

# Using Optical Flow to Quantify Movement Differences in Response to Emotional Stimuli Among People with Schizophrenia and Controls

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## Introduction

- Nonverbal behavior during social interactions is very important to human communication
- People with schizophrenia (SZ) show deficits in nonverbal expressivity<sup>1</sup>
- Use of clinician ratings to measure symptoms associated with schizophrenia has been common in the field<sup>2</sup>
- Recent growth of objective, automated techniques to study nonverbal behavior (e.g. Motion Energy Analysis<sup>3</sup>, Optical Flow Estimation<sup>4</sup>, etc.)
- Optical Flow Estimation: frame-differencing algorithm that calculates vector fields of estimates of the spatiotemporal changes resulting from motion changes over time/successive frames

### Aims:

- Conduct an exploratory study using optical flow to quantify differences in the average amount of movement in people with SZ vs. controls as they watch evocative video clips
- For the SZ group, evaluate the relationship between movement during positive and negatively valenced stimuli and positive and negative symptom severity and CPZ scores

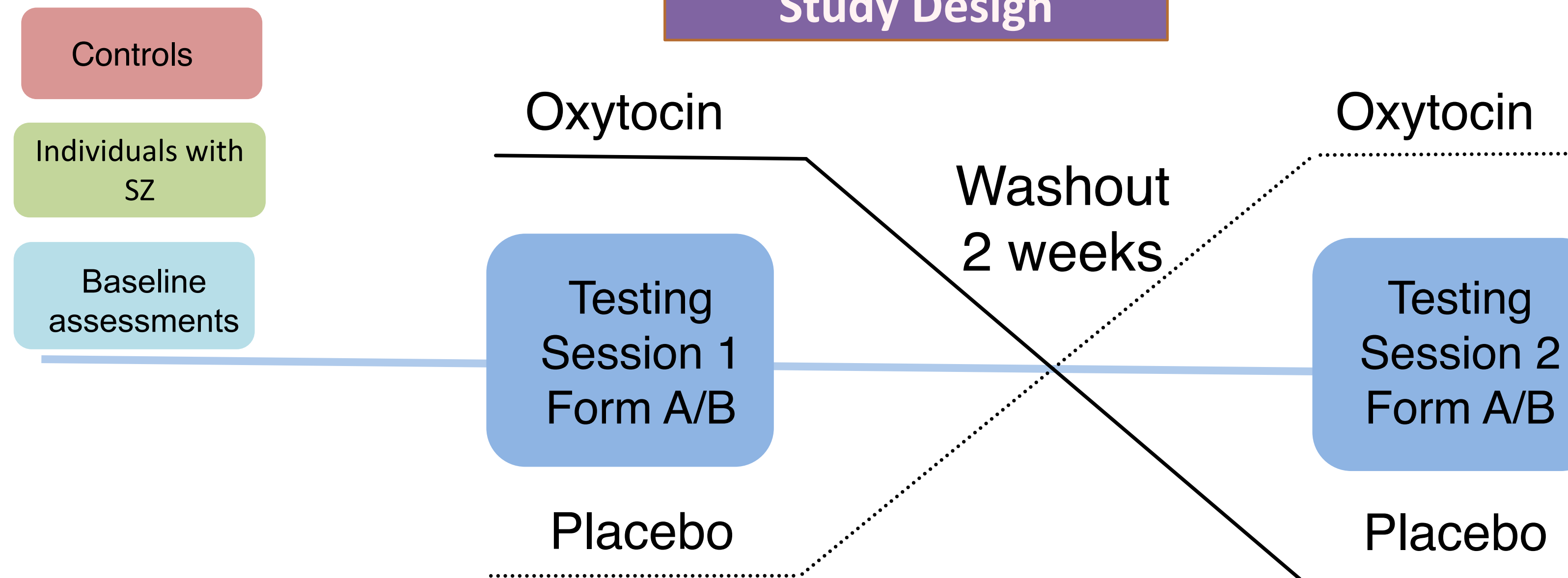
## Methods

- Men with SZ and HCs viewed brief and evocative video clips while being video-recorded (**Positive, Negative, Neutral**)
- Following each video, the participant described for 30s what happens in the video
- Video-recordings of participants were timestamped according to when each video stimuli started/ended and when the participant started/ended describing each video
- Videos were run through optical flow
- Movement amplitude values for watching and describing the videos were together averaged across video stimuli within each stimulus valence
- Correlations were run between average movement amplitude values and positive (Positive and Negative Syndrome Scale<sup>5</sup>) and negative symptom (Clinical Assessment Interview for Negative Symptoms<sup>6</sup>) measures
- Paired sample & independent sample t-tests and a 2 x 3 Mixed Model ANOVA were run to look at group and valence-type differences in average amount of movement

