

THE EFFECTS OF SOCIAL ISOLATION & LONELINESS ON FEAR LEARNING IN MID-ADOLESCENCE

Emily Towner, Livia Tomova, Kirsten Thomas & Sarah-Jayne Blakemore
Department of Psychology, University of Cambridge, UK

Introduction

Loneliness and isolation are increasing in societies all around the world^{1,2}.

Adolescents may be particularly sensitive to the effects of isolation³⁻⁵.

Social isolation has been found to increase anxiety behaviours in animal models of adolescence⁶.

In rodents, social isolation in adolescence has been associated with a significant deficit in the extinction of conditioned fear⁷.

Research Question

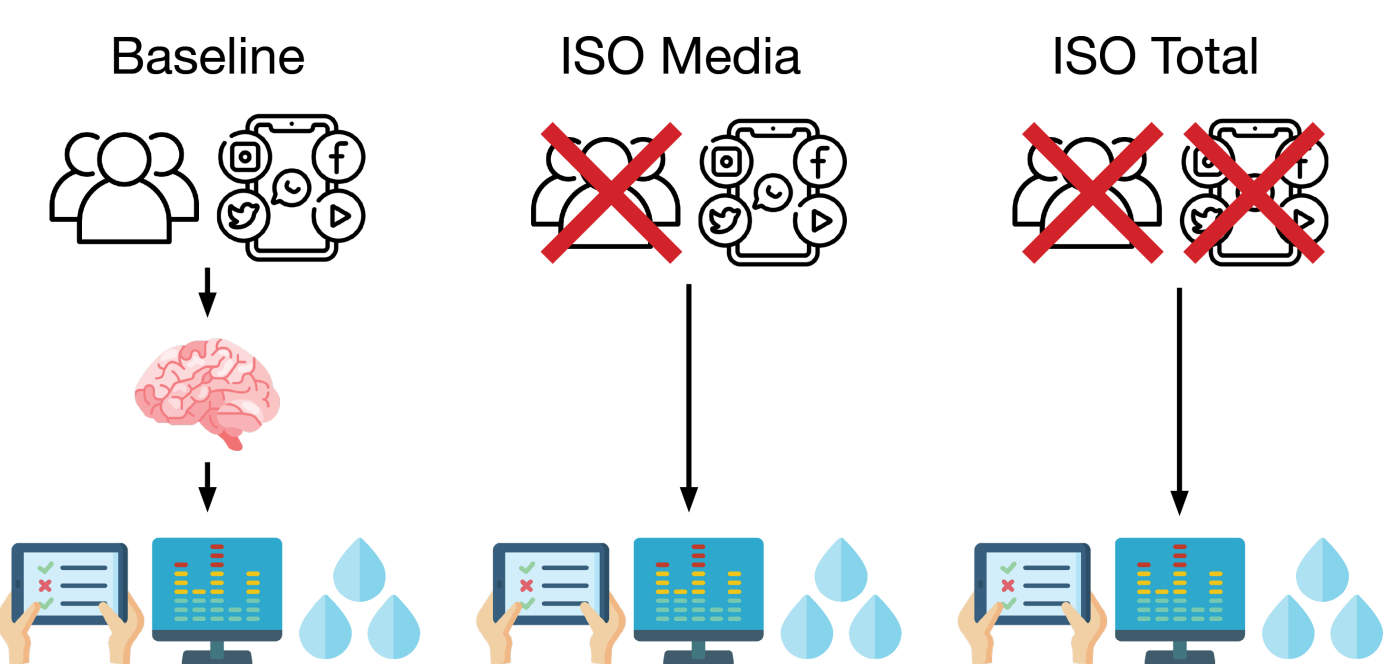
How does social isolation affect fear learning in human adolescents?

Methods

Participants 40 participants (Age 16-19 years; 18 male)

Study Design 3 experimental sessions

Manipulation 3-4 hours in isolation (ISO)



