

# Minimally invasive and continuous rating of affective experience in immersive Virtual Reality: a feasibility study.

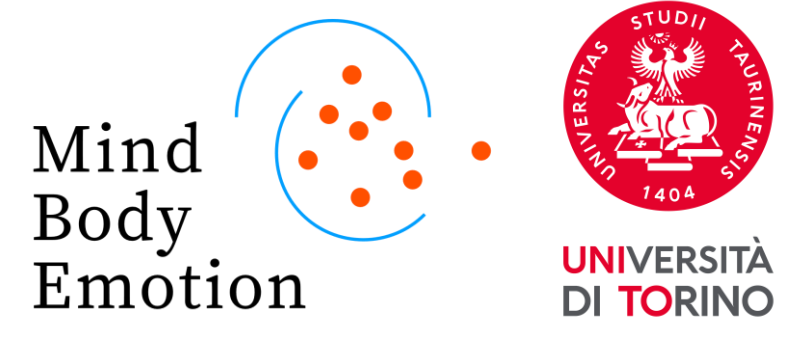
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## Introduction

### Background

- Subjective experience: integral component of affective states (AS) [1].
- **Summary ratings (SR)** commonly used after stimulus to capture subjective experience of AS.
- **Continuous rating (CR)** under dynamic stimulation
  - may allow more fine-grained understanding of AS but
  - may alter the experience of AS ("invasiveness") [5,6].
- Immersive virtual reality (VR)
  - contextually rich and engaging computer-generated scenarios [2].
  - more naturalistic elicitation of specific psychological states [3, 4].
  - higher experimental control than real-life assessment [7].

### Aims

Develop a rating method (RM) for the CR of AS during dynamic stimulation in VR.

