The interplay between stress, imagining the future, and intertemporal choice
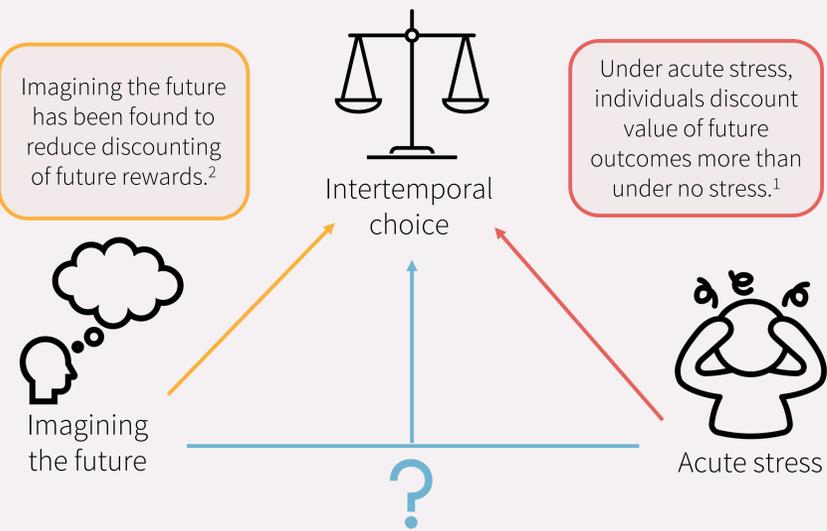
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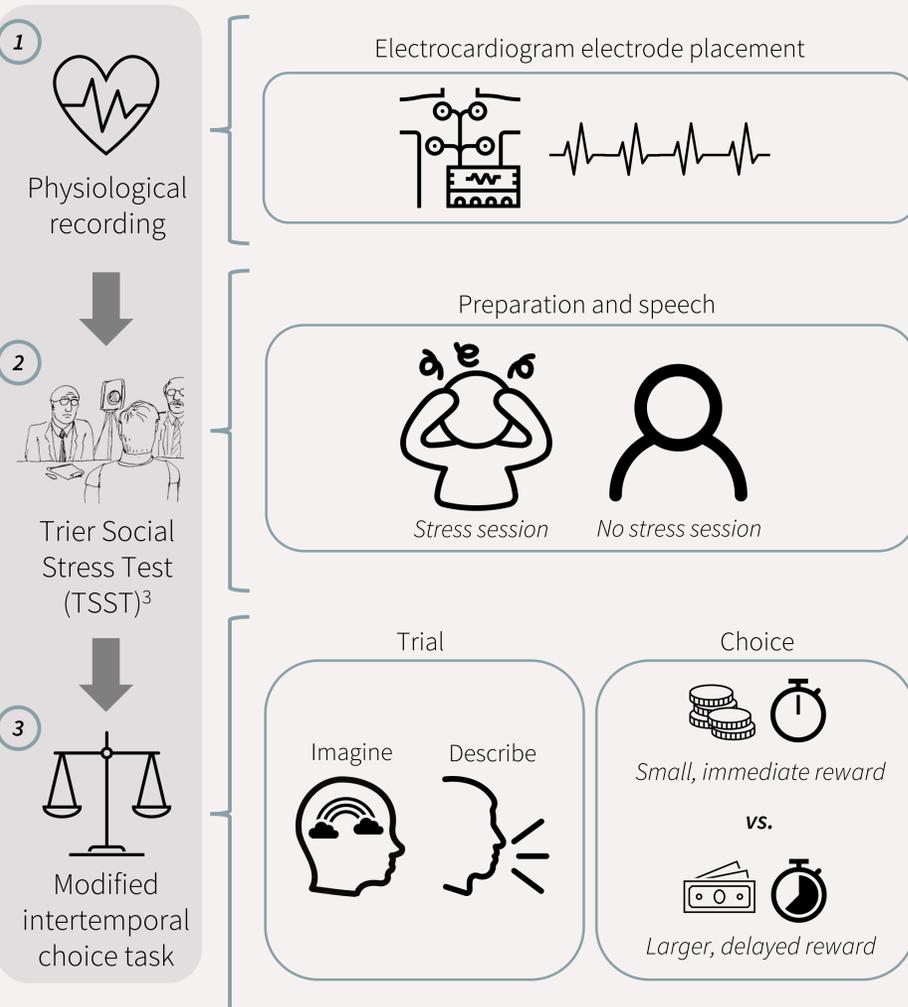
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How do stress and imagination interact and impact intertemporal choice?

