

# Keep your cool. The effects of acute and chronic stress on rationality

**Felix Jan Nitsch / 2021-04-01 / JDM Lab Meeting @ Uni Padova**

Comparative Psychology (Prof. Tobias Kalenscher)

Institute of Experimental Psychology

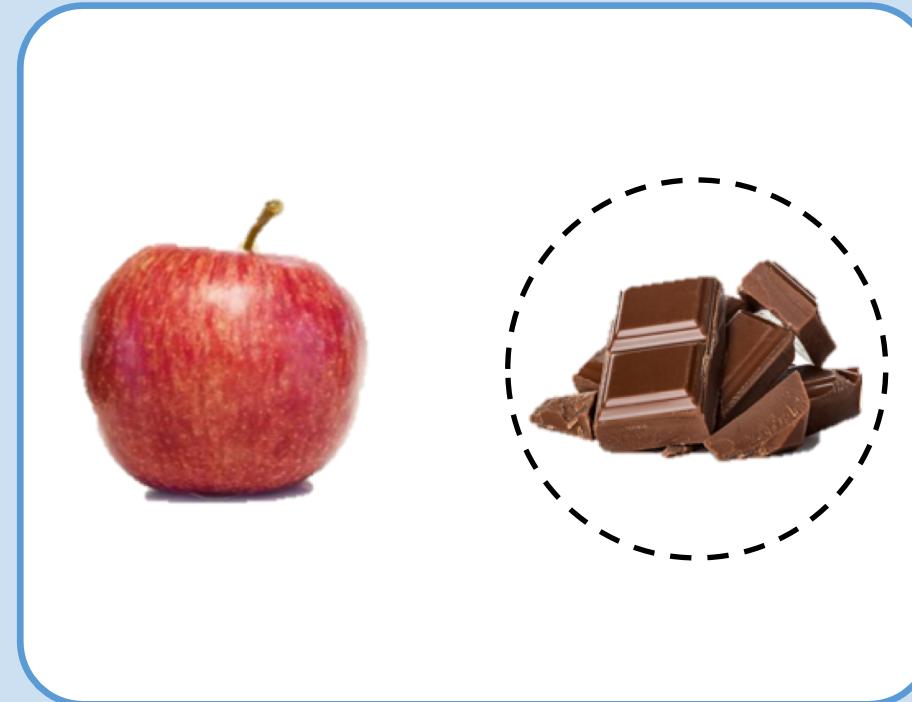
# Agenda

1. Rational Choice Theory
2. How robust is rationality?
3. Stress, influence on preferences
4. Is rationality robust to stress?
5. Discussion & Outlook

What would you choose?

Would that be a rational choice?

What makes a choice rational?



→ Preferences are subjective

# What is a decision?

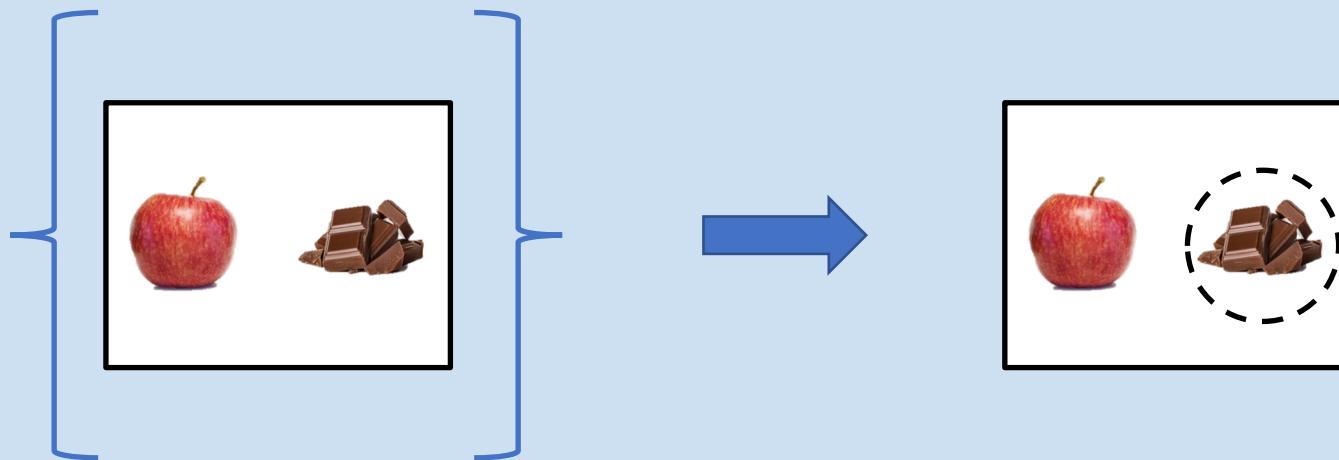
$$C = \{x_i, x_j, \dots, x_n\}$$

The choice set  $C$  consists of all choice options

$x_i, x_j, \dots, x_n$  available

$$x_i = x_c \rightarrow x_i R x_j \forall x_j \in C$$

The chosen option  $x_c$  is revealed preferred to all other objects in the choice set  $C$



Revealed Preference implies that  $x_i$  must be, subjectively, at least as good as  $x_j$  (weak preference), or else the decision maker would have chosen  $x_j$ . We write  $x_i R_D x_j$ .

# The importance of consistency: Rational Choice Theory

**Axiom 1 (Completeness):** For any pair of choice options  $x_i, x_j$ , at least one must be weakly preferred to the other (strong preference or indifference).

**Axiom 2 (Transitivity):** For any triplet of choice options  $x_i, x_j, x_k$ , if option  $x_i$  is (weakly) preferred to option  $x_j$  and  $x_j$  to  $x_k$ , then option  $x_i$  must also be (weakly) preferred to option  $x_k$ . We write  $x_i Rx_k$ .