Baseline - 7T MRI + testing (always completed first)*

ISO-total - no access to social stimuli

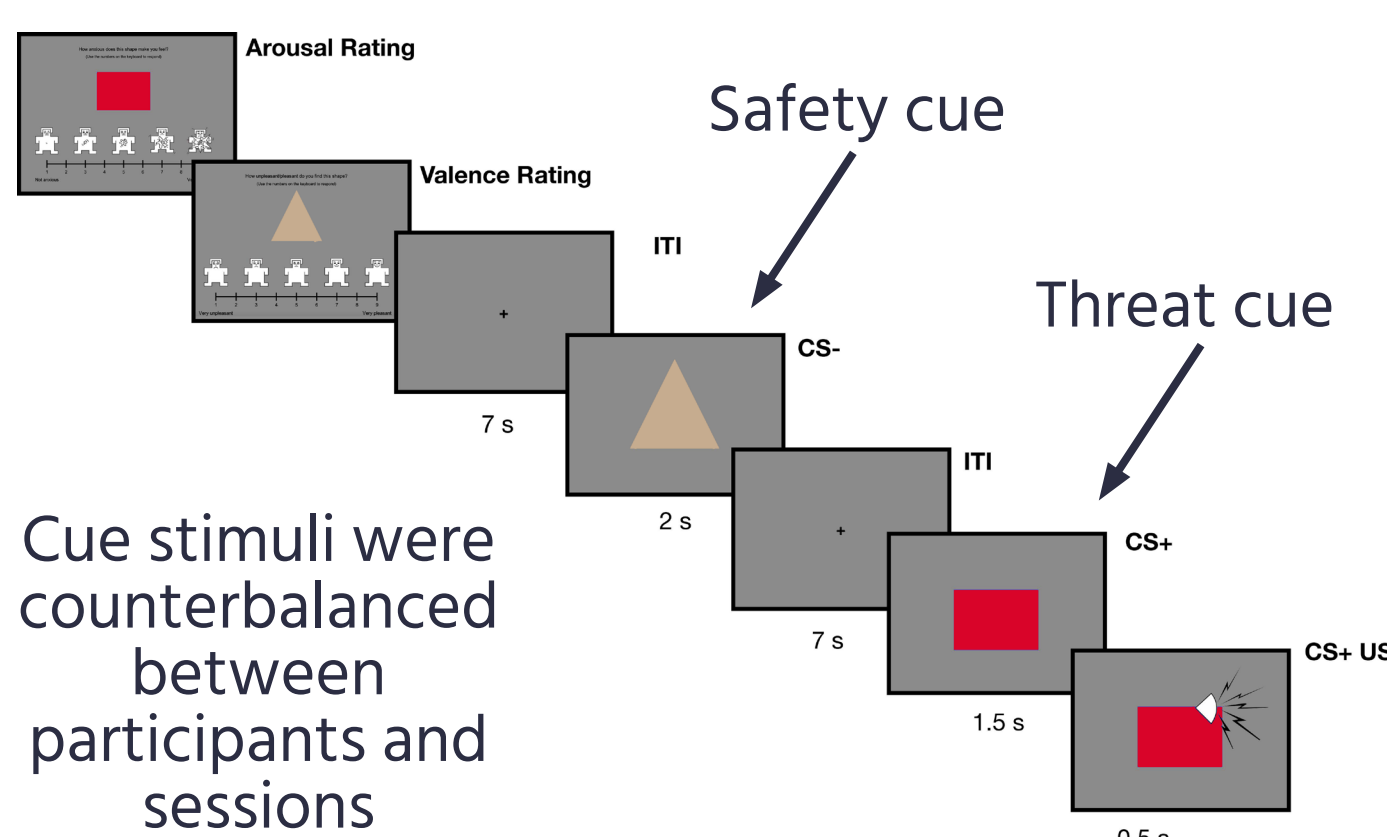
ISO-media - virtual social interactions allowed

*ISO-total and ISO-media counterbalanced

Fear Learning Task

Participants learn to associate neutral shapes with an aversive sound (a loud screech).

Assesses the ability to discriminate between learned threat (CS+) and safety (CS-) cues.



