Psychometric properties of startle and corrugator response in NPU and affective picture viewing tasks

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University of Wisconsin – Madison

Construct	Genes	Molecules	Cells	Circuits	**Physiology**	Behavior	Self-Report

Negative Valence System

Construct	Genes	Molecules	Cells	Circuits	**Physiology**	Behavior	Self-Report
Acute Threat (“Fear”)					X		
Potential Threat (“Anxiety”)					X		

Tasks

- No Shock, Predictable Shock, Unpredictable Shock (NPU)
- Affective Picture Viewing

Negative Valence System

Construct	Genes	Molecules	Cells	Circuits	**Physiology**	Behavior	Self-Report
Acute Threat (“Fear”)					X		
Potential Threat (“Anxiety”)					X		

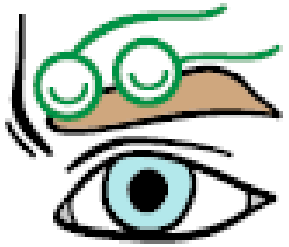
Tasks

- No Shock, Predictable Shock, Unpredictable Shock (NPU)
- Affective Picture Viewing

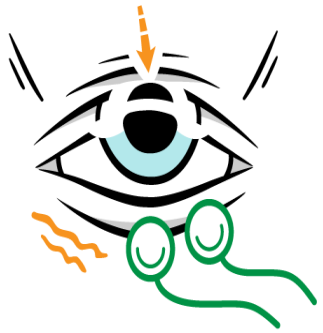
Measures

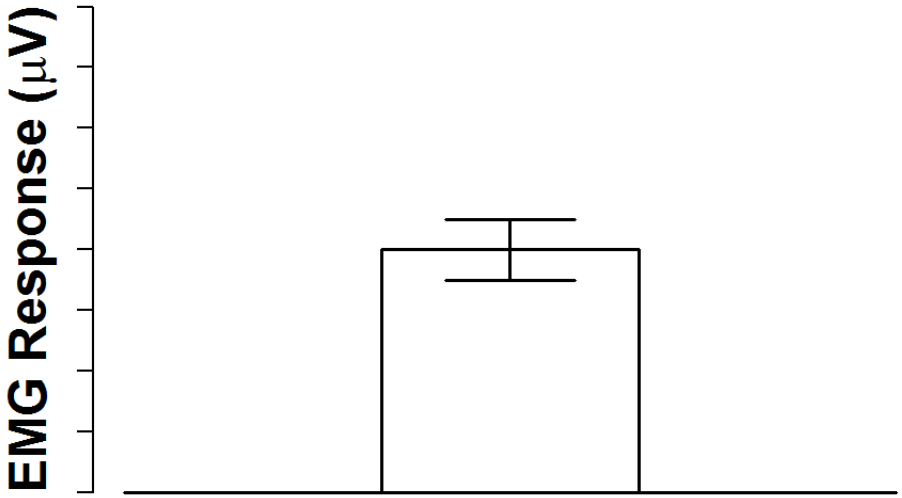
- Startle
- Corrugator

Corrugator Response

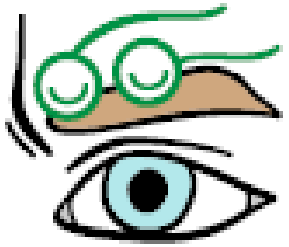


Startle Response

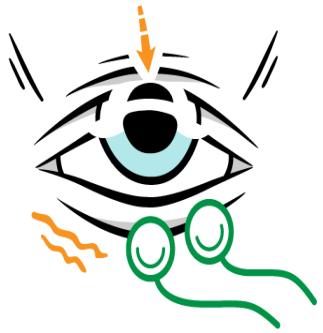


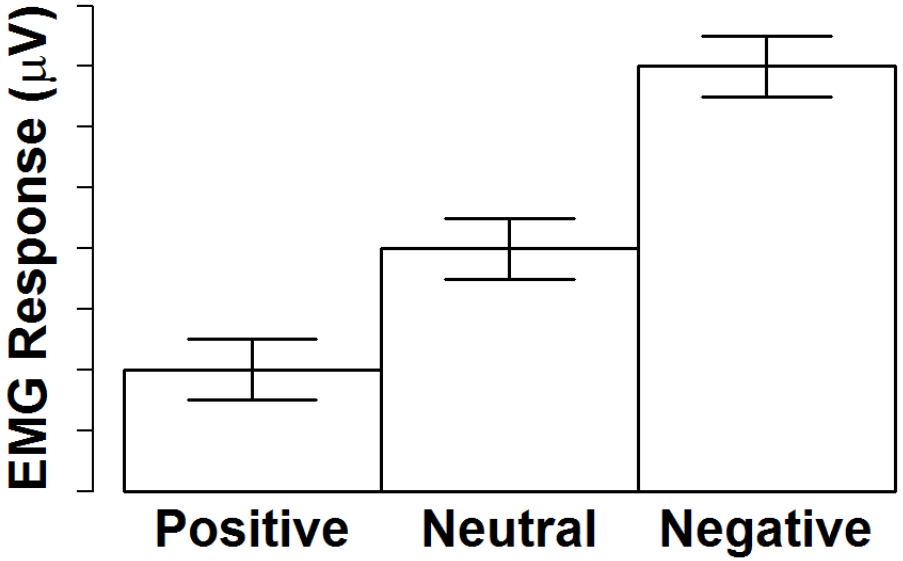


Corrugator Response

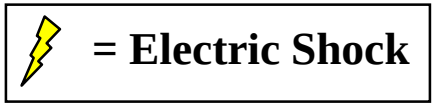


Startle Response

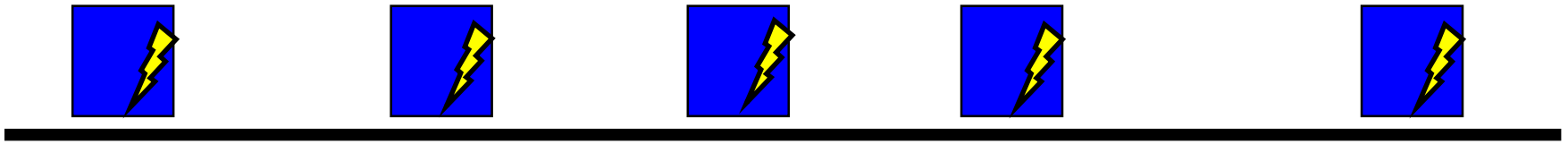




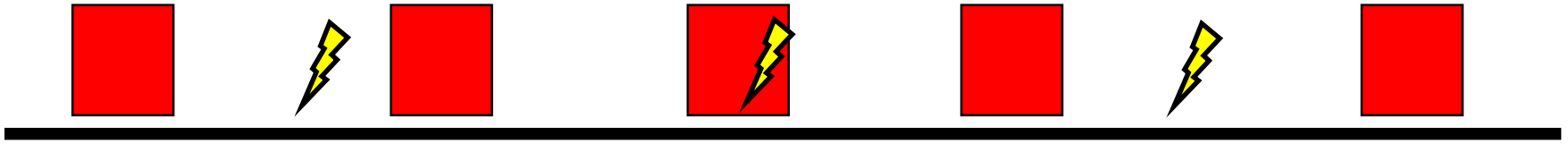
NPU Task



Predictable Shock Block



Unpredictable Shock Block



Blocks of colored square “cues” (5s each) with a variable ITI

Cues occur in three different within-subject conditions

- Predictable Shock: Shocks during cues only
- Unpredictable Shock: Shocks at any time
- No Shock: No shocks at any time

Startle/corrugator modulation calculated separately for predictable and unpredictable vs. no-shock

Affective Picture Viewing Task

International Affective Picture System (IAPS) valence conditions:

- Unpleasant
- Pleasant
- Neutral

Pictures (6s) intermixed & counterbalanced by valence within-subjects

Startle/corrugator modulation calculated separately for pleasant and unpleasant vs. neutral

N: 128

Study visits: 2

Separation: 1 week

Quantification: Raw microvolts (time domain)

Effect size and stability

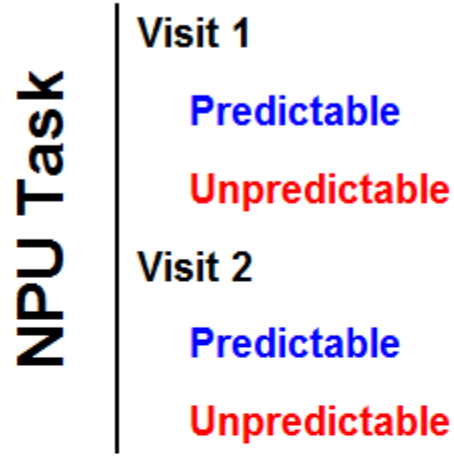
Effect size and stability

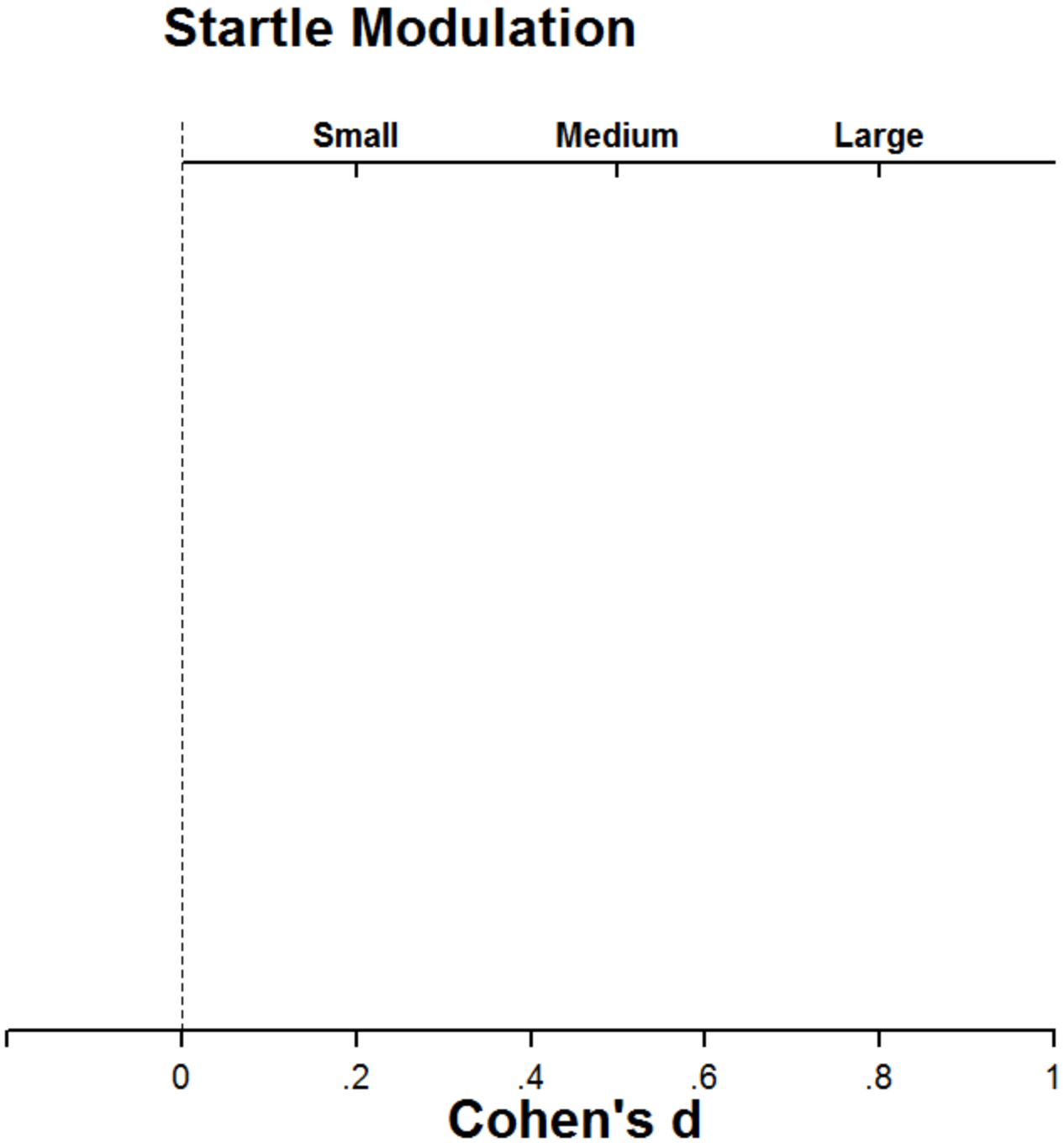
Internal consistency (split-half reliability)

