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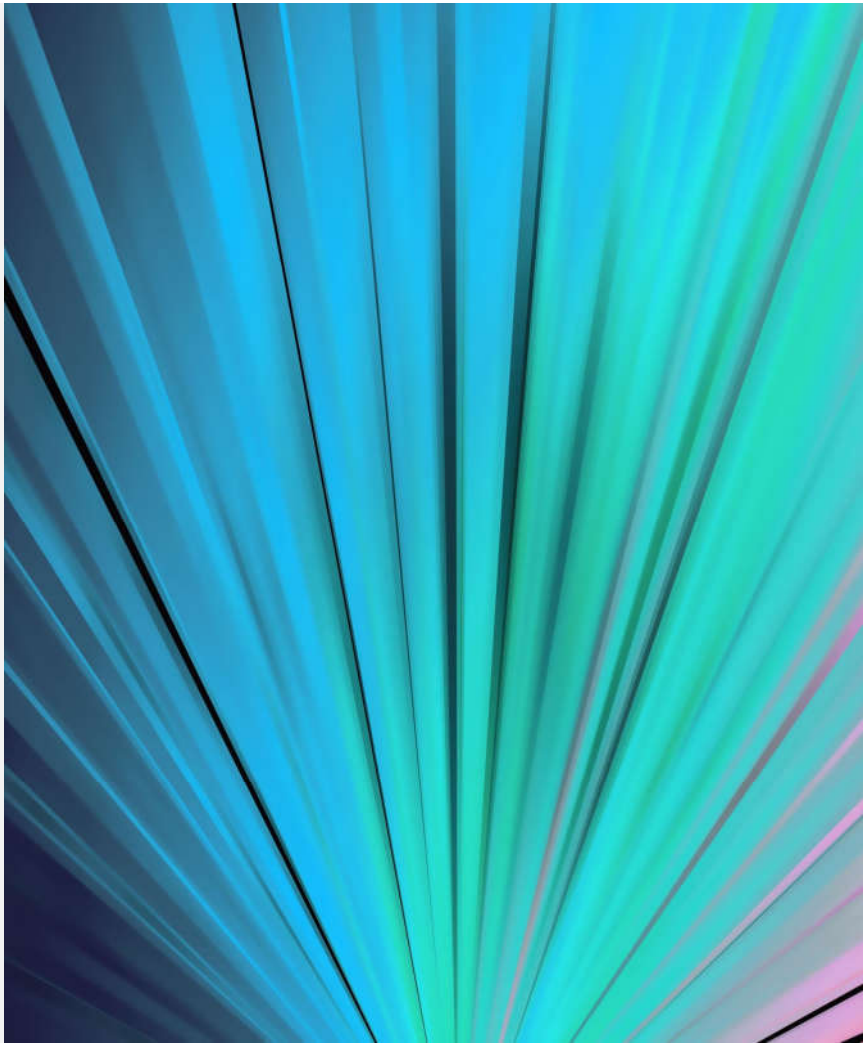
A novel method: Game-based assessment of dynamic personality

Jallu Lindblom
University of Tampere
Finland



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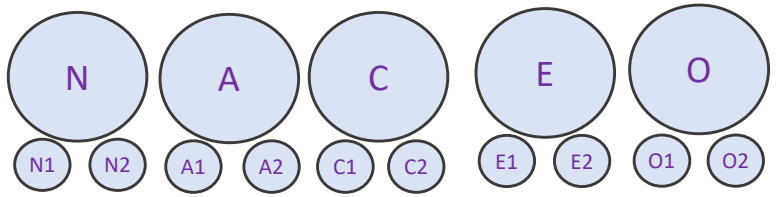
Personality and it's dynamics

- Traditional (or naïve) **trait-theory** conceptualizes personality as collection of relatively stable traits.
  - Neuroticism
  - Agreeableness
  - Conscientiousness
  - Extraversion
  - Openness

Big Five models have robust empirical support and provide economical model of behavioral tendencies and personality.



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Functions of the traits

Cybernetic Big Five (DeYoung, 2015)

- Individual differences in the traits have evolved to solve problems typical for human species
- As such, the traits are "aim/goal oriented" in the sense of increasing survival (e.g., dangers) and reproduction (e.g., social life)

N	Defensive responses to avoid **dangers and hazards**. *Costs in terms of health and relationships problems.*
A	**Collaboration** and avoidance of interpersonal hostility. *Costs in terms of potential exploitation.*
C	Self-control favoring **long-term goals**. *Costs in terms of increased rigidity.*
E	High **reward sensitivity** and sensation seeking. *Costs in terms of risk taking and dangers.*
O	**Cognitive style** involving making associations between disparate domains. *Costs in terms of impractical beliefs.*

Adapted from: Nettle 2006; DeYoung, 2015

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Personality and situations

Mischel & Shoda (1995): Cognitive-Affective Personality Systems (CAPS)

- Person x Situation –interactions are central to personality rather than assuming the traits to be expressed similarly in all situations
- One's "personality signature" can be captured by assessing *If.. Then..* contingencies

Taxonomies of situations (Asendorph & Rauthmann, 2020)

- Most models propose six situation chartacteristics that can evoke trait related responses

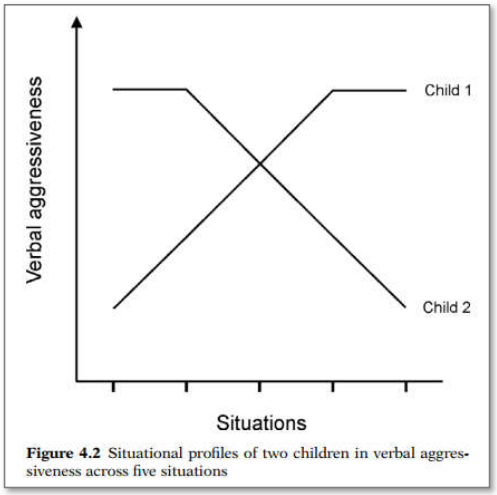

Figure 4.2 Situational profiles of two children in verbal aggressiveness across five situations

(From Asendorpf & Rauthmann (2020)

Threat(-A) Stress(+N) Tasks(+C) Processing(+O) Fun(+E) Mundane(?)

