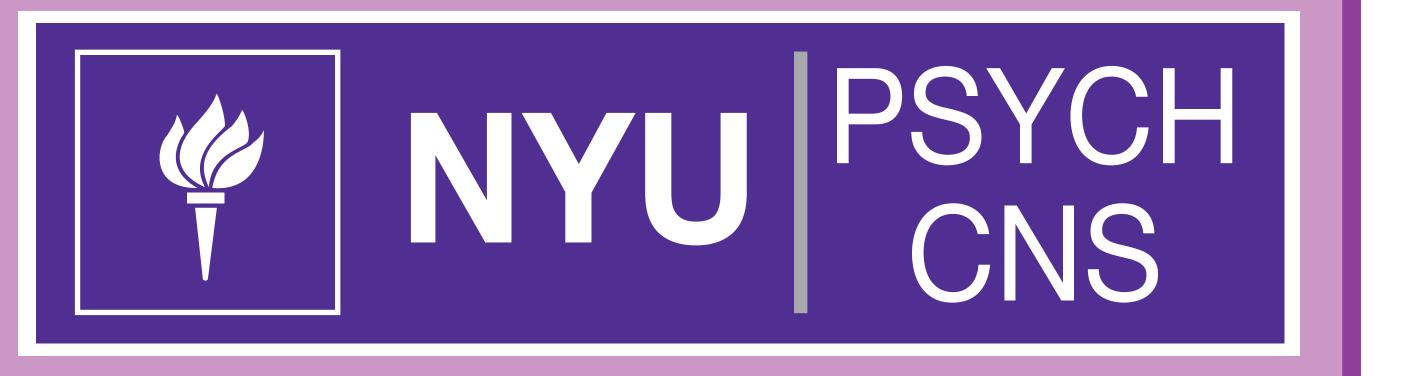# Effects of emotion and attention on contrast sensitivity correlate with trait anxiety

Emma Ferneyhough, Damian Stanley, Elizabeth Phelps & Marisa Carrasco
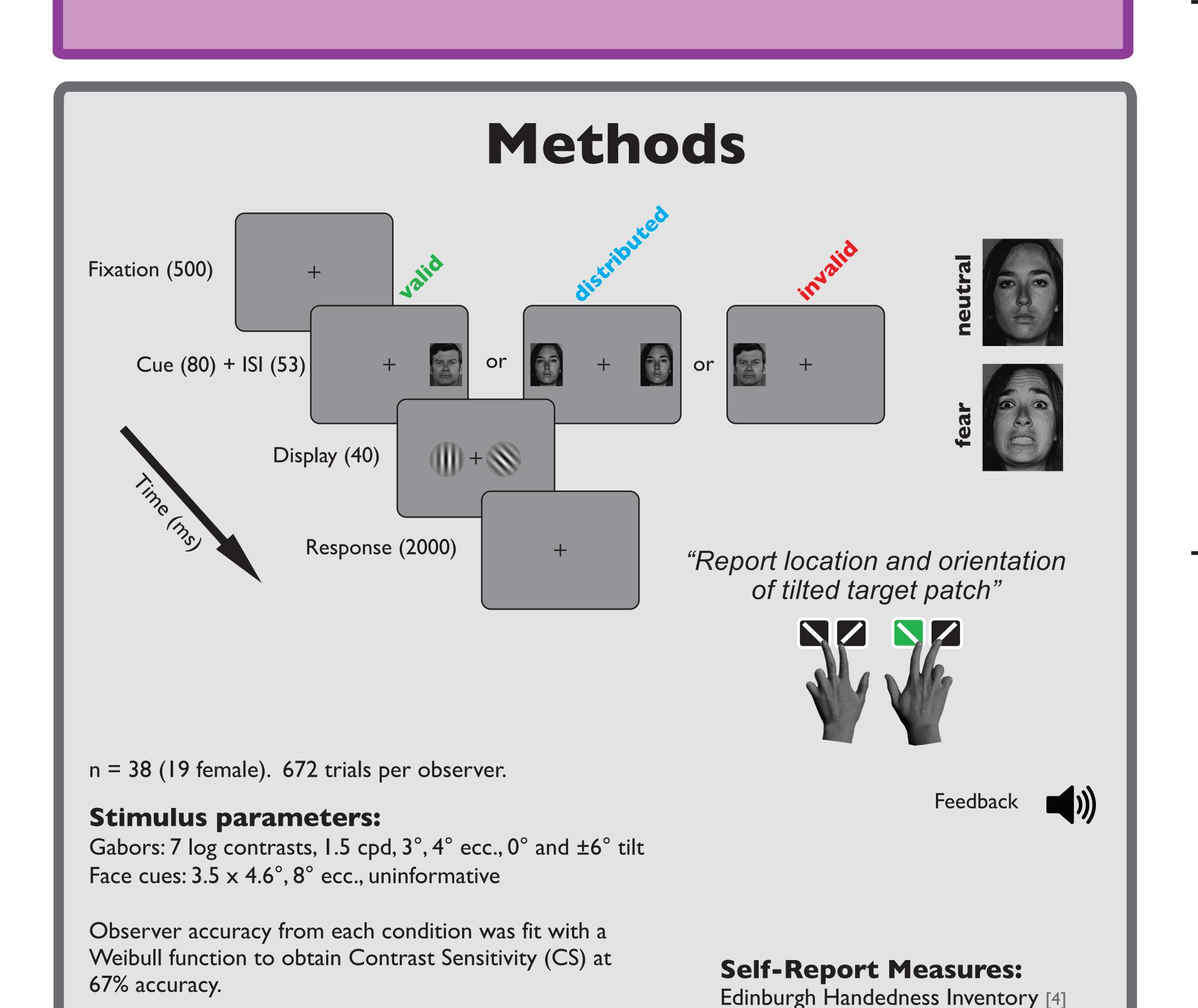Psychology & Neural Science, New York University