### Evocative Video Task



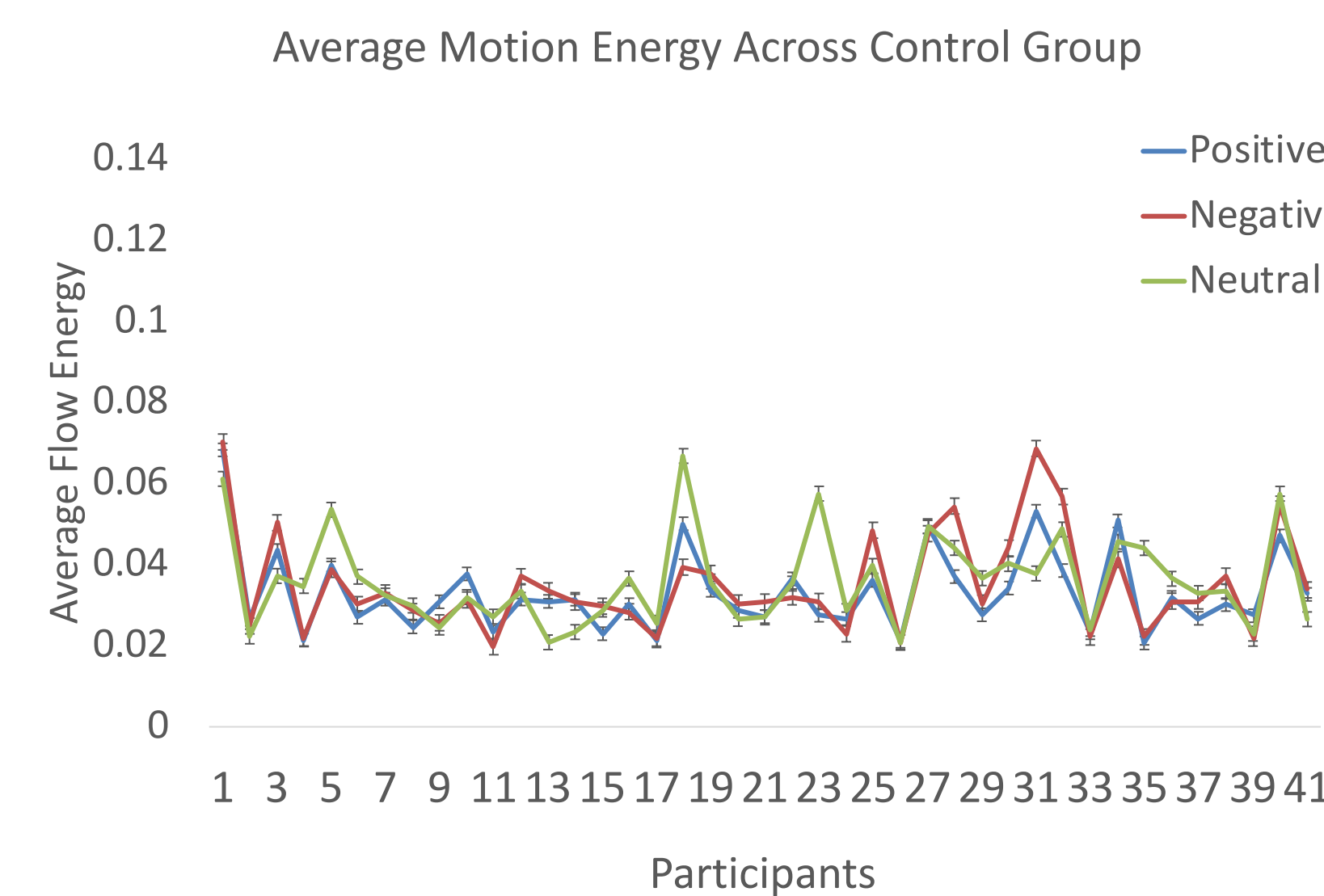