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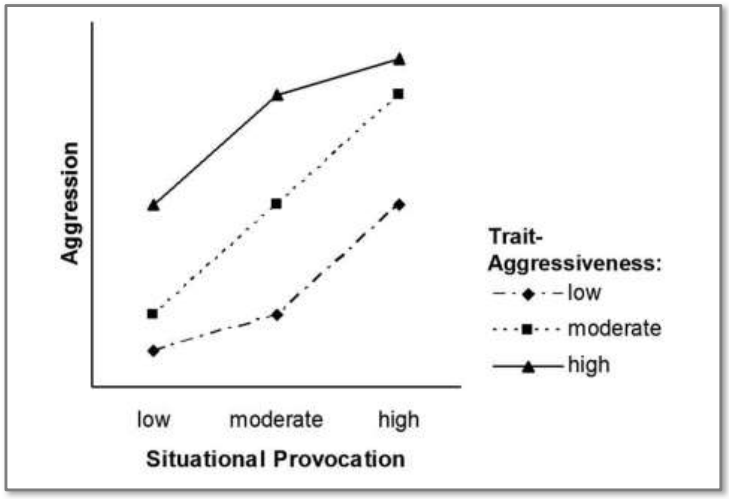
From traits and situations to behaviors

Nonlinear Interaction of Person and Situation model (NIPS; Schmitt et al., 2013)

- Traits strengthen the impact of situational provocation on behaviors (and vice versa)
- There can be “low”, “moderate” or “high” provocation
  - In the *extreme situations* the situation is the primary determinant of behavior
  - In *moderate situations* the personality is the determinant of personality



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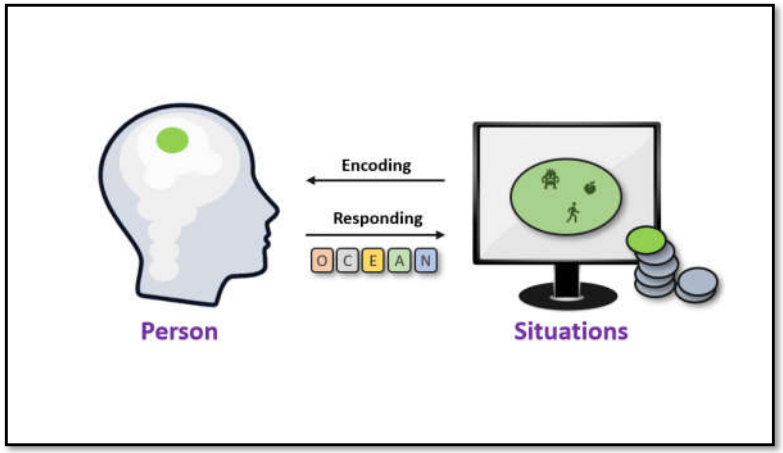
Game-based assessment?

- It is a challenge for research to assess persons over multiple situations
  - Data collection is burdensome
    → Small samples
  - Difficult to control situation selection
  - Narrow range (evolutionary history VS current style of life)
- Most existing experimental methods focus on very narrow aspects of behavior (e.g., attention)
- Some game-based assessment approaches aim to measure traits (e.g., McCord et al, 2019) but none the person x situation -interactions

→ Need for a new method!



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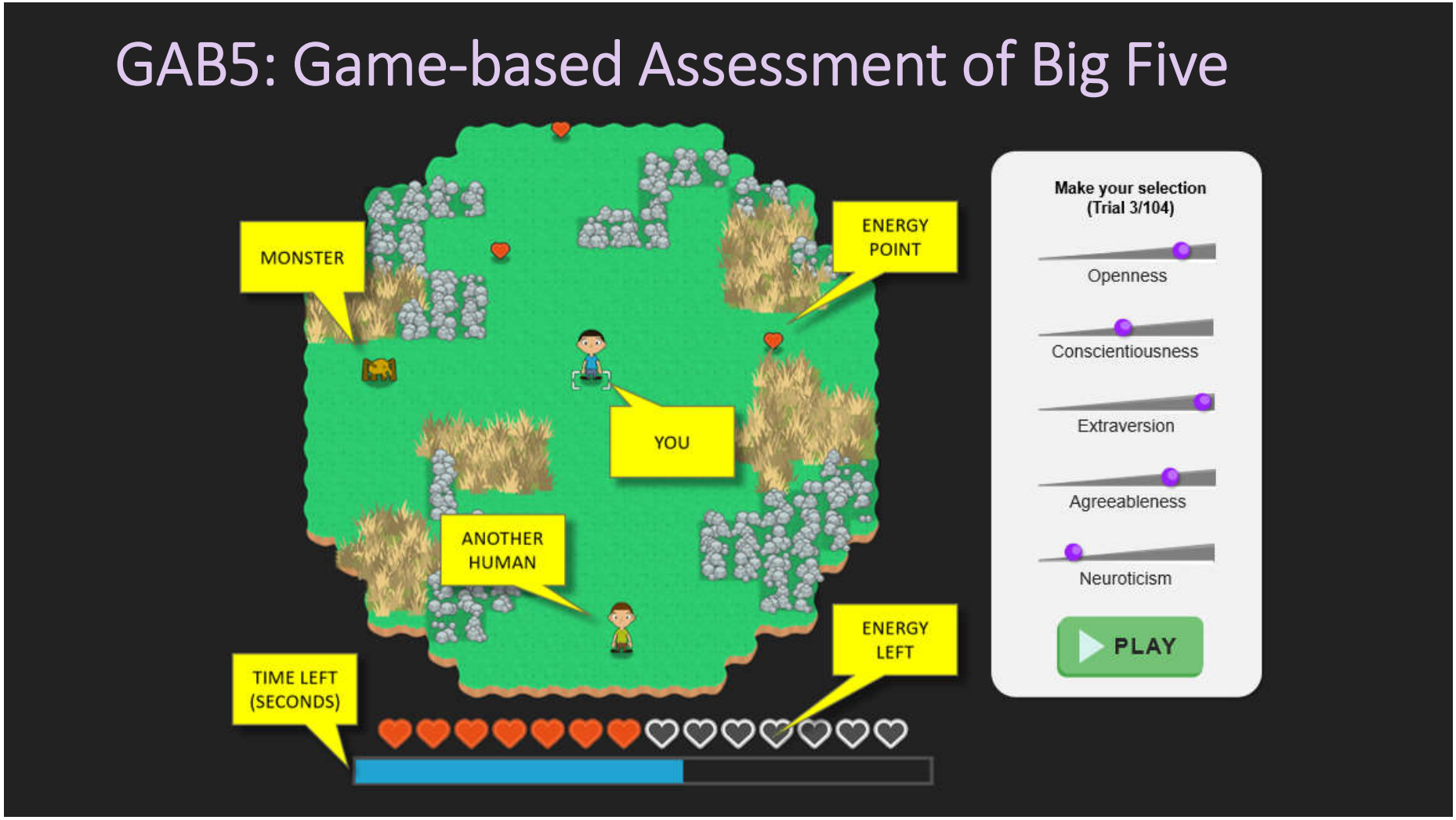
GAB5: Game-based Assessment of Big Five