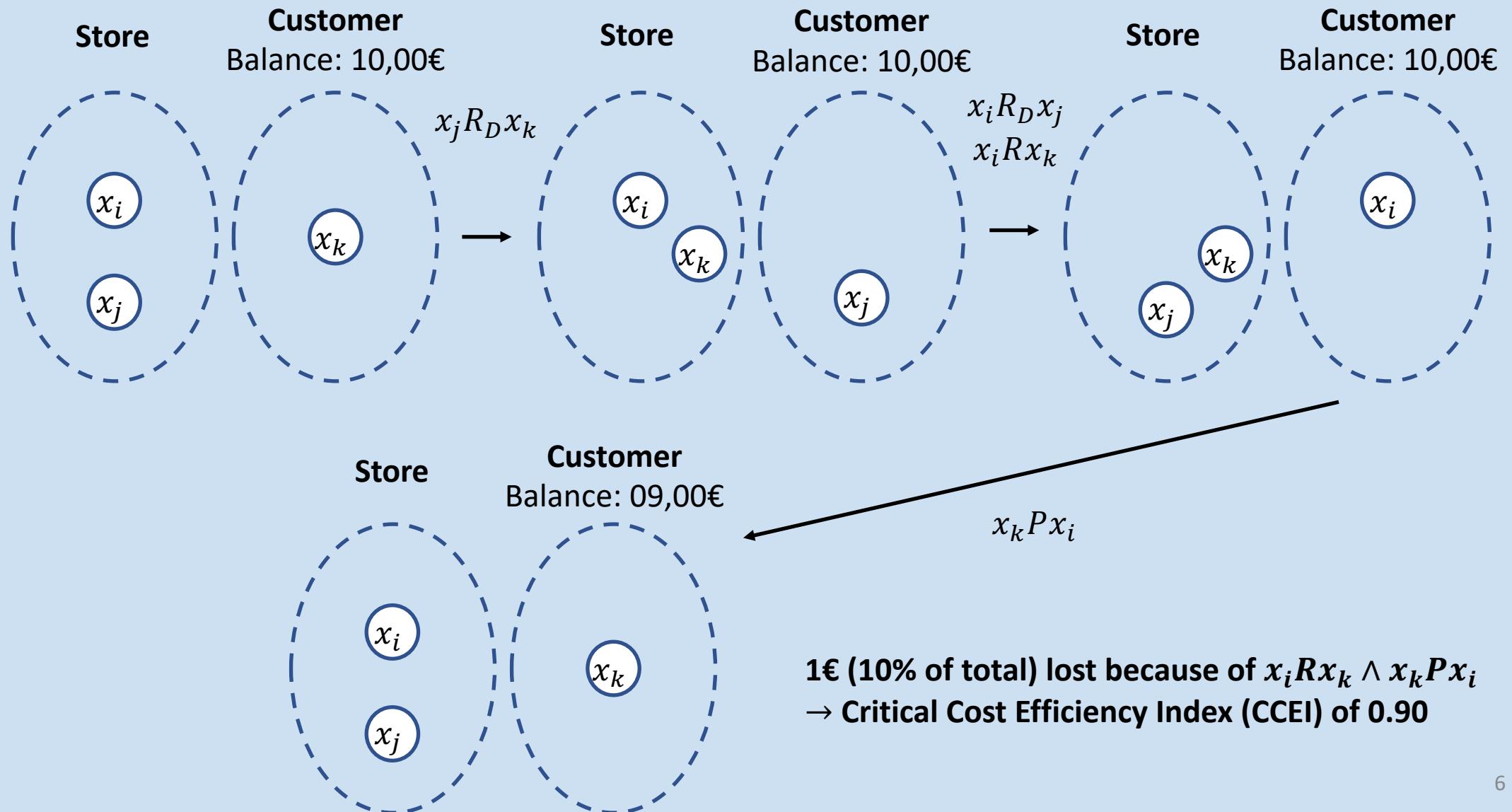
**Additional assumption (Cost-Efficiency):** The willingness to pay to choose one choice option  $x_i$  over another option  $x_j$  excludes indifference (weak preference becomes strong preference). We write  $x_i Px_j$ .

**Generalized Axiom of Revealed Preferences (GARP):**

A decision-maker is rational if and only if  $x_i Rx_j \leftrightarrow \neg x_j Px_i$

GARP is a necessary and sufficient condition for subjective utility maximization.

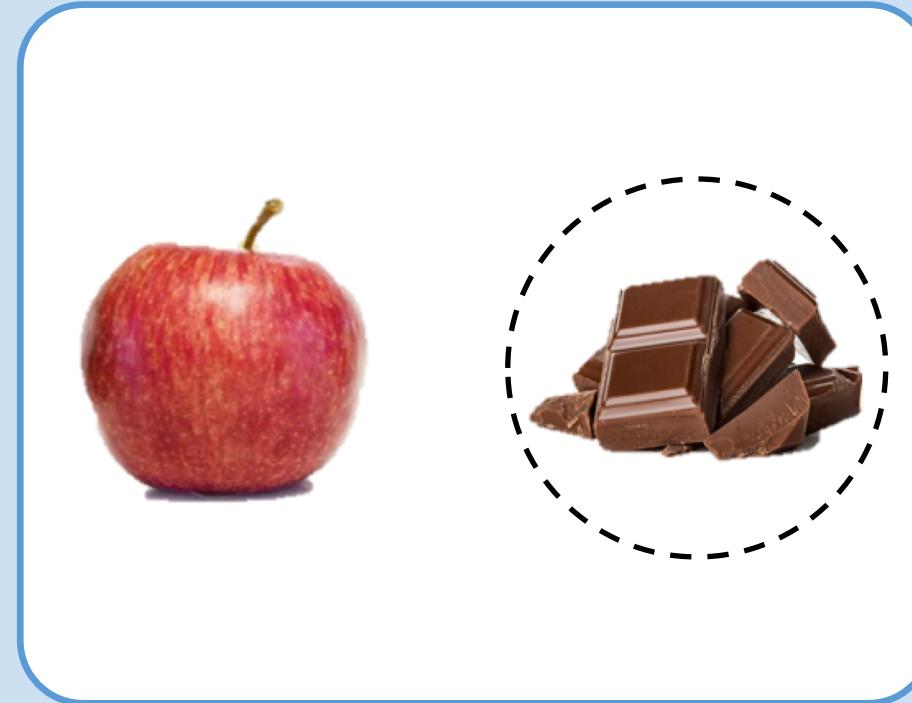
# Critical Cost Efficiency



What would you choose?

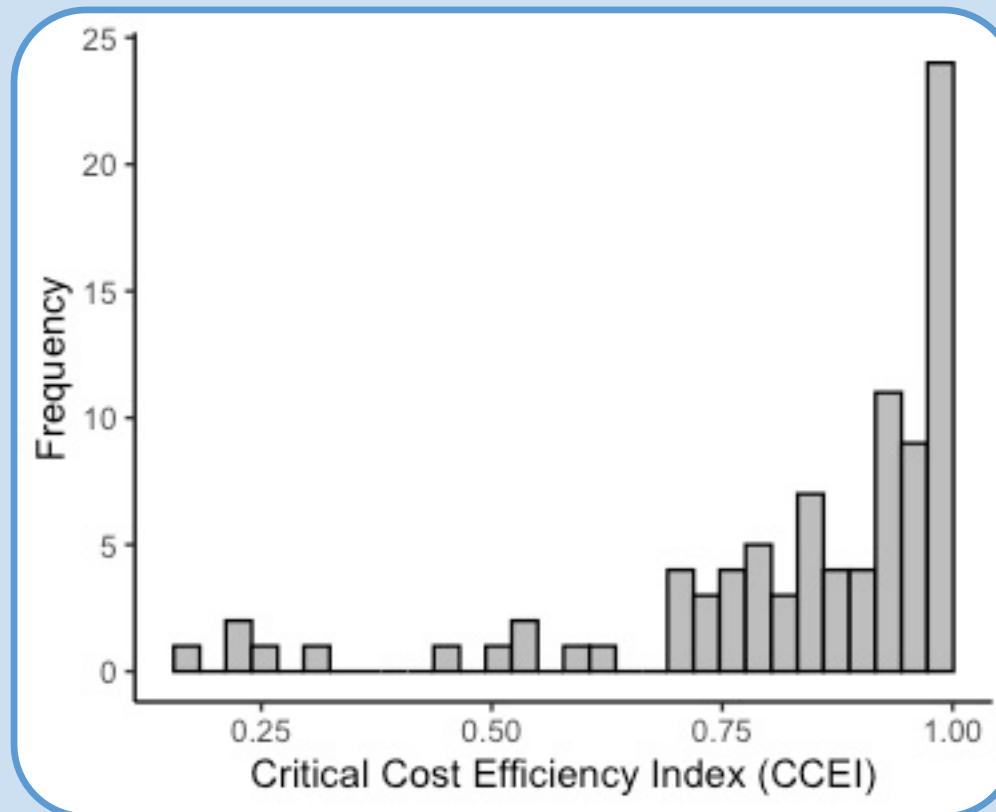
Would that be a rational choice?