1. Investigate link between CR and SR.
2. Determine best (i.e., least invasive) **rating method (RM)**.

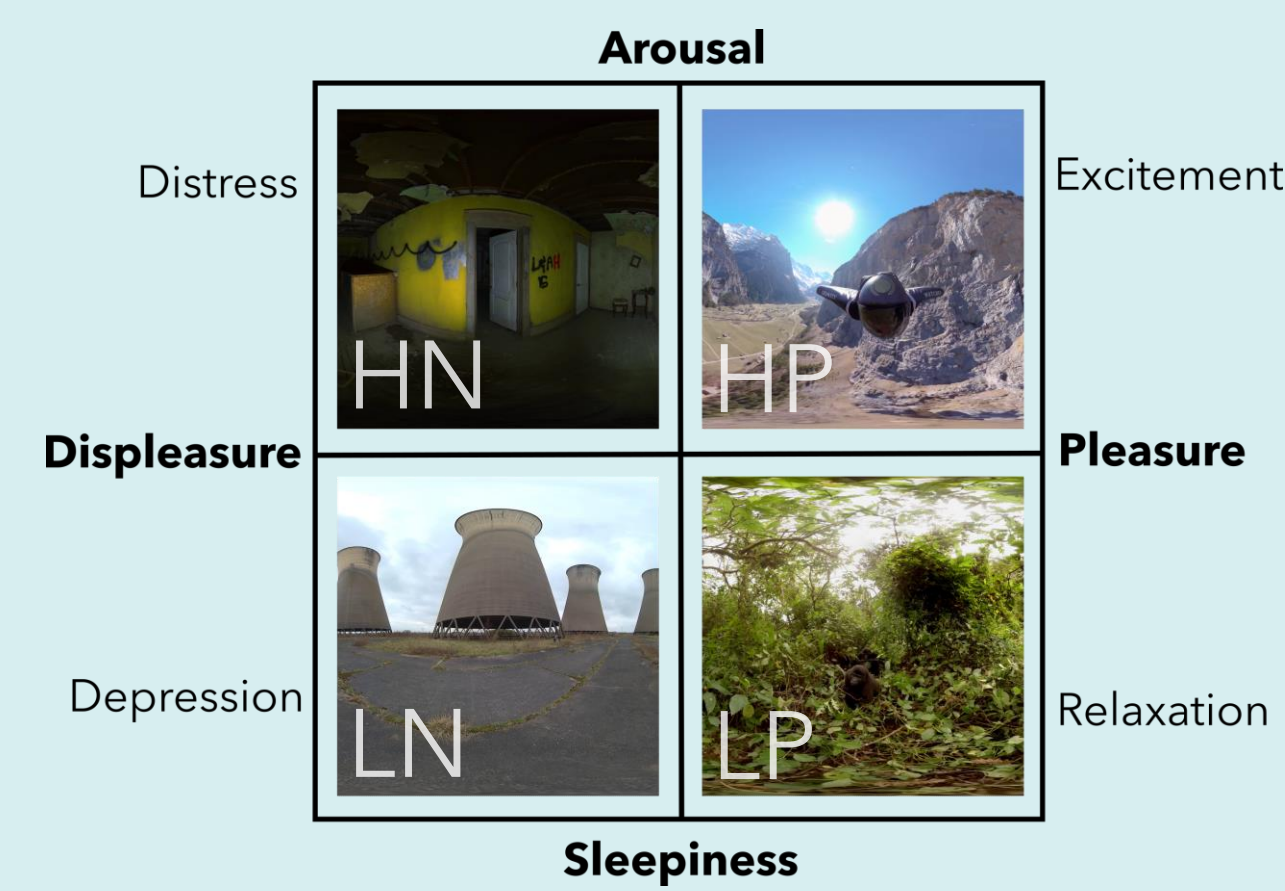
### Hypotheses

1. CR are statistically associated with SR.
2. Proprioceptive RM is the least invasive.

## Methods



### Stimuli - 360° videos

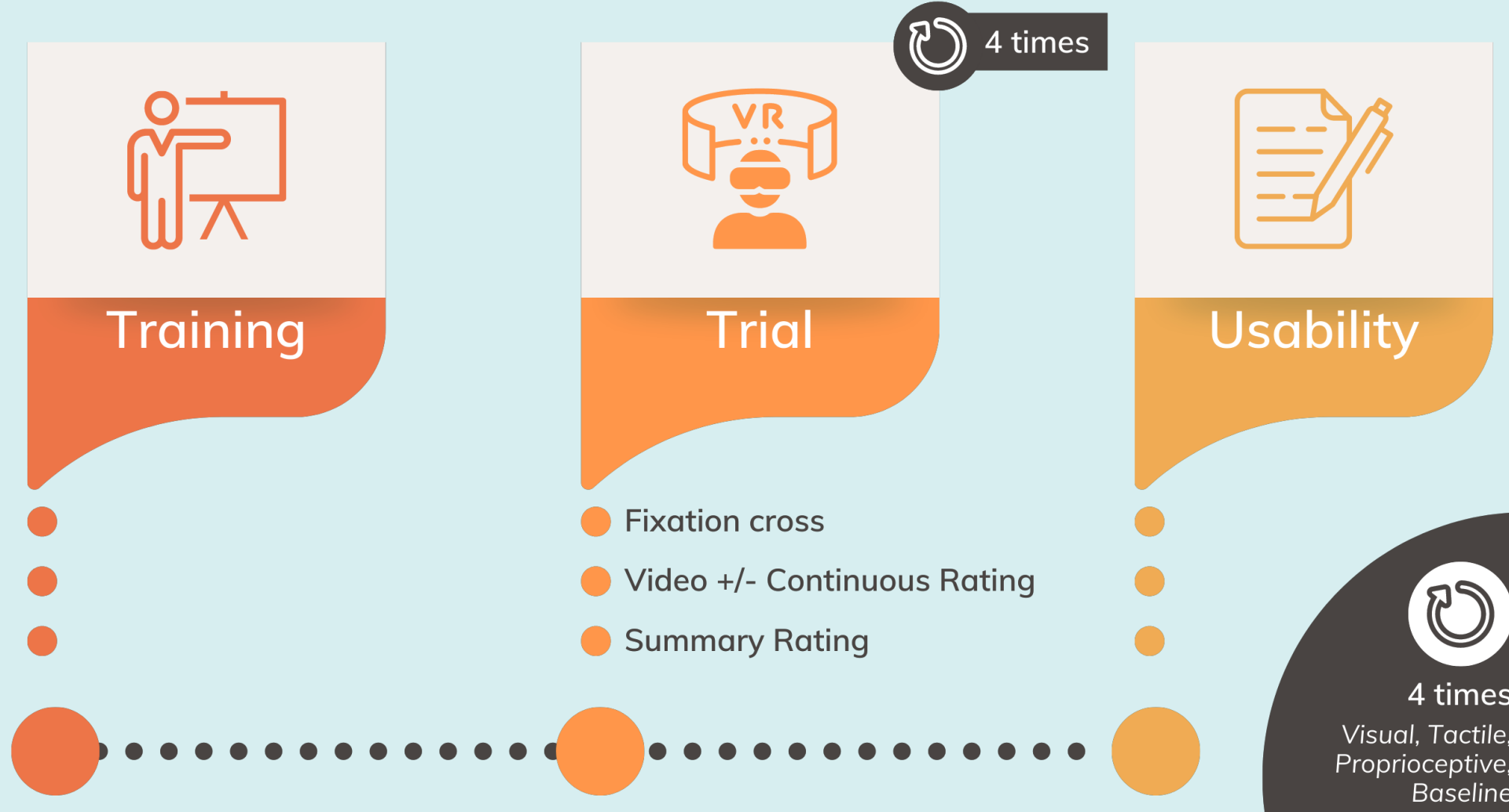


### RMs



Scan me for a demo!

### Experimental design

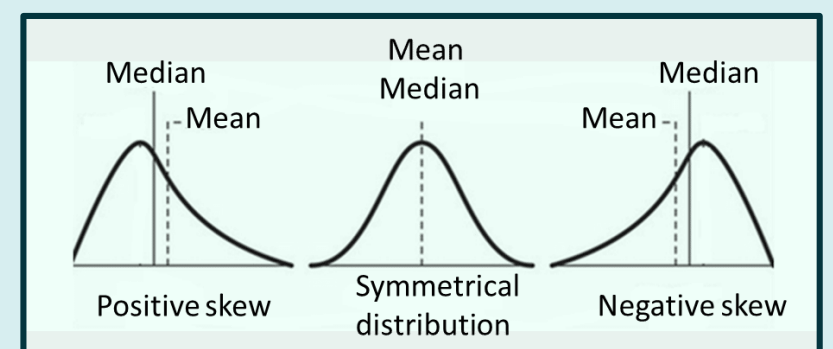


### Questionnaires

- Digital Survey
- Previous VR experience
- Simulation Sickness Questionnaire
- RM preference
- In-VR
  - System Usability Scale
  - Sense of Presence
  - Perceived Invasiveness ("The rating method was distracting and/or disturbing")
- Kunin Scale (satisfaction)

### CR indices (CRi)

- Last rating
- Central tendencies (e.g., mean)
- Dispersion tendencies (e.g., max/min, STD)
- Shape of distribution (e.g., skewness, kurtosis)
- Area under the curve (AUC)



