PERSONALITY TRAITS IN THE RELATIONSHIP OF EMOTION AND PERFORMANCE IN COMMAND-AND-CONTROL ENVIRONMENTS

14th International Conference on Advances in Computer-Human Interactions

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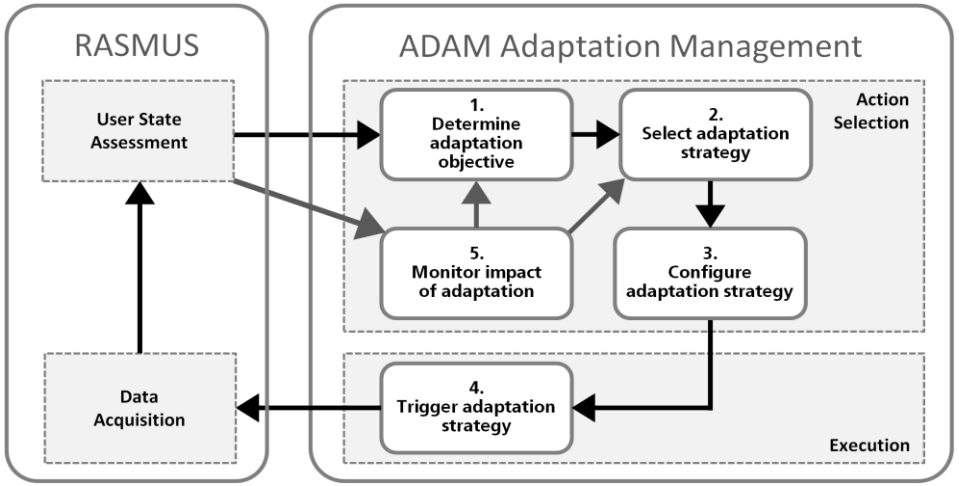
IARIA

Alina Schmitz-Hübsch

- Research Fellow at Fraunhofer FKIE, Germany
- M. Sc. in Psychology
- Research fields
  - Adaptive Human-Machine-Interaction
  - User State Diagnosis
  - Emotional User State
  - Eye Tracking in Reading

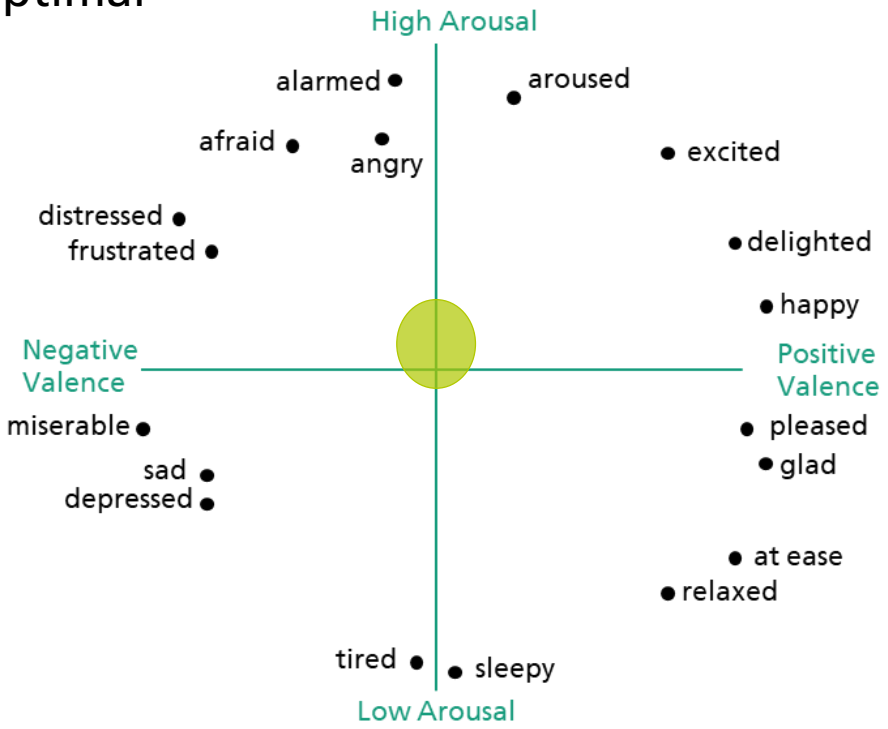
Adaptive Systems and User State Diagnosis

- Problem:
  - Accidents in human-machine systems are often caused by critical user states
- Solution: Adaptive human-machine systems
  - Address critical user states using adaptation strategies



Background

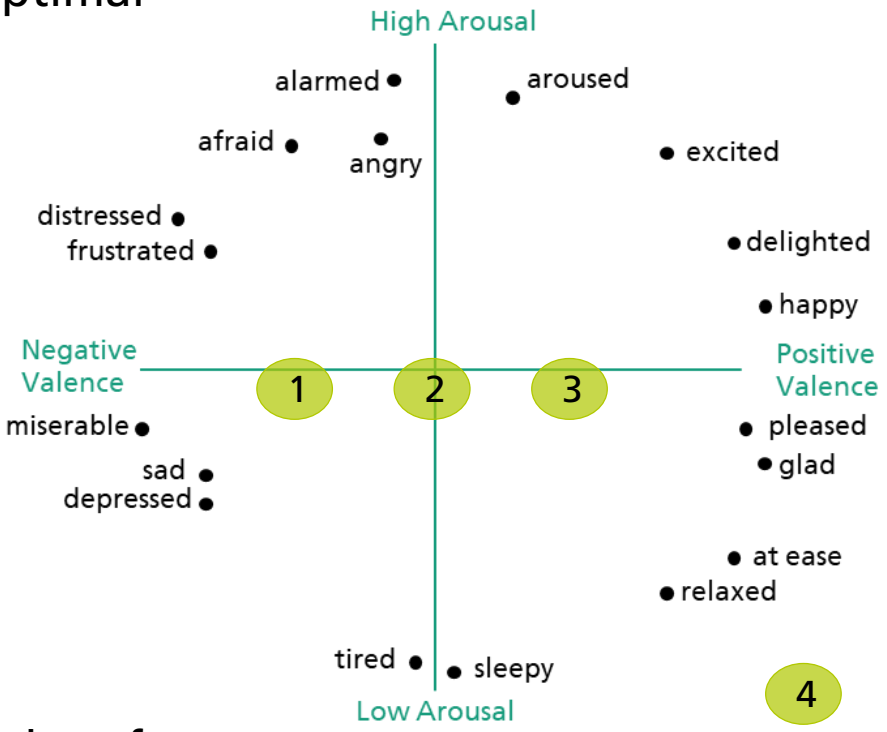
- Neutral valence and medium arousal as *Sweet Spot* of the emotional user state for optimal performance (Cai & Lin, 2011)
- C2: Interindividual differences in the correlation between emotional user states and performance (Schmitz-Hübsch & Fuchs, 2020; Schmitz-Hübsch, Stasch & Fuchs 2021)



Circumplex Model after Russell (1980)

Background

- Neutral valence and medium arousal as *Sweet Spot* of the emotional user state for optimal performance (Cai & Lin, 2011)
- C2: Interindividual differences in the correlation between emotional user states and performance (Schmitz-Hübsch & Fuchs, 2020; Schmitz-Hübsch, Stasch & Fuchs 2021)
- Four categories of individuals: High performance associated with…
  1. …Negative valence.
  2. …Neutral valence.
  3. …Positive valence.
  4. No correlation between valence and performance.