Imagining the future has been found to reduce discounting of future rewards.[2]

Under acute stress, individuals discount value of future outcomes more than under no stress.[1]

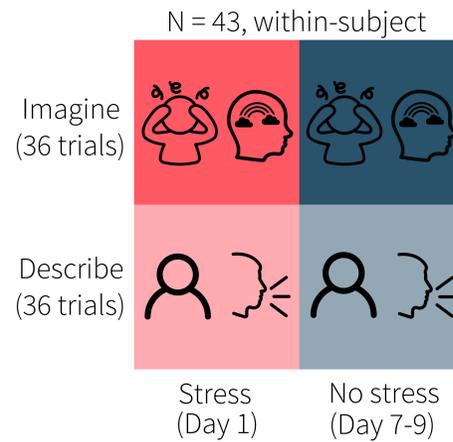Imagining the future → Intertemporal choice ← Acute stress

?

Does **imagining the future** moderate the **effect of stress** on **intertemporal choice**?
Or does **stress** negate the benefits of **imagining the future** on **intertemporal choice**?
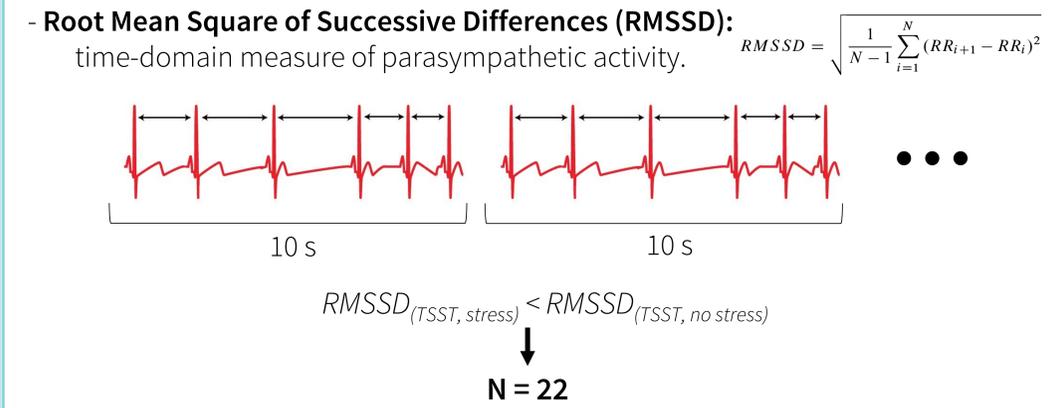
Methods

1 Physiological recording

Electrocardiogram electrode placement

2 Trier Social Stress Test (TSST)[3]

Preparation and speech

Stress session   *No stress session*

3 Modified intertemporal choice task

Trial
Imagine   Describe

Choice
Small, immediate reward
vs.
Larger, delayed reward

Analyses and Results

Experimental design

N = 43, within-subject

Imagine (36 trials)
Describe (36 trials)

Stress (Day 1)   No stress (Day 7-9)

Measuring physiological stress response

- **Root Mean Square of Successive Differences (RMSSD):** time-domain measure of parasympathetic activity.

$$RMSSD = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(RR_{i+1} - RR_i)^2}$$

10 s   10 s   • • •

$RMSSD_{(TSST, stress)} < RMSSD_{(TSST, no\ stress)}$

↓

N = 22

Imagining the future reduces discounting under stress

Hyperbolic discounting function: SV = A/(1+kD)

SV: Subjective value
A: Objective amount of reward
D: Delay
k: Subject-specific discount rate