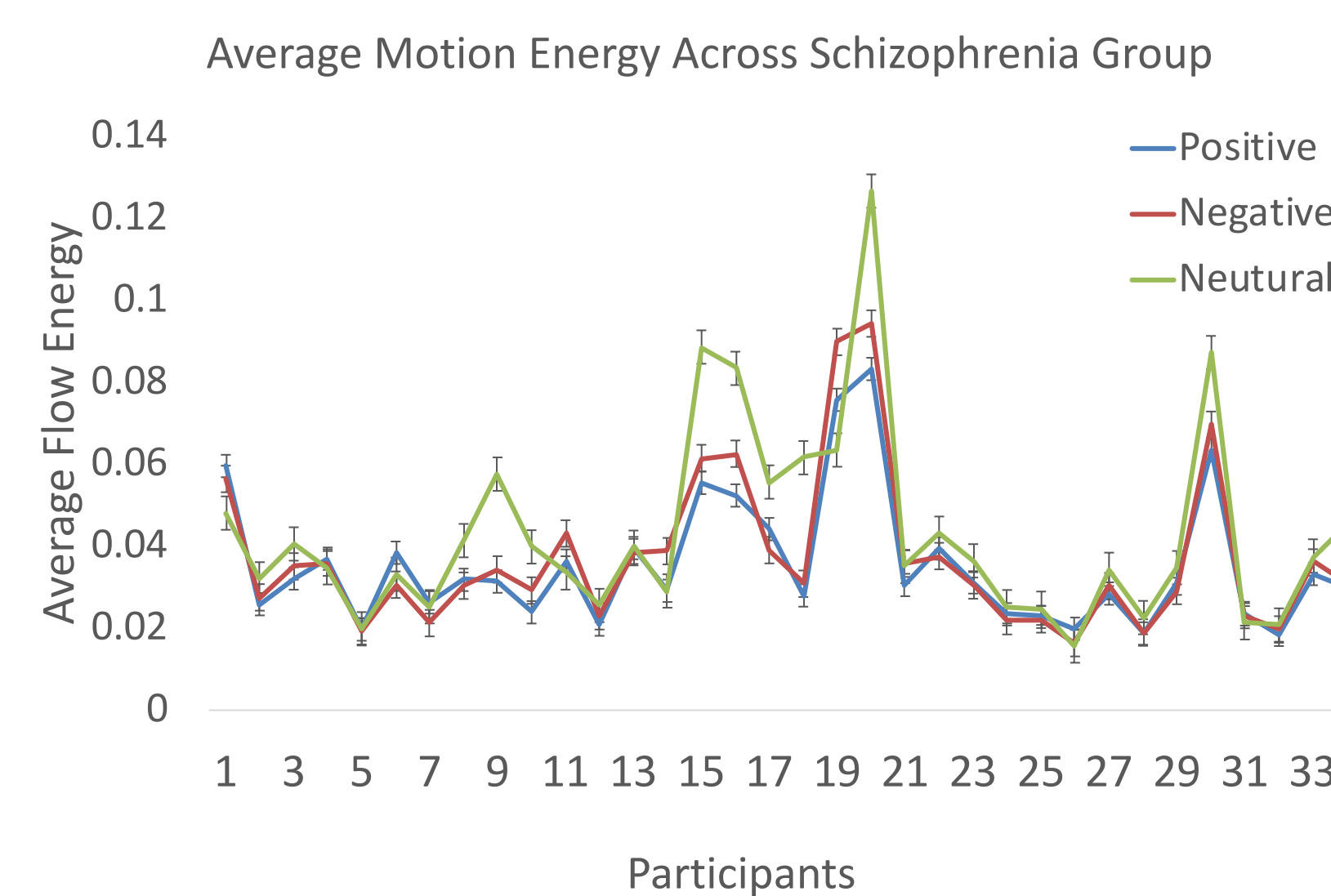
## Study Design