Circumplex Model after Russell (1980)

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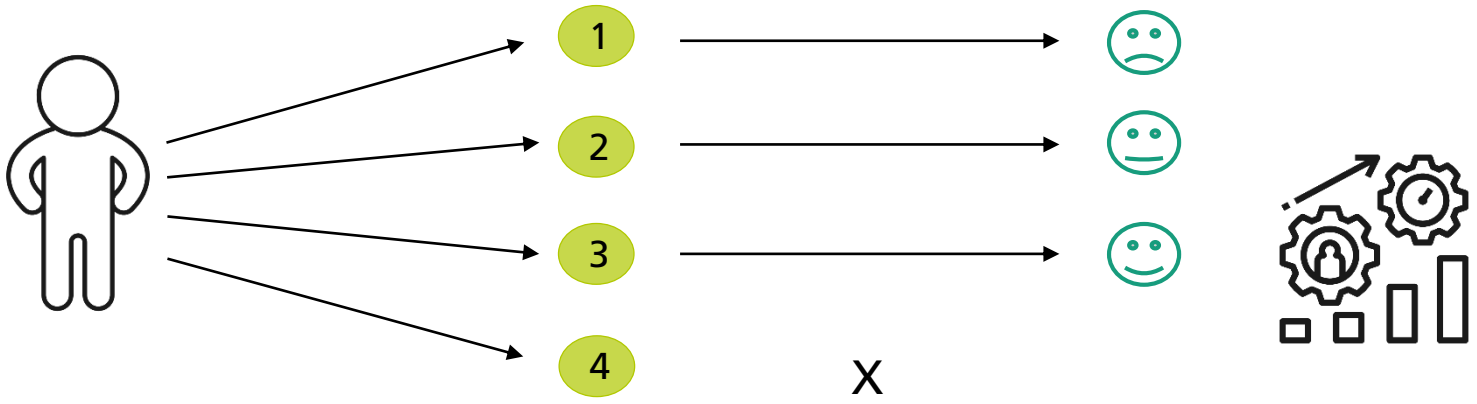
Background

- An affect-adaptive system should consider Affective Response Categories in adapting interaction
  - Problem: System needs to assign current user to one of the categories prior to adapting



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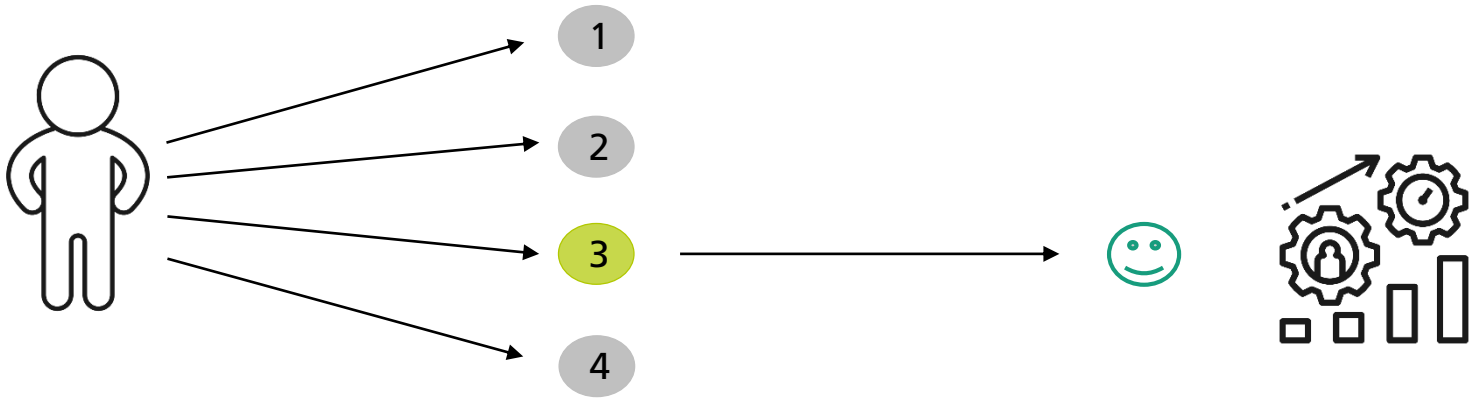
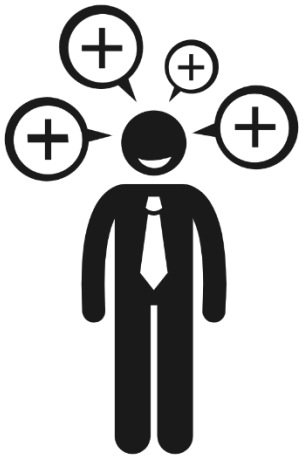