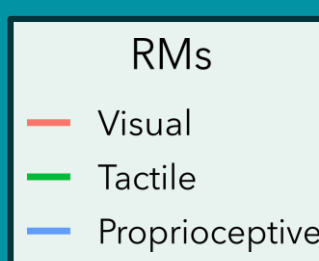
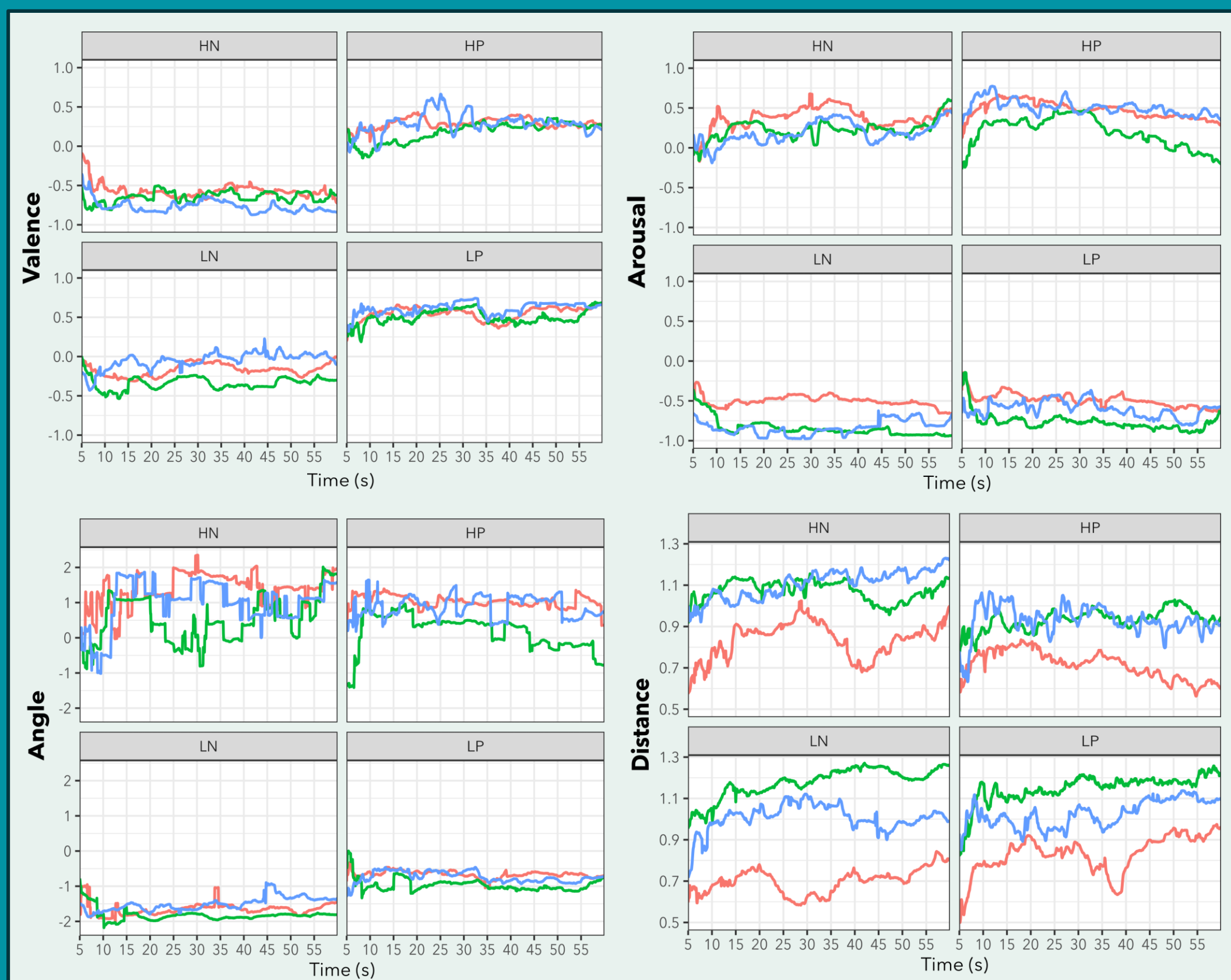
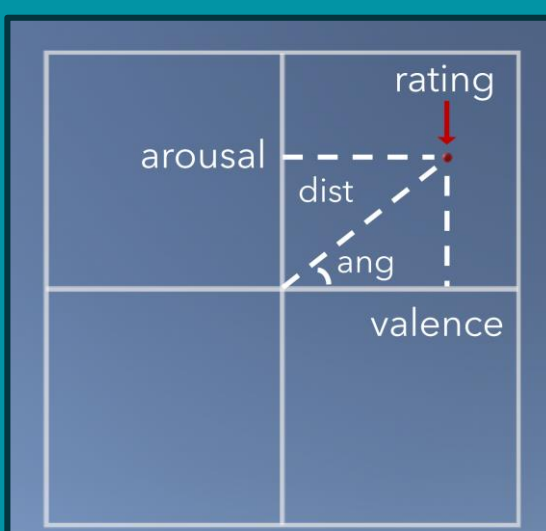
## CR-SR association