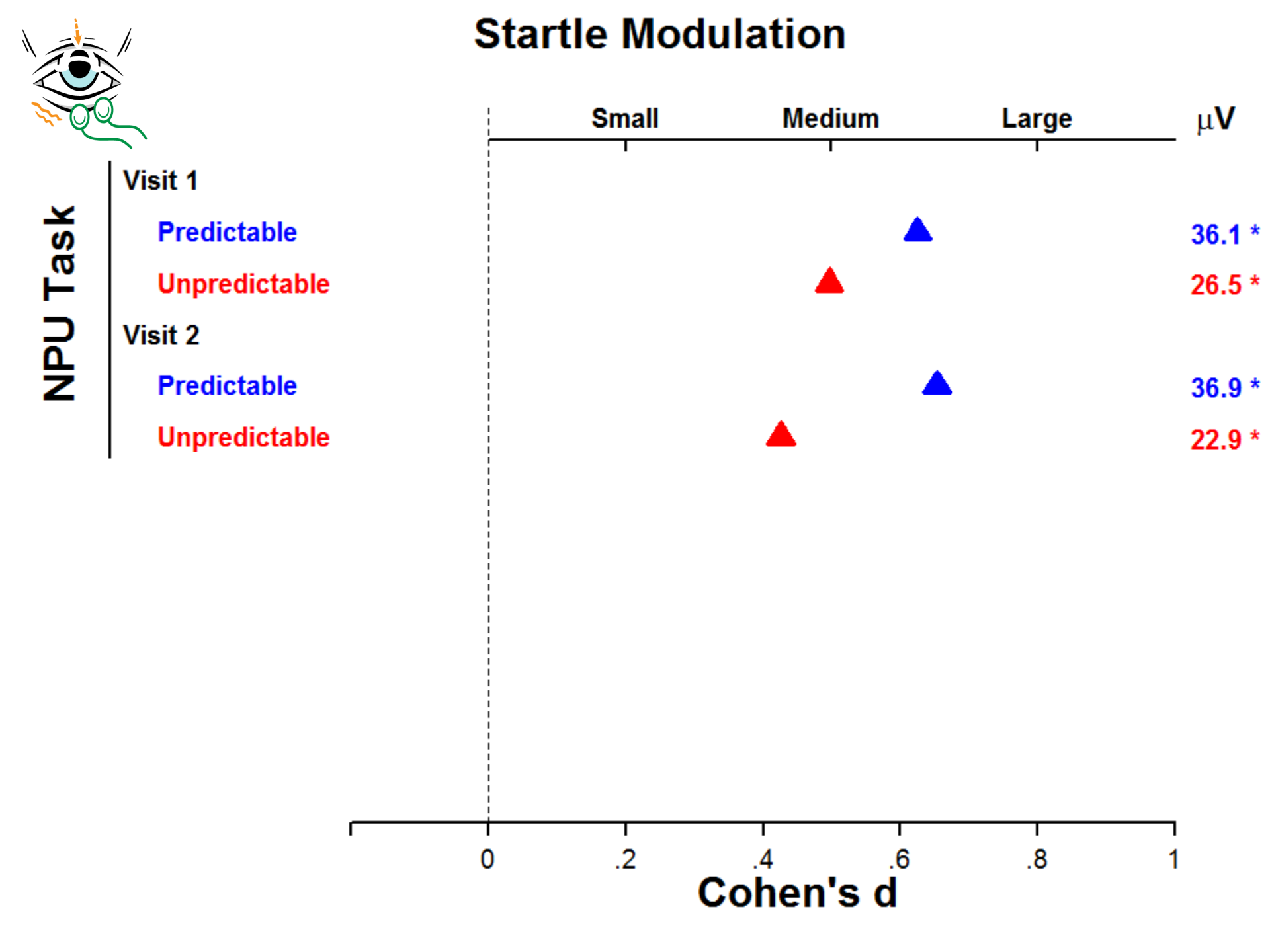
Effect size and stability

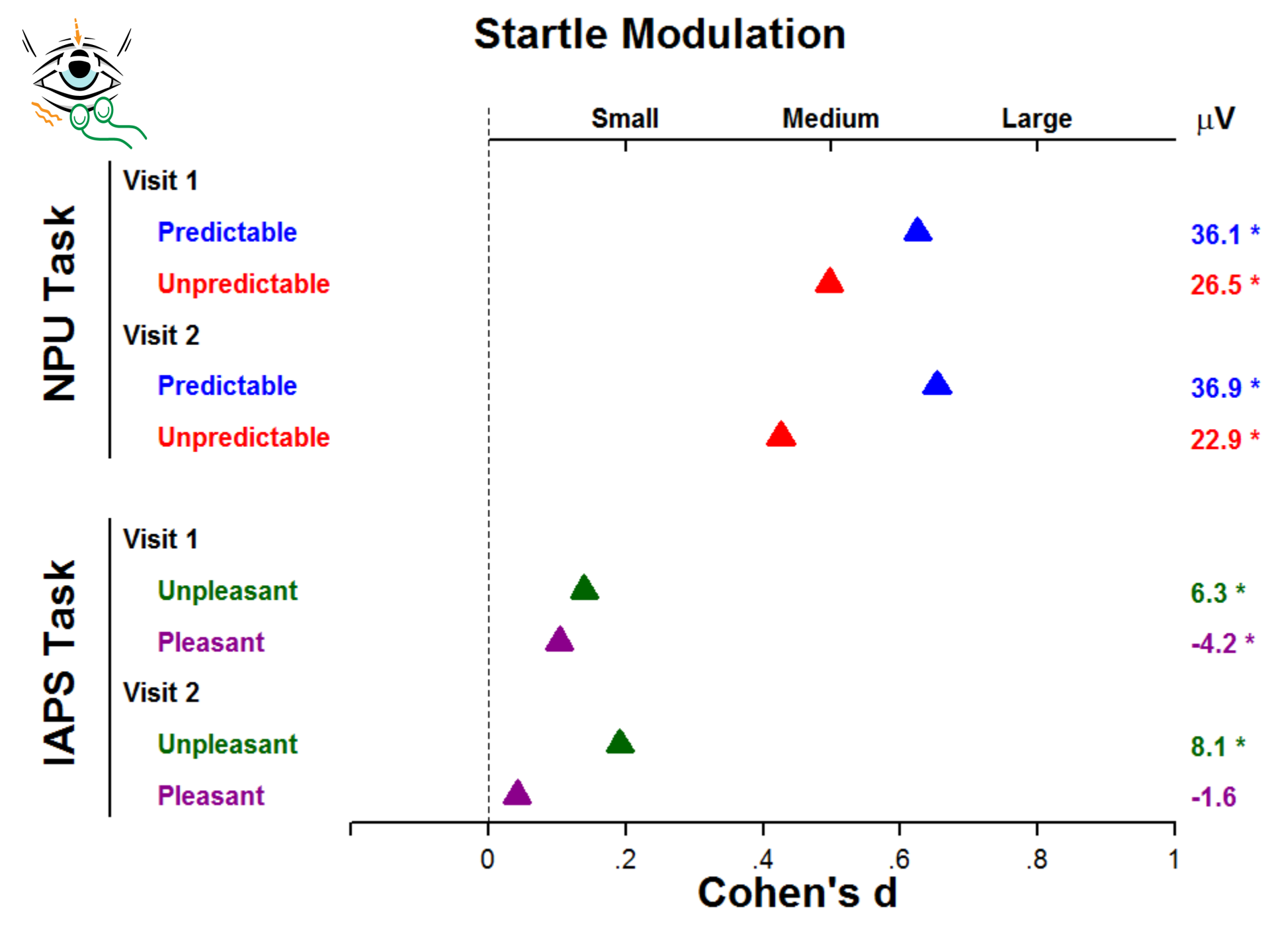
Internal consistency (split-half reliability)

Temporal stability (test-retest reliability)