  - Possible solution: Personality traits

Background

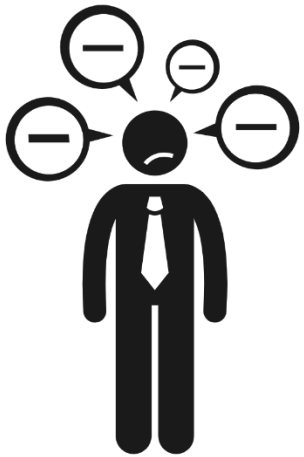


Personality Traits

Appraisal Style

Interindividual differences

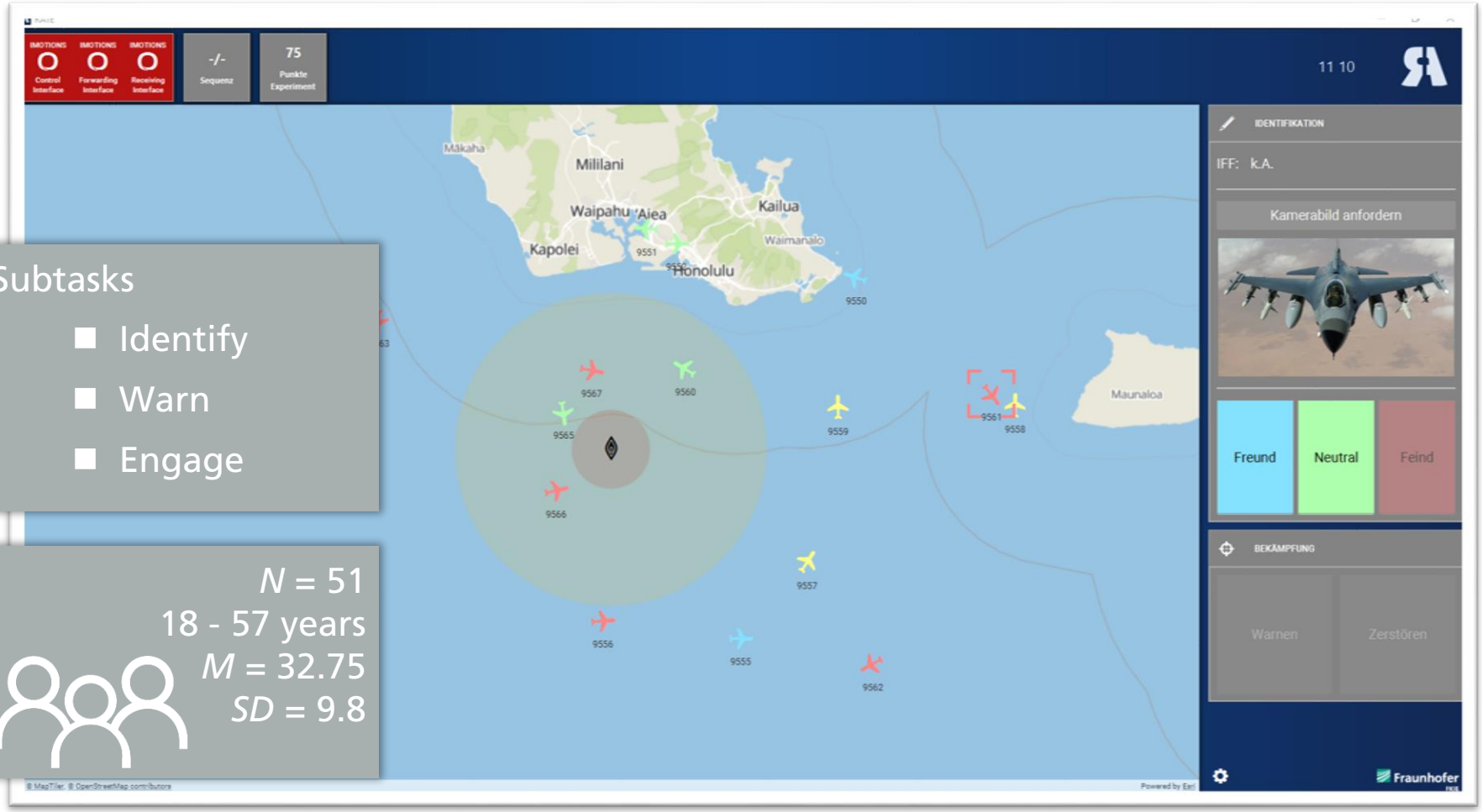
Affective Response Categories



Hypothesis

- Hypothesis 1: The emotional user state is associated with task performance.
  - H1a. Higher arousal is significantly associated with low performance for all subjects.
  - H1b. The relationship between emotional valence (positive, neutral, negative) and performance varies across subjects.
- Hypothesis 2: Personality traits have a moderating effect on the emotion-performance relationship.
  - H2a. There are significant interaction effects of neuroticism with valence (I) and arousal (II).
  - H2b. There are significant interaction effects of conscientiousness with valence (I) and arousal (II).
  - H2c. There are significant interaction effects of neuroticism and conscientiousness with valence (I) and arousal (II).

Rich and Adaptable Test Environment (RATE) for C2



Subtasks

- Identify
- Warn
- Engage

N = 51
18 - 57 years
M = 32.75
SD = 9.8

intern

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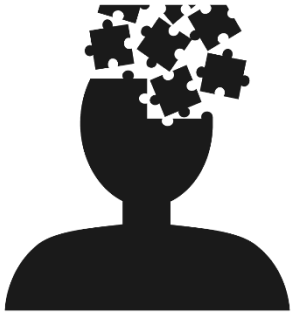
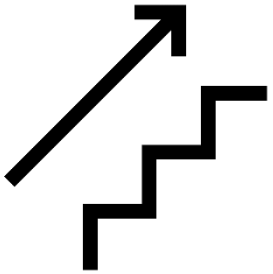
Operationalization of Variables

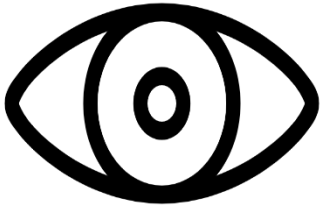
Independent Variables



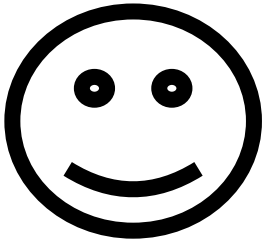
Personality (NEO-FFI)
- Neuroticism
- Conscientiousness



Scenario Difficulty
12 levels



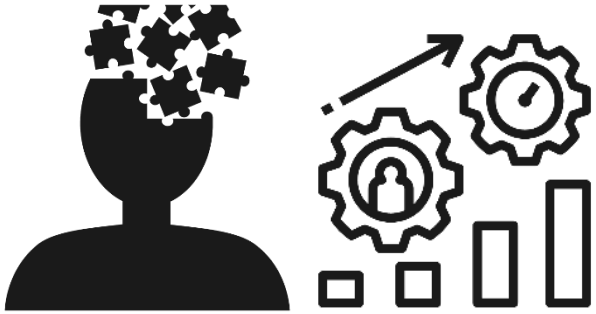
Emotional Arousal
pupil width
(Tobii Pro Spectrum)

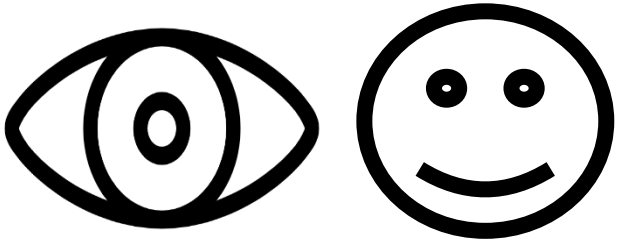


Emotional Valence in
facial expressions
(Emotient FACET)