What makes a choice rational?



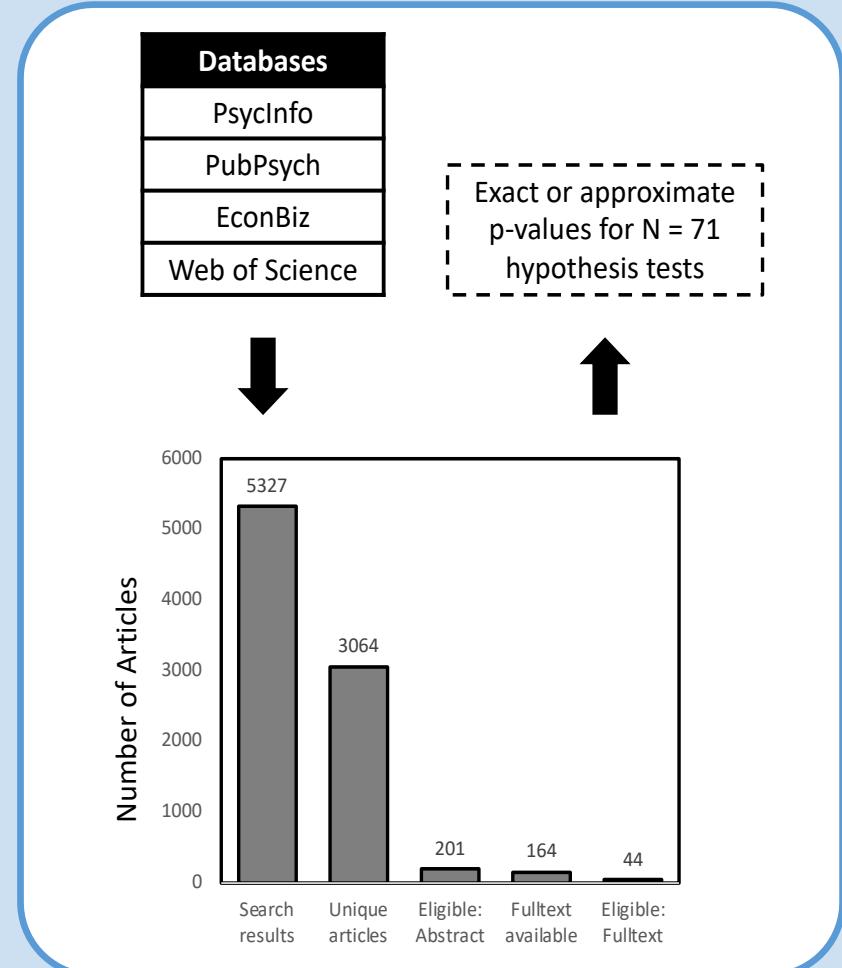
Rationality means to maximize subjective utility.

Generally, people are relatively consistent in their choices

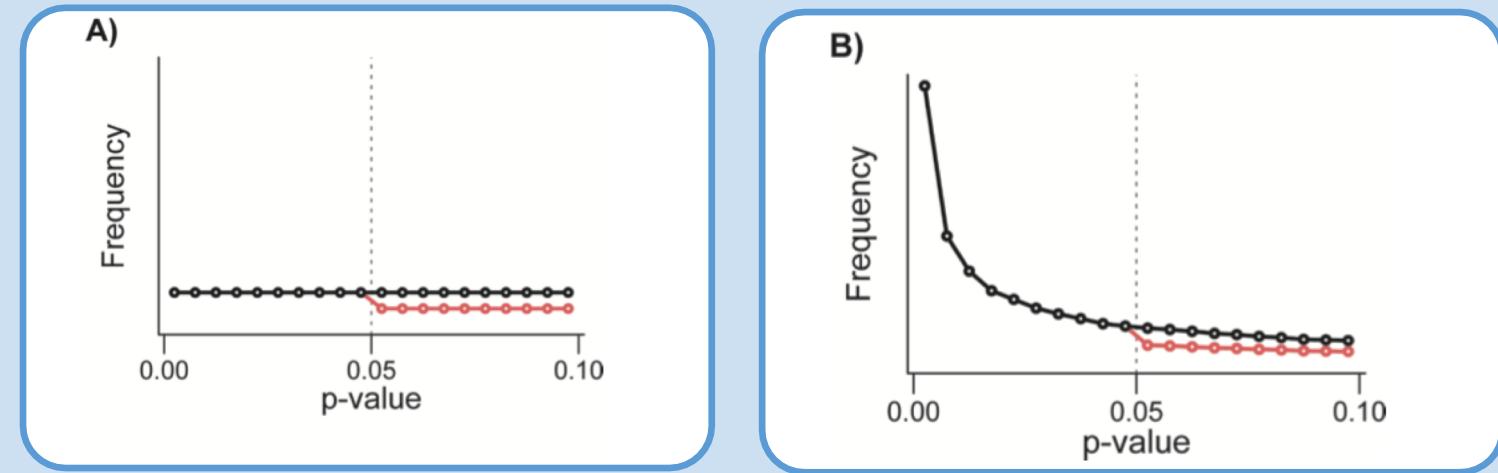


See also Choi et al. (2007, 2014)

