Master Thesis

Breakfastclub

How Personality Traits effect attention and happiness in a simulated classroom

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How different personalities effect classroom attention and happiness?

Master Thesis - Objectives

- Develop a deterministic closed loop classroom simulation
- Base agent behavior on establish personality trait model
- Compare how different personality profiles effect individual agent and group behavior

Content

- What is an Agent based model?
- How to derive agent behavior from a personality trait model?
- The Simulation
- Experiment & Results

Agent based models

An **agent-based model (ABM)** is a class of computational models for simulating the actions and interactions of autonomous agents (both individual or collective entities such as organizations or groups) with a view to assessing their effects on the system as a whole.

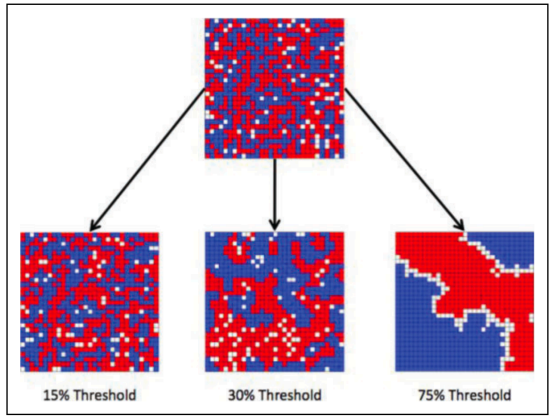
- Wikipedia

Applied in various fields

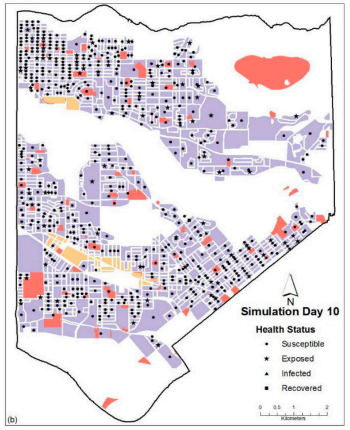
- Biology (e.g. epidemics)
- Economics (e.g. Stock Trade)
- Social Studies (e.g. Social Networks)

Agent based models - Examples

Thomas Schelling's (1971) – Social Segregation [1]



Perez (2009) – Contagious disease spread [2]