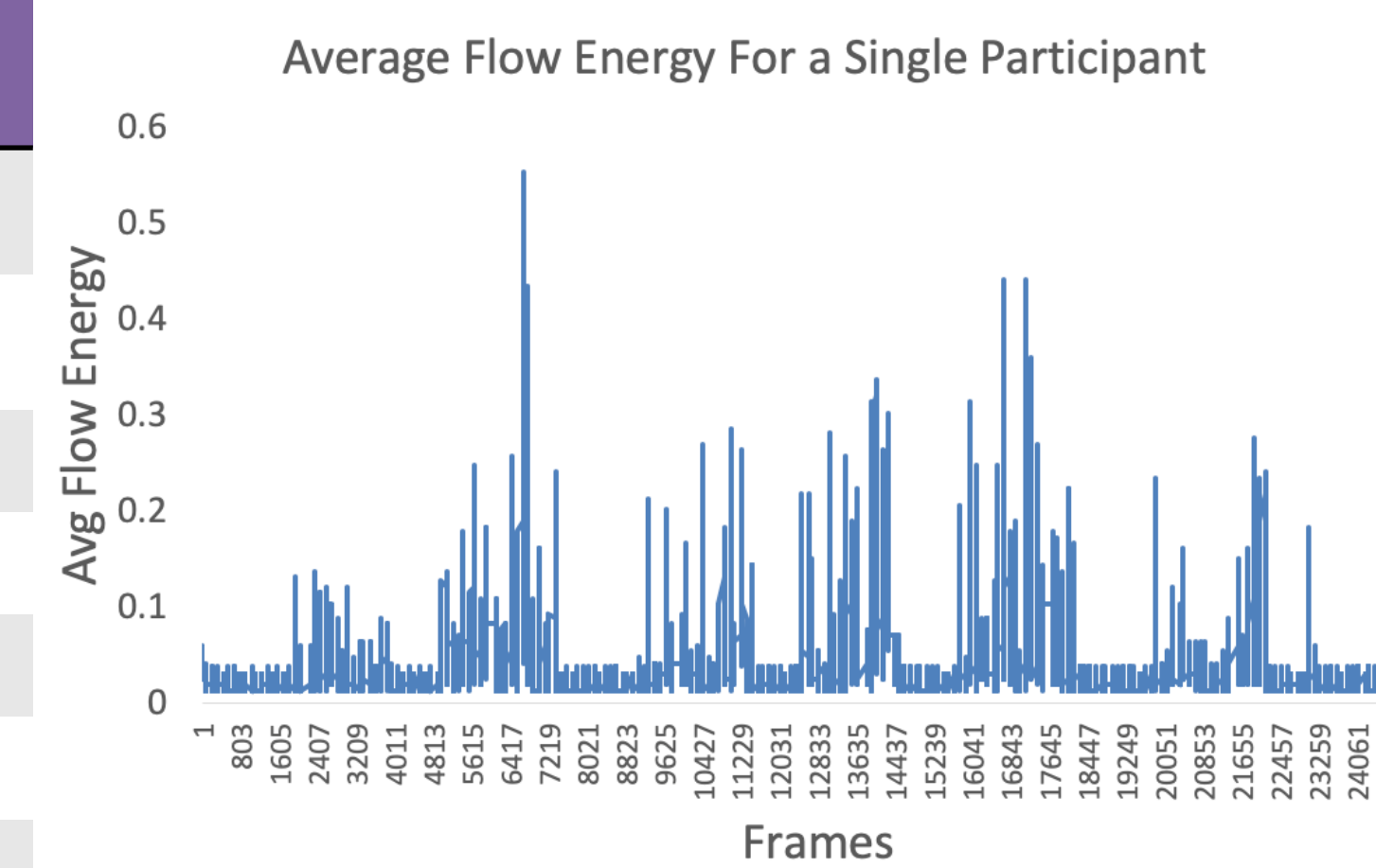