1

### Mean CR across participants

- Low CR variability
- CR in line with videos' quadrants

### Dimensions



2

### Comparison of Pearson correlations between CRi and SR for each RM

- SR most correlated with CR mean
- Significant RM effects on CR<sub>RM</sub>-SR correlation
- Visual > Proprioceptive > Tactile

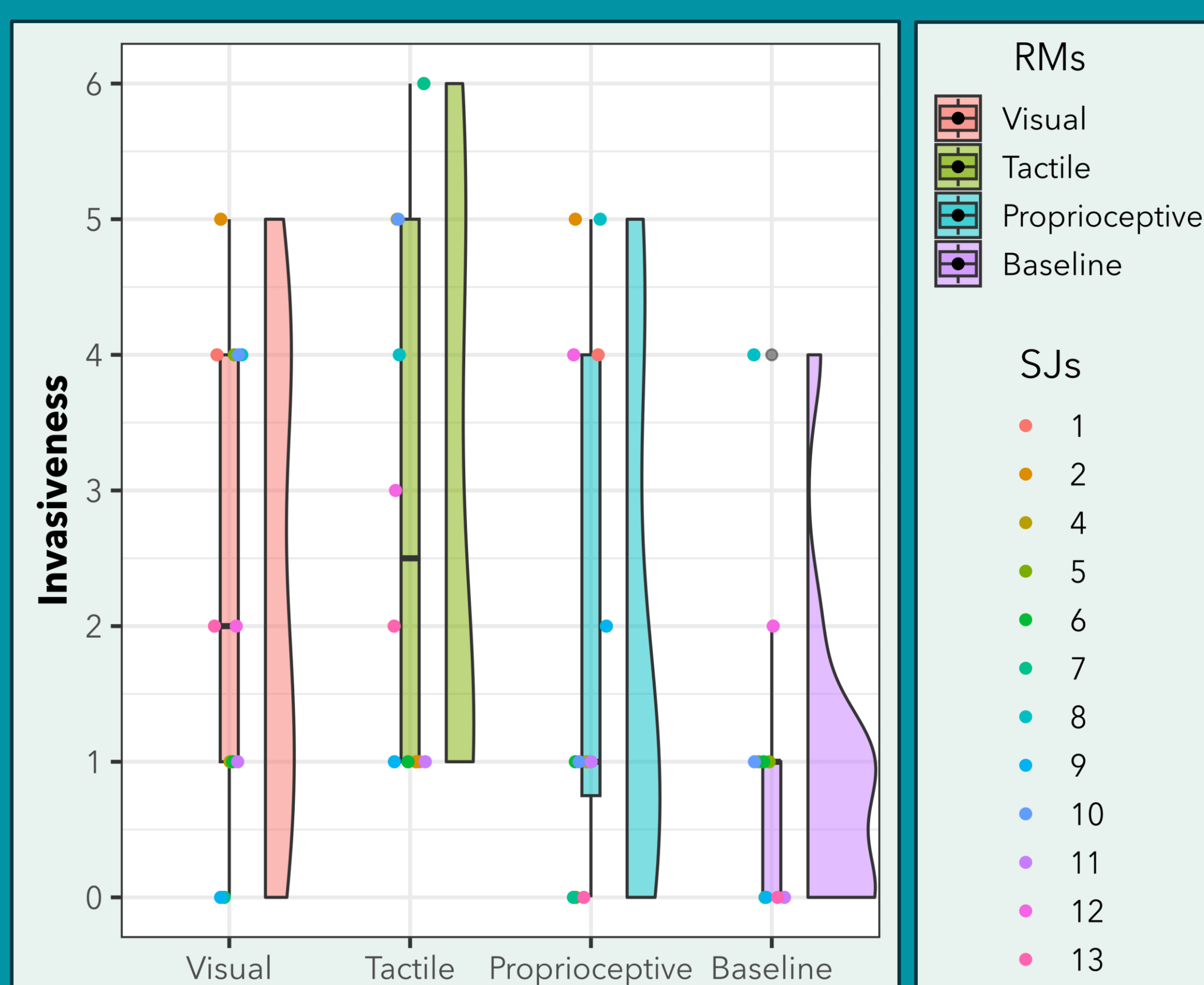
Dimension	valence				arousal				distance				angle				
	mean	std	skewness	kurtosis	mean	std	skewness	kurtosis	mean	std	skewness	kurtosis	mean	std	skewness	kurtosis	
CRi																	
r <sub>Visual</sub>	0.905	-0.009	-0.55	-0.131	0.841	0.311	-0.422	0.081	0.2	0.331	0.146	-0.243	0.827	0.499	-0.542	0.19	
r <sub>Tactile</sub>	0.72	0.067	-0.505	0.097	0.717	0.408	-0.486	-0.369	0.003	-0.091	0.256	-0.134	0.646	0.544	-0.479	-0.295	
r <sub>Proprioceptive</sub>	0.867	0.168	-0.682	-0.277	0.804	0.341	-0.393	-0.23	0.31	-0.177	-0.012	0.131	0.732	0.59	-0.502	0.07	
Visual vs. Tactile	p = 0.3	p = 0.571	p = 0.425	p = 0.469	p = 0.01	p = 0.097	p = 0.977	p = 0.062	p = 0.001	p = 0.023	p = 0.833	p = 0.211	p < 0.001	p = 0.212	p = 0.518	p = 0.017	
Visual vs. Proprioceptive	p = 0.905	p = 0.846	p = 0.079	p = 0.281	p = 0.001	p = 0.181	p = 0.844	p = 0.042	p = 0.295	p = 0.094	p = 0.687	p = 0.943	p = 0.039	p = 0.03	p = 0.774	p = 0.65	
Tactile vs. Proprioceptive	p = 0.332	p = 0.695	p = 0.454	p = 0.085	p = 0.8	p = 0.827	p = 0.878	p = 0.899	p = 0.014	p = 0.54	p = 0.833	p = 0.229	p = 0.018	p = 0.606	p = 0.732	p = 0.033	