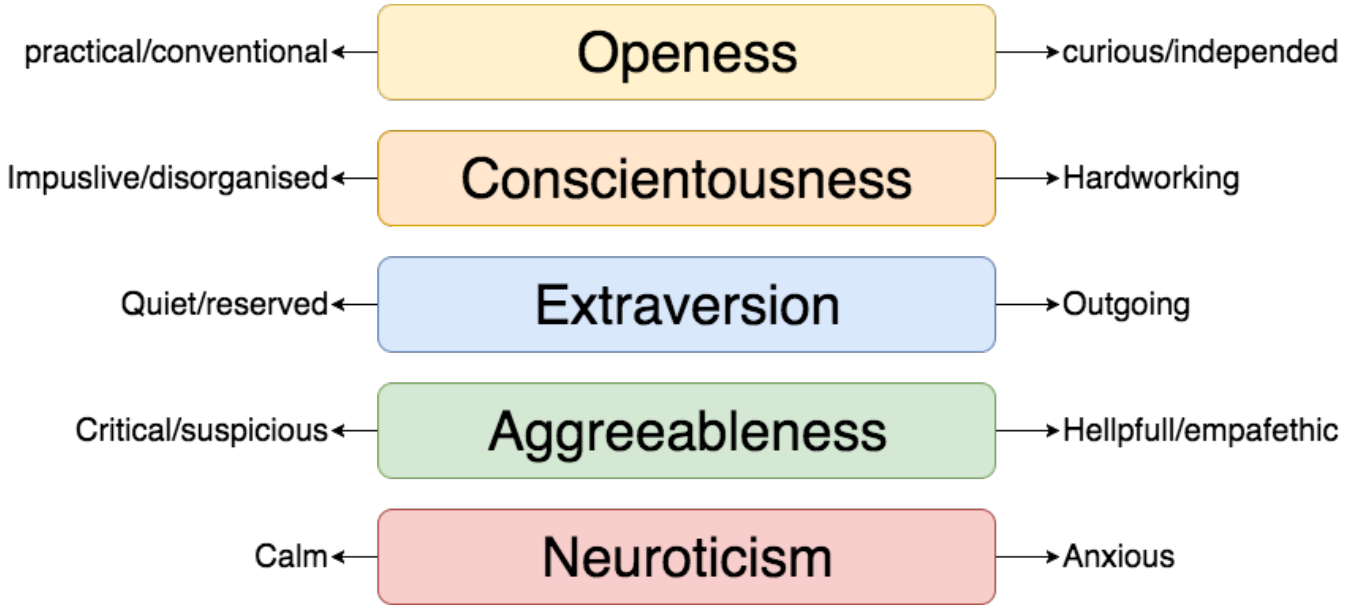


[1] Schelling, T. C. (1971). Dynamics Model of Segregation. *Journal of Mathematical Sociology*, *1*(May 1969), 143–186.
[2] Perez, L., & Dragicevic, S. (2009). An agent-based approach for modeling dynamics of contagious disease spread. *International Journal of Health Geographics*, *8*(1), 1–17. https://doi.org/10.1186/1476-072X-8-50

Which personality trait model to use?

Big Five – Personality Trait Model

OCEAN or Big Five is a widely used empirical model, applied in theoretical and practical settings[1].



[1] Norman, W. T. (1963). Toward an adequate taxonomy of personality attributes. *Journal of Abnormal and Social Psychology*, *66*(6), 574–583. https://doi.org/10.1037/h0040291

Big Five in the classroom

- Empirical studies show how the big five effect the behavior or children in the classroom [1]
- On school achievements and outcome [2]
- Big Five in children with ADHD [3]

[1] Ehrler, D. J., Evans, J. G., & McGhee, R. L. (1999). Extending Big-Five theory into childhood: A preliminary investigation into the relationship between Big-Five personality traits and behavior problems in children. *Psychology in the Schools*
[2] Asendorpf, J. B., & Van Aken, M. A. G. (2003). Validity of Big Five Personality Judgments in Childhood: A 9 Year Longitudinal Study. *European Journal of Personality*, *17*(1), 1–17. https://doi.org/10.1002/per.460
[3] Nigg, J. T., Blaskey, L. G., Huang-Pollock, C. L., Hinshaw, S. P., John, O. P., Willcutt, E. G., & Pennington, B. (2002). Big five dimensions and ADHD symptoms: Links between personality traits and clinical symptoms. *Journal of Personality and Social Psychology*, *83*(2), 451–469. https://doi.org/10.1037/0022-3514.83.2.451

How to build a agent based model of a virtual classroom based on the Big Five?