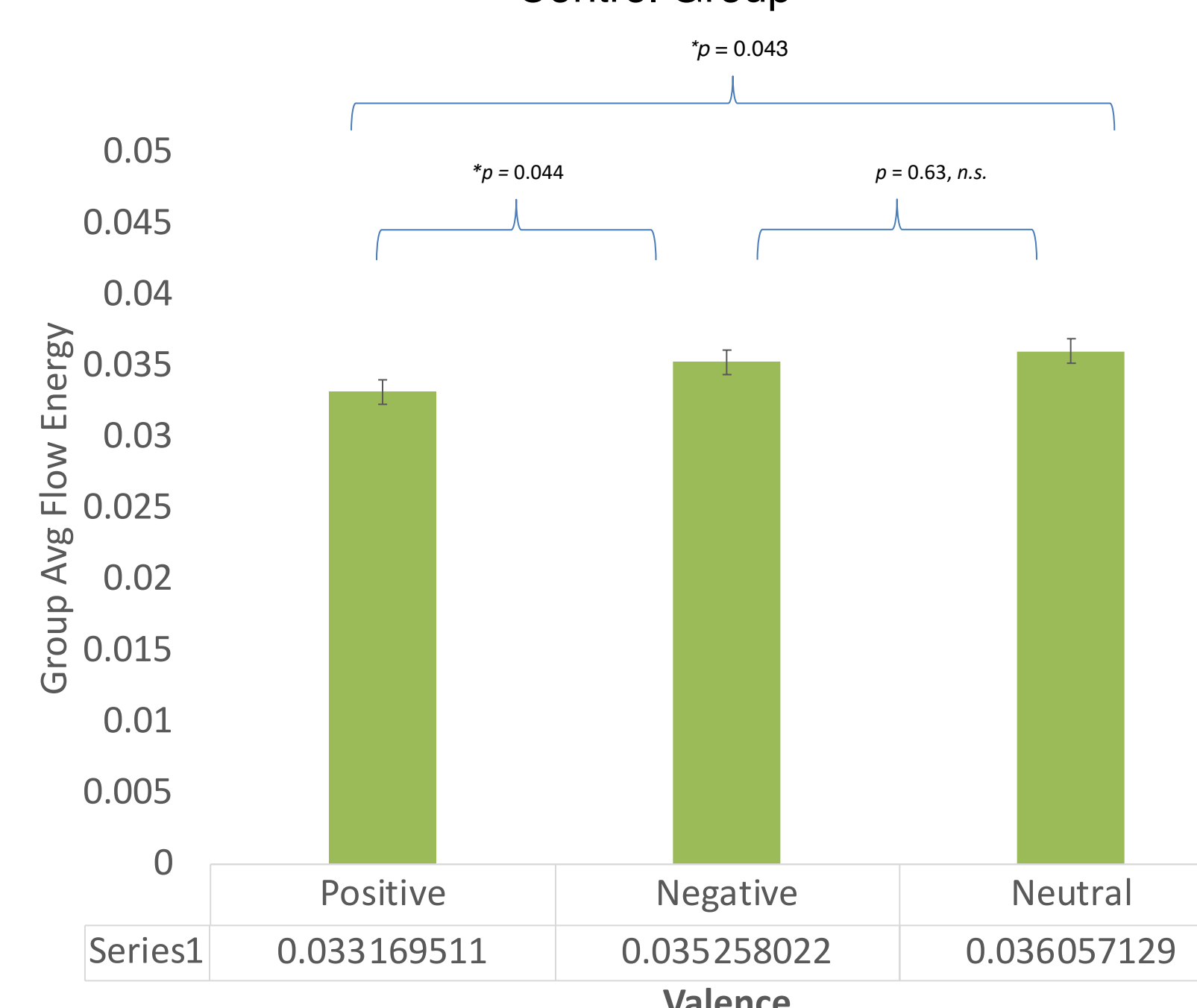