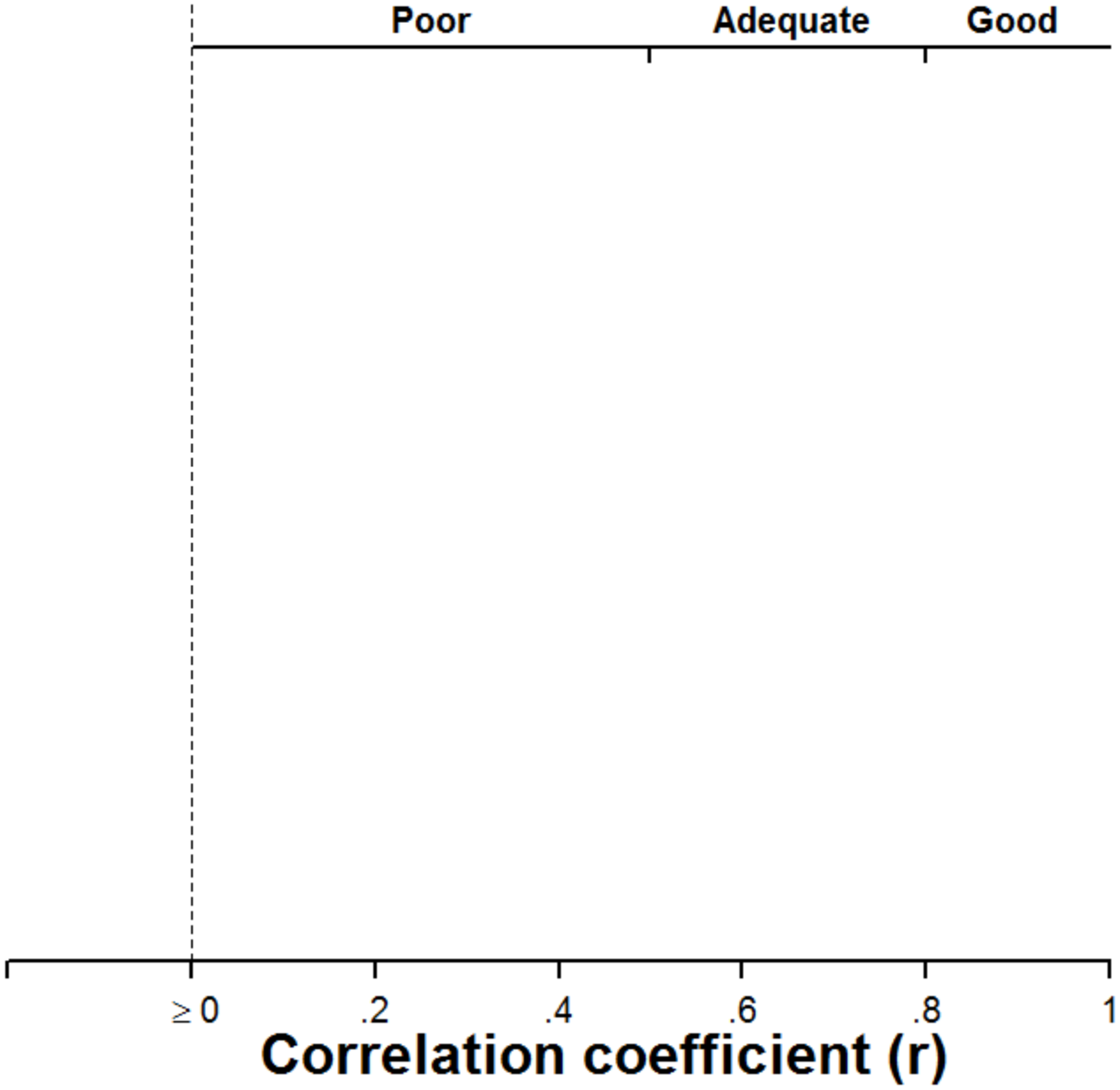

NPU Task
Visit 1
Predictable
Unpredictable
Visit 2
Predictable
Unpredictable

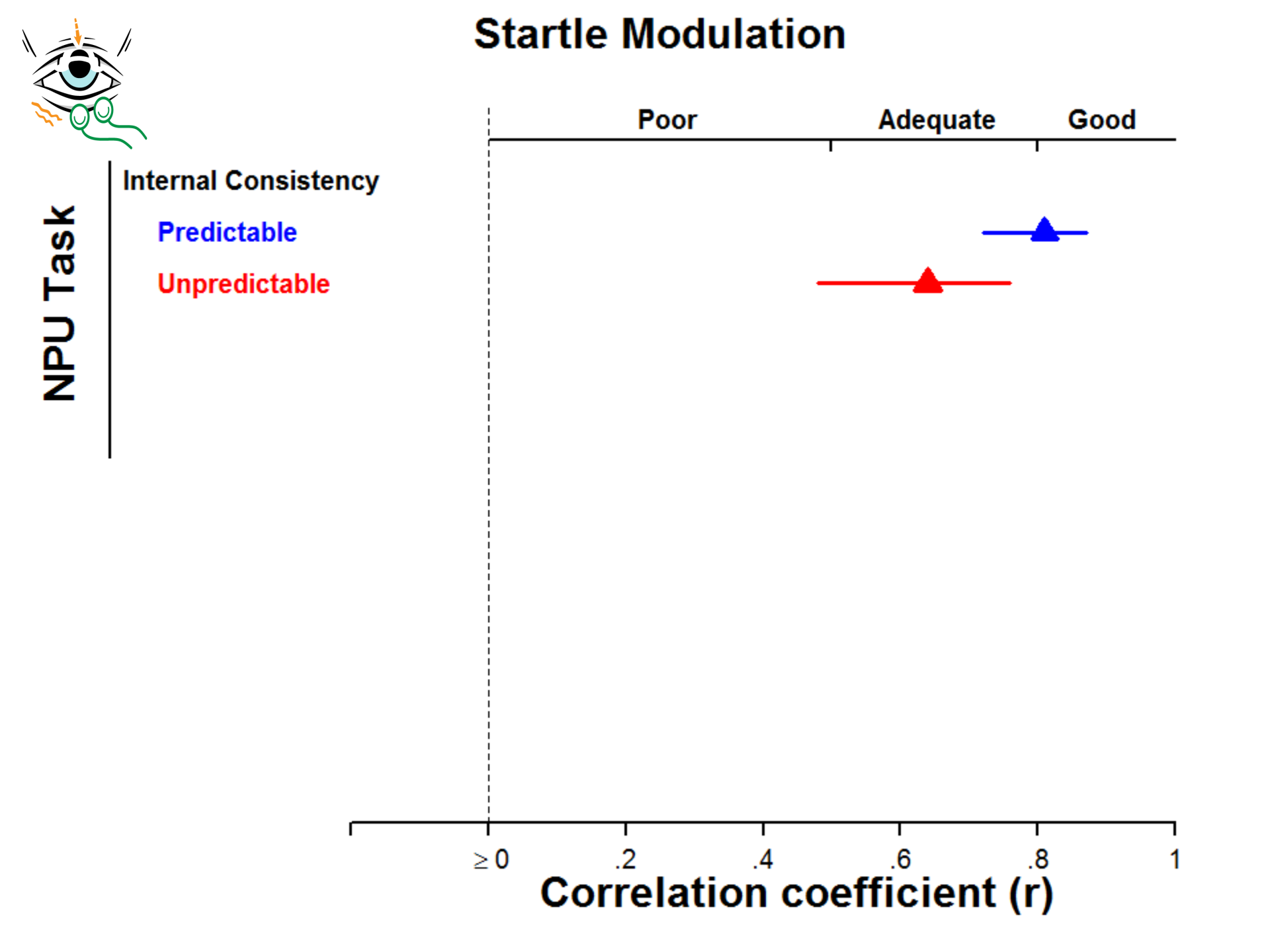

Startle Modulation
Small
Medium
Large
0
.2
.4
.6
.8
1
Cohen's d

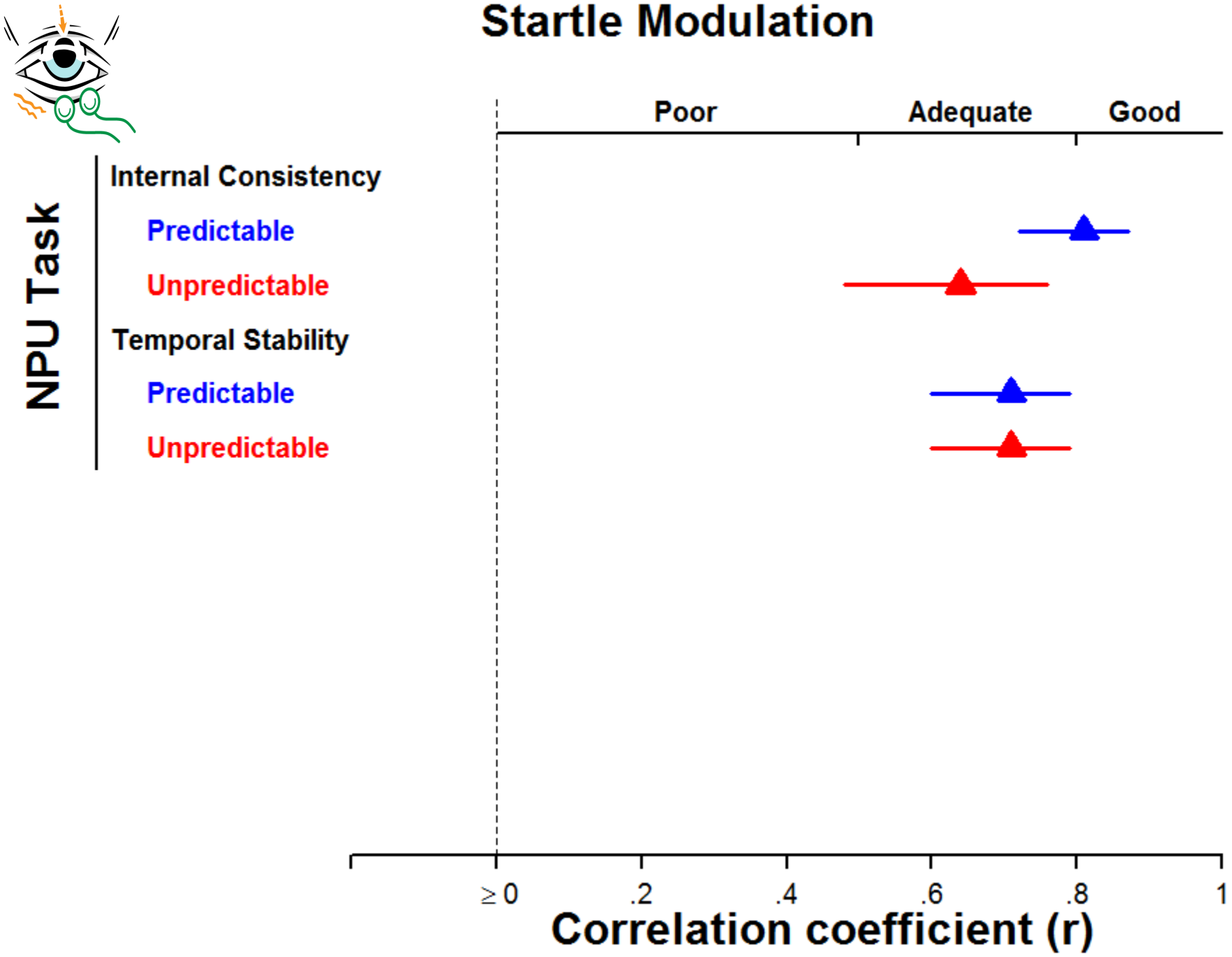

Startle Modulation
Small
Medium
Large
μV
NPU Task
Visit 1
Predictable
36.1 *
Unpredictable
26.5 *
Visit 2
Predictable
36.9 *
Unpredictable
22.9 *
0
.2
.4
.6
.8
1
Cohen's d

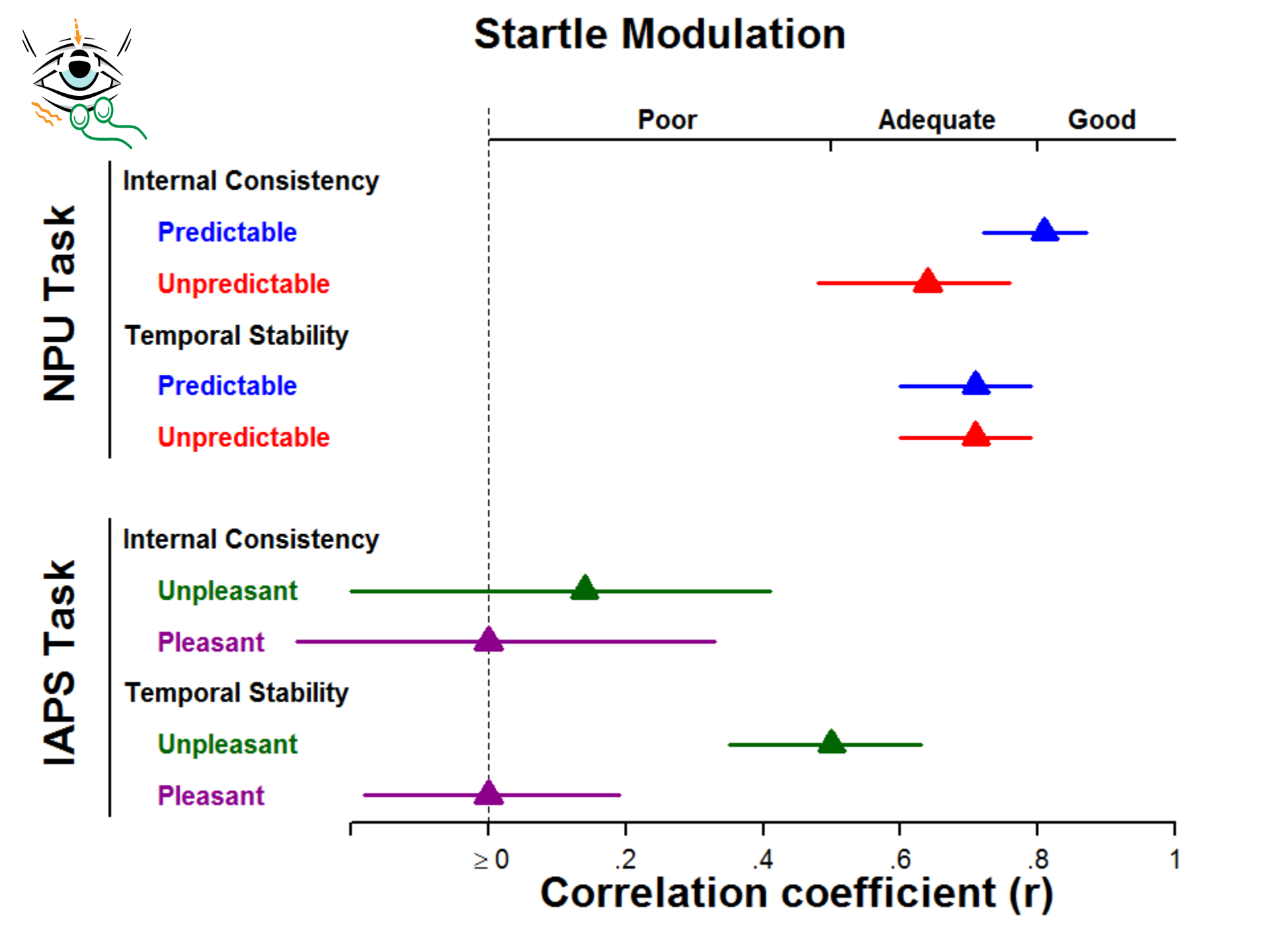

Startle Modulation
Small
Medium
Large
μV
NPU Task
Visit 1
Predictable
36.1 *
Unpredictable
26.5 *
Visit 2
Predictable
36.9 *
Unpredictable
22.9 *
IAPS Task
Visit 1
Unpleasant
6.3 *
Pleasant
-4.2 *
Visit 2
Unpleasant
8.1 *
Pleasant
-1.6
0
.2
.4
.6
.8
1
Cohen's d

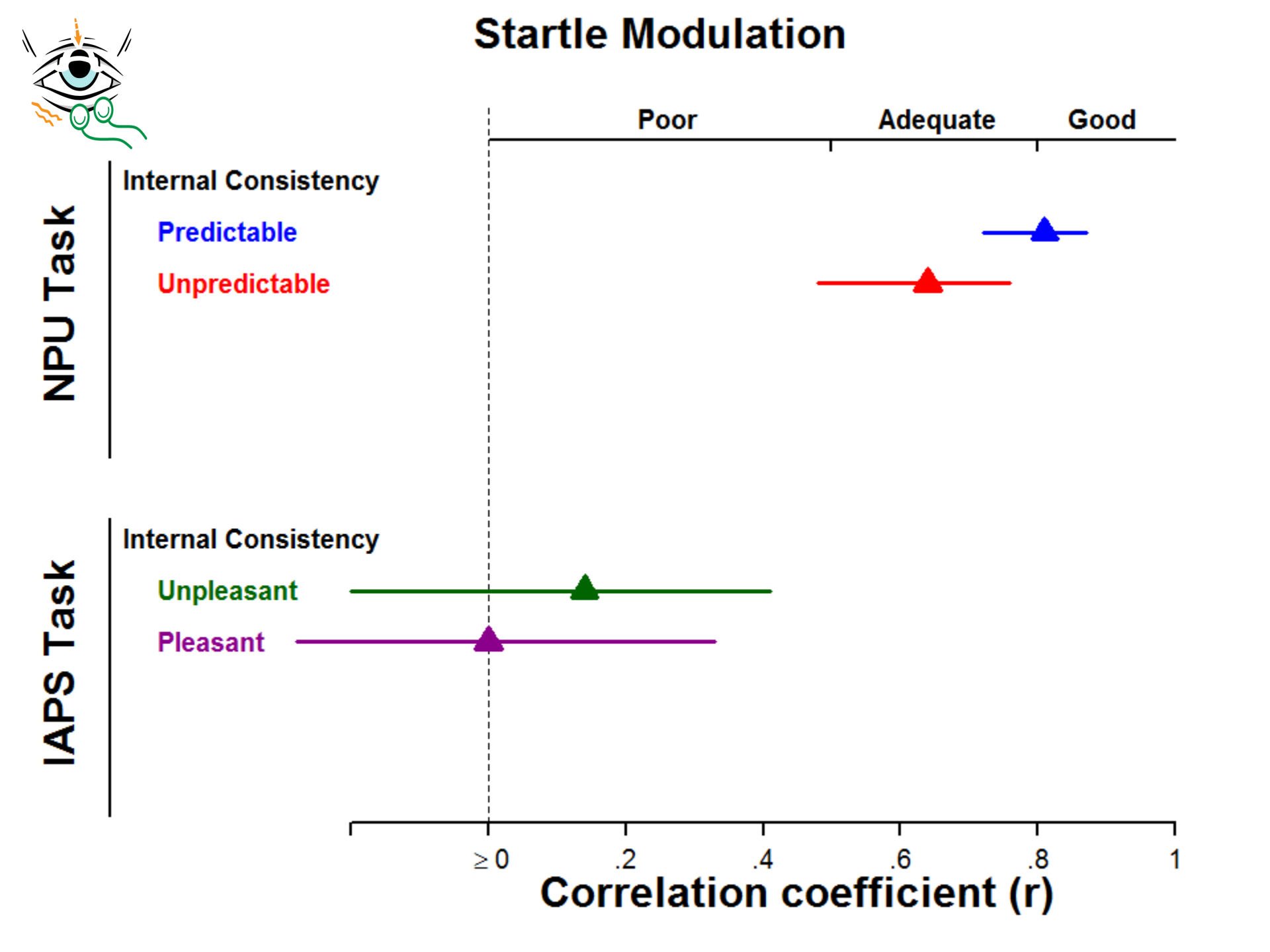
Startle Modulation

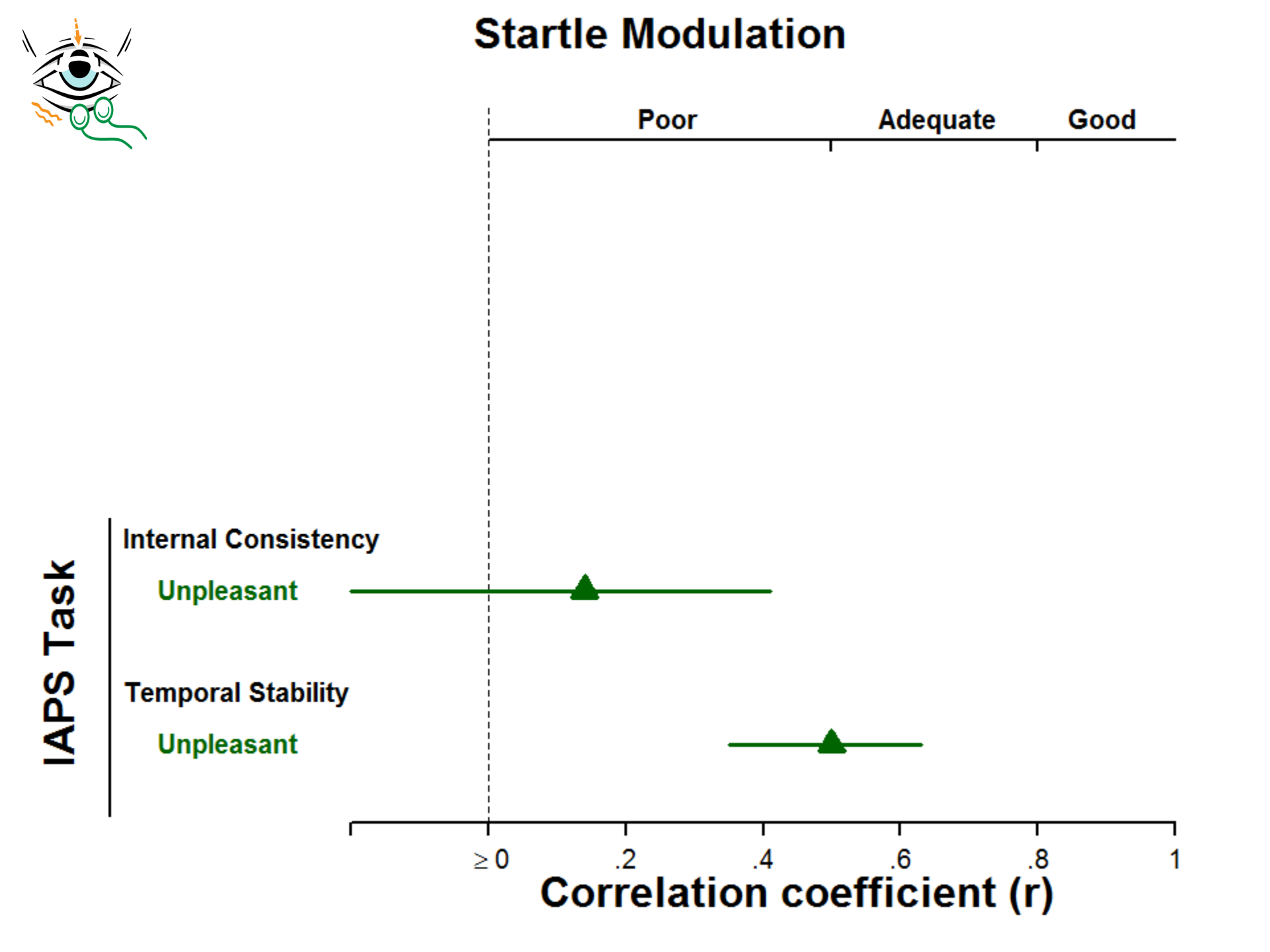



Startle Modulation
Poor
Adequate
Good
Internal Consistency
Predictable
Unpredictable
NPU Task
≥ 0
.2
.4
.6
.8
1
Correlation coefficient (r)