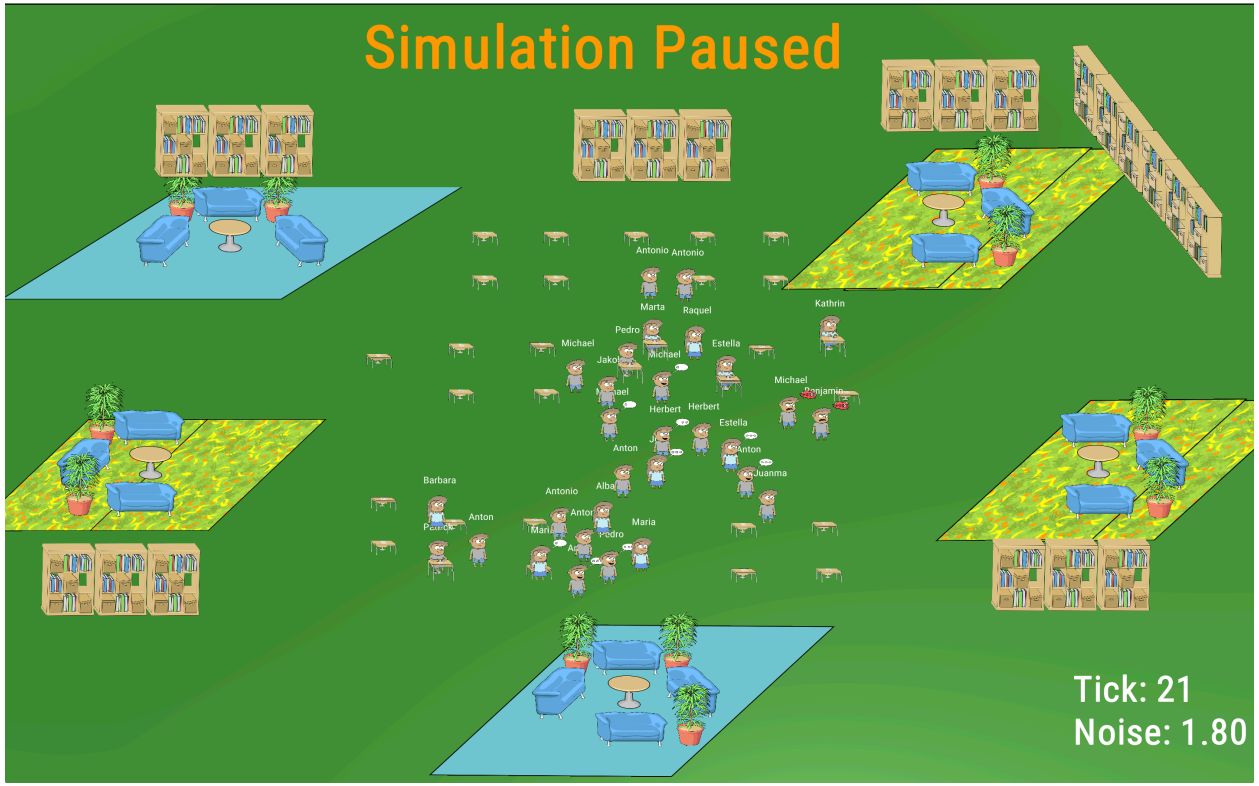
Agent based models

Main Components

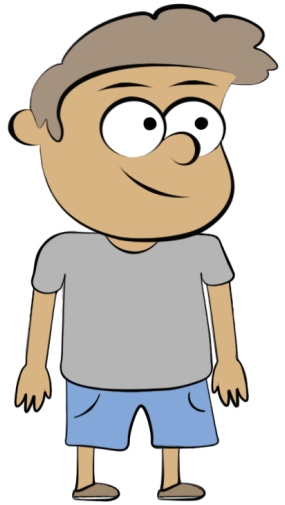
- Environment (i.e. define the classroom)
- Agents (i.e. possible behavior and characteristics)
- Logic (i.e. how to select and control behavior)