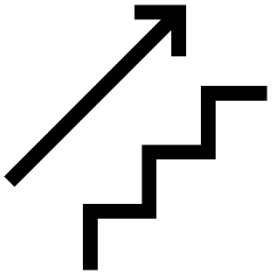
Operationalization of Variables

Independent Variables





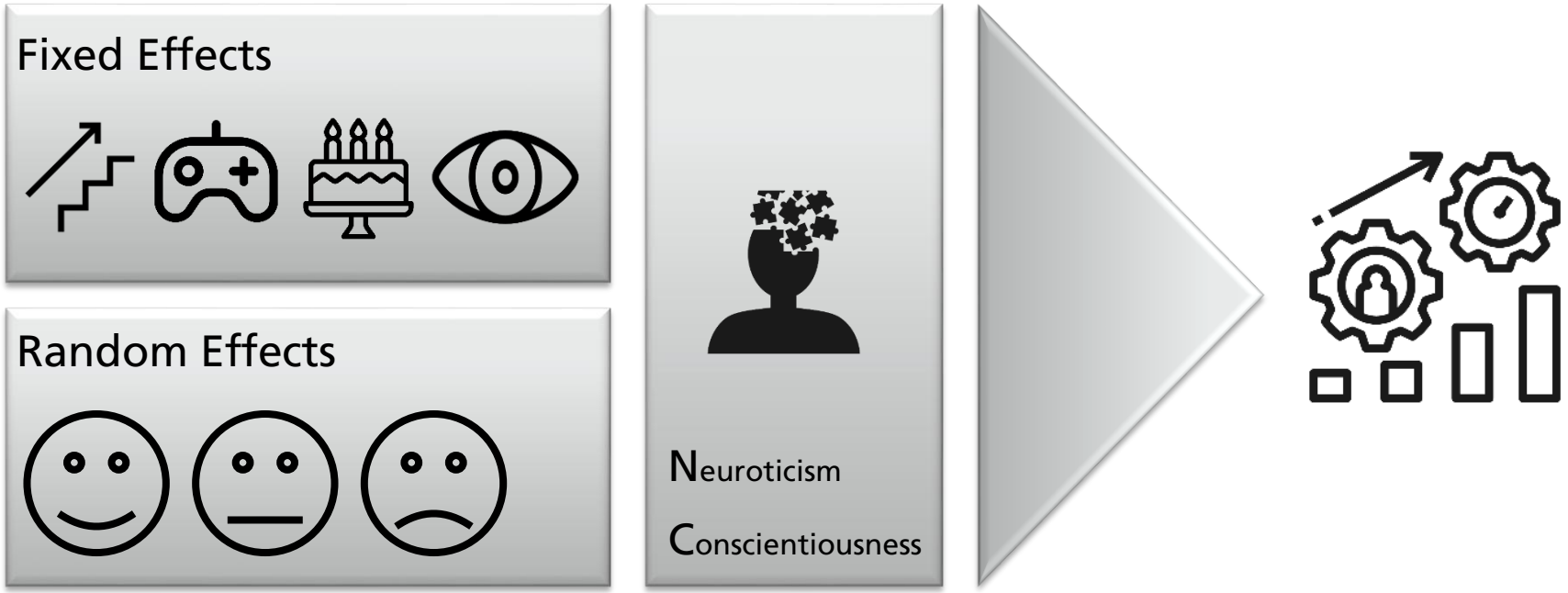
Dependent Variable



Performance
RATE Score

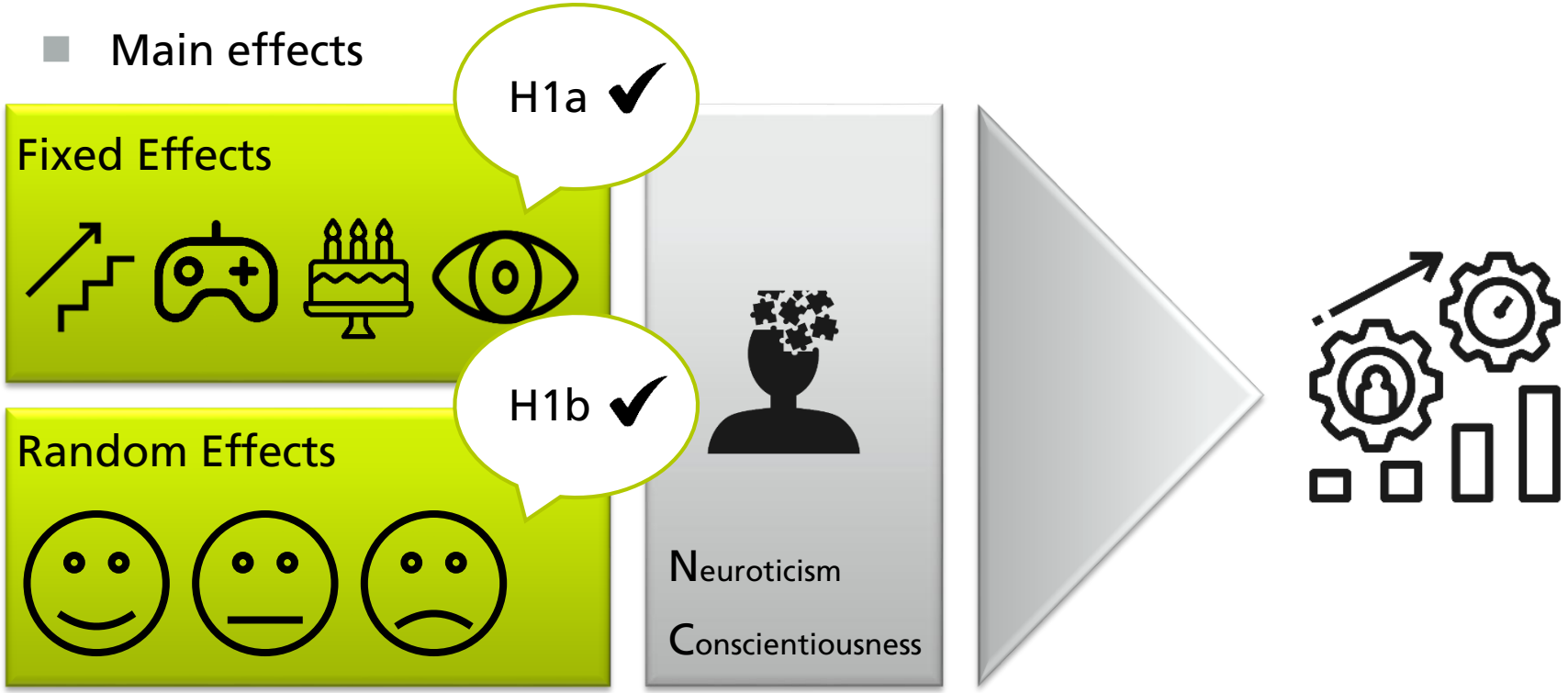
Statistical Analysis

- Maximum likelihood estimation of the parameters in a linear mixed-effects model
  - lme4 package for R



Results

- Maximum likelihood estimation of the parameters in a linear mixed-effects model
  - Main effects