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Experimental design

Three experimental factors
balance randomized in the trials

- Number of monsters (0-4)
- Number of other humans (0-4)
- Number of energy (0-5)

High number of repetitions
of varying trials, e.g. 104 situations

- Duration max 13-20 seconds
  (some played “blinded” to save time)

Randomly generated fields
(spatial configurations and terrain)

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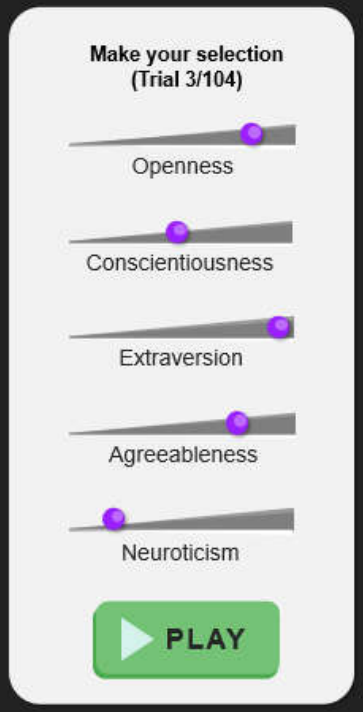
Instructions for the participants

The player is instructed to stay alive and collect energy

- The game is presented as problem solving task (not to “have fun”)
- Each trial gains 0 to 1000 scores as a feedback

The player does not have real time control of the game character!

- In the beginning of each round the player defines the Big Five personality traits of own game character



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Instructions for the participants

Your character with …

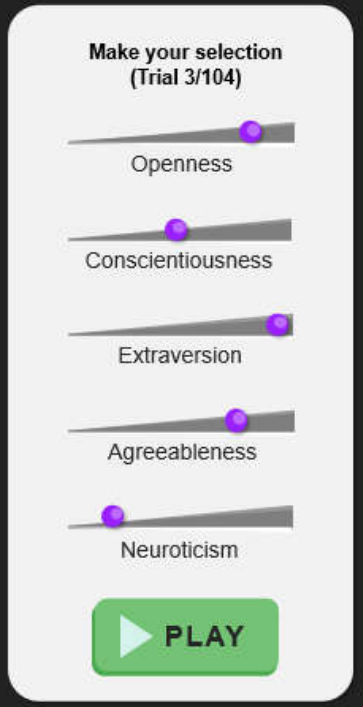
OPENNESS
- … high O reacts to and considers things that are far from themselves. They also actively explore their environment.
- … low O focuses only on their immediate surroundings.

CONSCIENTIOUSNESS
- … high C sticks to their decisions and goals.
- … low C can be absent-minded but responds quickly to changing situations.

EXTRAVERSION
- … high E approaches things that provide or can provide energy with enthusiasm.
- … low E does not get excited about much and may prefer being alone.

AGREEABLENESS
- … high A willingly cooperates with others and acts kindly.
- … low A may attack others and act deceitfully in cooperative situations.

NEUROTICISM
- … high N is fearful, easily angered, and prone to fighting.
- … low N is calm, fearless, and unconcerned about dangers.



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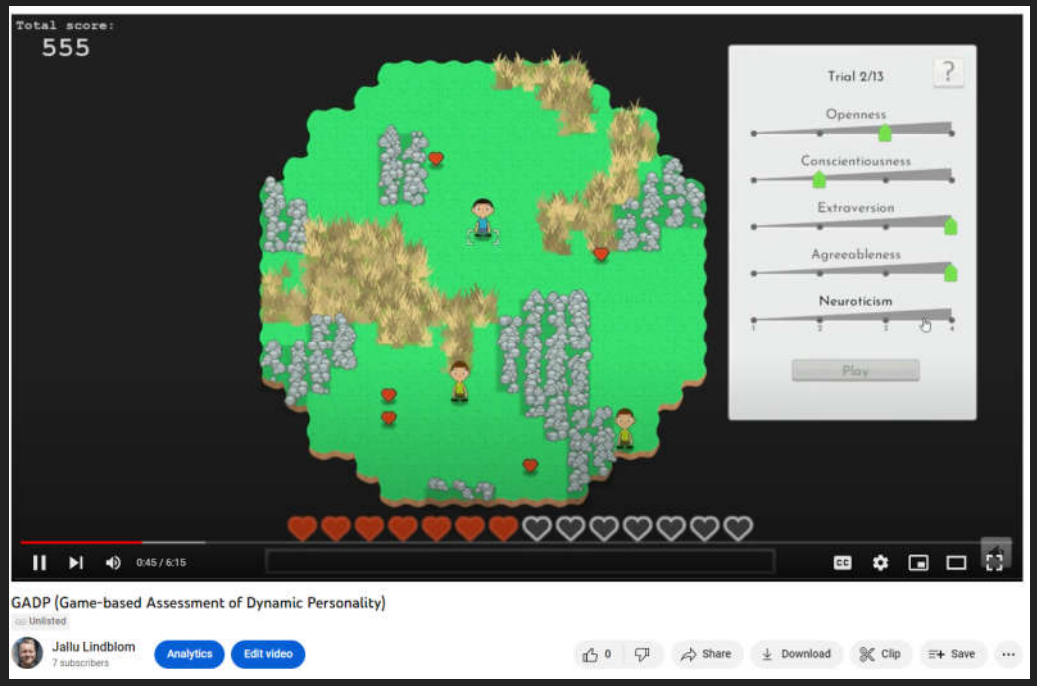

https://youtu.be/ze-vvWLQnMU

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Pilot study - How B5 traits associate with game responses in GAB5?