Environment

- Number of Students
- Individual/Group tables



The Agents



Personality

- Openness
- Conscientiousness
- Extraversion
- Agreeableness
- Neuroticism

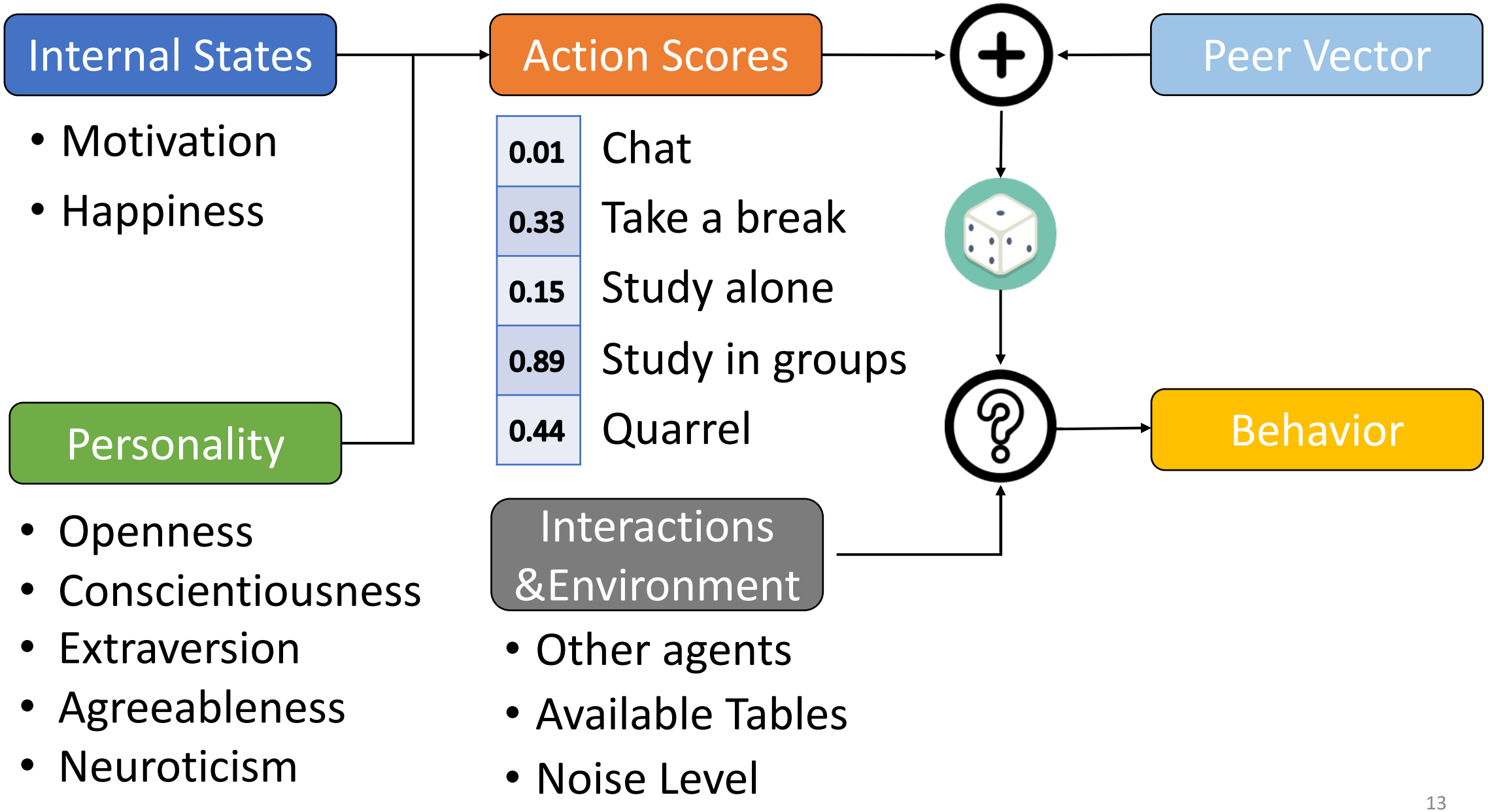
Internal States

- Motivation
- Happiness
- Attention

Behavior

- Chat
- Take a break
- Study alone
- Study in groups
- Quarrel

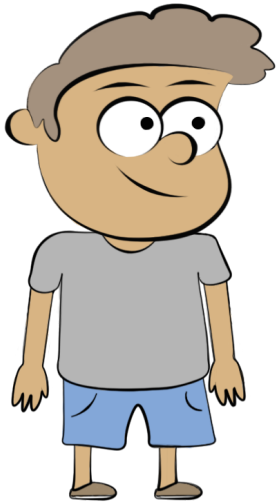
Logic


Internal States
• Motivation
• Happiness
Personality
• Openness
• Conscientiousness
• Extraversion
• Agreeableness
• Neuroticism
Action Scores
0.01 Chat
0.33 Take a break
0.15 Study alone
0.89 Study in groups
0.44 Quarrel
Interactions &Environment
• Other agents
• Available Tables
• Noise Level
Peer Vector
Behavior