## Invasiveness

3

### Invasiveness questionnaire

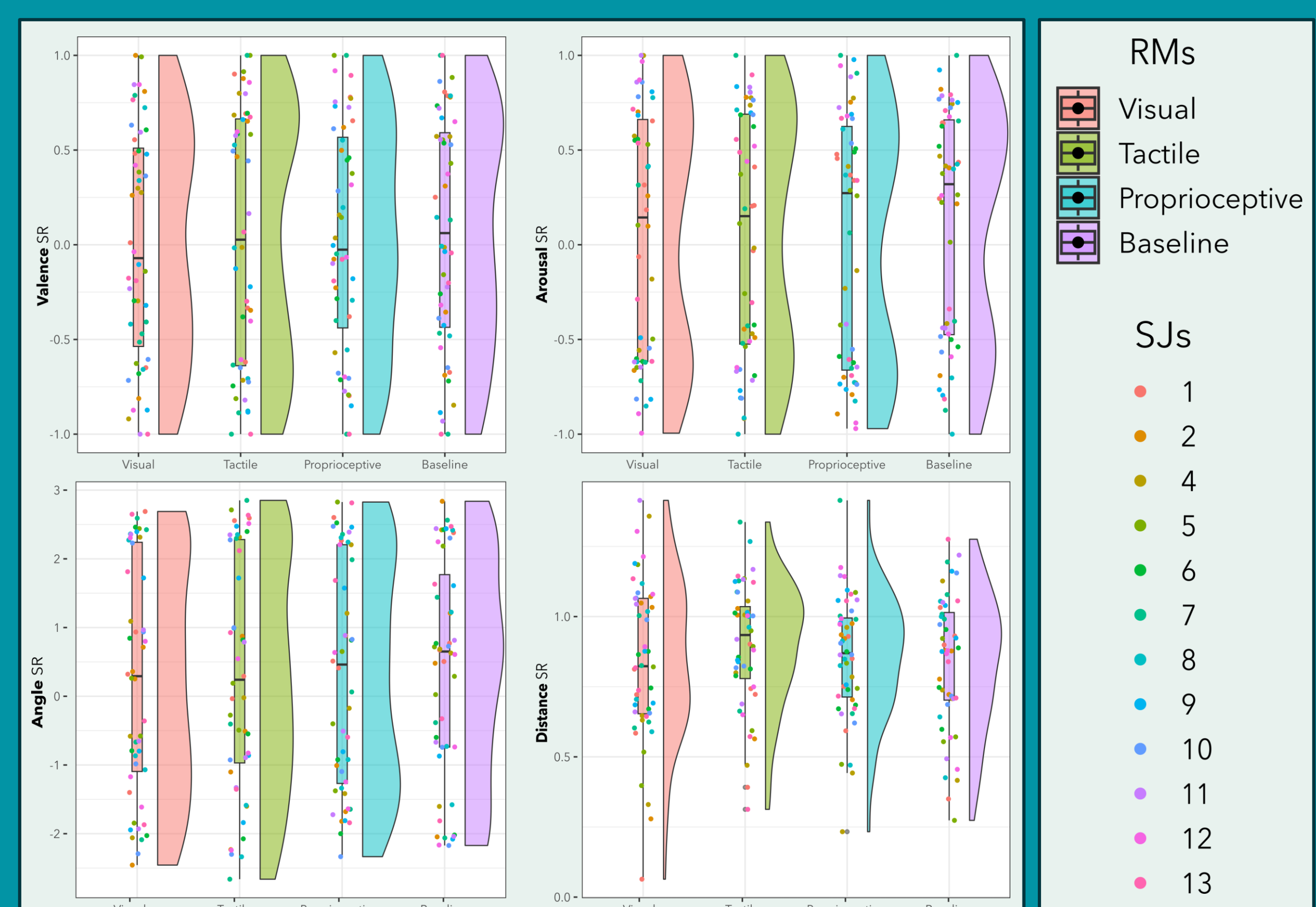
- Visual preferred RM
- No significant RM effect
  - RMs not equivalent
- Significant differences RMs vs. Baseline



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### SR

- SR<sub>RMs</sub> and SR<sub>Baseline</sub> equivalent



## Discussion

1. Preliminary results
  - a. SR strongly associated with CR mean
  - b. RMs not distracting + Visual preferred
2. Short stimuli (1-min) with low affective variability
  - a. Good for comparing CR to SR (e.g., repetition to avoid order effects)
  - b. Don't take full advantage of CR
3. Next steps
  - a. Refinement of prototypes + full data collection
  - b. Select one prototype + longer stimuli with more affective variability
  - c. Extend to clinical populations
  - d. Combine with physiological recordings

## References

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