Measures

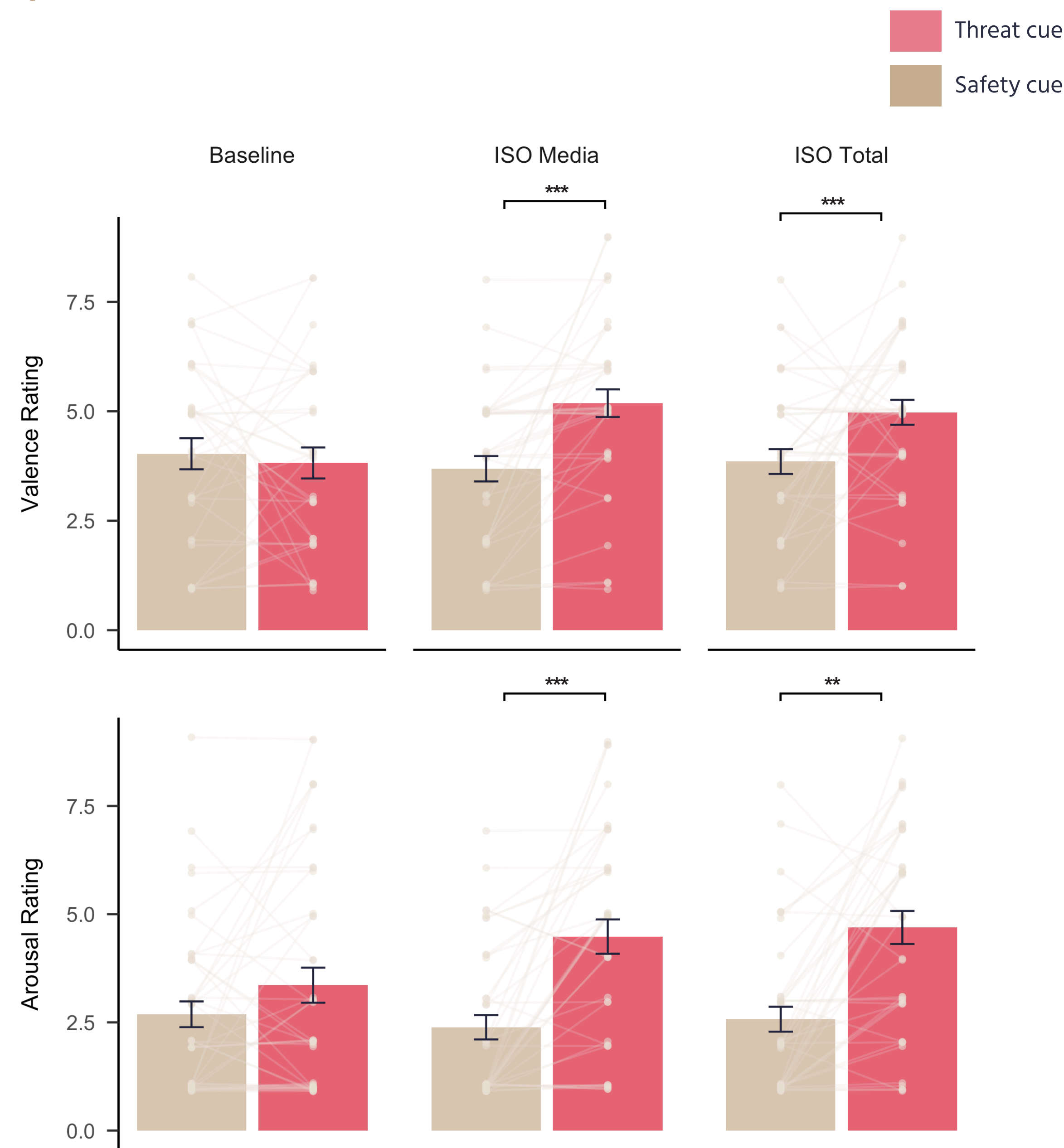
Arousal rating - "How anxious does this shape make you feel?"
[1] not at all anxious - [9] very anxious

Valence rating - "How unpleasant/pleasant do you find this shape?"
[1] very pleasant - [9] very unpleasant

Skin conductance response - average reconstructed response amplitude per condition
PSPM⁸

Loneliness - "How lonely do you feel right now?"
[0] not at all - [100] extremely