RQ1: Do individual differences in B5-traits predict average level B5-responses?

RQ2: Do experimentally controlled game situations (monsters, humans, energy) evoke B5-responses?

RQ3: Do B5-traits and game situations interact to predict B5-responses?

Trait hypothesis:
Traits correlate with the corresponding behaviors (e.g., A-trait → A-responses).

Situation hypothesis:
Situations evoke the corresponding behaviors (e.g., Monsters → +N responses).

Situation x Person hypothesis:
Situations and traits interact to predict behaviors. (e.g., Monsters * N-trait → N-responses)

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Study design and participants

Participants

- N = 165 university students
- Age: M = 23.5, range: 19 - 56
- 76% female

Self-reported B5 traits

- Big Five Aspects Scale (IPIP-pool)
- Cronbach's alphas for N = .90, A = .85, C = .87, E = .89, O = .80.
- DeYoung, C. G., Quilty, L. C., & Peterson, J. B. (2007). Between facets and domains: 10 aspects of the Big Five. Journal of Personality and Social Psychology, 93, 880-896.

Game-based Assessment of Big Five (GAB5 v1.0 with Gameset 1.0)

- 104 trials (50% small & 50% large)
- Randomized: humans, monsters, energy
- Participants played from home using web-browser

- GAB5 is freely available from: https://projects.tuni.fi/game-based-assessment

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RQ1: Do B5-traits correlate with B5-responses?

GAME RESPONSES

TRAITS	Neuroticism			Agreeableness			Conscientiousness			Extroversion			Openness		
	B	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*
Trait (corresponding trait)	-0.02	0.01	0.122	0.05	0.01	<.001	0.02	0.01	0.047	0.07	0.01	<.001	-0.03	0.01	<.001
Trait, controlling for other traits	-0.02	0.01	0.045	0.05	0.01	<.001	0.01	0.01	0.670	0.08	0.01	<.001	-0.04	0.01	<.001
	No.			Yes!			No.			Yes!			What!?		

Results from Linear Mixed Model (with AR1). Sex, age and previous gaming experiences were used as a covariate.

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RQ2: Do the game situations influence B5-responses?

GAME RESPONSES

	Neuroticism			Agreeableness			Conscientiousness			Extroversion			Openness		
	B	*F*	*p*	*B*	*F*	*p*	*B*	*F*	*p*	*B*	*F*	*p*	*B*	*F*	*p*
Monsters	0.18	335.58	<.001	-0.14	40.40	<.001	-0.18	128.67	<.001	-0.19	127.62	<.001	-0.10	80.54	<.001
Humans	-0.17	68.09	<.001	0.17	363.50	<.001	-0.03	9.08	<.001	0.15	75.13	<.001	0.11	17.07	<.001
Energy	-0.04	8.16	<.001	-0.02	2.38	0.036	0.16	167.16	<.001	0.10	68.71	<.001	0.15	115.86	<.001

Results from Linear Mixed Model (with AR1). Sex, age and previous gaming experiences were used as a covariate. Note: F and p values are from LMM using the game situations as factors. For simplicity, b values are from LMM using the the game situations as covariates (assuming linear effects, which is unrealistic assumption)

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RQ2: Do the game situations influence B5-responses?

GAME RESPONSES

	Neuroticism			Agreeableness			Conscientiousness			Extroversion			Openness		
	B	*F*	*p*	*B*	*F*	*p*	*B*	*F*	*p*	*B*	*F*	*p*	*B*	*F*	*p*
Monsters	0.18	335.58	<.001	-0.14	40.40	<.001	-0.18	128.67	<.001	-0.19	127.62	<.001	-0.10	80.54	<.001
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Energy	-0.04	8.16	<.001	-0.02	2.38	0.036	0.16	167.16	<.001	0.10	68.71	<.001	0.15	115.86	<.001
Monsters x Humans	0.02	6.26	<.001	0.02	2.78	<.001	0.02	3.60	<.001	0.01	4.84	<.001	-0.01	5.67	<.001
Monsters x Energy	0.01	1.81	0.014	0.01	1.49	0.073	-0.01	3.44	<.001	0.00	2.90	<.001	-0.01	3.07	<.001
Humans x Energy	0.01	1.68	0.028	0.00	1.51	0.066	-0.02	3.48	<.001	-0.03	5.11	<.001	-0.03	4.58	<.001
Monsters x Humans x Energy	0.00	3.26	<.001	0.00	1.56	0.113	0.00	3.22	<.001	0.00	2.32	0.010	0.01	1.70	0.074

Yes! Both in simple and very complex ways ….

Results from Linear Mixed Model (with AR1). Sex, age and previous gaming experiences were used as a covariate. Note: F and p values are from LMM using the game situations as factors. For simplicity, b values are from LMM using the the game situations as covariates (assuming linear effects, which is unrealistic assumption)

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Clustering of the game situations to answer RQ3

Cluster 6 (22%)
- Average N A C E O
- Lots of other people
- Quite easy

"Social"

Cluster 5 (21%)
- +N -A
- Monsters and other people
- Difficult

"In trouble with others"

Cluster 4 (11%)
- +C
- Lots of everything
- Quite easy

"Focus on anything"

- neuroticism
- agreeableness
- conscientiousness
- extraversion
- openness

Cluster 1 (17%)
- +N -A -E -O
- Alone with monsters
- Difficult

"Alone in trouble"

Cluster 2 (12%)
- +C
- Monsters and food
- Quite easy

"Eat and fight"

Cluster 3 (17%)
- -N +C +E +O
- Lots of food
- Very easy

"Have fun"

Self-organizing maps (SOM) with 20 nodes using r-packages *kohonen* (Wehrens & Kruisselbrink, 2023) and *aweSOM* (Boelaert et al., 2022)