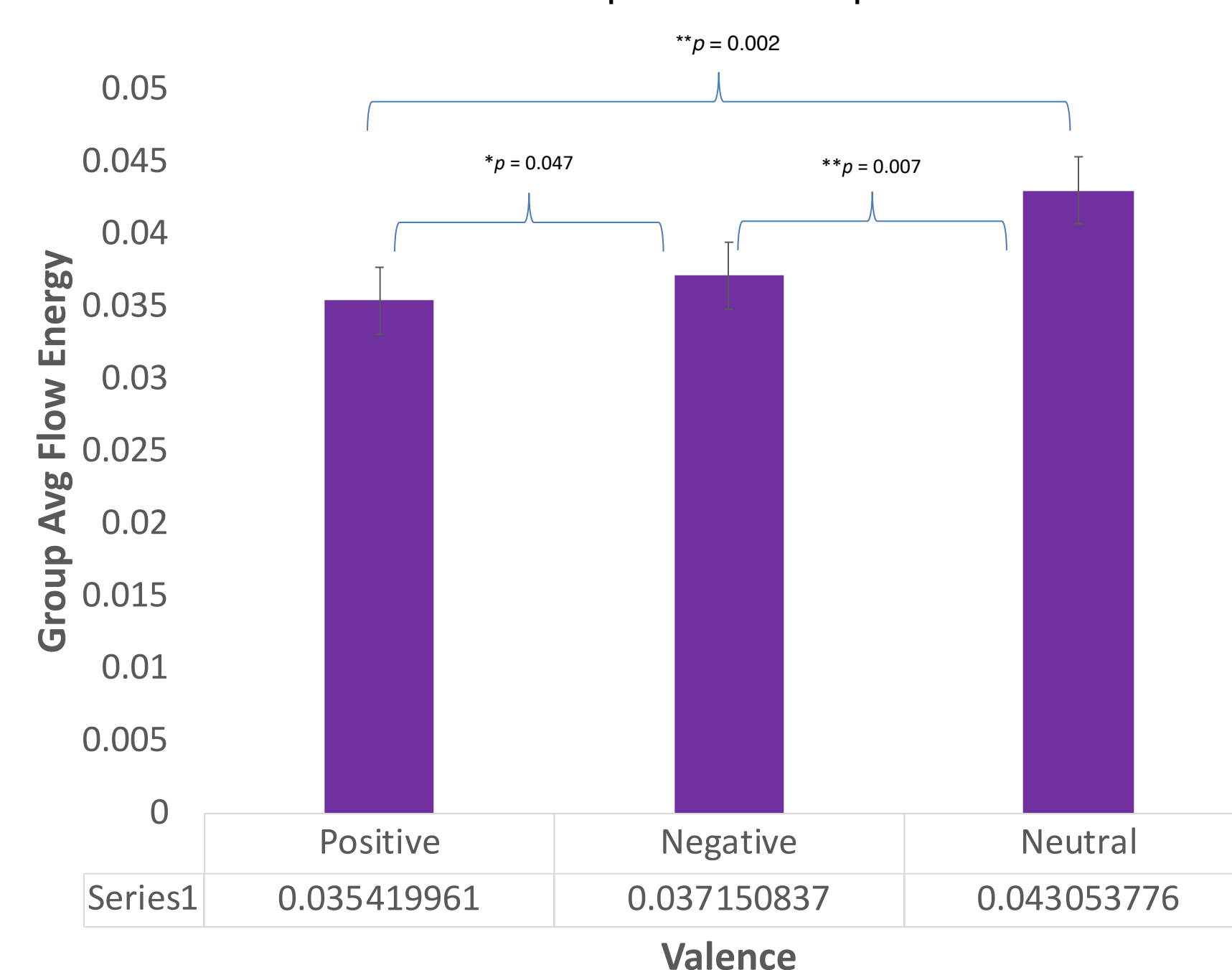
## Results