Mean k (High discounting / Low discounting) — Stress-Imagine, Stress-Describe, No stress-Imagine, No stress-Describe
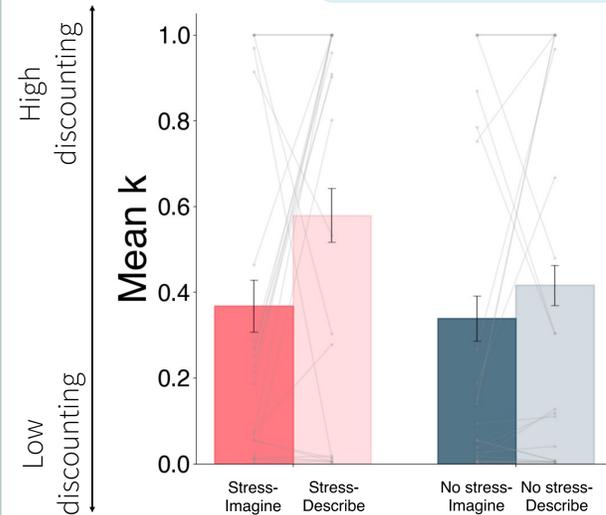
k ~ session*trial type + (1 | participant)

	β	95% CI: lower, upper
No stress/Stress	0.1635	-0.0195, 0.3464
Describe/Imagine	-0.0771	-0.2600, 0.1059
Stress*Imagine	-0.1347	-0.3935, 0.1240

Stress does not affect imagination

Internal details are episodic details of the central topic/event.

Mean Number of Internal Details — Stress-Imagine, Stress-Describe, No stress-Imagine, No stress-Describe
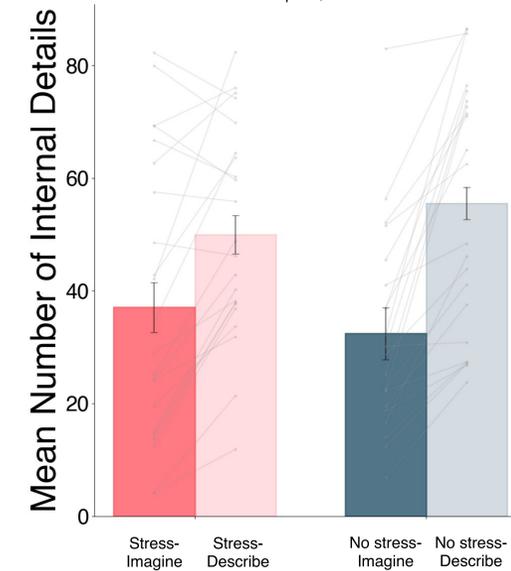
Number of internal details per trial ~ session*trial type + trial number + (session*trial type | participant)

	β	95% CI: lower, upper
No stress/Stress	-3.8322	-9.3559, 1.6611
Describe/Imagine	-21.7142	-28.4814, -14.9448
Stress*Imagine	9.2780	0.1459, 18.4244

Content of imagination is positive even under stress

Example of positive semantics: 'Because the weather is good, I would go to the flea market…'

Mean Positive Score — Stress-Imagine, Stress-Describe, No stress-Imagine, No stress-Describe
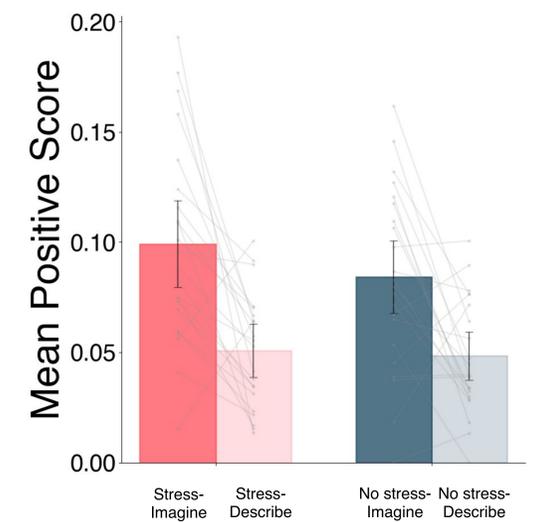
Positive score per trial ~ session*trial type + (1 | participant)

	β	95% CI: lower, upper
No stress/Stress	2.999e-03	-0.0152, 0.0212
Describe/Imagine	3.618e-02	0.0180, 0.0544
Stress*Imagine	1.184e-02	-0.0138, 0.0375

Conclusion

Imagining a positive future might buffer the effects of stress and reduce the discounting of future rewards.

Future directions

Include sympathetic activity measures and complete sample to identify participants who showed a physiological stress response.

References

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