Influences on Agent Behavior

Internal States

Environment

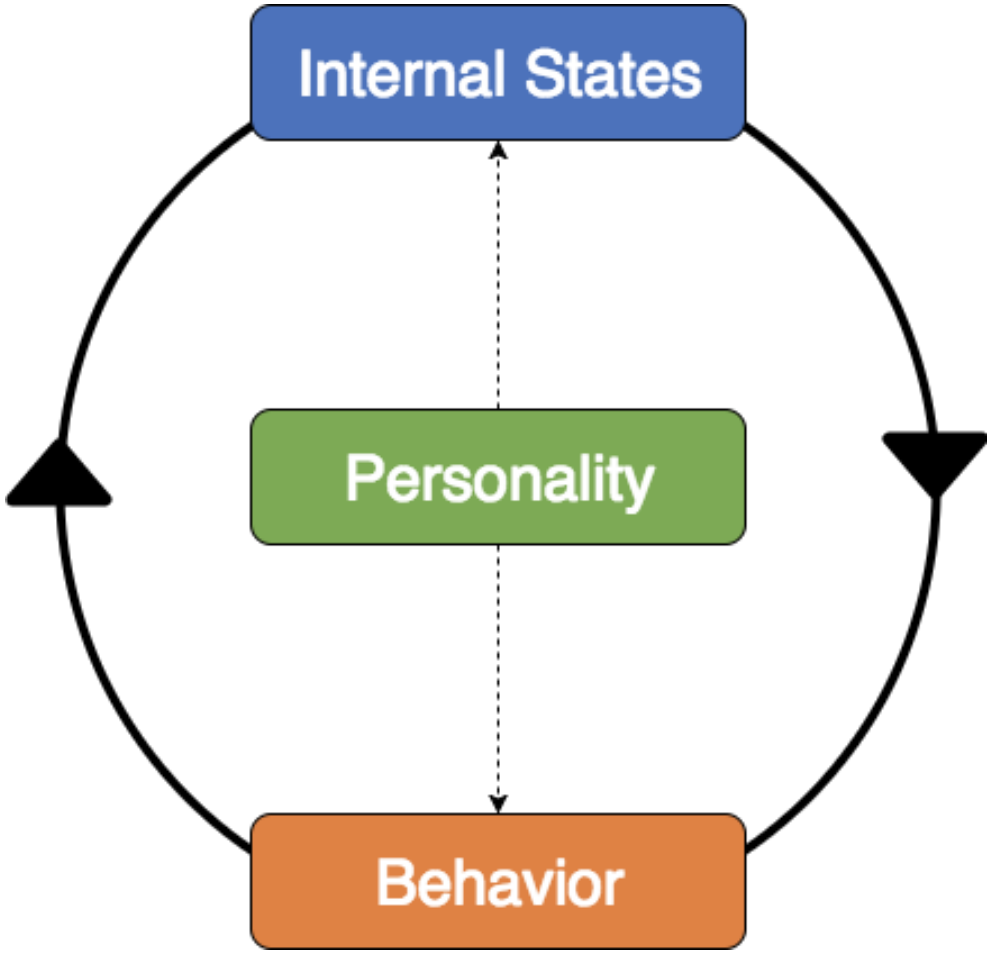


Peer Pressure

Interactions

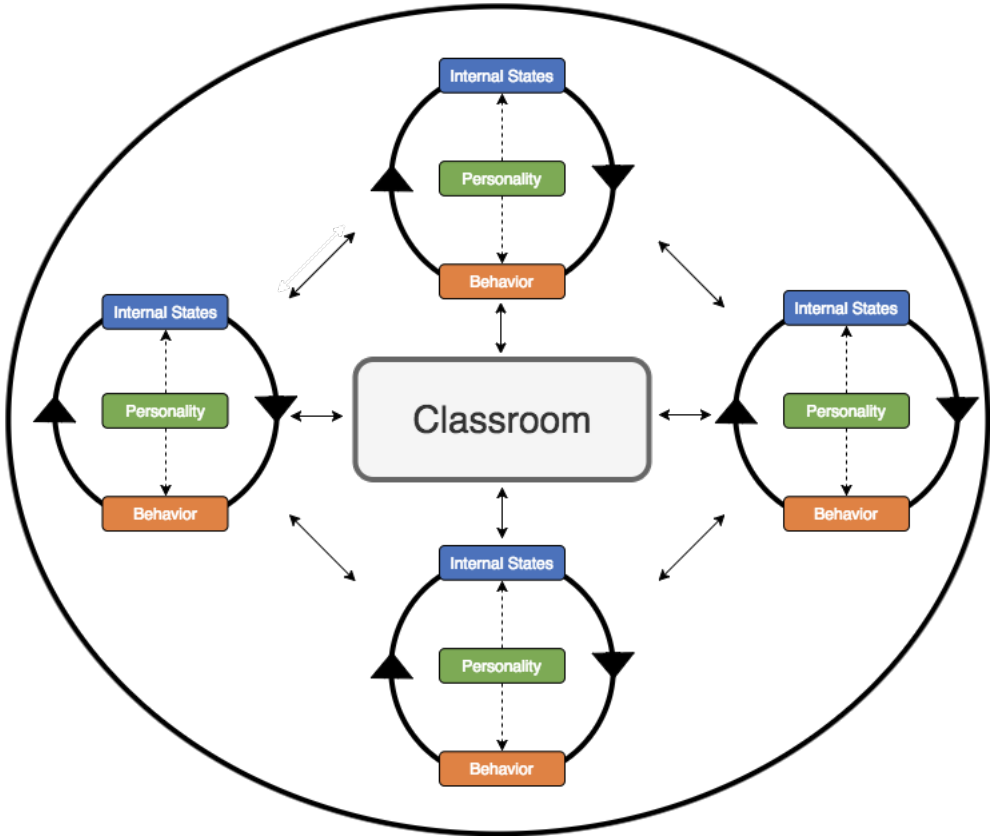
Agent Dynamics

- Each Agent is a dynamic system
- Parameterized by its Personality Traits
- Internal States guide and are altered by Agents Behavior