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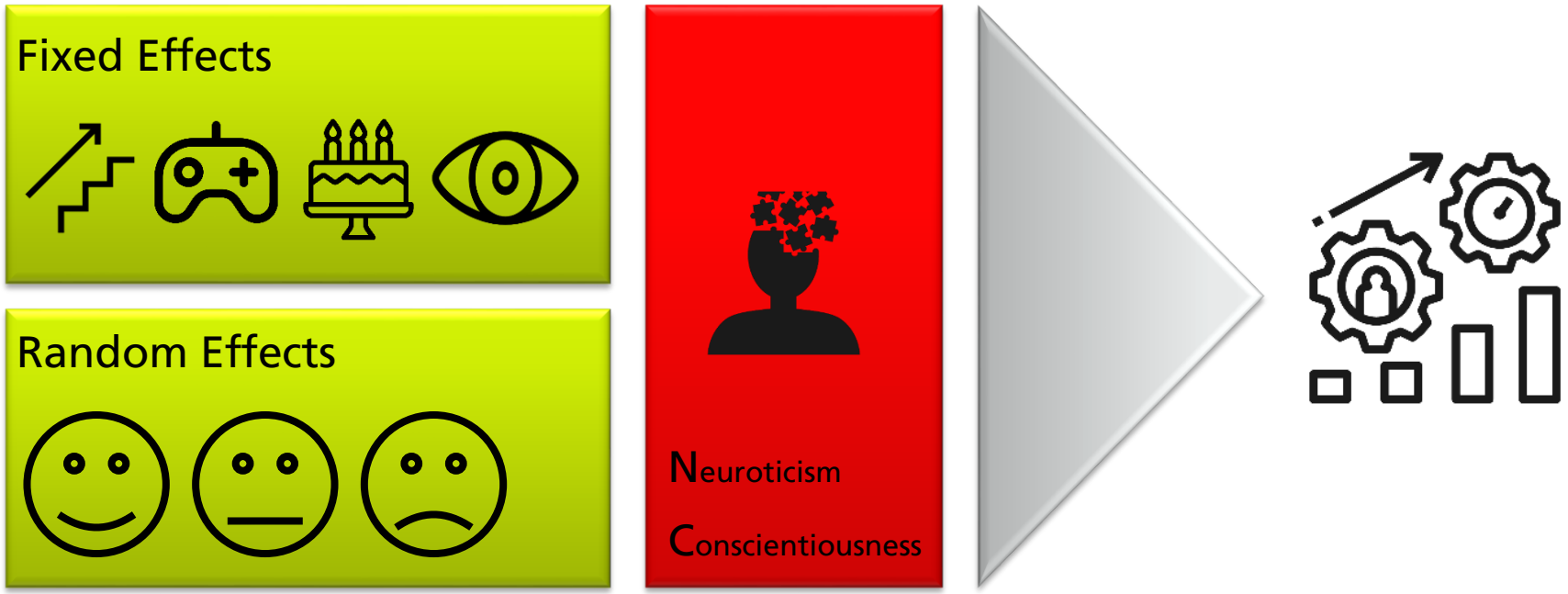
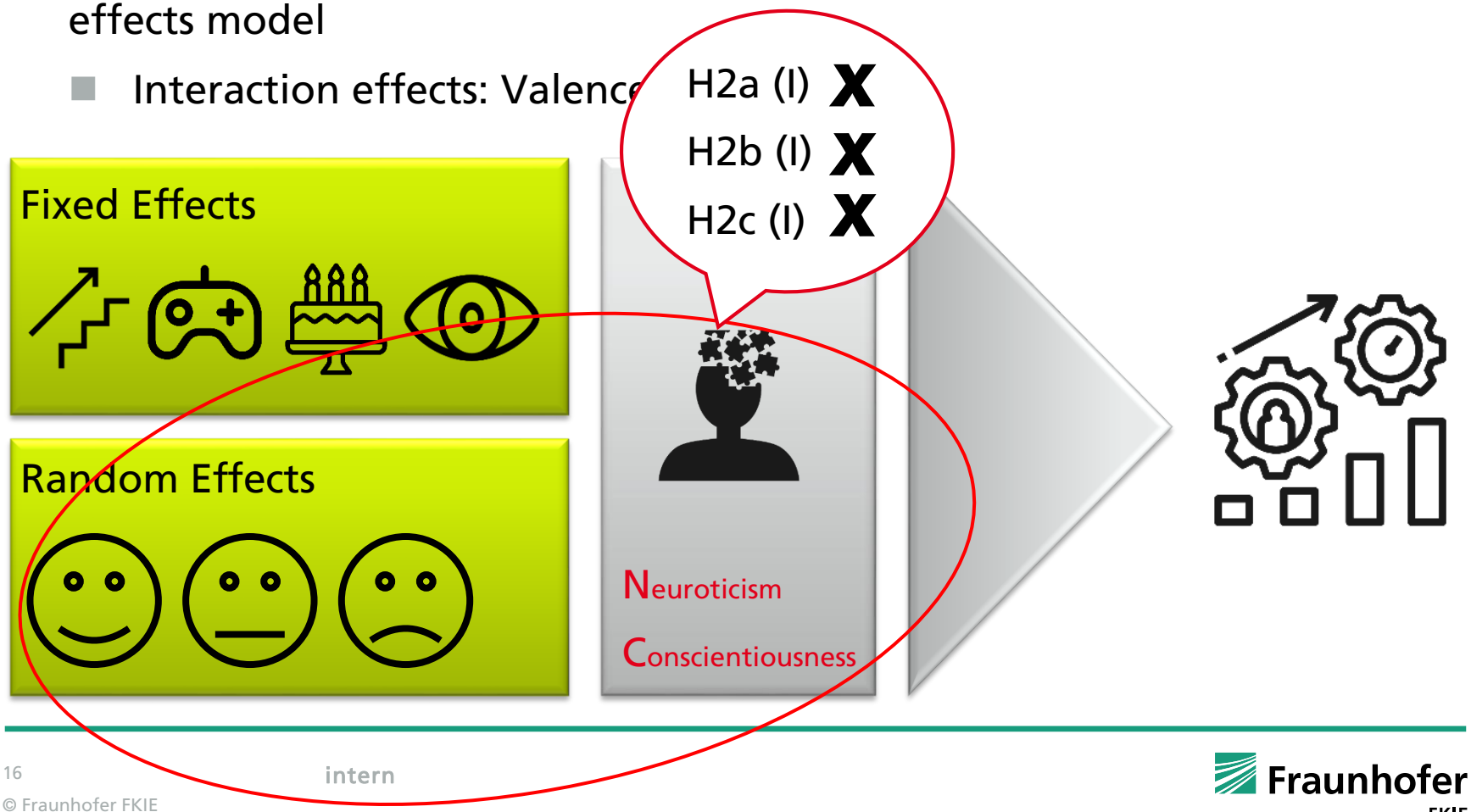


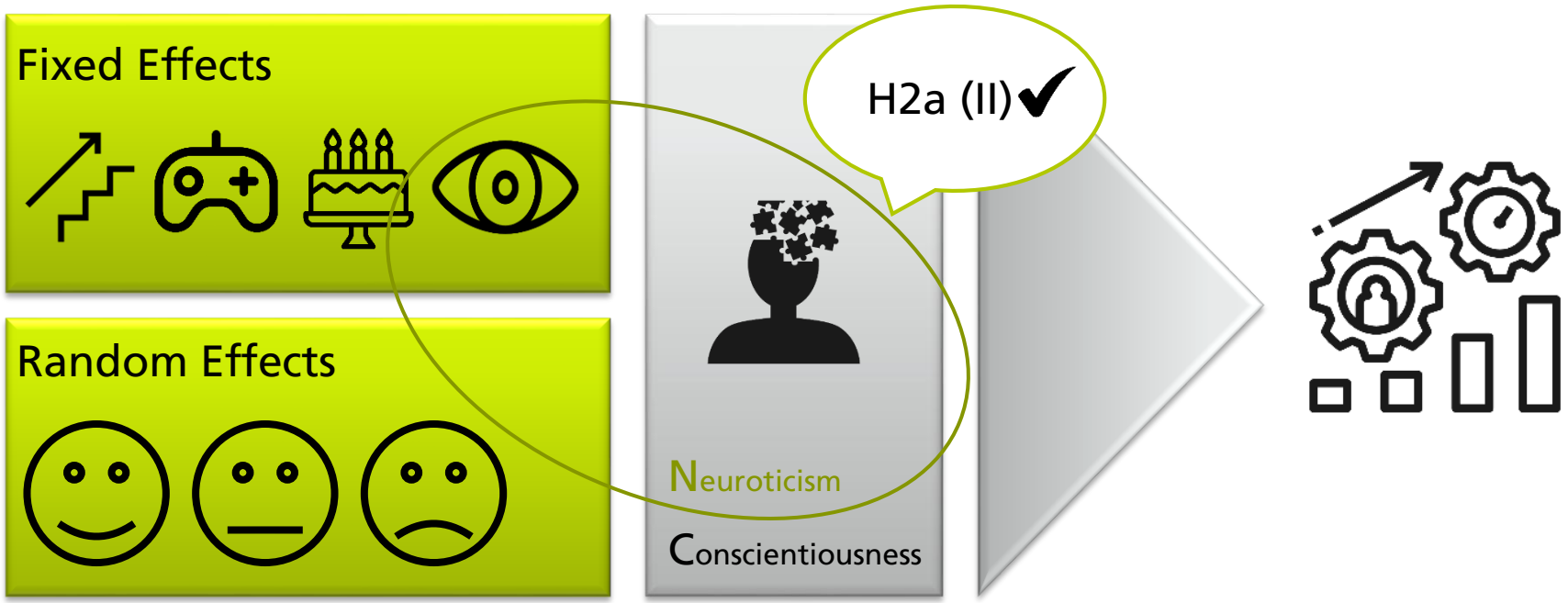
Results

- Maximum likelihood estimation of the parameters in a linear mixed-effects model
  - Interaction effects: Valence