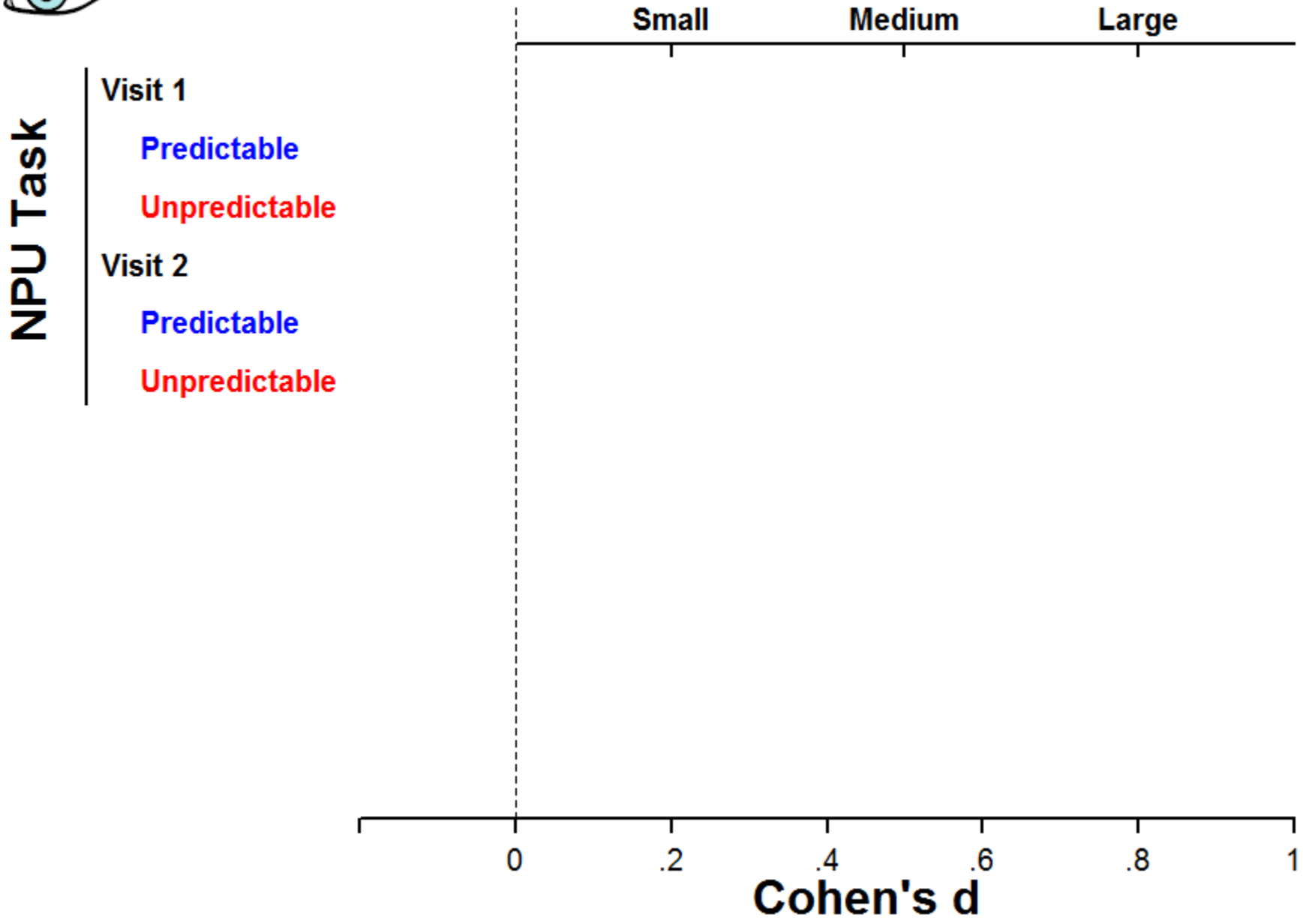

Startle Modulation
Poor
Adequate
Good
NPU Task
Internal Consistency
Predictable
Unpredictable
Temporal Stability
Predictable
Unpredictable
≥ 0
.2
.4
.6
.8
1
Correlation coefficient (r)


Startle Modulation
Poor
Adequate
Good
NPU Task
Internal Consistency
Predictable
Unpredictable
Temporal Stability
Predictable
Unpredictable
IAPS Task
Internal Consistency
Unpleasant
Pleasant
Temporal Stability
Unpleasant
Pleasant
≥ 0
.2
.4
.6
.8
1
Correlation coefficient (r)

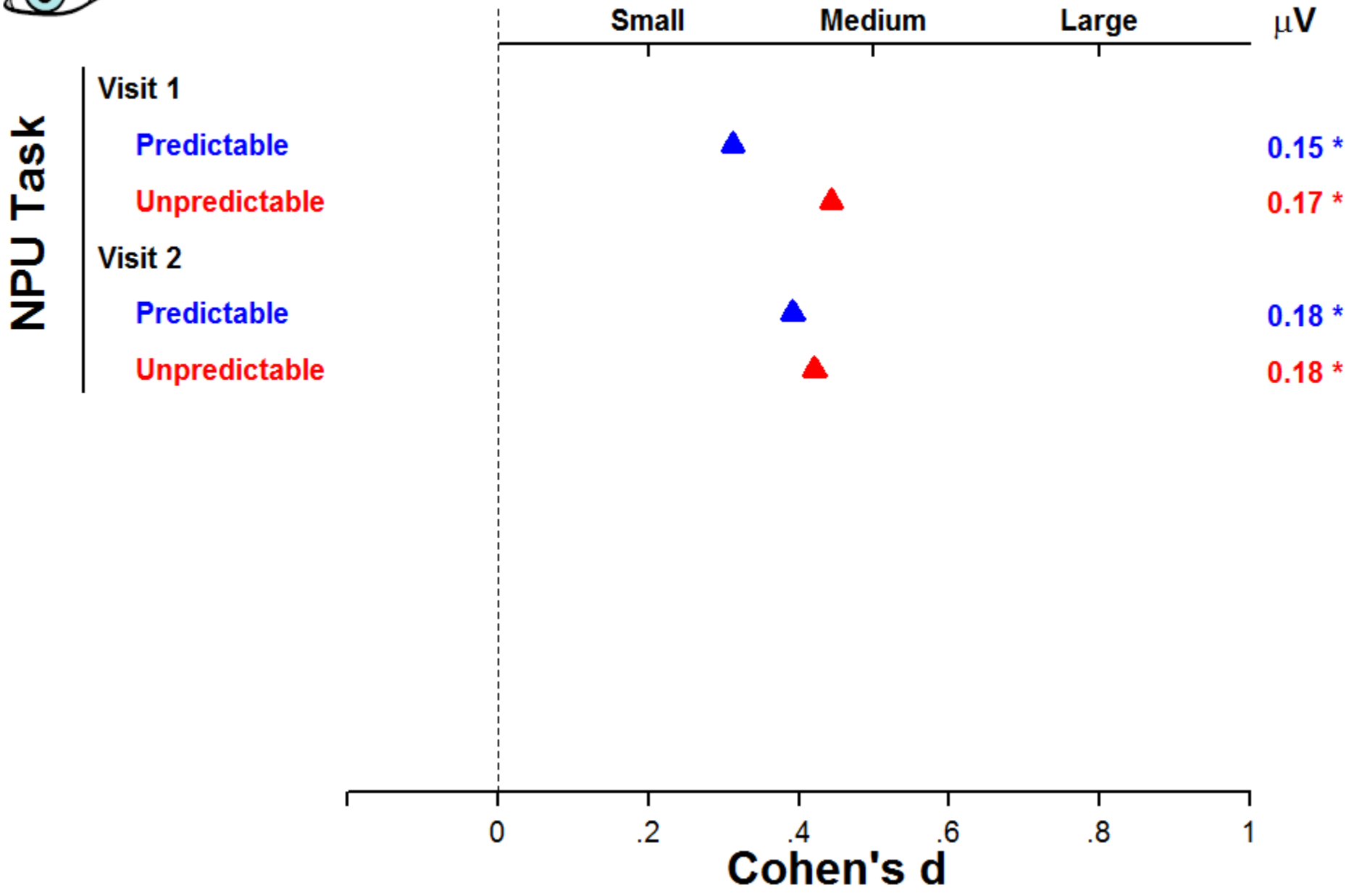

Startle Modulation
Poor
Adequate
Good
NPU Task
Internal Consistency
Predictable
Unpredictable
IAPS Task
Internal Consistency
Unpleasant
Pleasant
≥ 0
.2
.4
.6
.8
1
Correlation coefficient (r)


Startle Modulation
Poor
Adequate
Good
IAPS Task
Internal Consistency
Unpleasant
Temporal Stability
Unpleasant
≥ 0
.2
.4
.6
.8
1
Correlation coefficient (r)