Group Dynamics

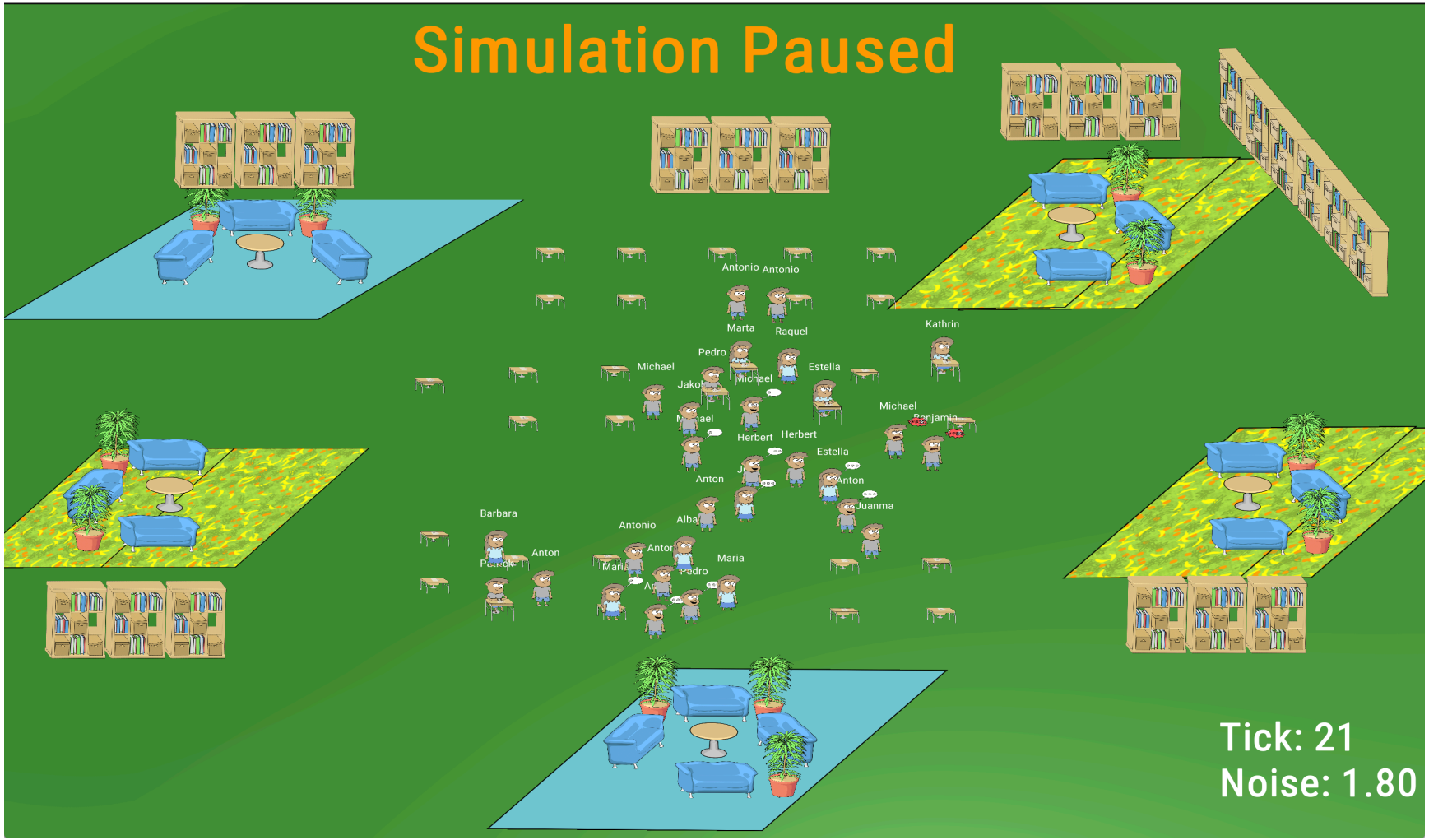
- Agents interact with each other and the environment
- Group dynamics emerge from agent interactions
- Different Agent Profiles have different Group dynamics