Results

- Maximum likelihood estimation of the parameters in a linear mixed-effects model
  - Interaction effect: Arousal x Neuroticism



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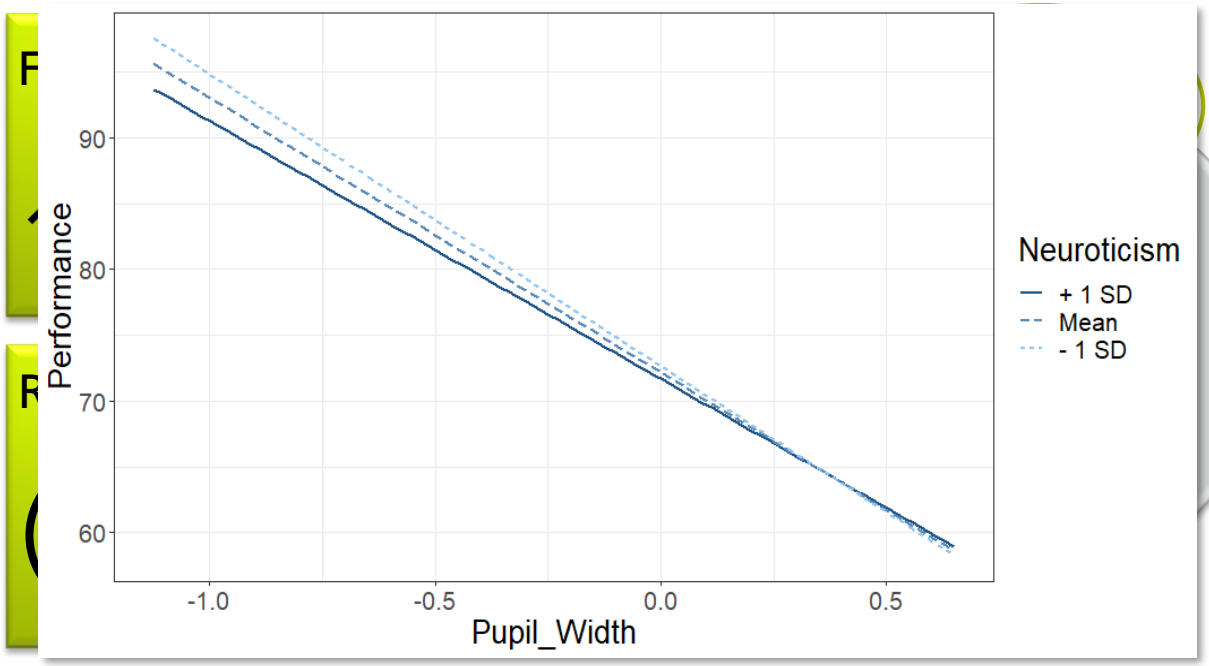
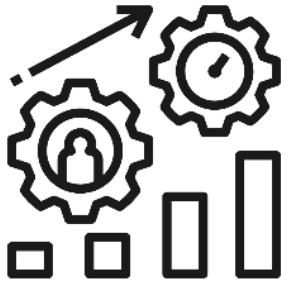
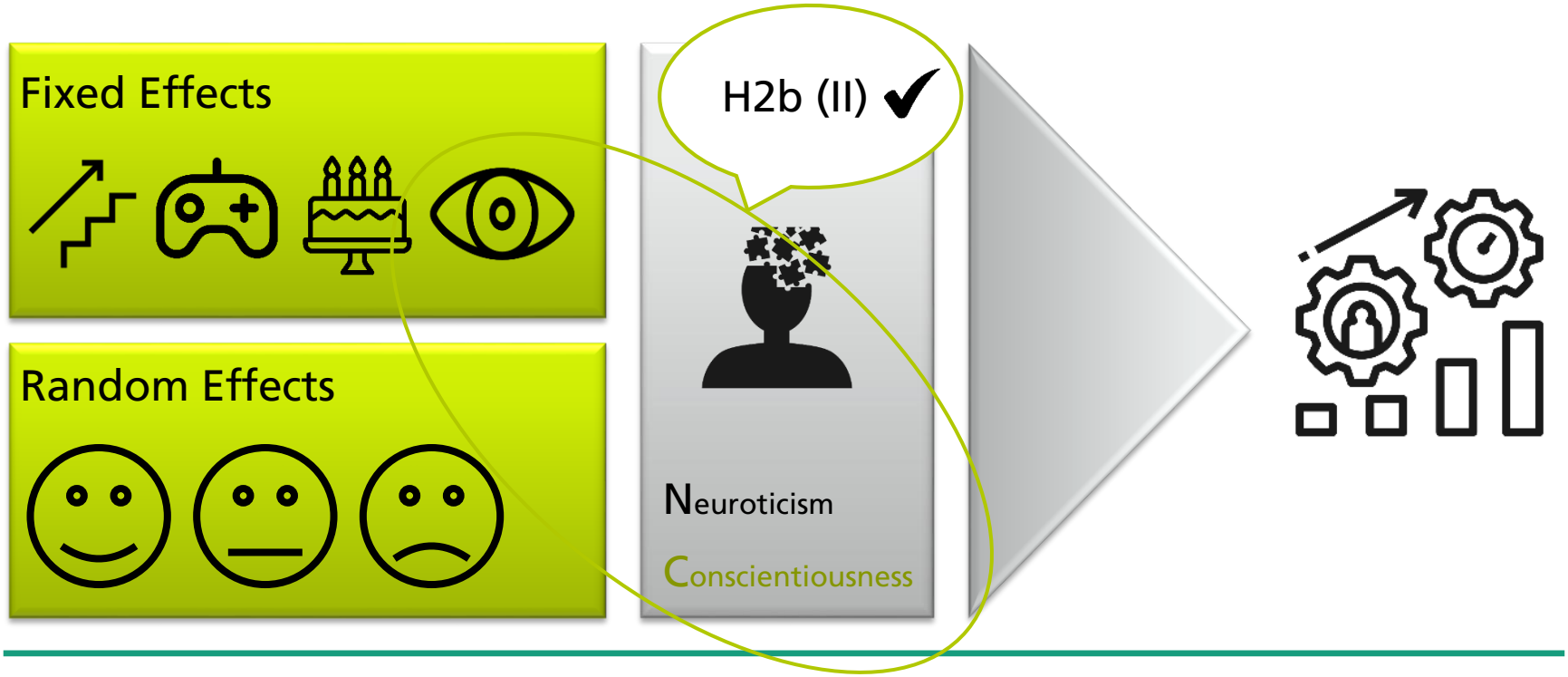




Results

- Maximum likelihood estimation of the parameters in a linear mixed-effects model
  - Interaction effect: Arousal x Conscientiousness