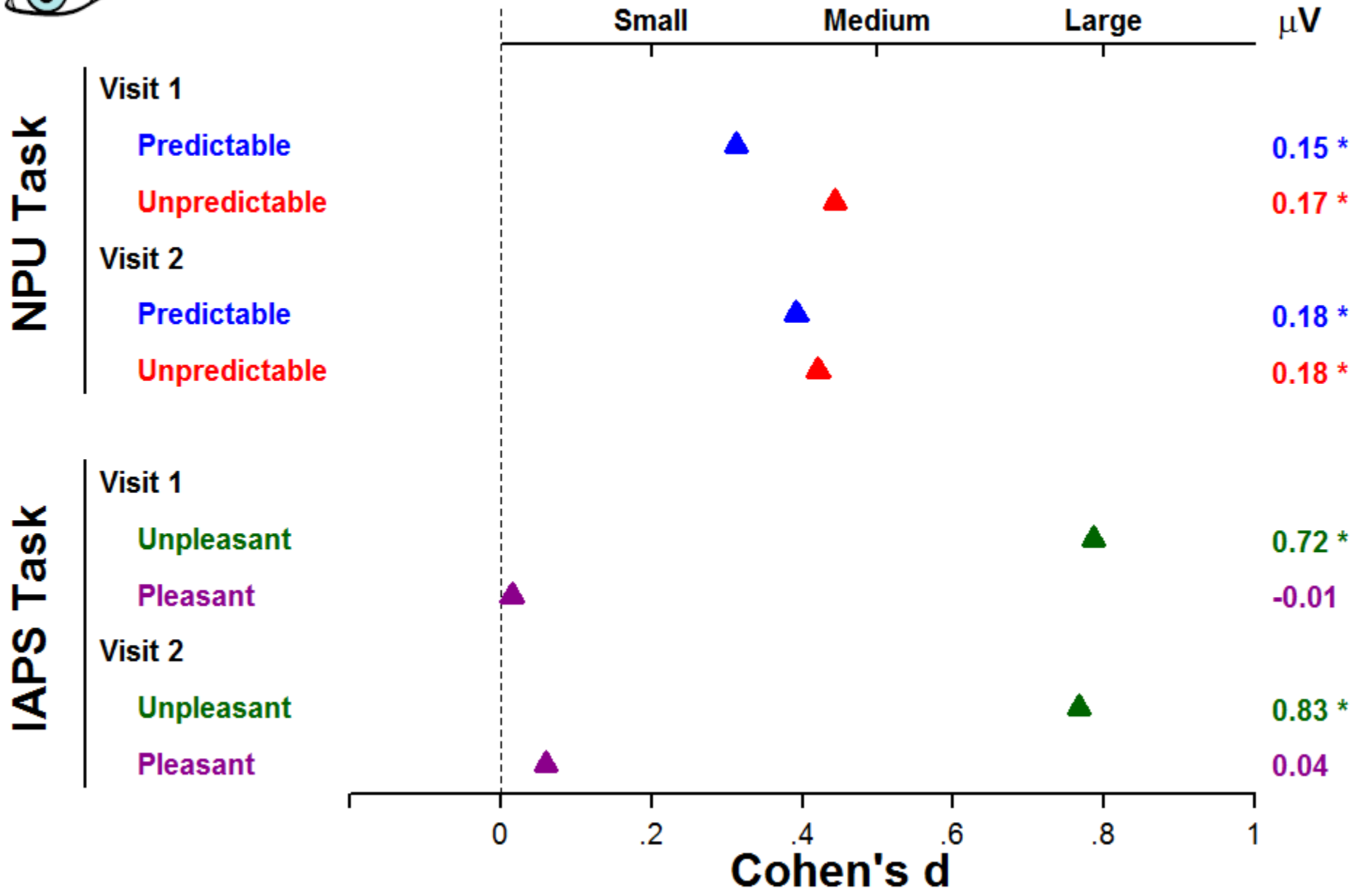
Corrugator Modulation



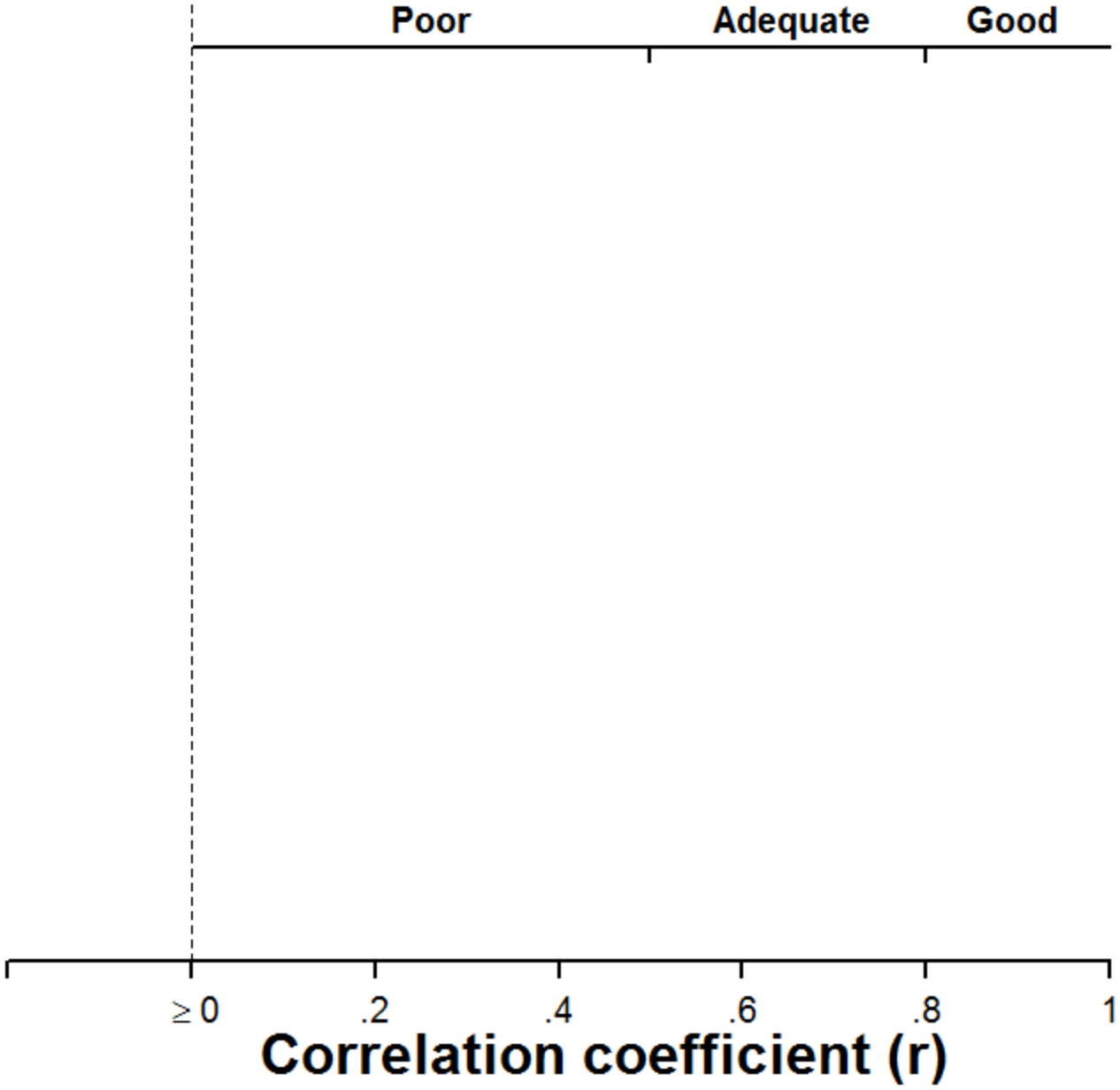
Corrugator Modulation



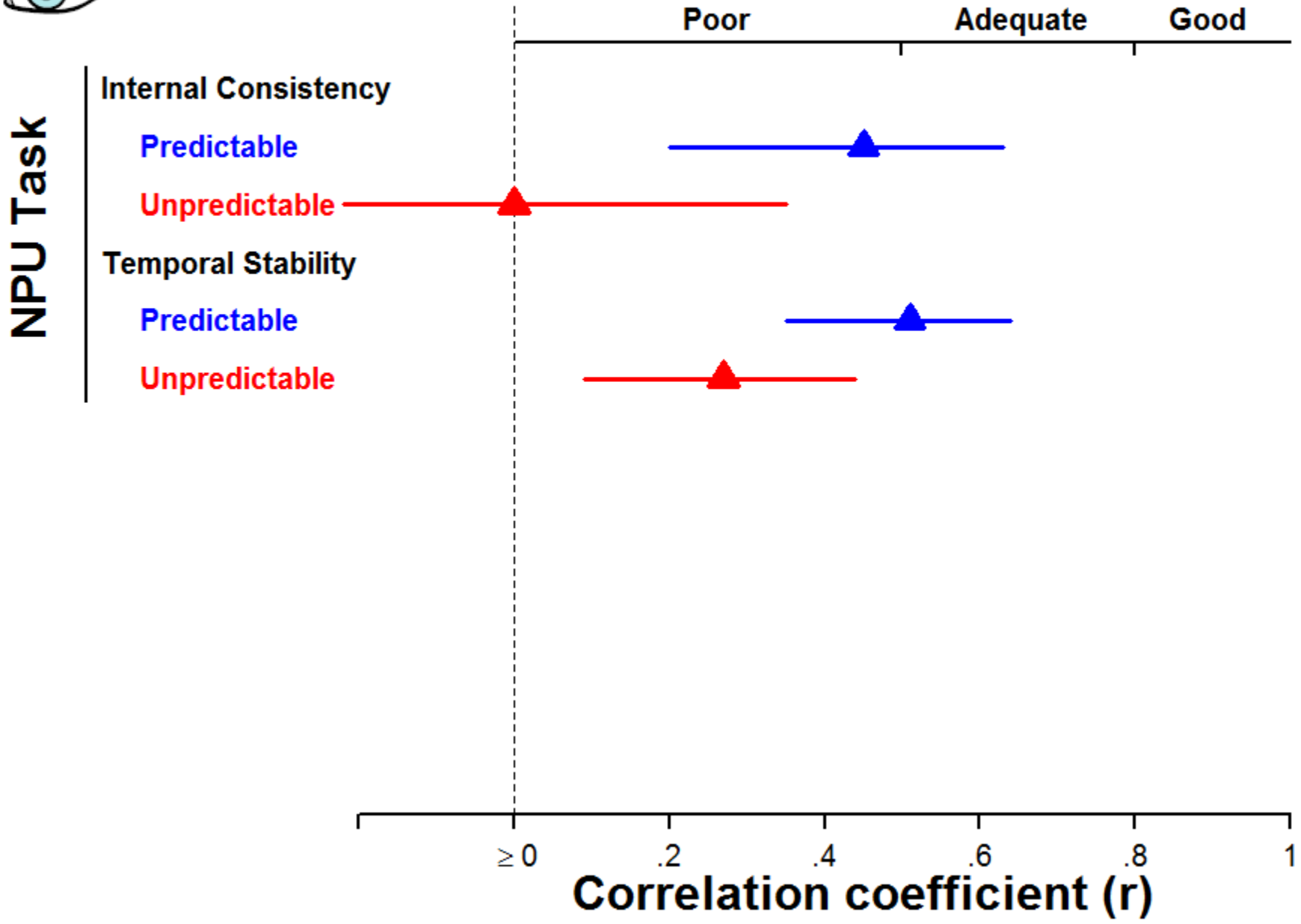
Corrugator Modulation



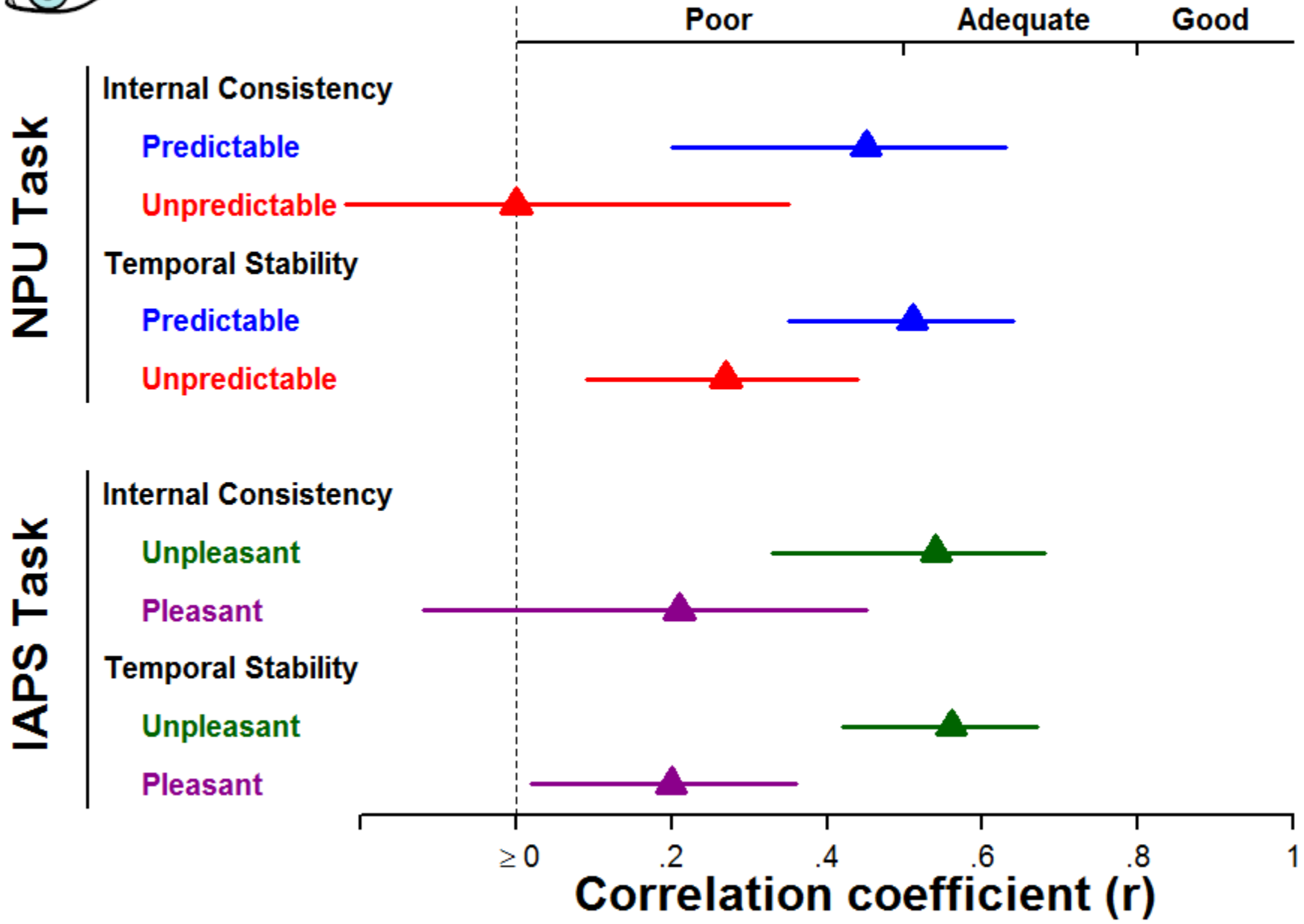
Corrugator Modulation



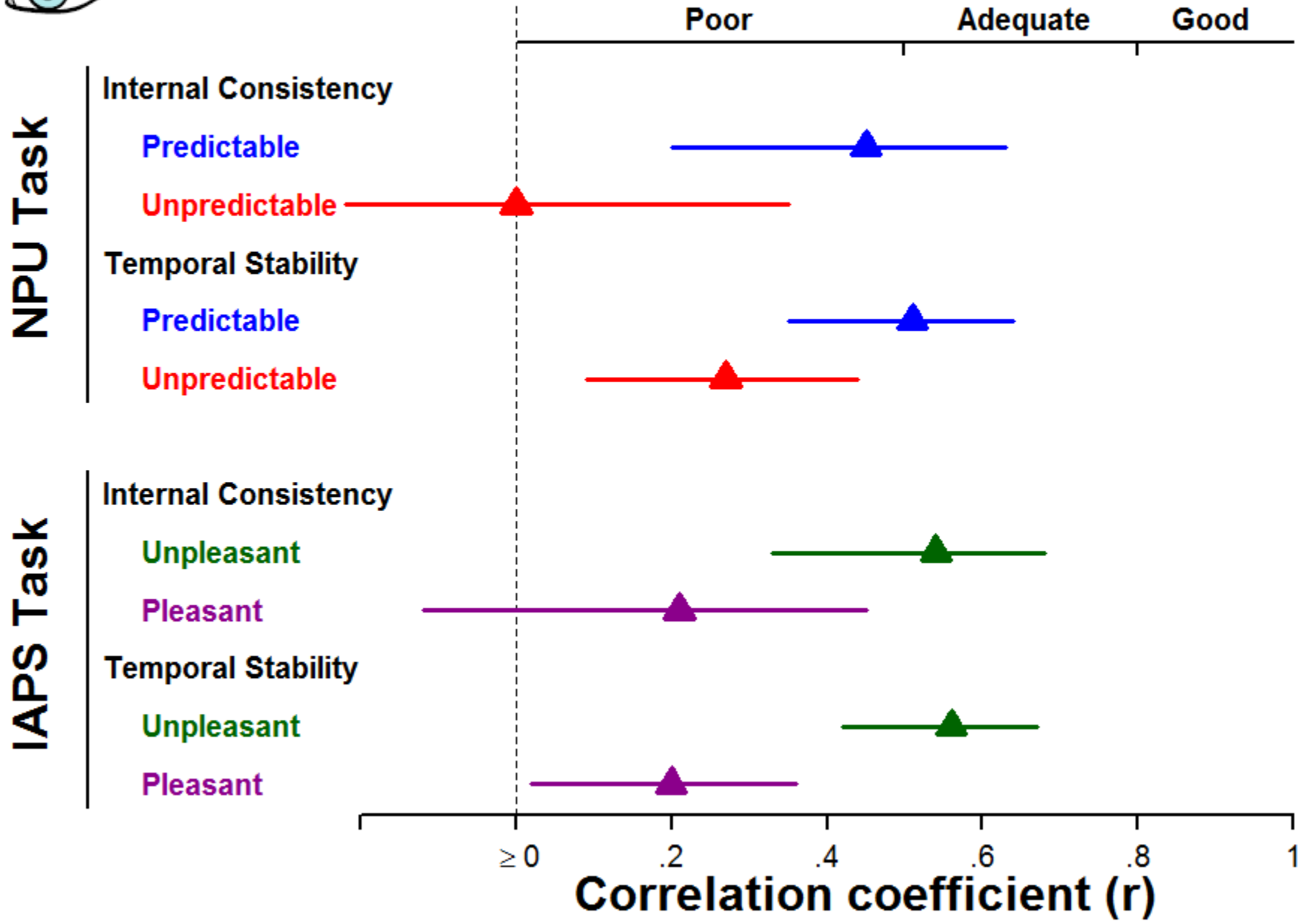
Corrugator Modulation



Corrugator Modulation



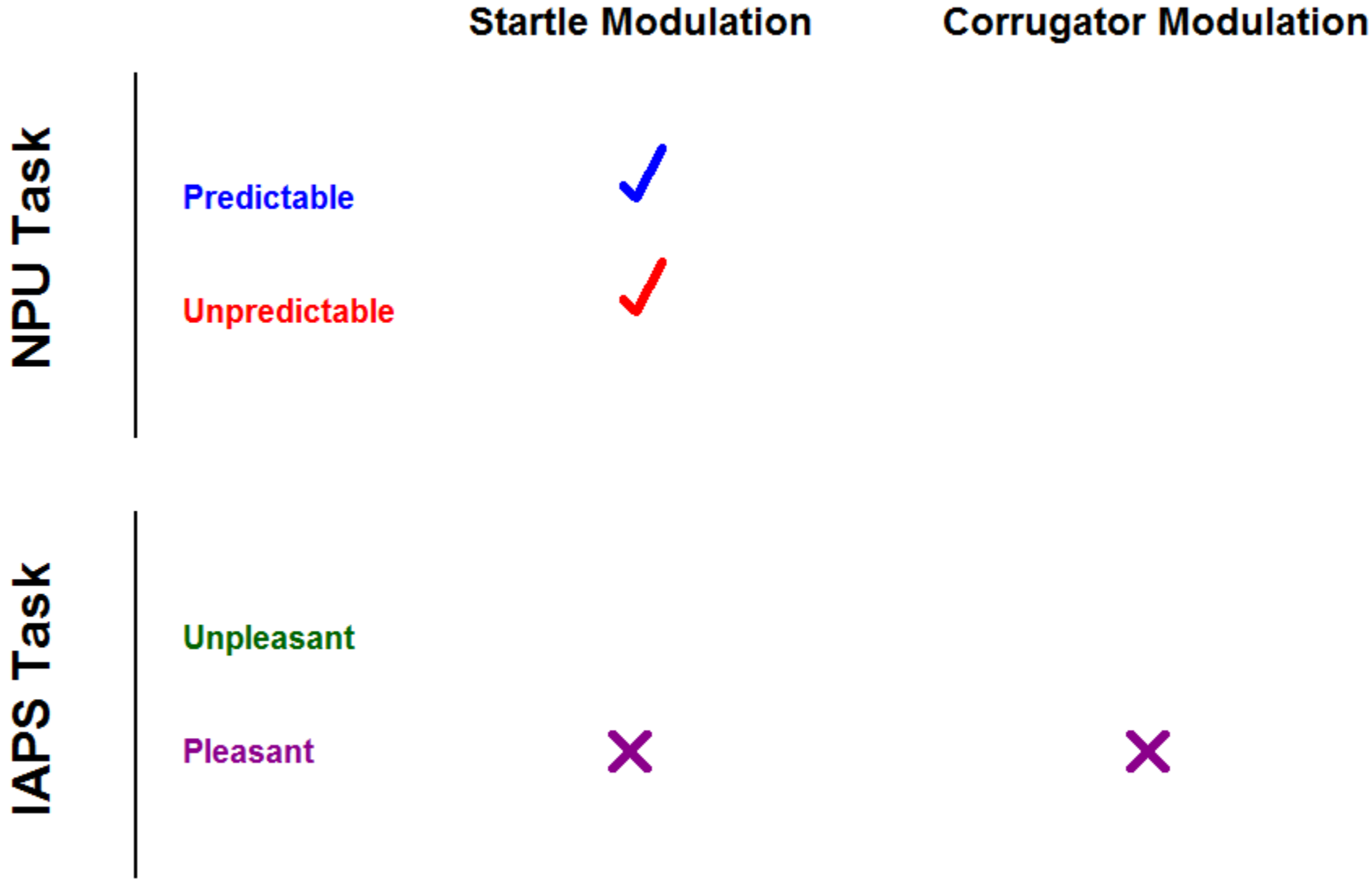
Corrugator Modulation



Psychometric Summary

	Startle Modulation	Corrugator Modulation
NPU Task		
Predictable	✓	
Unpredictable	✓	
IAPS Task		
Unpleasant		
Pleasant		

Psychometric Summary



Psychometric Summary

		Startle Modulation	Corrugator Modulation
NPU Task	Predictable	✓	?
	Unpredictable	✓	?
IAPS Task	Unpleasant	?	?
	Pleasant	✗	✗

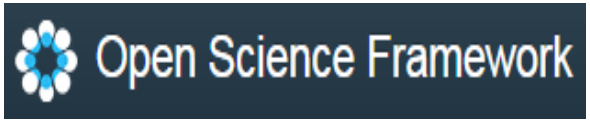
RDoC
Research Domain Criteria Initiative

Psychophysiology tasks can contribute to RDoC, if…

- More large studies on reliability
- Cross-lab collaborations
- Empirical recommendations for method & quantification

Kaye JT, Bradford DE & Curtin JJ (2016). Psychometric properties of startle and corrugator response in NPU, Affective Picture Viewing, and Resting State tasks. *Psychophysiology*, 53(8), 1241-1255.

https://osf.io/fdjg9/



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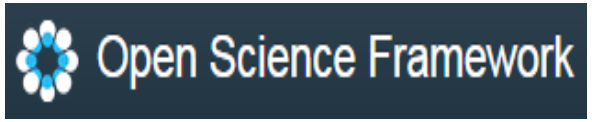