The Simulation

Simulation - Breakfastclub

- Agent based model implemented in Unity3D
- Agent behavior is based on OCEAN (Big Five) Personality Trait model
- Models attention, happiness and motivation



Three phase Analysis

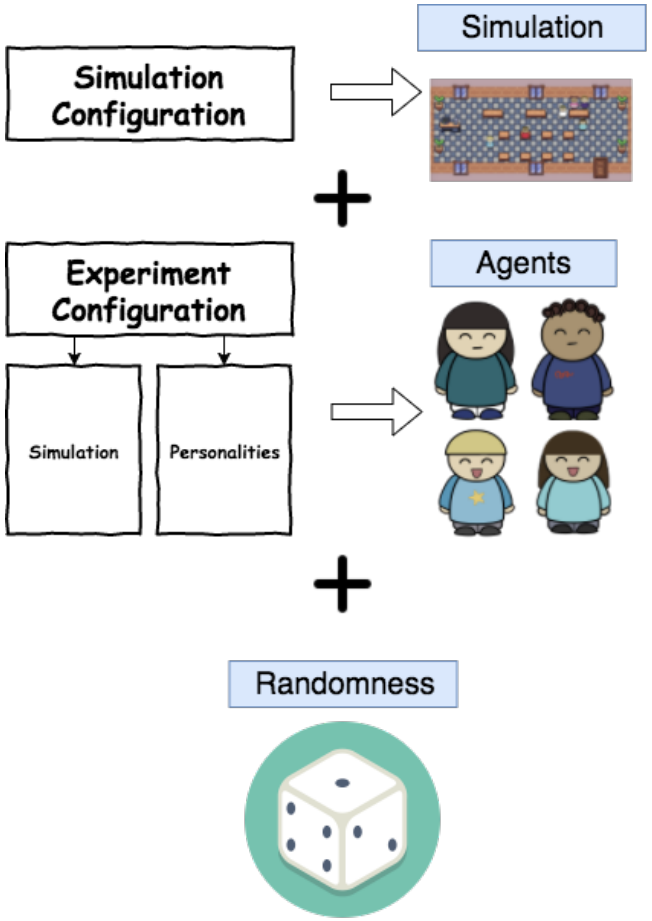
What is the behavior of one set of agents?

What is the average happiness and attention of a combination of personalities?

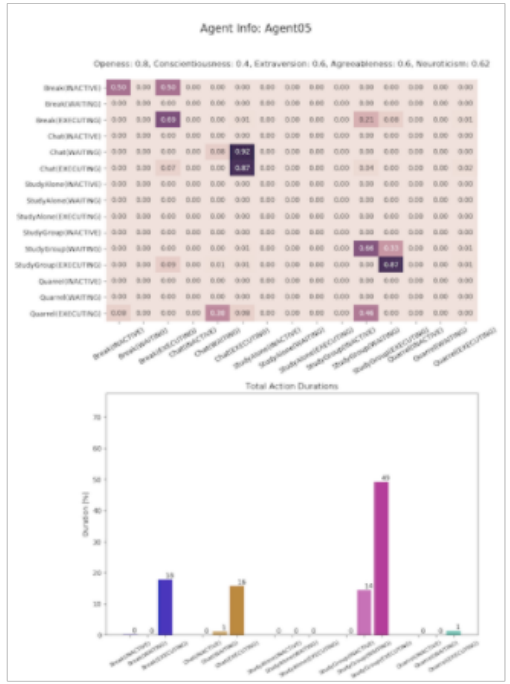
How do different personality combinations compare to each other?