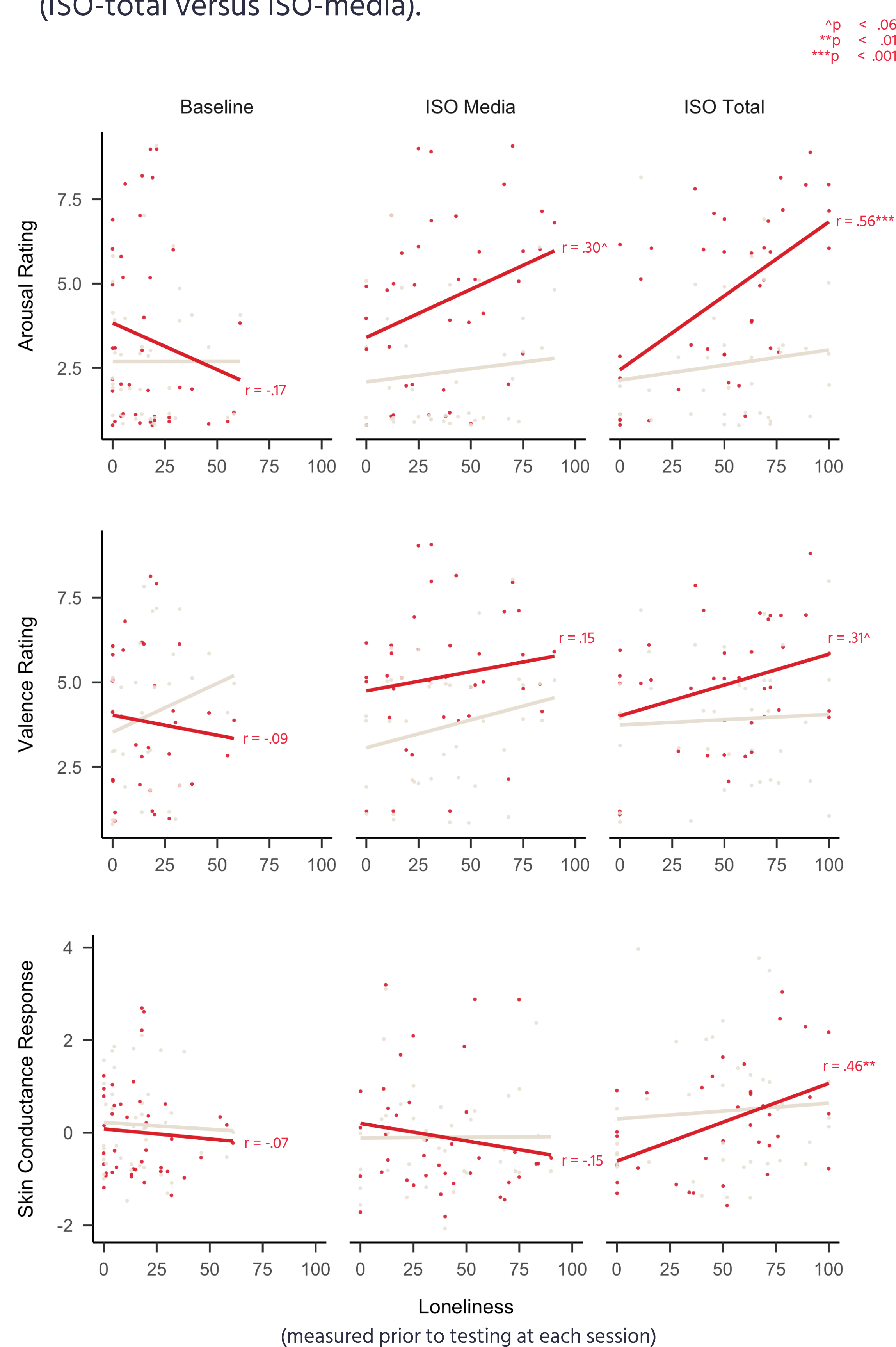
Results



Social isolation is associated with increased behavioural fear learning relative to baseline.

There is an interaction such that the threat cue (CS+) was rated significantly more anxiety provoking and unpleasant ($p < .01$) compared to the safety cue (CS-) in both isolation sessions compared to baseline (controlling for sex/gender, age, and IQ [MaRs-IB⁹]).

There are no differences in arousal or valence ratings to either cue between isolation sessions (ISO-total versus ISO-media).



There is a significant 3-way interaction between cue type (threat v.s. neutral), session (baseline, iso-media, iso-total) and loneliness on both behavioural measures of fear learning ($p < .05$).

Those who reported greater loneliness after isolation rated the threat cue significantly more anxiety provoking and unpleasant compared to the safety cue, particularly after total isolation.

Further, there is a significant positive correlation between loneliness and skin conductance response to the learned threat cue after total isolation.

Discussion

We found evidence that even brief periods of social isolation can increase fear learning in human adolescents.

Heightened fear learning could be one mechanism by which social isolation and loneliness increase anxiety⁶.

Loneliness has been linked to mental health problems in adulthood¹⁰, and this experimental evidence suggests that heightened fear learning might be a pathway by which social isolation exerts long term negative effects on well-being during development.

Outstanding Questions

Practise effects - baseline was always completed first

Exclusion criteria for physiological data - non-responders

Virtual social interactions - during iso-media session

Future Directions - 7T MRI

The amygdala is a critical structure for emotion processing and has become known as the brain's 'fear centre'¹¹.

The amygdala has both functional and structural associations with threat learning¹²⁻¹³ (a key mechanism underlying the development and maintenance of anxiety – which commonly emerges during adolescence¹⁴).