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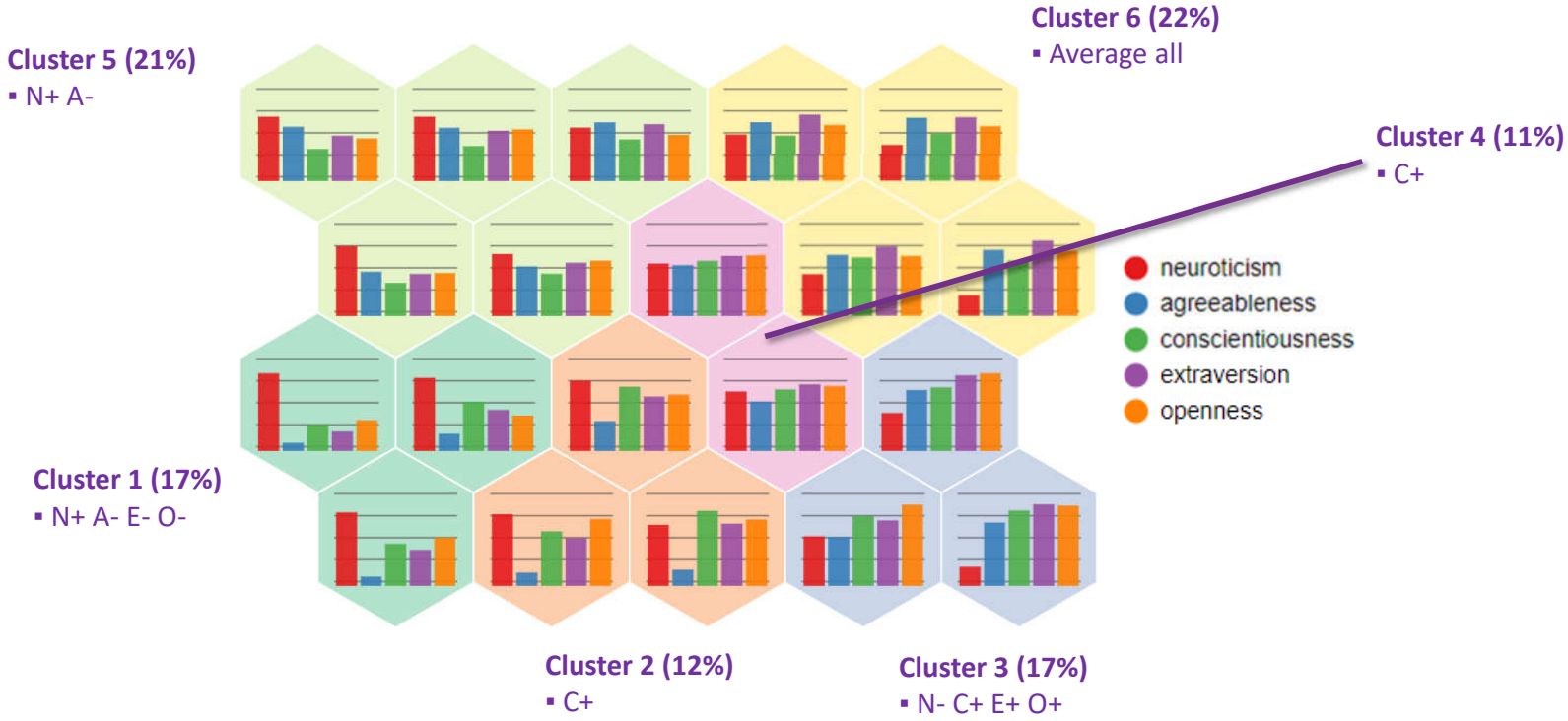
The B5 game responses with ±1SD in each group of trials



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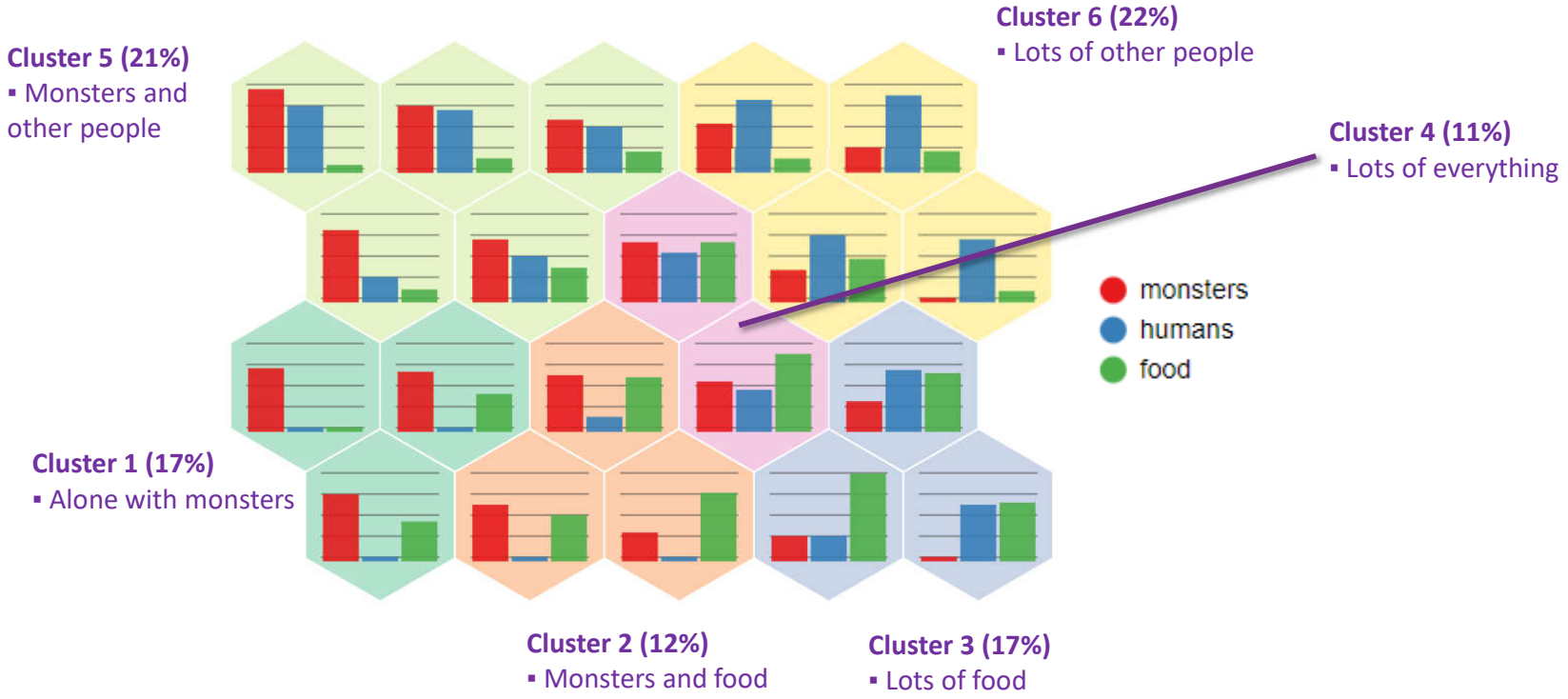
Game elements present in each group of trials



