-6.39
	Number of Fixations at face Sadness	5.43
	Number of Saccades Anger	-4.62
	Reaction time Surprise	3.68
FEIT+VPT	Number of Saccades Sadness	-13.17
	Number of Saccades Surprise	-6.19
	Number of Fixations at face Sadness	5.41
	Number of Saccades Self-Inconsistent	4.85
	Number of Fixations at human Self-Consistent	-4.68

FEIT features: Number of Saccades Sadness, Number of Saccades Surprise, Number of Fixations at face Sadness, Number of Saccades Anger, Reaction time Surprise.

VPT features: Number of Saccades Self-Inconsistent, Number of Fixations at human Self-Consistent.

## Discussion

- The model using the FEIT’s and VPT’s eye movements outperformed the model using only the FEIT features in all of the evaluation metrics
- The model using only the VPT’s eye movements failed to predict the SRS-2
- The regression coefficients are large for the features obtained from the FEIT, however, VPT task contributes to the prediction of SRS-2

## Conclusion

- The prediction accuracy of autistic traits can be improved by using eye movement during VPT in addition to facial emotion identification

## Reference

Iwauchi Kota, Tanaka Hiroki, Okazaki Kosuke, Matsuda Yasuhiro, Uratani Mitsuhiro, Morimoto Tsubasa, Nakamura Satoshi, Eye-movement analysis on facial expression for identifying children and adults with neurodevelopmental disorders , Frontiers in Digital Health, vol.5, 2023.