However, the amygdala is not a unitary structure.

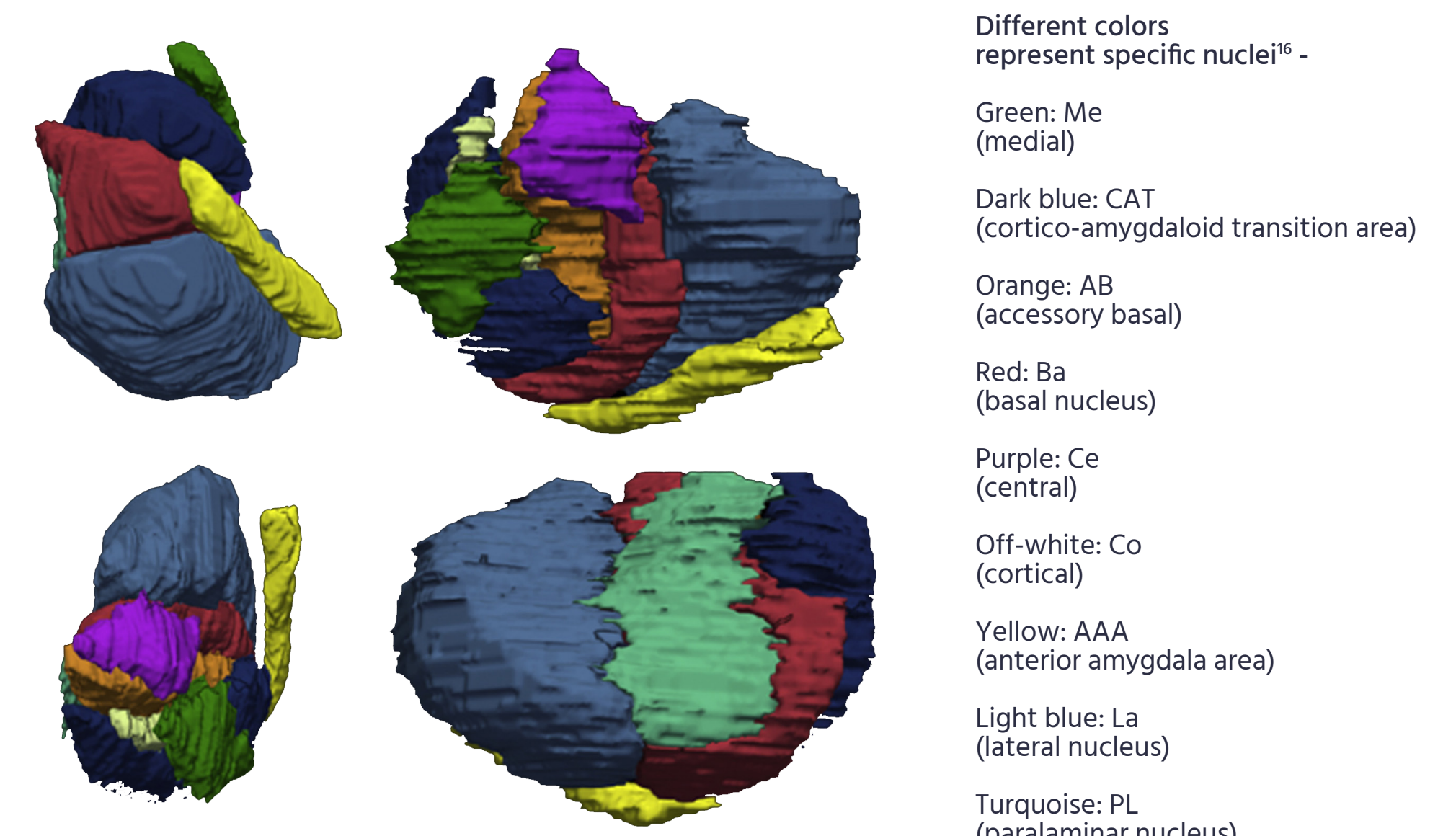
Human and animal research has indicated specific subnuclei having particular roles in different components of threat processing¹⁵.

Recent advances in neuroimaging have allowed the automatic segmentation of the human amygdala into distinct subnuclei¹⁶.

Functional imaging studies have shown the centromedial amygdala (CMA) as responsive to aversive outcomes, while implicating the basolateral amygdala (BLA) in the encoding of predictive aversive cues¹⁷⁻¹⁸.

We plan to investigate the relationship between fear learning and amygdala morphometry.

Amygdala Subnuclei



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