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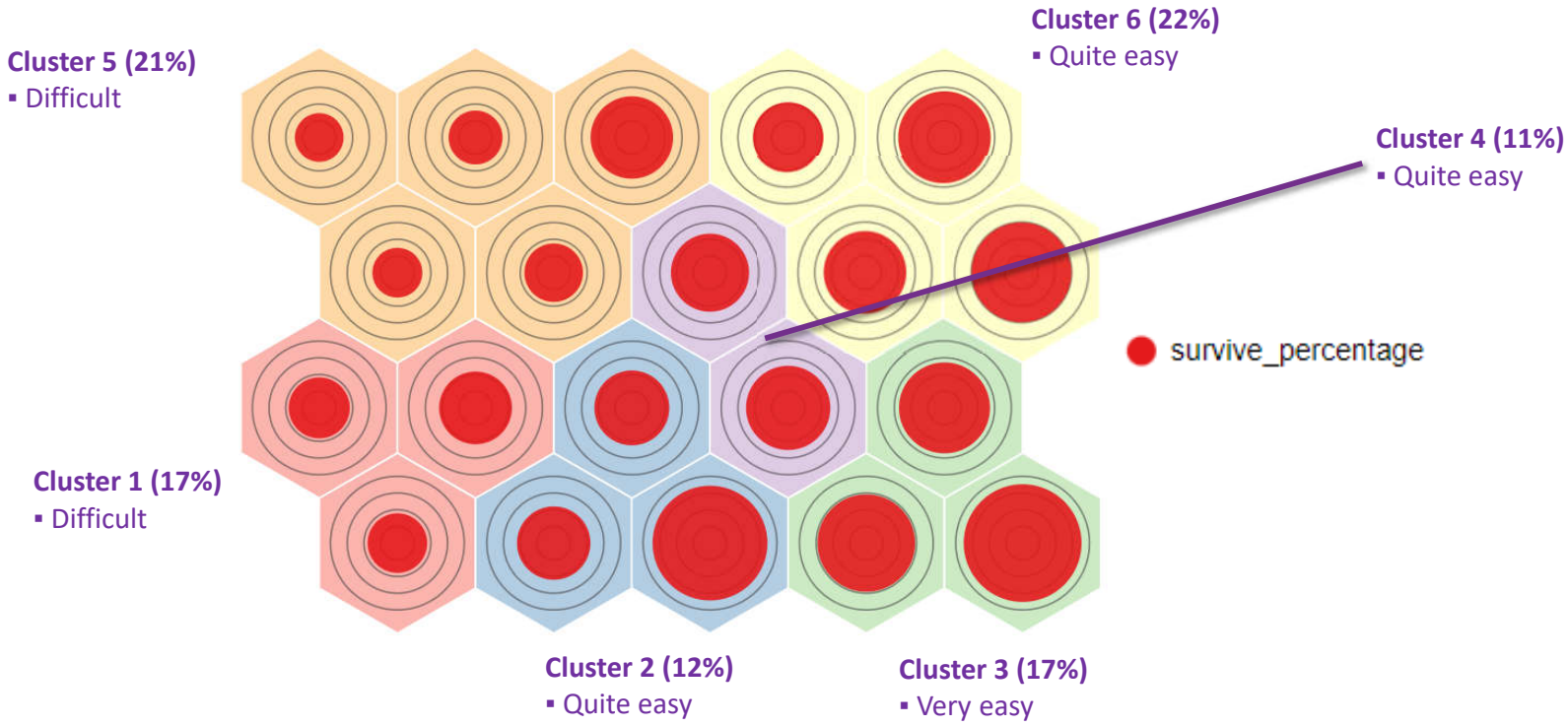
Survival percentages in each group of trials