	SZ (n = 34)	HC (n = 41)
Age	33.24 (SD = 12.21)	27.93 (SD = 6.79)
Years of Education	14.07 (SD = 1.70)	15.27 (SD = 1.53)
CPZ	170.16 (SD = 187.07)	--
CAINS Global	16.35 (SD = 9.53)	5.71 (SD = 3.33)
MAP	12.29 (SD = 6.84)	5.10 (SD = 2.89)
EXP	4.06 (SD = 4.20)	0.61 (SD = 1.09)
PANSS_Positive	9.74 (SD = 3.93)	--

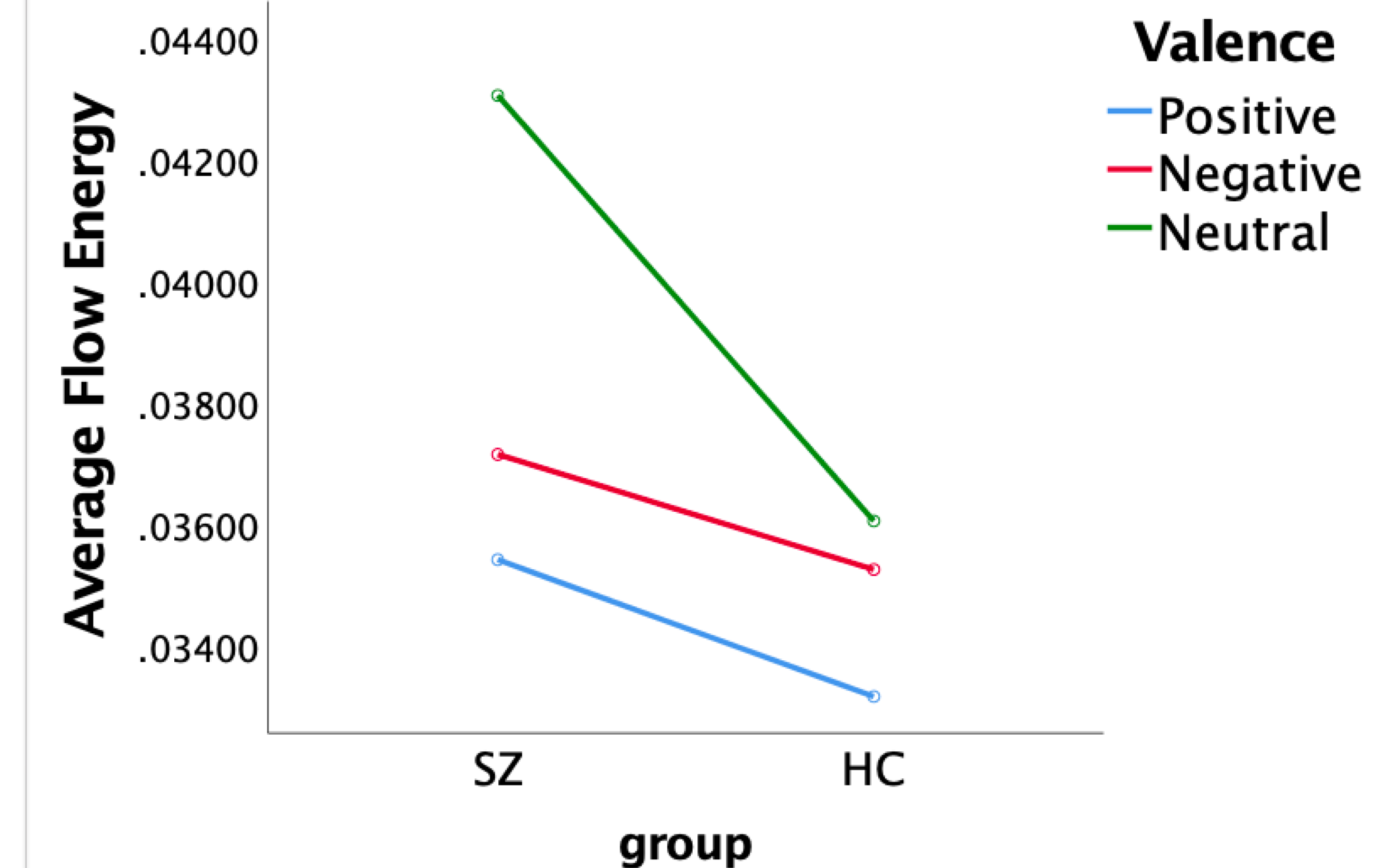
CAINS: Clinical Assessment Interview for Negative Symptoms  
MAP: Motivation & Pleasure subscale  
EXP: Expression subscale  
PANSS: Positive and Negative Syndrome Scale