# How robust is rationality?

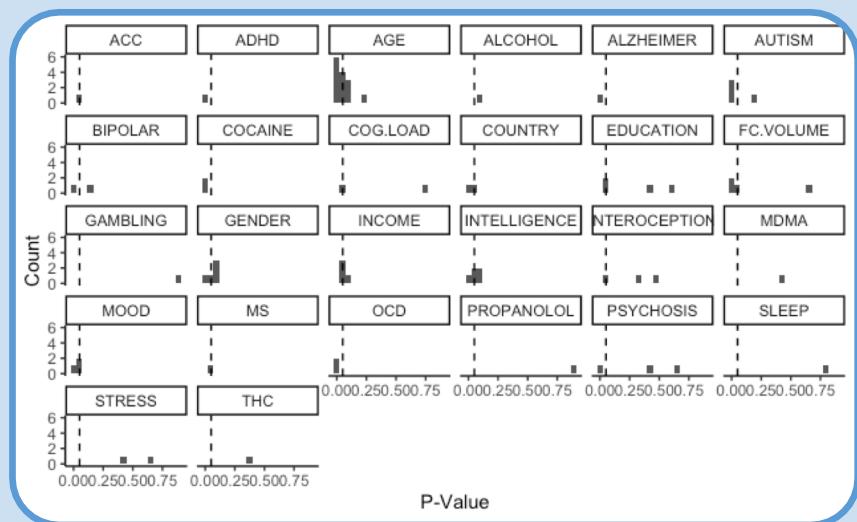
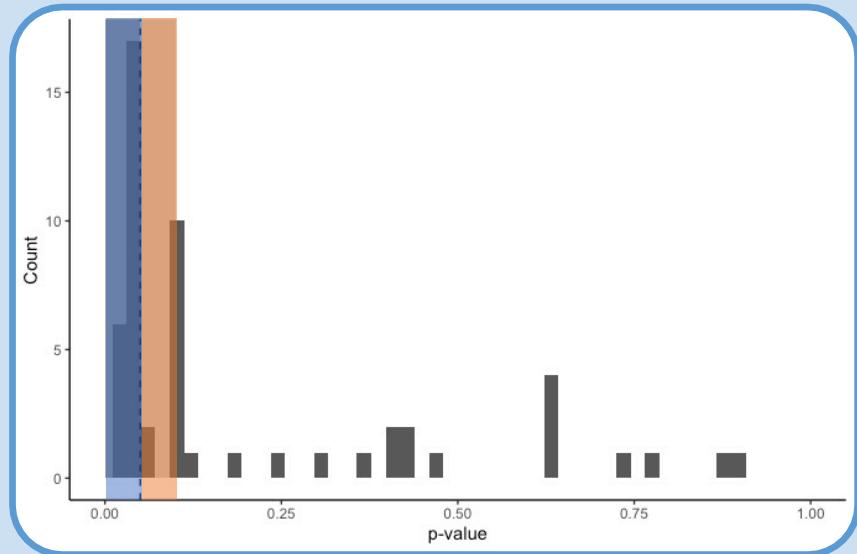


- Systematic review of 5327 articles, identifying 44 research articles and 71 hypothesis tests that addressed the influence of endogenous and exogenous factors on choice consistency
- P-Curve Analysis for evidential value



We considered the 43 of all 71 published significance tests with p-values within two equal-sized bins around  $p=0.050$  (lower: 0.000-0.050; upper: 0.050-0.100)

# How robust is rationality?

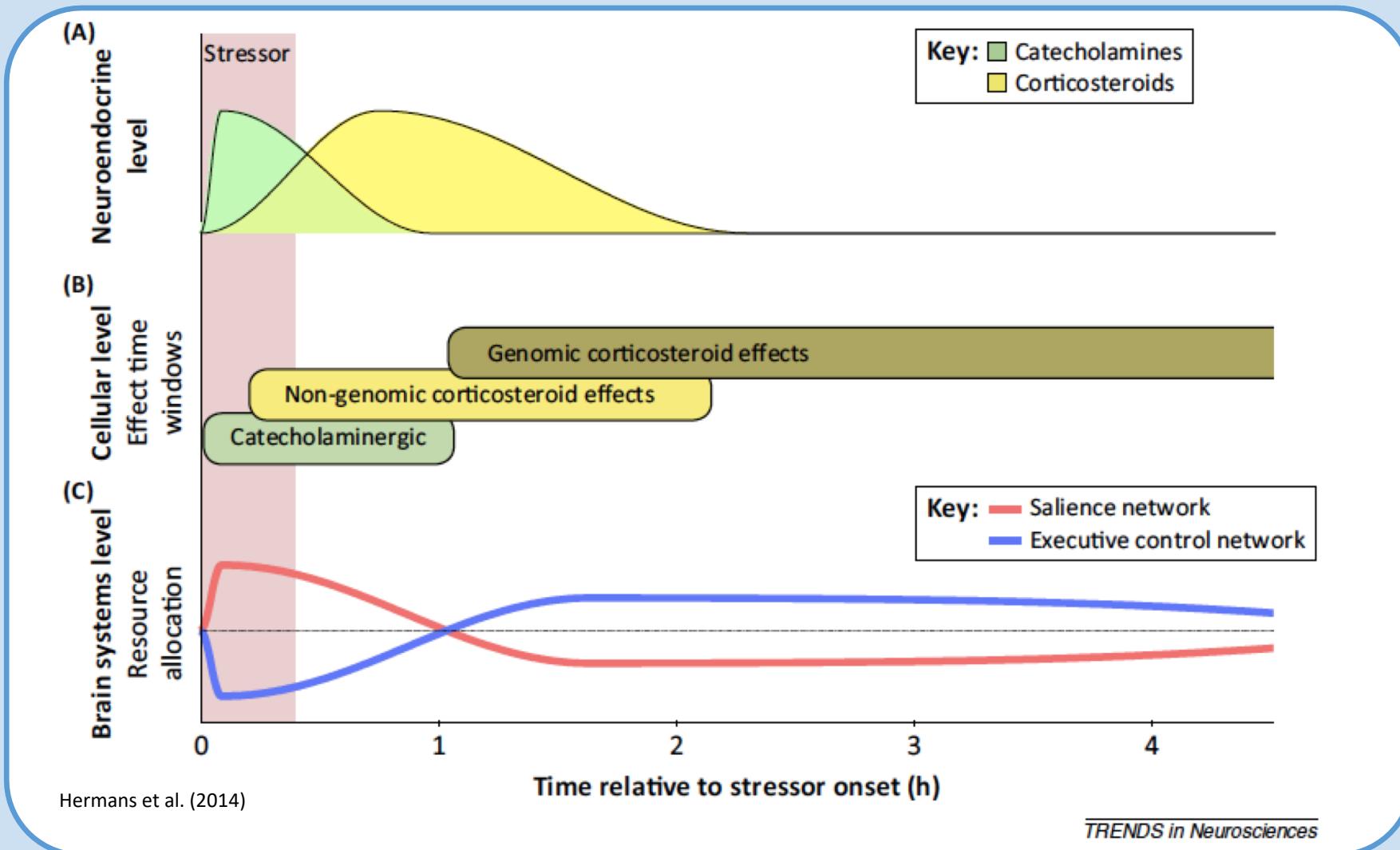


- Choice-consistency is likely affected by endogenous or exogeneous factors
  - 30 of the 43 tests fell in the lower bin ( $\text{Pr}=0.714$ ,  $\text{CI} = [0.554, 0.842]$ ,  $p=0.008$ )
  - Result holds under robustness check for publication bias against non-significant findings
- Evidence for specific factors is still limited
  - Breadth of the search for influence factors (26 different influence factors in 44 articles)
  - Severe lack of replications (for 20 of 26 influence factors only less than 3 independent significance tests were available)