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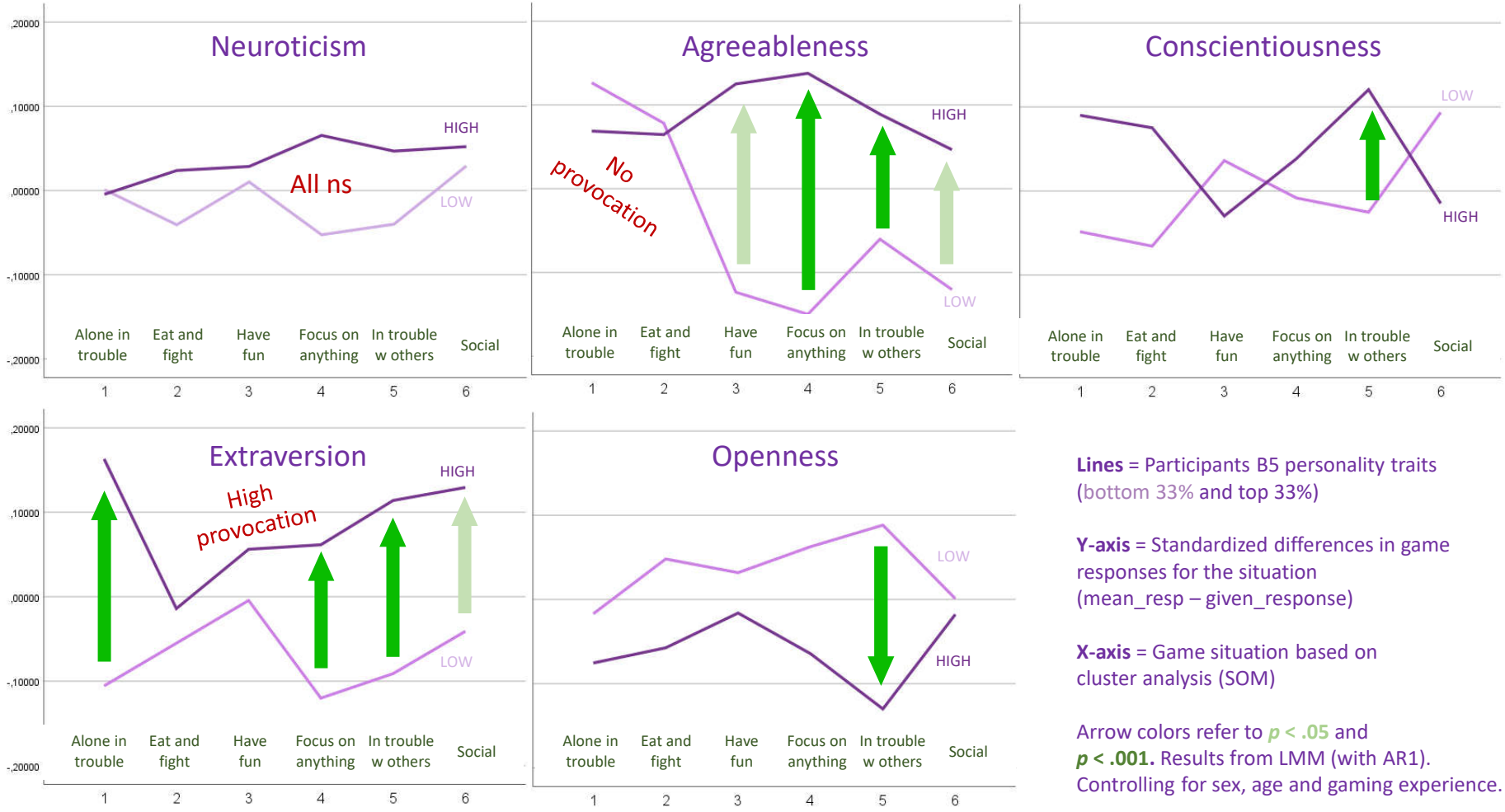

Lines = Participants B5 personality traits (bottom 33% and top 33%)

Y-axis = Standardized differences in game responses for the situation (mean_resp – given_response)

X-axis = Game situation based on cluster analysis (SOM)

Arrow colors refer to $p < .05$ and $p < .001$. Results from LMM (with AR1). Controlling for sex, age and gaming experience.

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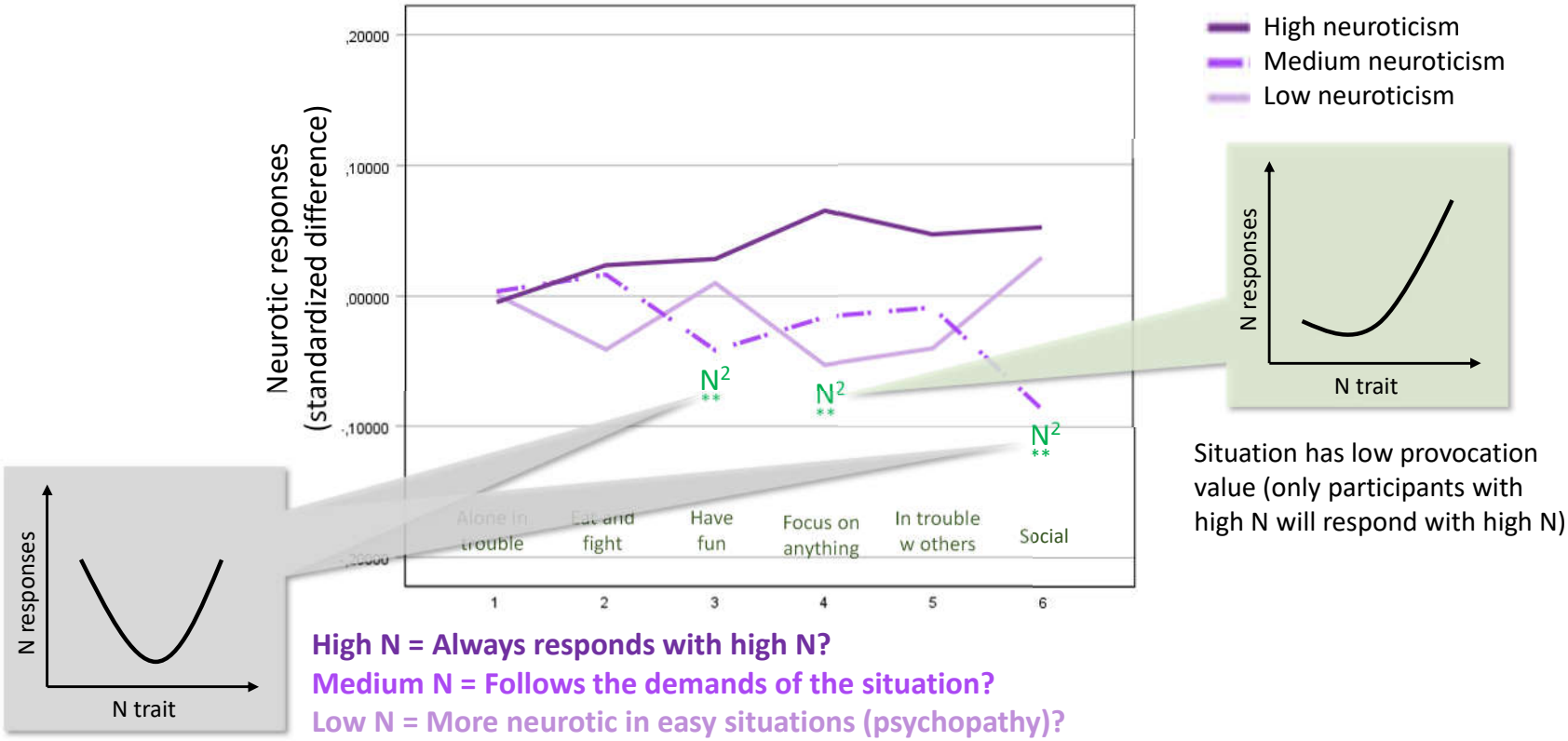
Perhaps the effects of *neuroticism* trait are nonlinear?