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Background

- Attention cued by dots or faces produce both **benefits** (valid cue) and **costs** (invalid cue) of contrast sensitivity [1].
- Face cues expressing **fear** potentiate the **benefit** of attention on contrast sensitivity, compared to neutral expressions [2].
- Fear face cues slow disengagement from cued locations compared to neutral face cues, especially in highly anxious individuals [3].

Questions

Does a fear cue elicit a **cost** in contrast sensitivity?
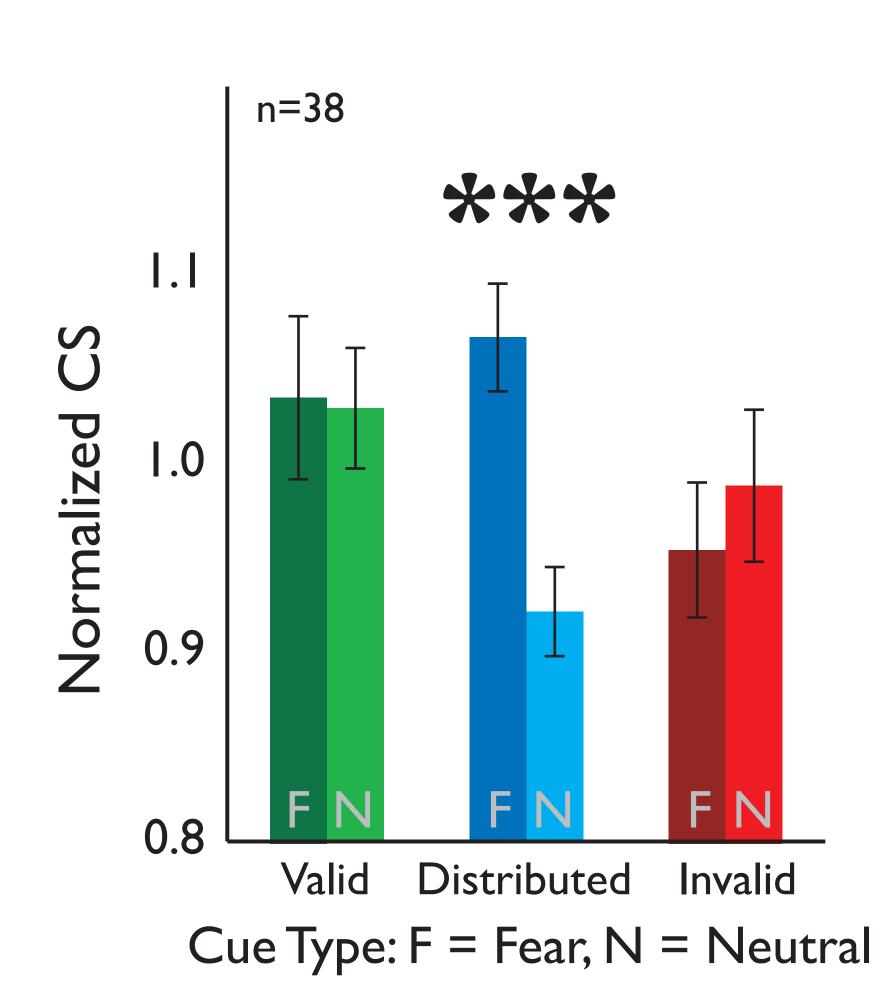Is this cost modulated by trait anxiety?