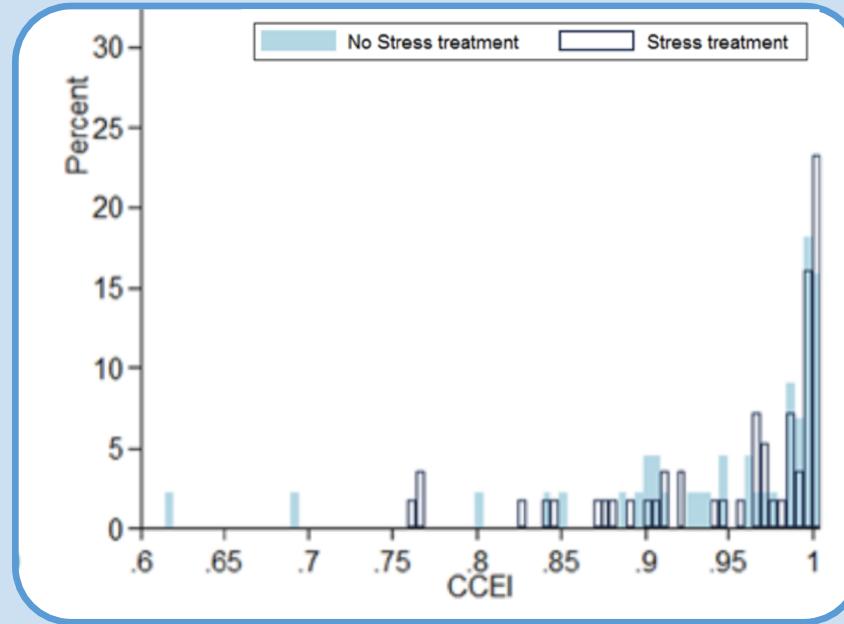
# What about Stress?

„Acute stress alters the way our brain functions. This brain-state shift can be understood as a **strategic reallocation of resources** to functions that are vital when survival is at stake: It **sharpens our senses**, creates a state of fearful arousal, and strengthens our memories of stressful experiences, but **impairs our capacity for slow deliberation.**“ – *Hermans et al. (2011)*

# Dynamic catecholamine and corticosteroid effects result in an ambivalent net effect on the brain



# Stress dynamically affects preferences – irrational?



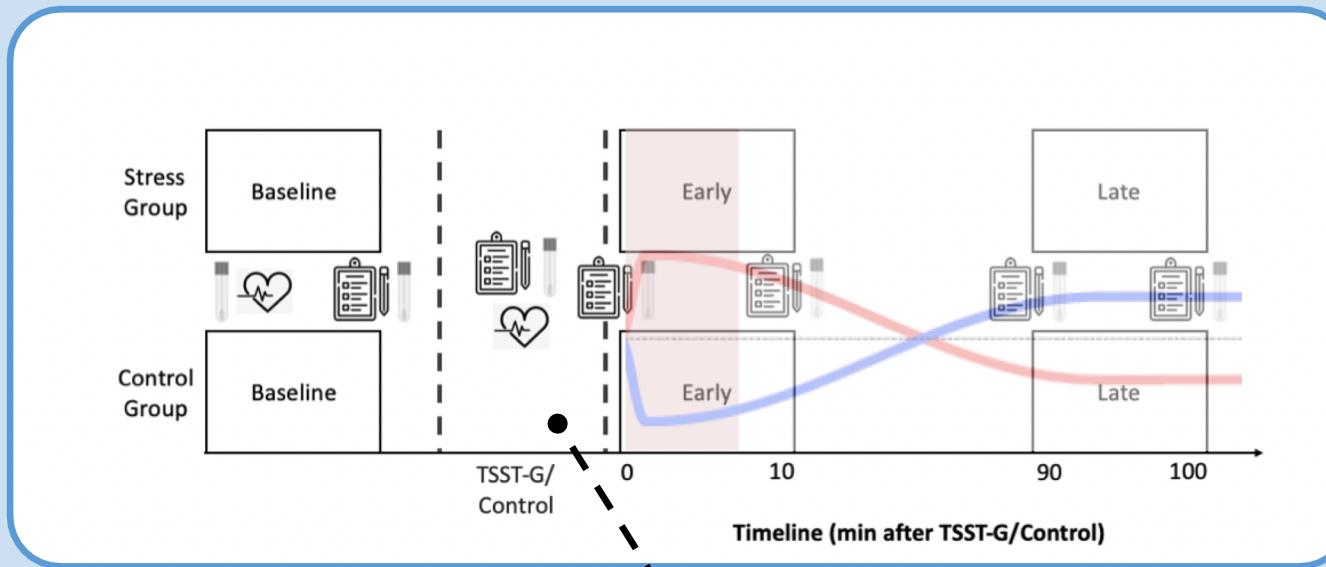
- Cettolin et al. (2019): no effect of Cold Pressor Test on choice consistency in risky decisions
- Margittai et al. (2018): no effect of pharmacol. stress intervention on choice consistency in risky decisions

# Open Questions

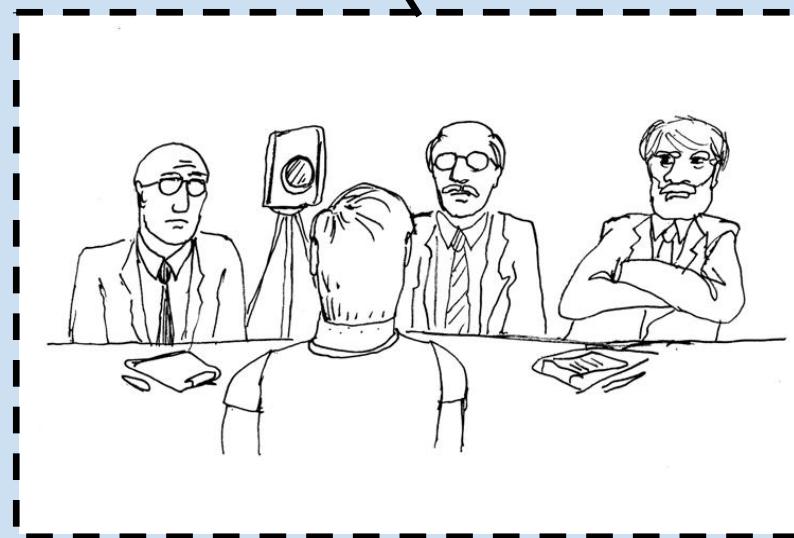
1. What about other choice domains (i.e. food choice)?
2. What about other acute stress protocols (i.e. Trier Social Stress Test)?
3. What about chronic stress?