F31 AA022845
R01 AA024388

DGE 0718123

Research Team

John Curtin, Daniel Bradford, Charles Rohrer, Austin Kayser, Susan Schneck, Rachel Hamilton, Rachel Korhumel

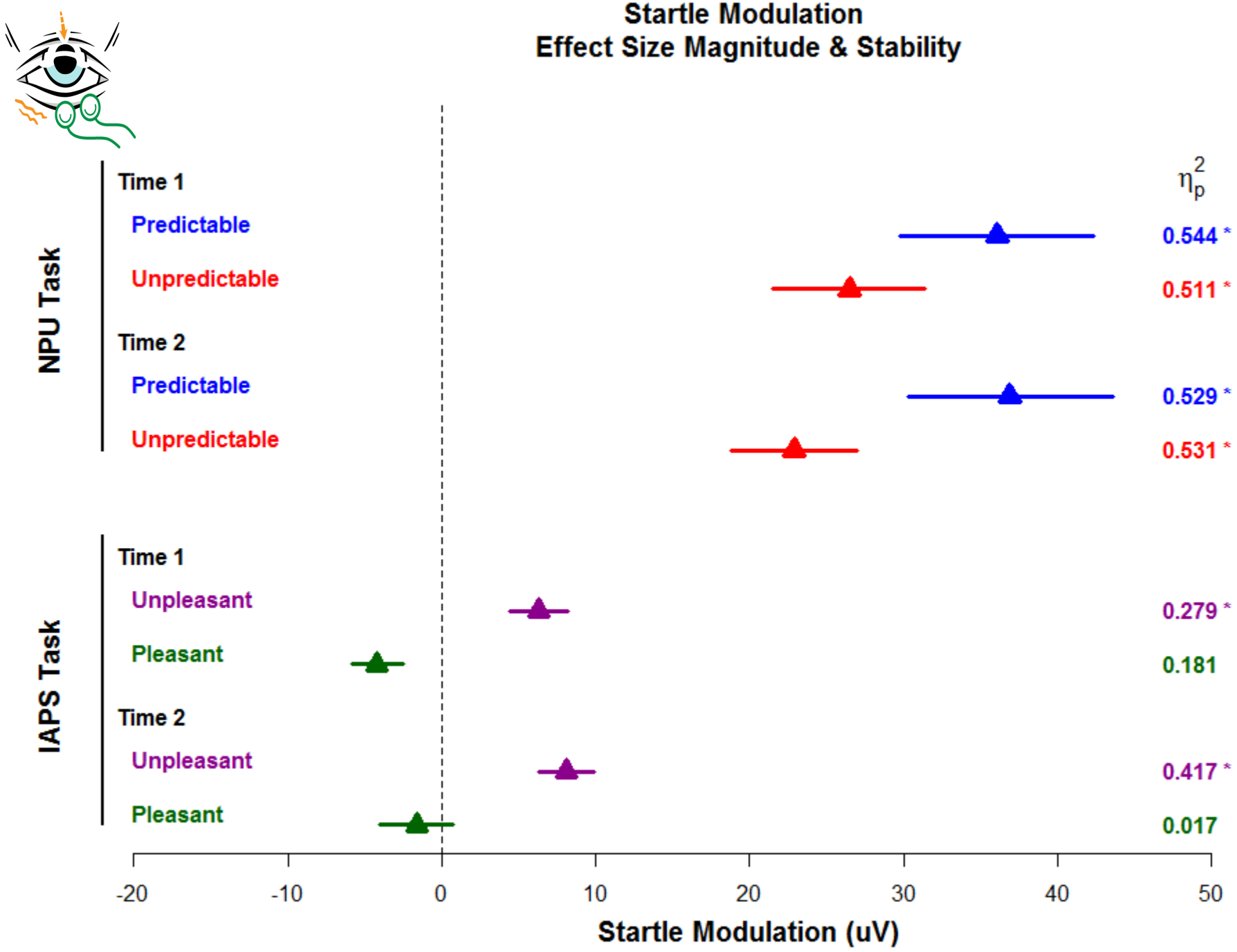
Bradford DE, Kaye JT & Curtin JJ. The relationships among multiple psychophysiological and self-report measures of negative affect indexed across multiple tasks within the same sample. Poster #4-46

Kaye JT, Bradford DE & Curtin JJ (2016). Psychometric properties of startle and corrugator response in NPU, Affective Picture Viewing, and Resting State tasks. *Psychophysiology*, 53(8), 1241-1255.

https://osf.io/fdjg9/

ADDITIONAL SLIDES

Effect Size
X-Axis Microvolts


Startle Modulation
Effect Size Magnitude & Stability
NPU Task
Time 1
Predictable
Unpredictable
Time 2
Predictable
Unpredictable
IAPS Task
Time 1
Unpleasant
Pleasant
Time 2
Unpleasant
Pleasant
η_p^2
0.544 *
0.511 *
0.529 *
0.531 *
0.279 *
0.181
0.417 *
0.017
-20
-10
0
10
20
30
40
50
Startle Modulation (uV)

Corrugator Modulation
Effect Size Magnitude & Stability

NPU Task

Time 1
Predictable — η_p^2 0.045 *
Unpredictable — 0.093 *

Time 2
Predictable — 0.085 *
Unpredictable — 0.115 *

IAPS Task

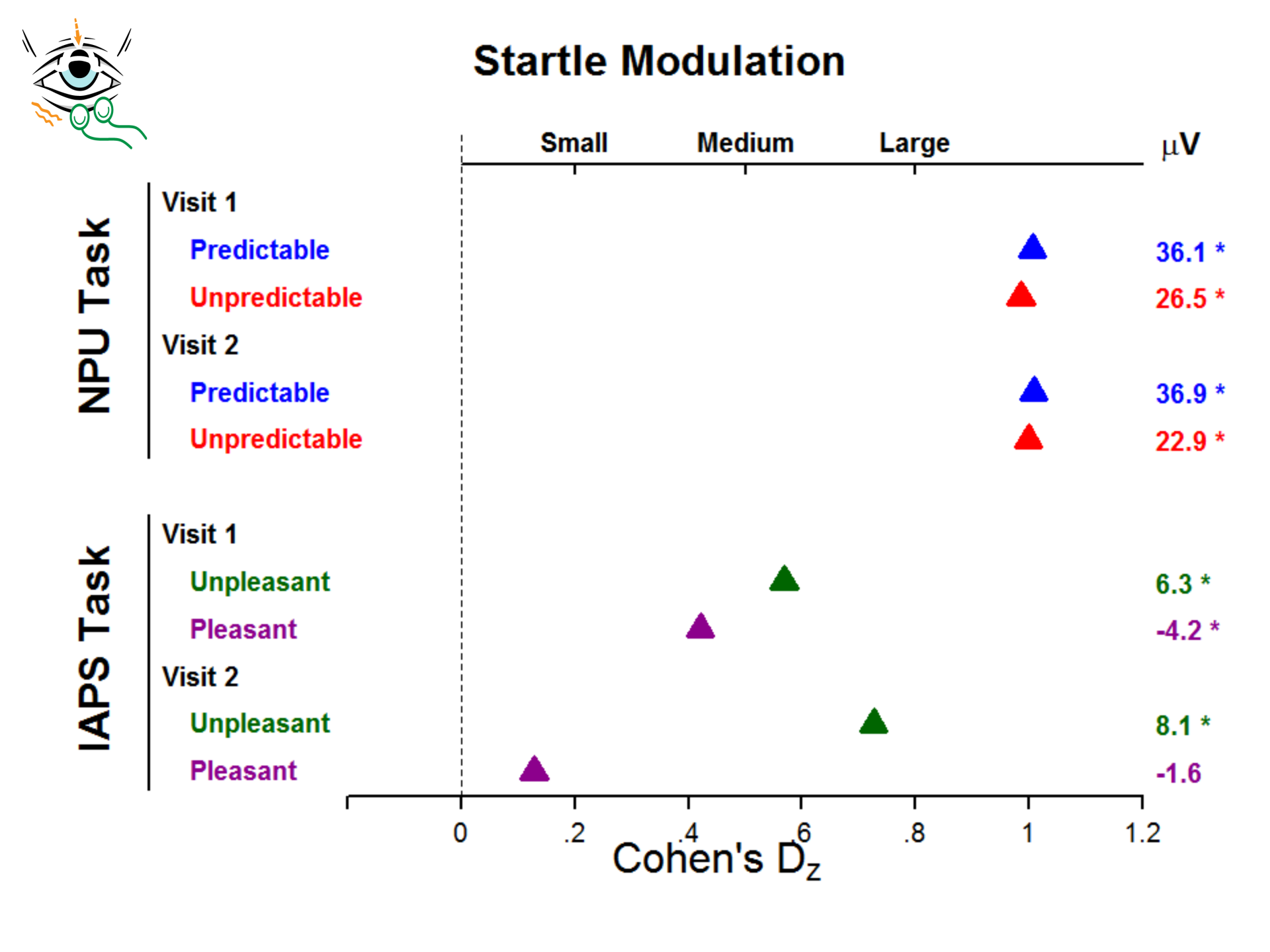
Time 1
Unpleasant — 0.34 *
Pleasant — 0.0002