Methods

Fixation (500)
Cue (80) + ISI (53)   valid   distributed   invalid
Display (40)
Time (ms)
Response (2000)

neutral
fear

"Report location and orientation of tilted target patch"

Feedback

n = 38 (19 female). 672 trials per observer.

Stimulus parameters:
Gabors: 7 log contrasts, 1.5 cpd, 3°, 4° ecc., 0° and ±6° tilt
Face cues: 3.5 x 4.6°, 8° ecc., uninformative

Observer accuracy from each condition was fit with a Weibull function to obtain Contrast Sensitivity (CS) at 67% accuracy.

CS = 1 / (Contrast Threshold)

Self-Report Measures:
Edinburgh Handedness Inventory [4]
State Trait Anxiety Inventory [5]
Positive and Negative Affect Scale [6]

Results

All Observers

n=38
Normalized CS
*** over Distributed
Valid   Distributed   Invalid
Cue Type: F = Fear, N = Neutral

For **Distributed** cues, **fear** leads to enhanced contrast sensitivity (CS) relative to **neutral**.

No emotion effect for Valid or Invalid cues

2 (emo) x 3 (cue) ANOVA, F = 3.74 p < 0.03

one-tailed paired t-tests: ^ = p<0.1, * = p<0.05, ** = p<0.01, *** = p<0.001

Trait Anxiety correlates with **Invalid** cue emotion effect

Females
Males
Emotion Effect (Fear Invalid - Neutral Invalid CS)
n=37
Low   High
STAI Trait Anxiety
R^2 = 0.14, p = 0.02
y = - 0.012x + 0.41

No correlation with Valid or Distributed cues
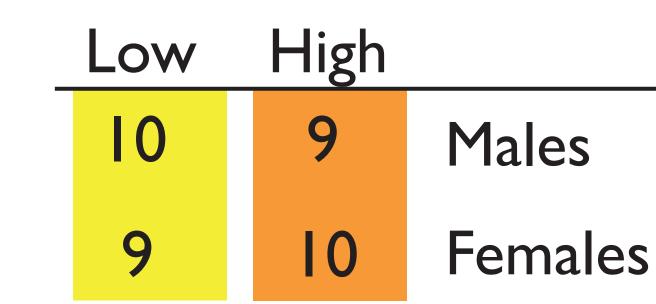
Females: R^2 = 0.34, p = 0.01
Males: R^2 = 0.08, p > 0.1

n=19 Low
Normalized CS
Valid   Distributed   Invalid

n=19 High
Normalized CS
Valid   Distributed   Invalid

Trait Anxiety

Only high trait anxious observers show cost of emotion

Observers equally likely to be male or female in each group

	Low	High	
	10	9	Males
	9	10	Females

Distributed cue: Fear CS > Neutral CS

n=19 Males
Normalized CS
Valid   Distributed   Invalid

n=19 Females
Normalized CS
^ *** *
Valid   Distributed   Invalid

Sex

Only female observers show benefits and costs of emotion

Identical anxiety scores across sex

Distributed cue: Fear CS > Neutral CS

2 (sex) x 2 (emo) x 3 (cue) ANOVA, F = 3.04 p = 0.05
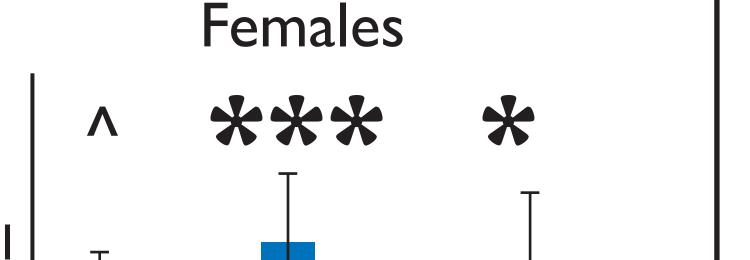

n=10
* ** *
Valid   Distributed   Invalid

High Trait Anxious Females

High trait anxious females drive the benefits and costs of emotion

Distributed cue: Fear CS > Neutral CS

2 (emo) x 3 (cue) ANOVA, F = 9.15, p < 0.002

Conclusions

Distributed fear cues increase contrast sensitivity.

Trait anxiety significantly correlates with costs of emotion.

Female observers show benefits and costs of emotion on attention; more so for high trait anxious females.

Results consistent with sex differences in facial expression recognition [7] and prevalence of anxiety disorders [8].

References: **1.** Ferneyhough, Stanley, Phelps & Carrasco, (in press); **2.** Phelps, Ling & Carrasco (2006); **3.** Fox, Russo, Bowles & Dutton (2001); **4.** Oldfield (1971); **5.** Spielberger (1983); **6.** Watson, Clark & Tellegen (1988); **7.** McClure (2000); **8.** Craske (2003)