# Research Questions & Methods

**Confirmatory Question:**  
Does acute stress  
dynamically affect  
consistency of choice?  
⇒TSST

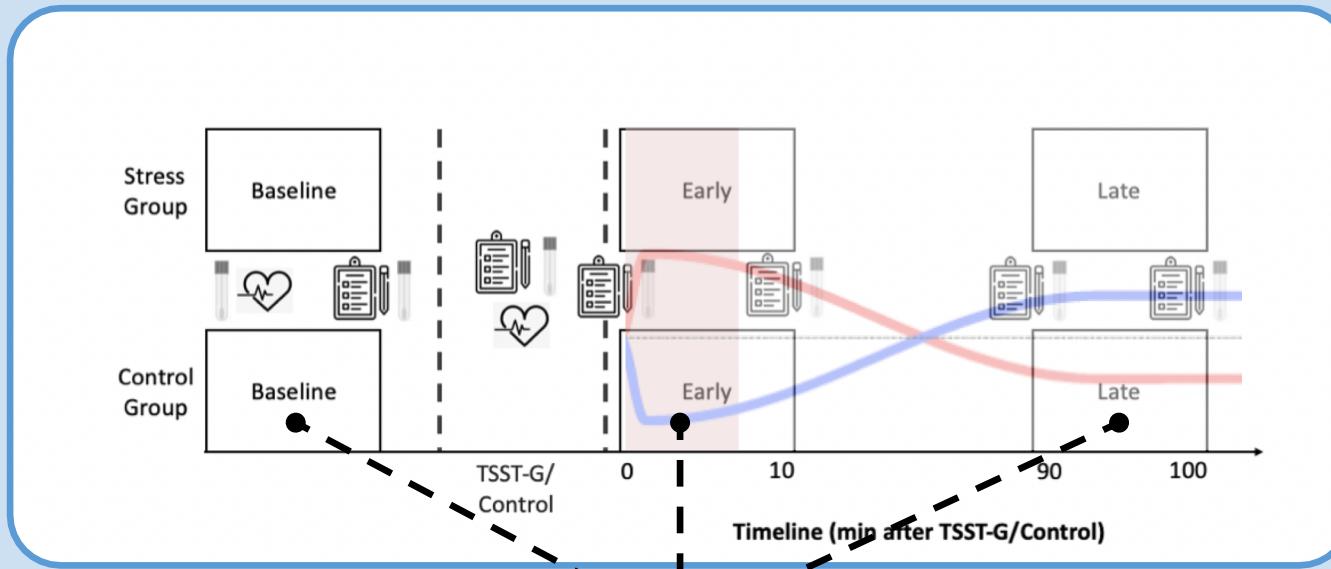


**Explorative Question:**  
Is self-reported chronic  
stress related to lower  
choice consistency?  
⇒TICS

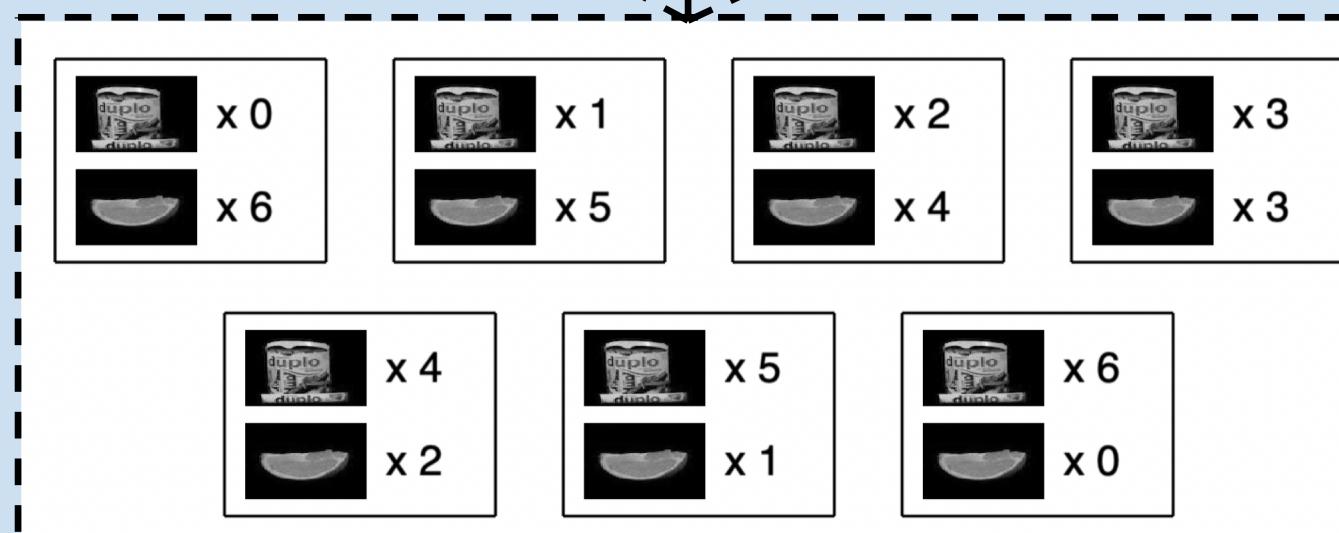


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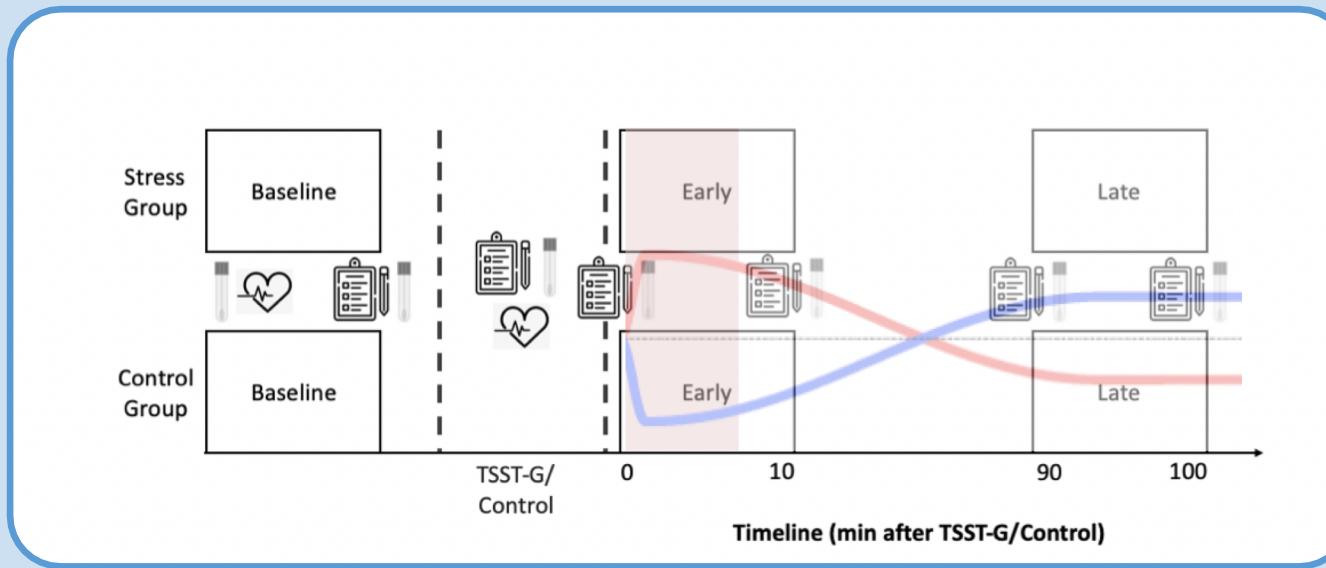