Time 2
Unpleasant — 0.309 *
Pleasant — 0.003

-0.4 -0.2 0.0 0.2 0.4 0.6 0.8 1.0 1.2

Corrugator Modulation (uV)

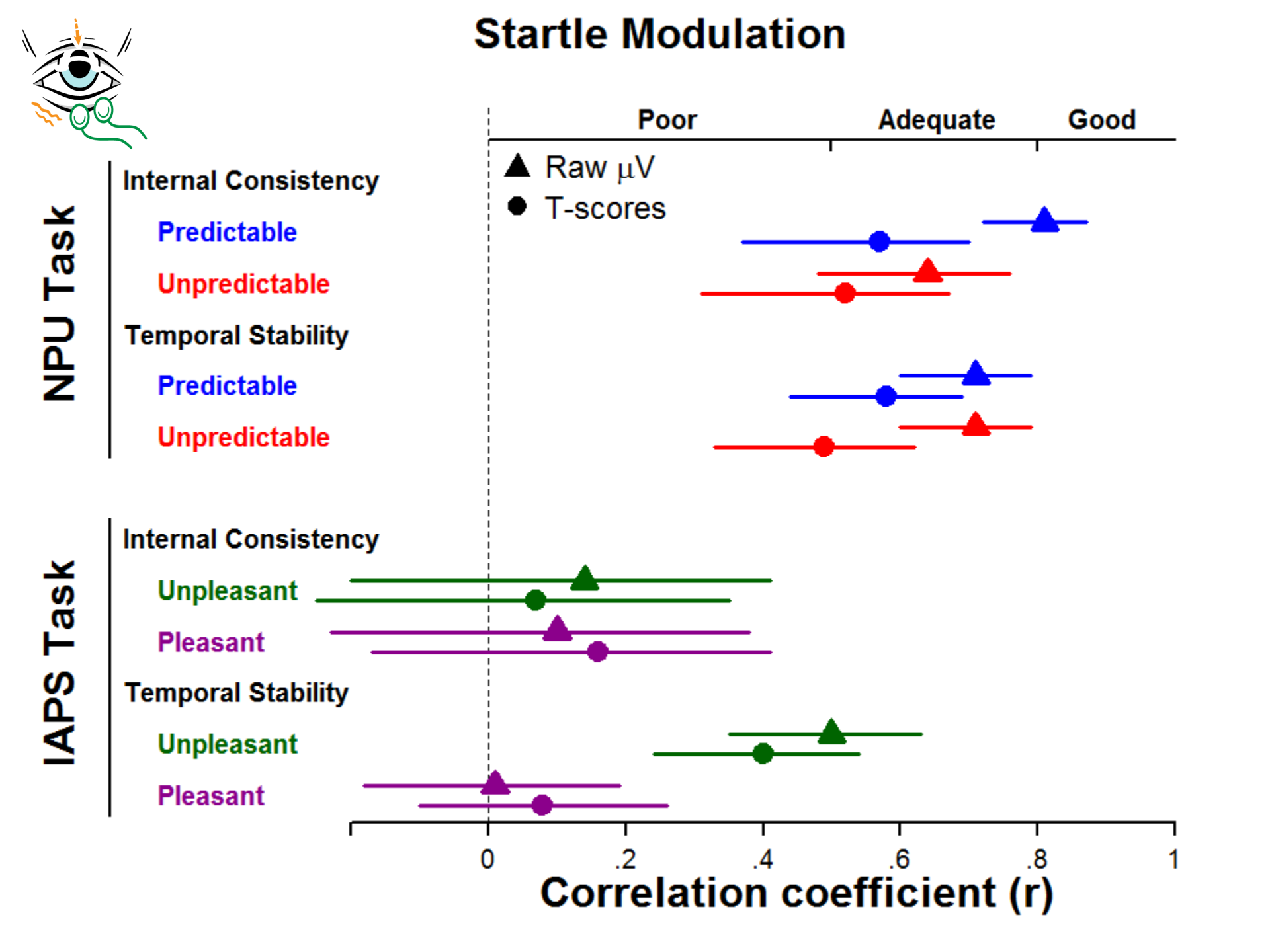
Effect Size
Cohen's D_z (within-sub)

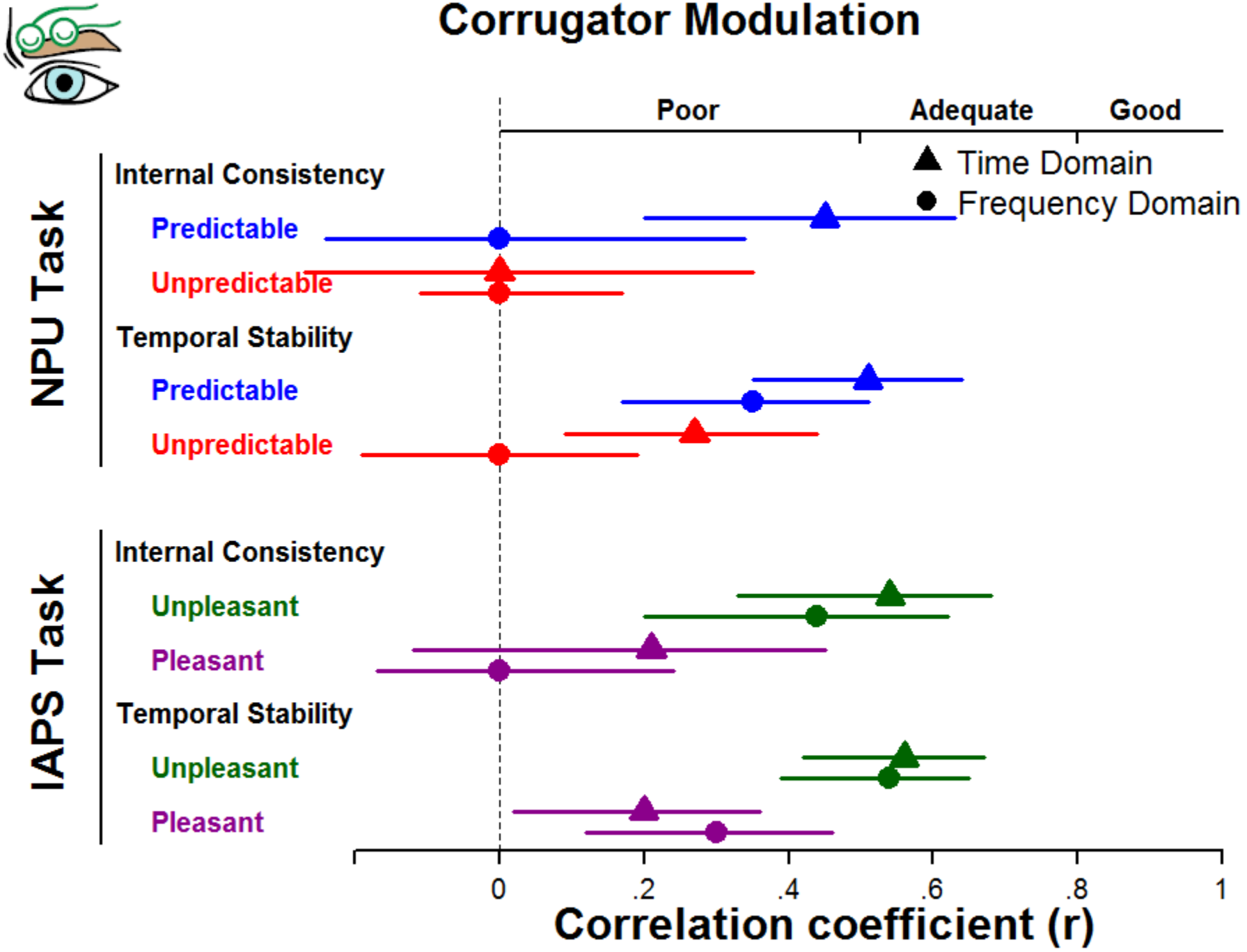

Startle Modulation
Small
Medium
Large
μV
NPU Task
Visit 1
Predictable
36.1 *
Unpredictable
26.5 *
Visit 2
Predictable
36.9 *
Unpredictable
22.9 *
IAPS Task
Visit 1
Unpleasant
6.3 *
Pleasant
-4.2 *
Visit 2
Unpleasant
8.1 *
Pleasant
-1.6
0
.2
.4
.6
.8
1
1.2
Cohen's Dz

Internal Consistency
Temporal Stability

Startle: Raw vs. T-scores

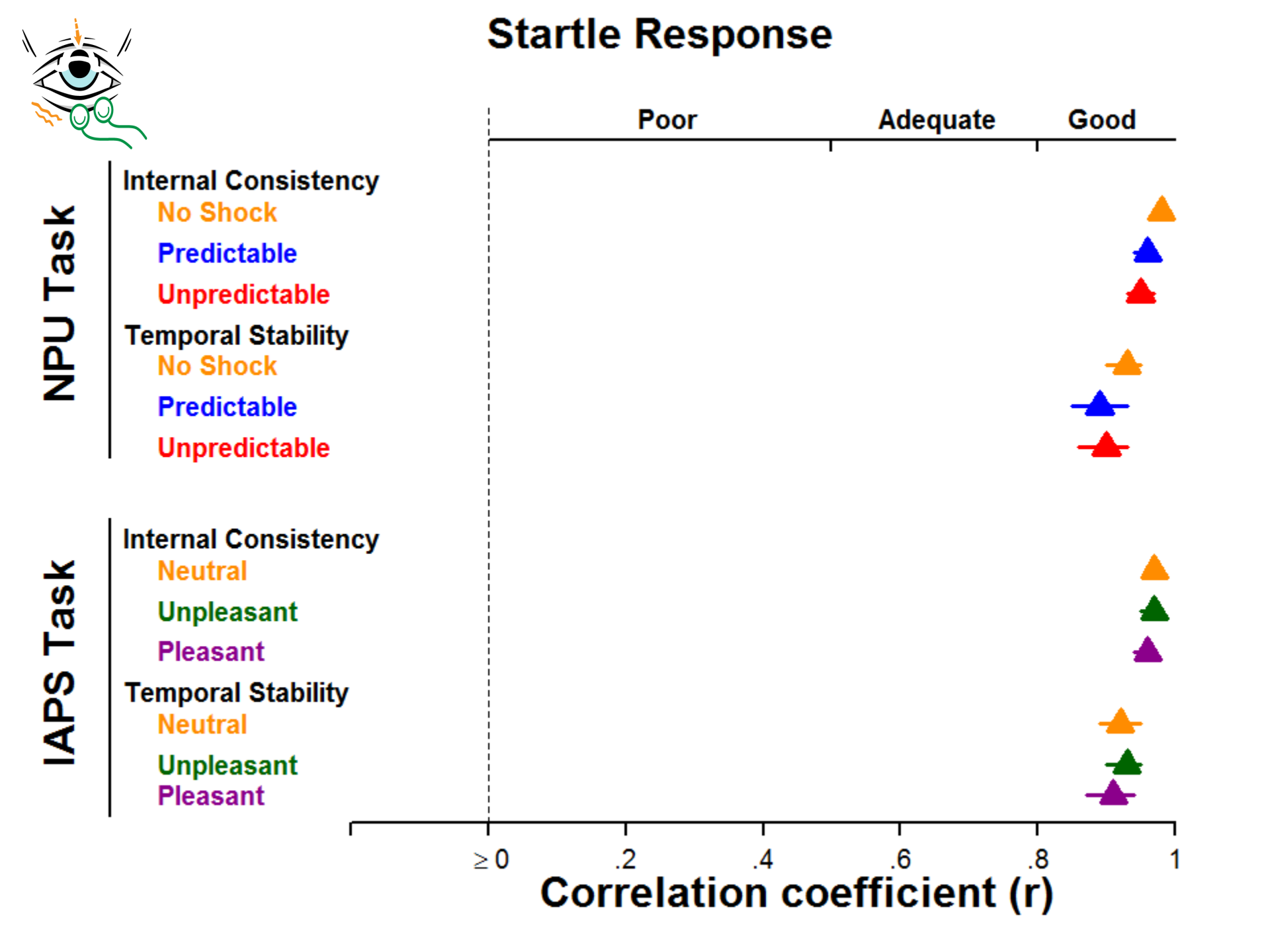
Corrugator: Time vs. Frequency


Startle Modulation
Poor
Adequate
Good
Raw μV
T-scores
NPU Task
Internal Consistency
Predictable
Unpredictable
Temporal Stability
Predictable
Unpredictable
IAPS Task
Internal Consistency
Unpleasant
Pleasant
Temporal Stability
Unpleasant
Pleasant
0
.2
.4
.6
.8
1
Correlation coefficient (r)