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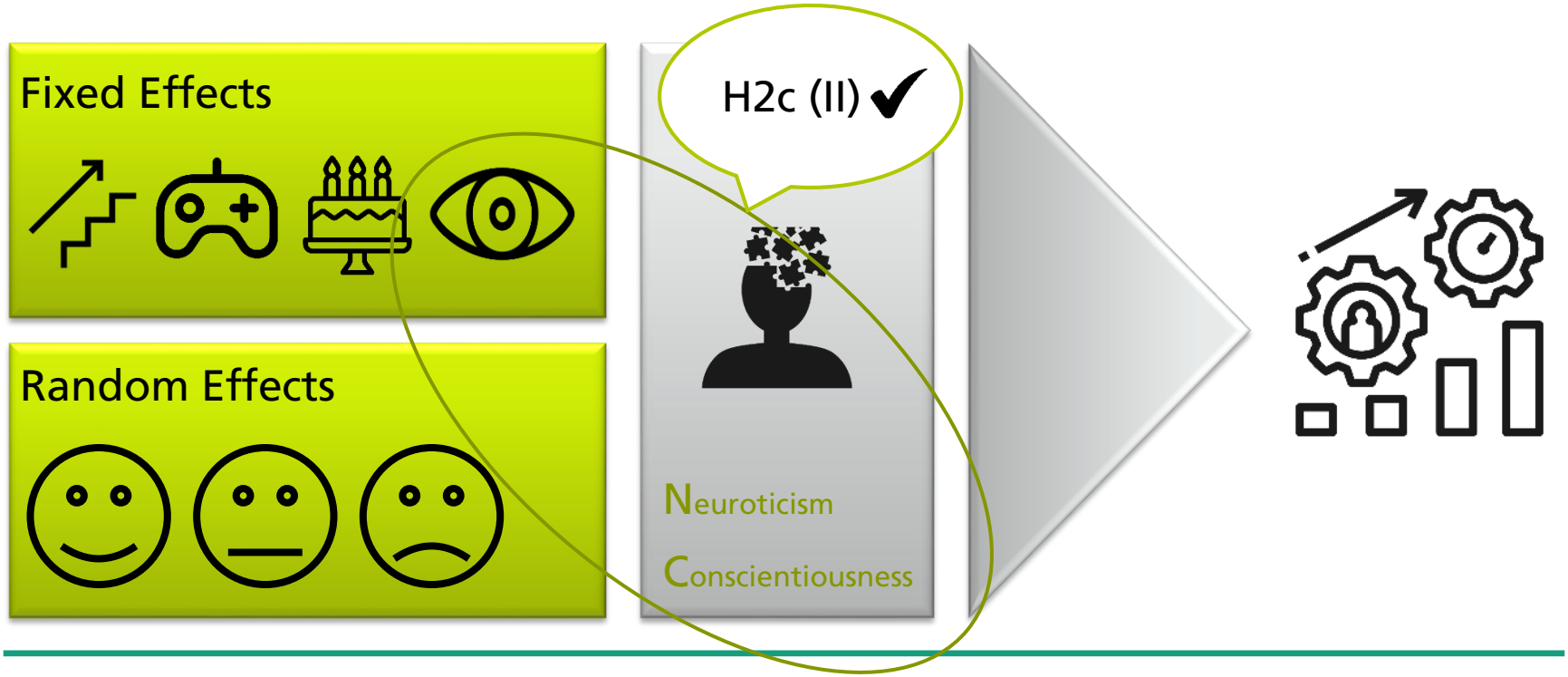
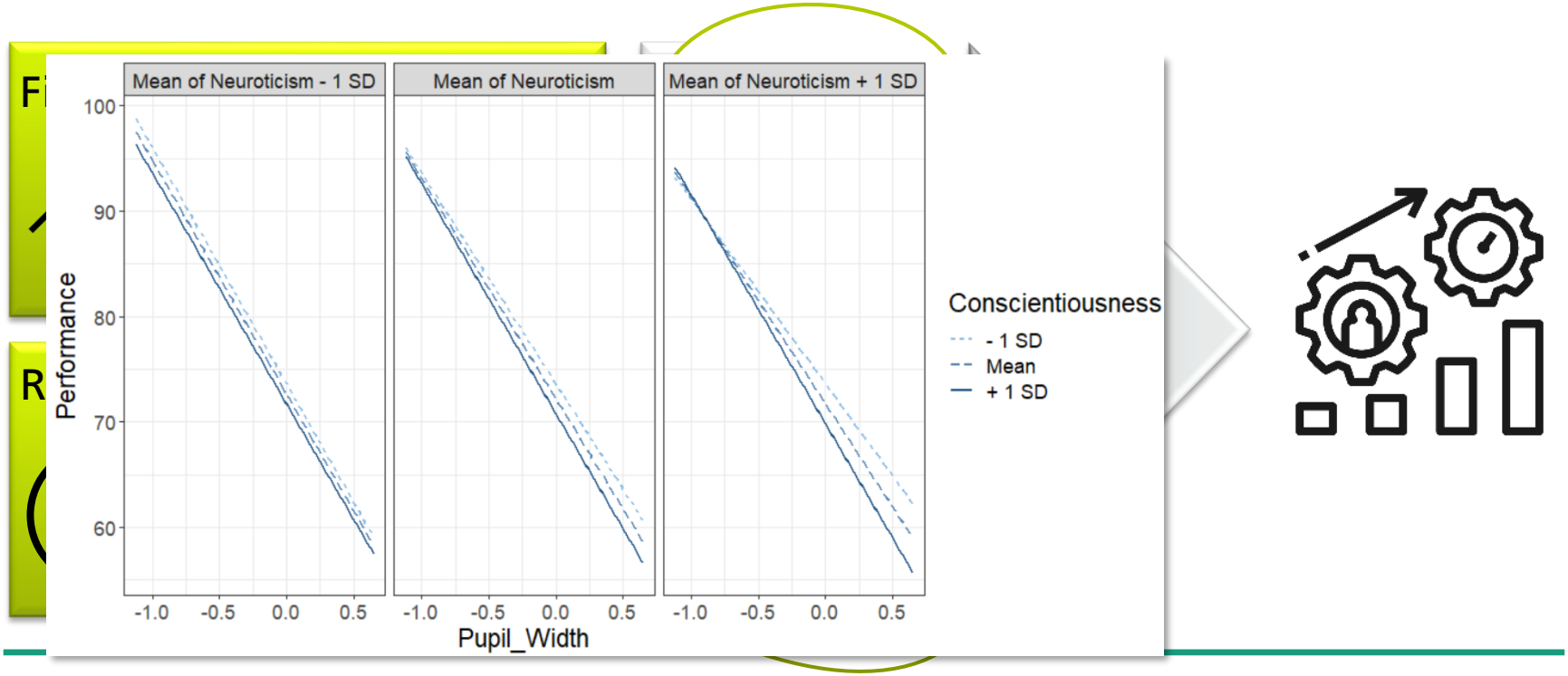


Results

- Maximum likelihood estimation of the parameters in a linear mixed-effects model
  - Interaction effect: Arousal x Conscientiousness x Neuroticism



Results

- Significant fixed effects: Low performance associated with…
  - …high difficulty level
  - …low gaming experience
  - …high age
  - …high pupil width.

Possibly confounding variables

H1a

H1b

- Significant random effects of positive, neutral and negative valence

Results

- Interaction effects

H2a (I)
- Neuroticism x Valence

H2a (II)
- High neuroticism in low arousal conditions associated with low performance.