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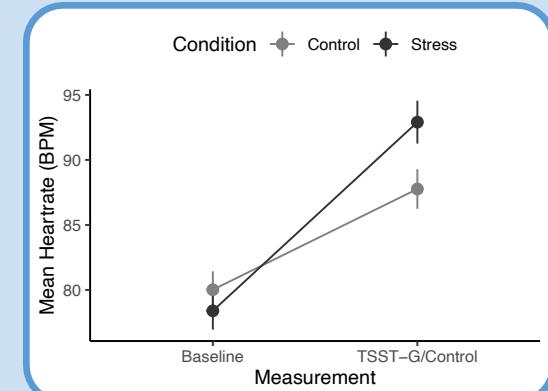
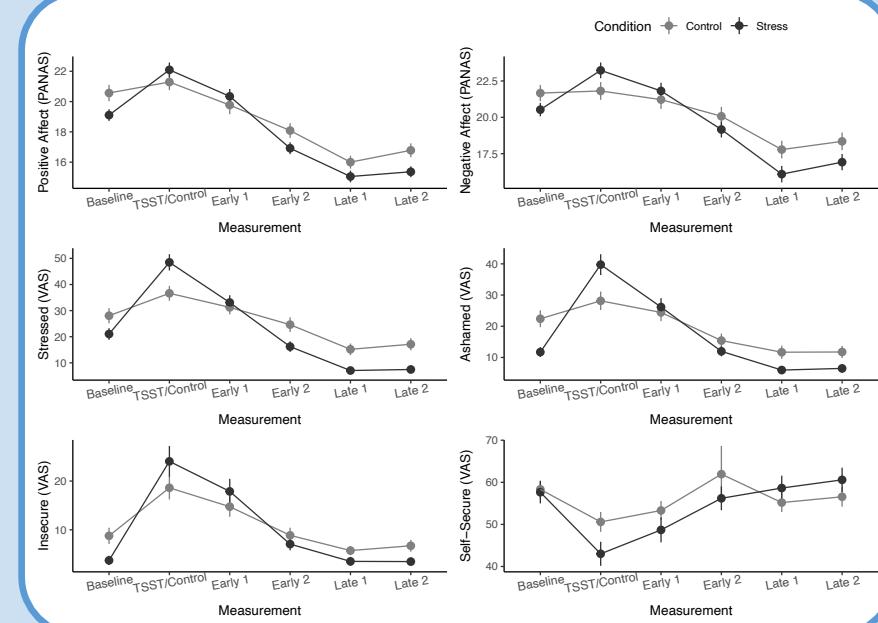
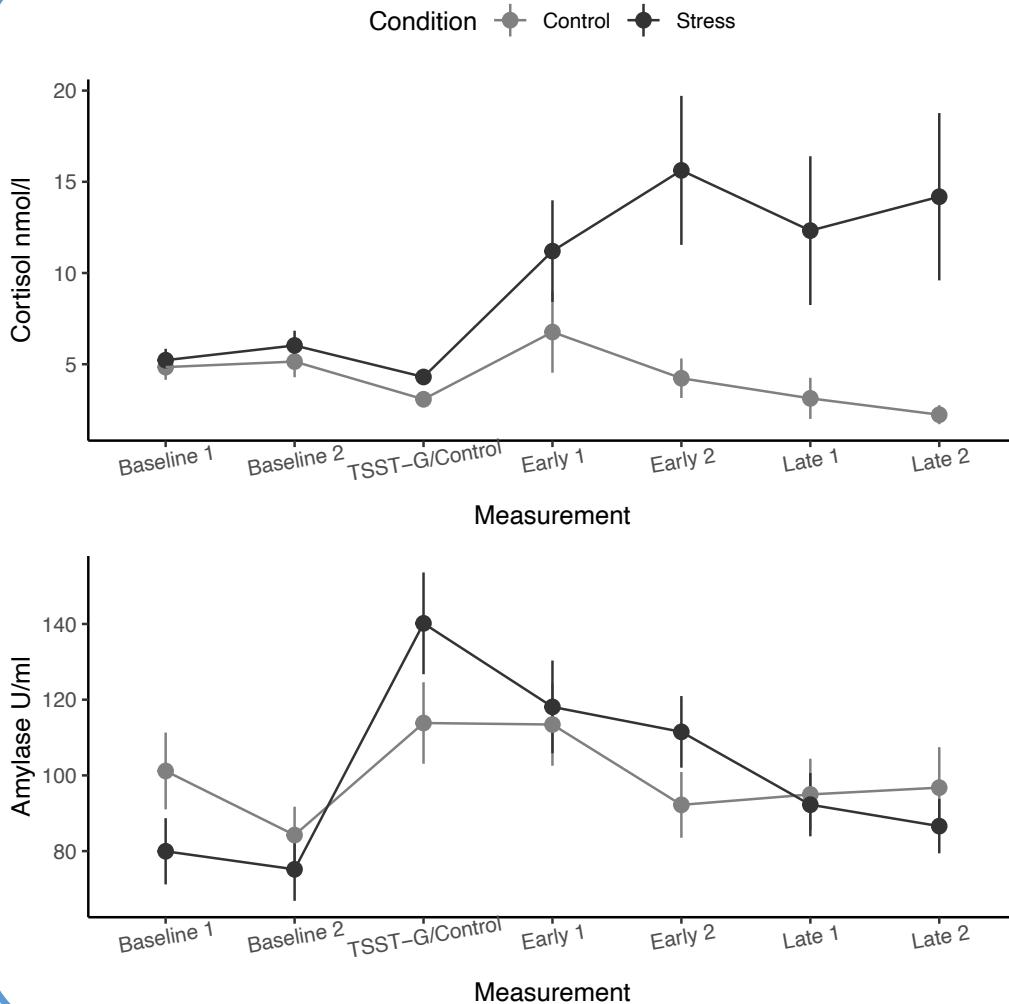
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## Sample Characteristics

- N = 144
  - 69/144 controls
  - 76/144 women
  - 102/144 with university education)
- Incentivized experiment
- No psychology or economics students