### Average Movement Differed Significantly Between Video Valence Types Across Groups



### Trend Approached Significance for Group x Valence Type Interaction



Main effect of group:  $F(1, 73) = 1.18, p = 0.28, \eta_p^2 = 0.02$   
Main effect of valence:  $F(2, 146) = 11.31, p < 0.001, \eta_p^2 = 0.13$   
Interaction:  $F(2, 146) = 3.24, p = 0.06, \eta_p^2 = 0.04$

### Average Movement not Correlated With Symptom Severity or CPZ Scores

	Positive Valence	Negative Valence	Neutral Valence
CAINS MAP	$r = -0.01$	$r = -0.02$	$r = 0.11$
CAINS EXP	$r = -0.16$	$r = -0.13$	$r = -0.02$
CAINS GLOBAL	$r = -0.08$	$r = -0.07$	$r = 0.07$
PANSS_Positive	$r = -0.05$	$r = 0.08$	$r = 0.02$
CPZ Scores	$r = 0.13$	$r = 0.15$	$r = 0.16$

All  $ps > 0.05$

## Discussion

### Limitations:

- Small and unequal sample size
- Single type of positive valenced video used
- Neutral videos may not be neutrally valenced
- Difficult to standardize video valence/emotionality
- Difficult to determine how to normalize optical flow energy
- Oxytocin administration to SZ group

### The Big Picture:

- People with SZ did not differ in their average amount of movement during the Evocative Video Task compared to controls
- Within groups, there were significant differences in the amount of movement between videos of different valences
- Optical flow estimation may be a powerful tool to study movement abnormalities in schizophrenia

### Literature Cited

1.) Brune et al. (2008), *J. Nerv. Men. Dis.* 282-288. 2.) Lavelle, Healthy & McCabe (2014), *J. Nerv. Ment. Dis.* 47-54., 3.) Ramseyer & Tschacher (2011), *J Consult Clin Psychol*, 284-95, 4.) Scherer et al. (2012) *ERLA conf. on Language Resources and Evaluation* 1114-1120. 5.) Kay et al. (1987), *Schizophrenia Bulletin*, 261-276. 6.) Kring et al. (2013), *Am J Psychiatry*, 165-172