Situation has low provocation value (only participants with high N will respond with high N)

High N = Always responds with high N?

Medium N = Follows the demands of the situation?

Low N = More neurotic in easy situations (psychopathy)?

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Conclusions I

These first pilot results provide support for the general hypothesis that GAB5 (and virtual environments in general) can be utilized to study Person x Situation interactions:

1. Positive correlations between self-reported Extraversion and Agreeableness and the corresponding game behaviors *(RQ1 & Trait hypothesis)*
    Yet, no association for Agreeableness or Extraversion
2. Theoretically meaningful effects of game-situations and Big Five related game responses *(RQ2 & Situation hypothesis)*
    Yet, the interaction effects were very complex → Cluster approach
3. While some of results were surprising, there were Situation x Trait interactions on game behavior *(RQ3 & Situation x Person hypothesis)*

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Conclusions II

- Self-reported B5 traits were expressed very differently
  - I) Trait expression *not applicable* (e.g., agreeableness and no others presents)
  - II) Individual differences in trait expression did not emerge due to *strong situational provocation* (e.g., extraversion and no effects in “have fun” situation)
  - III) Nonlinear expression of the trait due to *low provocation* (e.g., only very high neuroticism led to expression of neurotic responses in “focus on anything” situation)
- Surprising results in need of further research: Openness
  - High openness → Low openness game responses
  - Is openness response defined correctly in the game?
    = “Wide range of seeing and potentially responding to game objects”
  - Perhaps openness trait is more like a sensitivity factor and moderates responses to the situations?

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Limitations and further research

- The focus was narrow and neglected e.g., *response distributions* and more detailed analysis of the *experimental factors*
  - Need to consider nonlinearity of the PxS interactions!
  - Cross-trait effects may also be evident!
  - More complex and organized B5 response patterns?

Further validation of GAB5 is needed

  - How the game parameters, presented problems and elements shape the results …

- Conceptual paradox: How the traits (nondynamic) relate to contextual behavior (dynamic?)
  - Further validation is required using e.g., experimental designs and diary/EMA methods
- New avenues? Applications to study psychopatology (e.g., depression), attachment and psychopathy – using B5 responses as a universal language!

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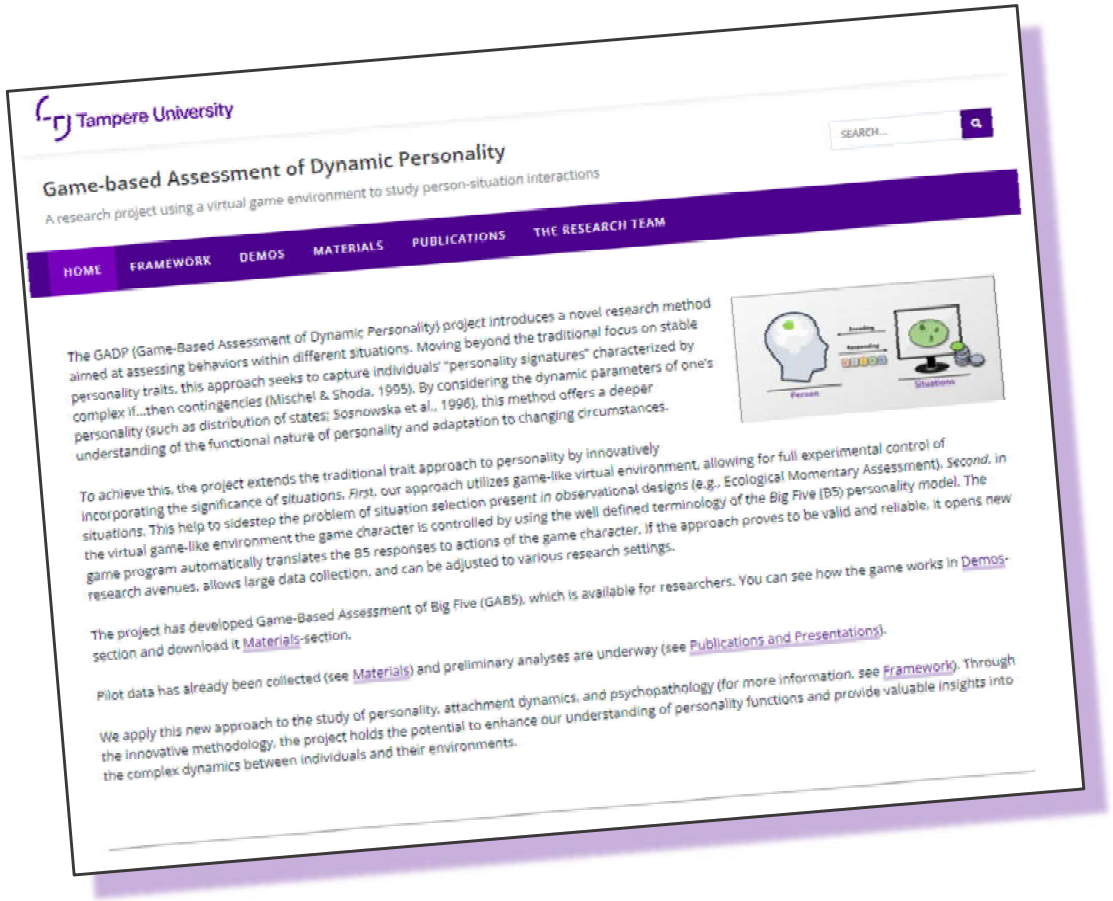
Thank you
for your attention!

jallu.lindblom@tuni.fi



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