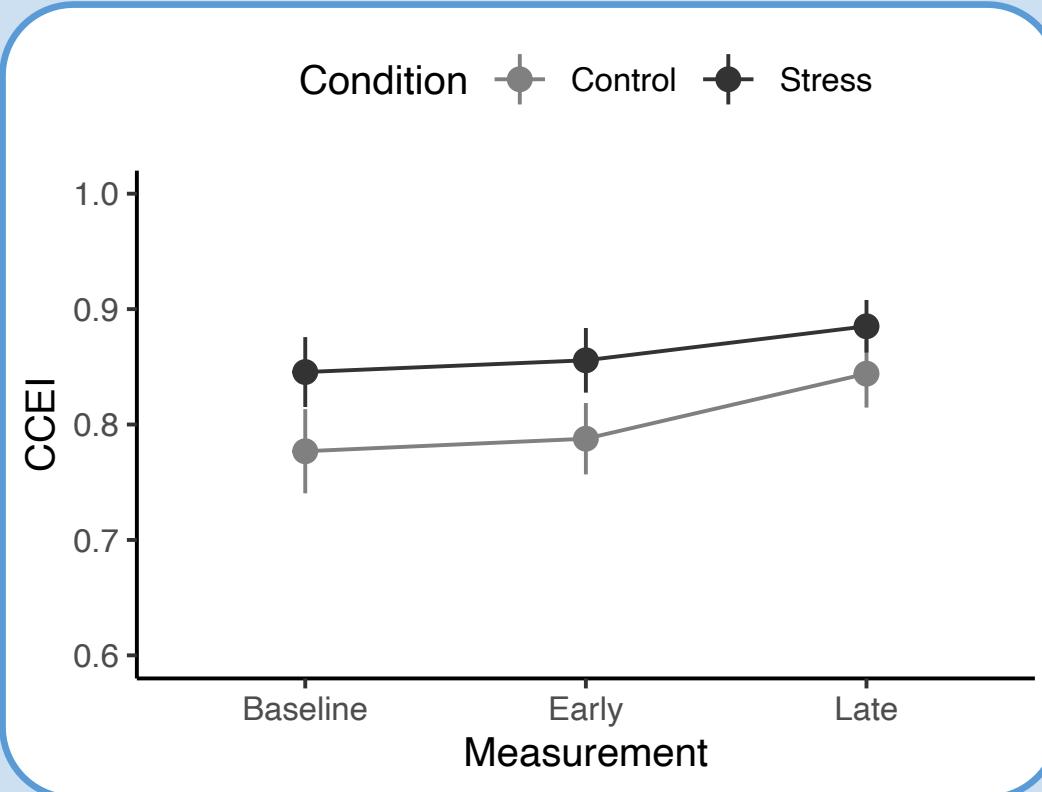
# Manipulation Checks



# Results

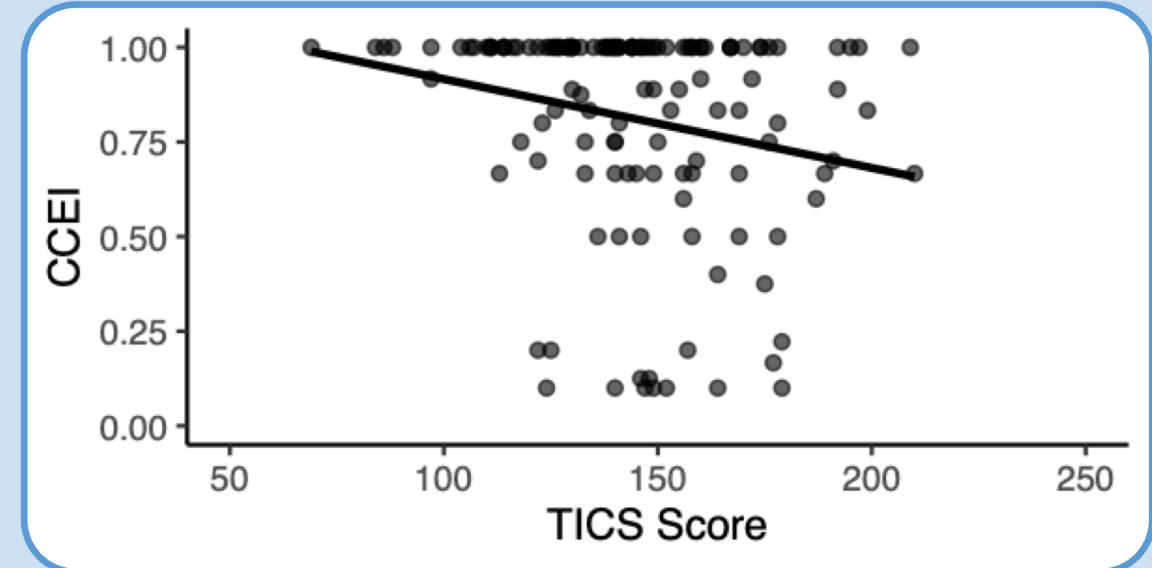
## Confirmatory Question:

Does acute stress dynamically affect consistency of choice?



## Explorative Question:

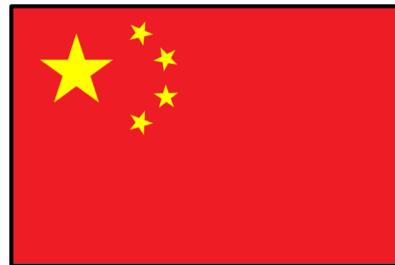
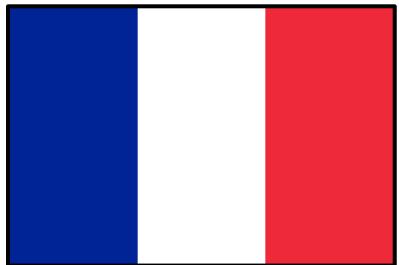
Is self-reported chronic stress related to lower choice consistency?



# Discussion

- Strong evidence ( $BF = 24$ ) against a temporally dynamic effect of acute stress on choice consistency
  - Both groups showed comparable consistency levels over all time points
  - In line with Cettolin et al. (2019)
  - However: We cannot exclude that preferences change between these time windows (indecisive evidence)
- Explorative analysis suggests possible deterioration of choice consistency under chronic stress ( $BF = 9$ )
  - Can we replicate this finding with a better suited study design?

# Outlook: Influence of COVID-19 related chronic stress on choice consistency



**Planned N:**  
~ 600



Which gamble on a coin flip would you like to play?

Heads: 10€ Tails: 0€	Heads: 7.5€ Tails: 3.7€	Heads: 5€ Tails: 7.4€	Heads: 2.5€ Tails: 11.1€	Heads: 0€ Tails: 14.8€
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# Comparative Psychology @ HHU Düsseldorf



Special thanks to mentors and collaborators:

Tobias Kalenscher,

Manuela Sellitto, Hilke Plassmann, Aiqing Ling,  
Marie Falkenstein, Leonie Koban

...for the great support to Adam Schweda  
...and to all my awesome students

Thank you for the invitation,  
listening and your time! ☺



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