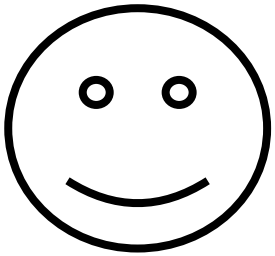
H2b (I)
- Conscientiousness x Valence

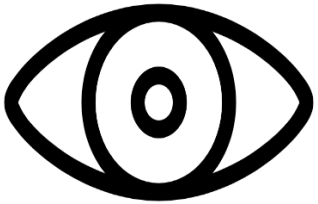
H2b (II)
- Low conscientiousness in high arousal conditions associated with low performance.

H2c (I)
- Neuroticism x Conscientiousness x Valence

H2c (II)
- High neuroticism and low conscientiousness in high arousal conditions associated with low performance.

Discussion

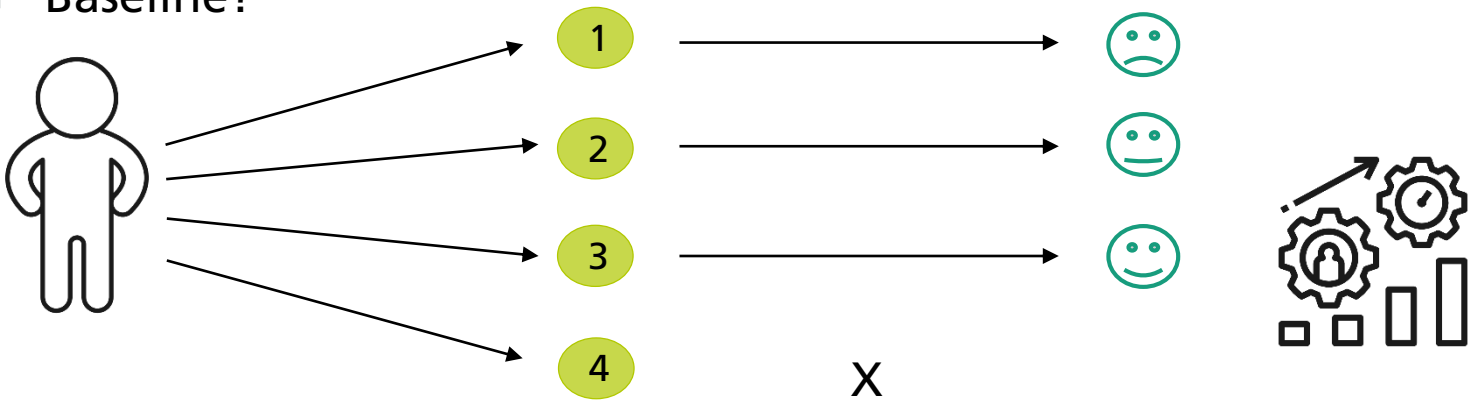




- Emotional user state and performance
  - Interindividual differences in the correlation of emotional valence and performance confirmed
  - Low performance associated with high pupil width
  - ⇨ Adaptive C2-systems should consider both dimensions of the emotional user state
- Personality traits play a role in the relationship of emotion and performance
  - Appraisal style might offer an explanation

Outlook

- Adaptive C2-systems should consider the emotional user state
  - The causal direction of the correlation of emotion and performance is yet to be determined
- Further investigations regarding the assignment of users to the Affective Response Categories are necessary
  - Personality traits?
  - Baseline?



References

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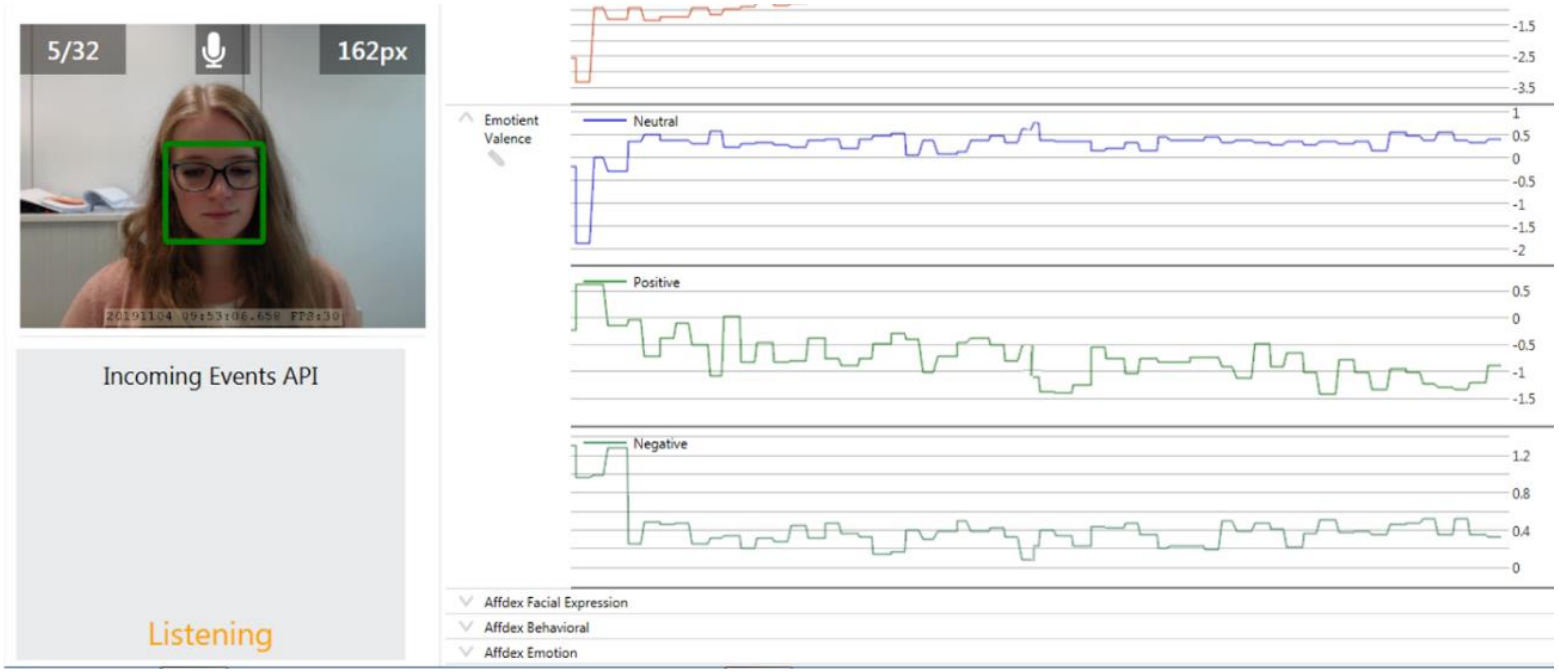
- A. Schmitz-Hübsch and S. Fuchs, "Challenges and Prospects of Emotional State Diagnosis in Command and Control Environments," *International Conference on Human-Computer Interaction*, July 2020, pp. 64-75, Springer, Cham.
- A. Schmitz-Hübsch, S. M. Stasch, and S. Fuchs, "Individual Differences in the Relationship between Emotion and Performance in Command-and-Control Environments," *International Conference on Human-Computer Interaction*, July 2021, in press.

Methodology

- Emotient FACET
  - Classifiers positive, negative negative valence



Schmitz-Hübsch, 2019