Corrugator Modulation
Poor
Adequate
Good
Time Domain
Frequency Domain
NPU Task
Internal Consistency
Predictable
Unpredictable
Temporal Stability
Predictable
Unpredictable
IAPS Task
Internal Consistency
Unpleasant
Pleasant
Temporal Stability
Unpleasant
Pleasant
0
.2
.4
.6
.8
1
Correlation coefficient (r)

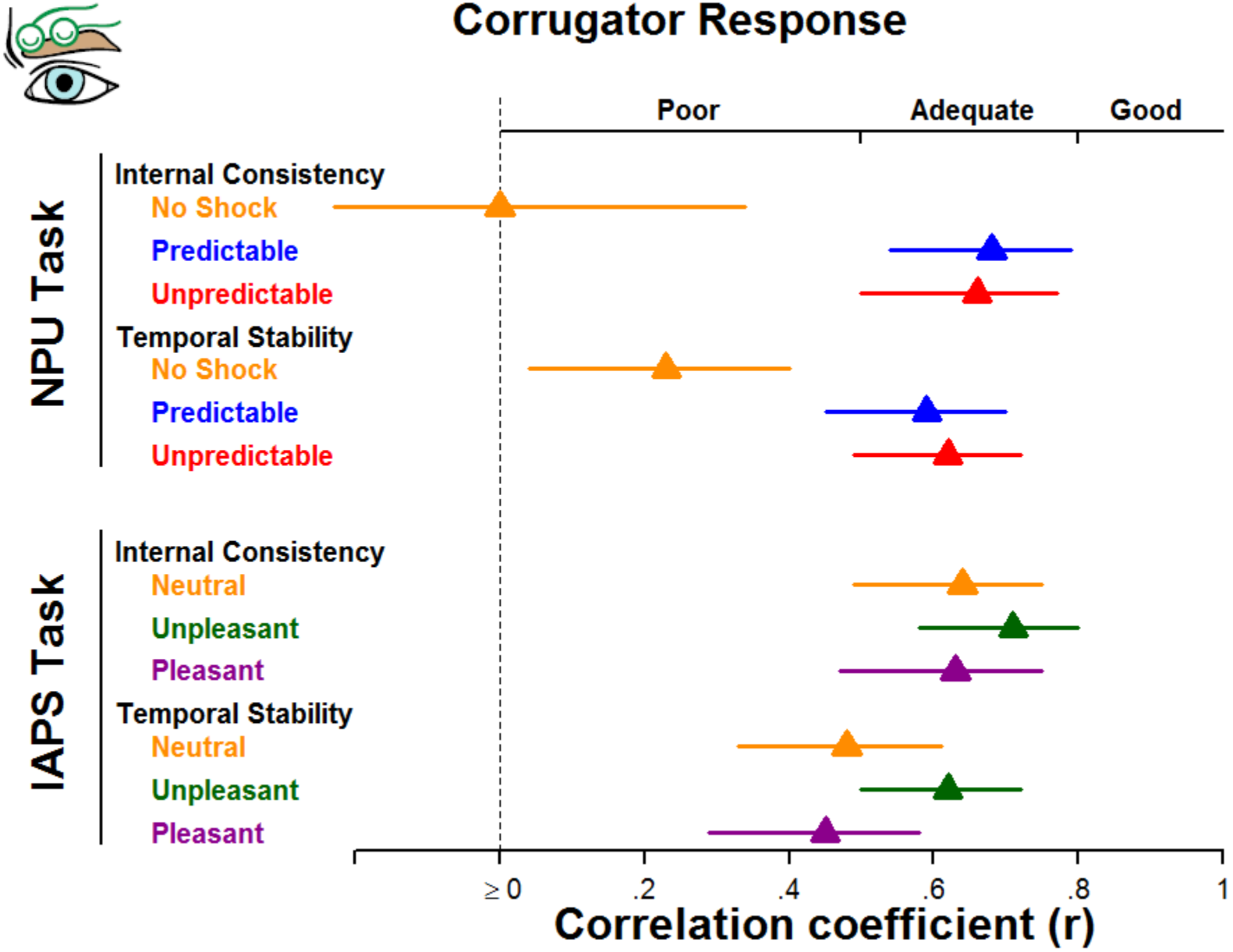
CONDITION SCORES

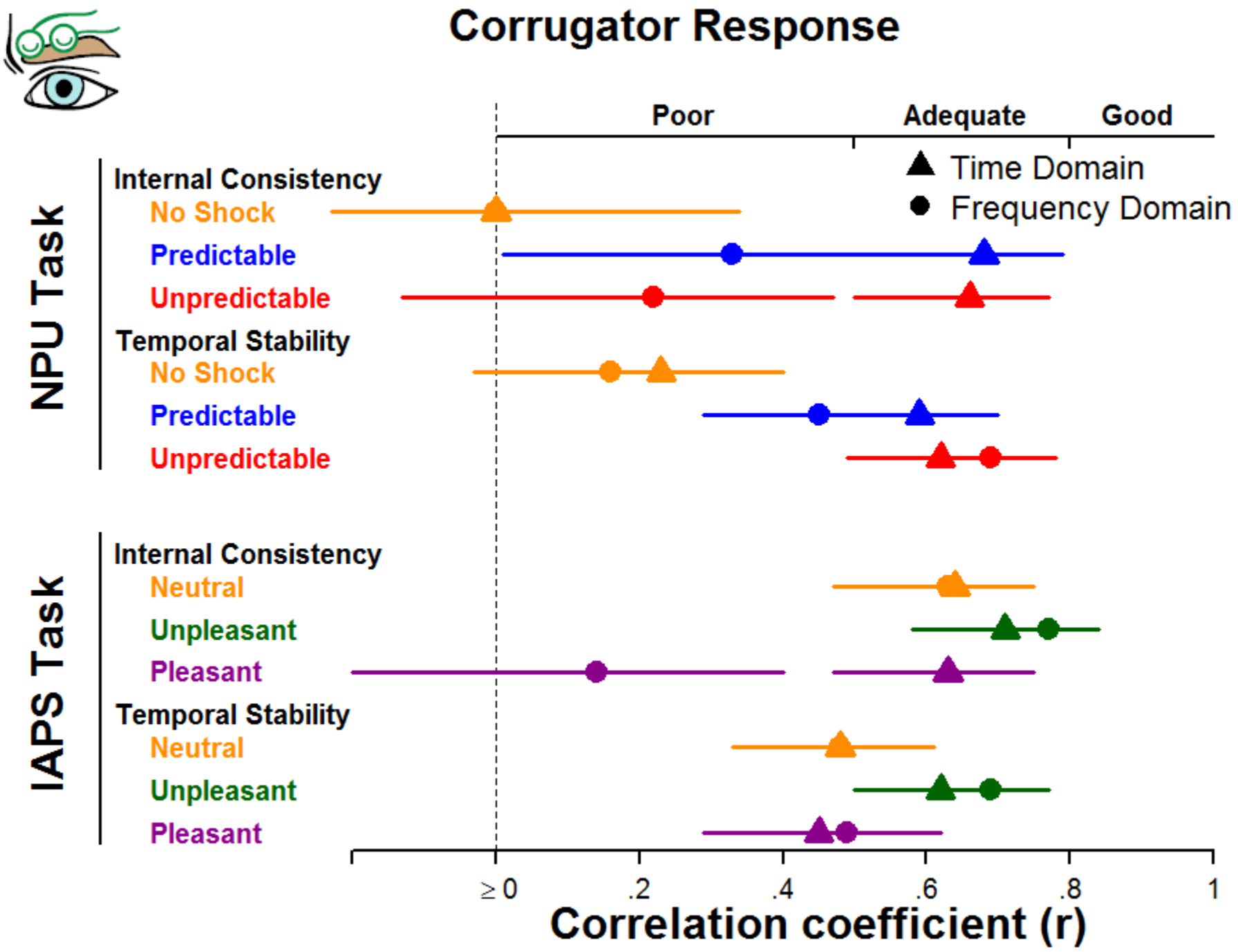
STARTLE


Startle Response
Poor
Adequate
Good
NPU Task
Internal Consistency
No Shock
Predictable
Unpredictable
Temporal Stability
No Shock
Predictable
Unpredictable
IAPS Task
Internal Consistency
Neutral
Unpleasant
Pleasant
Temporal Stability
Neutral
Unpleasant
Pleasant
≥ 0
.2
.4
.6
.8
1
Correlation coefficient (r)

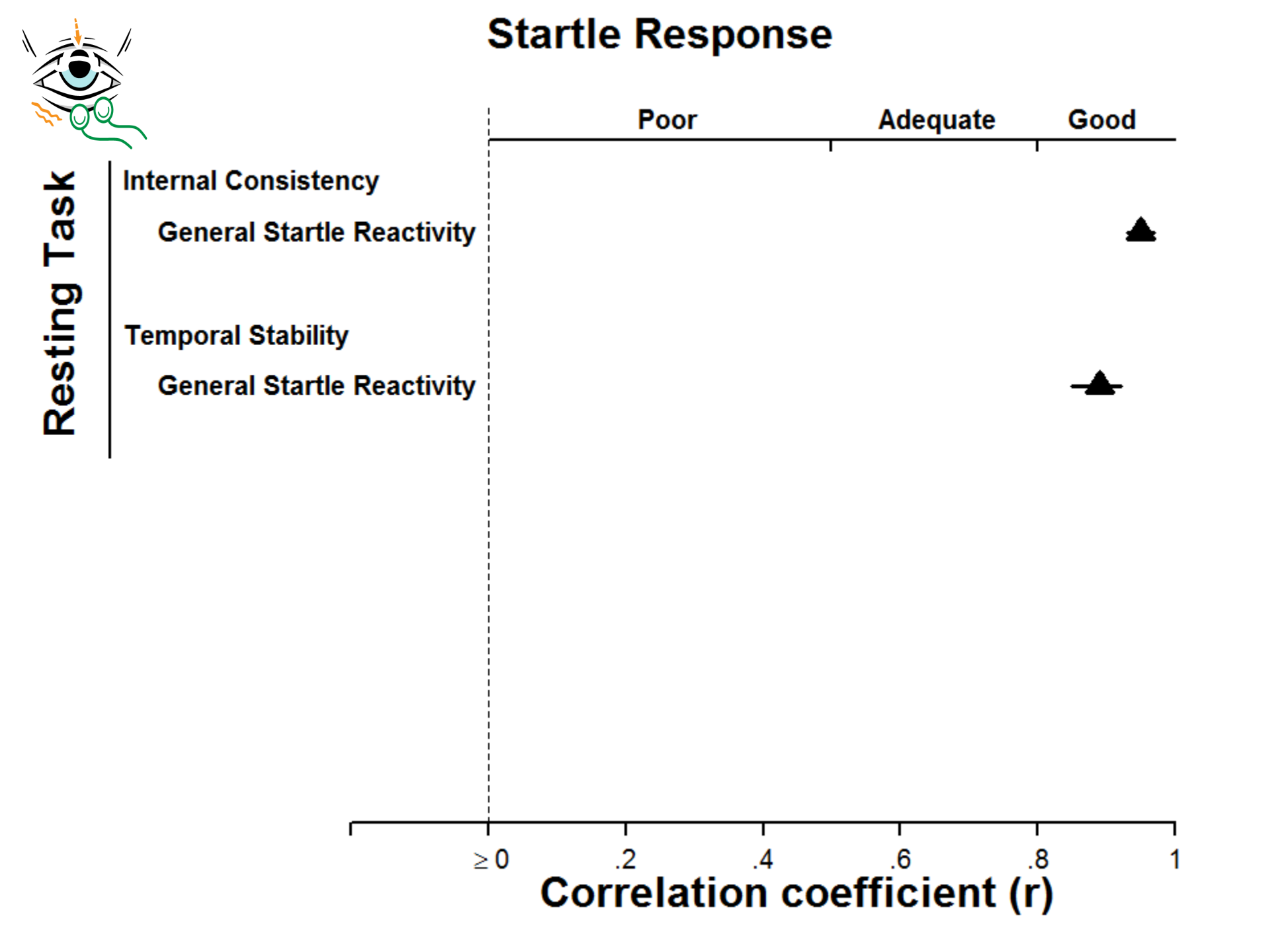
CONDITION SCORES

CORRUGATOR


Corrugator Response
Poor
Adequate
Good
NPU Task
Internal Consistency
No Shock
Predictable
Unpredictable
Temporal Stability
No Shock
Predictable
Unpredictable
IAPS Task
Internal Consistency
Neutral
Unpleasant
Pleasant
Temporal Stability
Neutral
Unpleasant
Pleasant
≥ 0
.2
.4
.6
.8
1
Correlation coefficient (r)


Corrugator Response
Poor
Adequate
Good
Time Domain
Frequency Domain
NPU Task
Internal Consistency
No Shock
Predictable
Unpredictable
Temporal Stability
No Shock
Predictable
Unpredictable
IAPS Task
Internal Consistency
Neutral
Unpleasant
Pleasant
Temporal Stability
Neutral
Unpleasant
Pleasant
≥ 0
.2
.4
.6
.8
1
Correlation coefficient (r)

General Startle Reactivity


Startle Response
Poor
Adequate
Good
Resting Task
Internal Consistency
General Startle Reactivity
Temporal Stability
General Startle Reactivity
≥ 0
.2
.4
.6
.8
1
Correlation coefficient (r)

Inter-task & Inter-measure

Inter-task & Inter-measure relationships

			NPU				IAPS	
			Startle		Corrugator		Startle	Corrugator
			U	P	U	P	U	U
NPU	Startle	U	x	**.75****	.05	**.26****	.18	.04
		P		x	.00	**.20***	**.20***	.04
	Corrugator	U			x	**.62****	-.15	**.23***
		P				x	-.14	.10
IAPS	Startle	U					x	-.02

U = Unpredictable/Unpleasant

P = Predictable

*p<.05, **p<.01

p < .05
Holm Adjusted

Poster 4-46 Saturday: Bradford, Kaye, & Curtin