Simulation

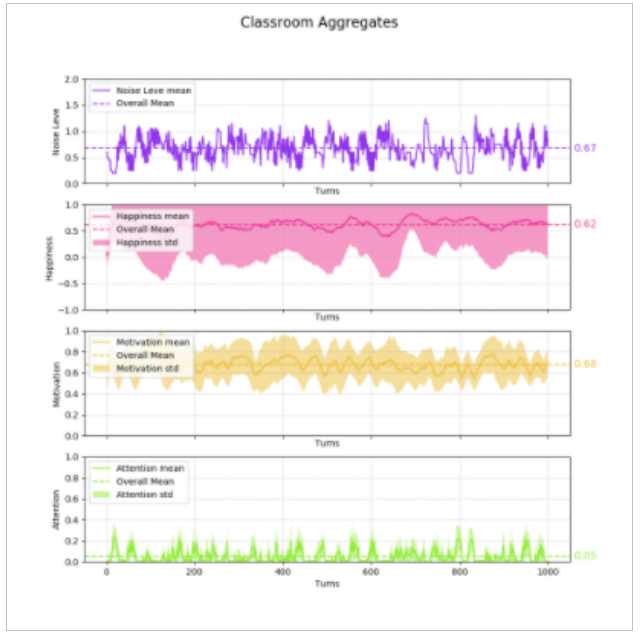
What is the behavior of one set of agents?



Agent Info

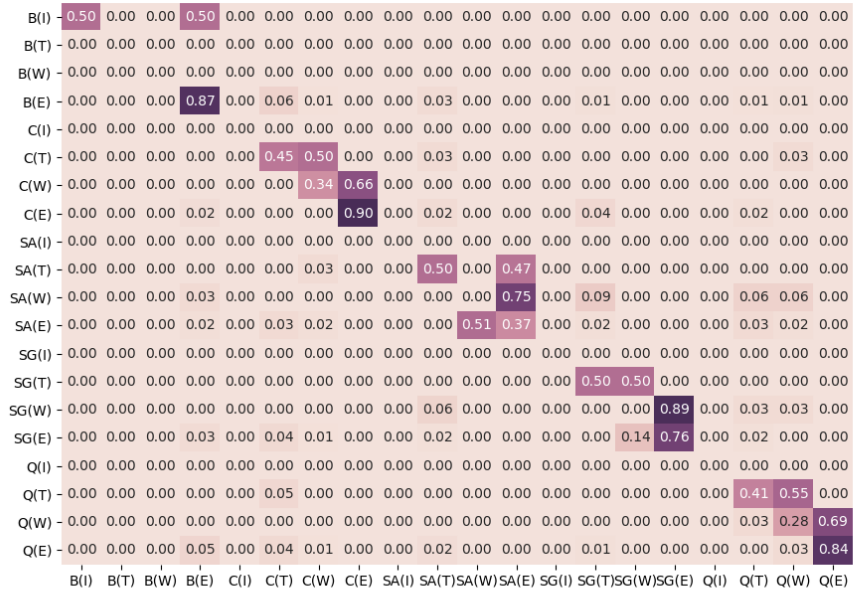


Classroom Info

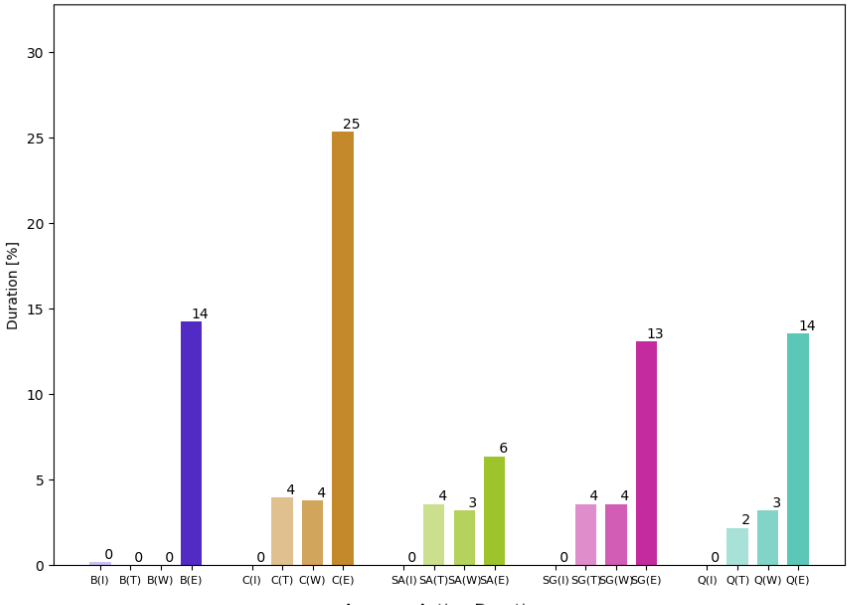


Agent Info

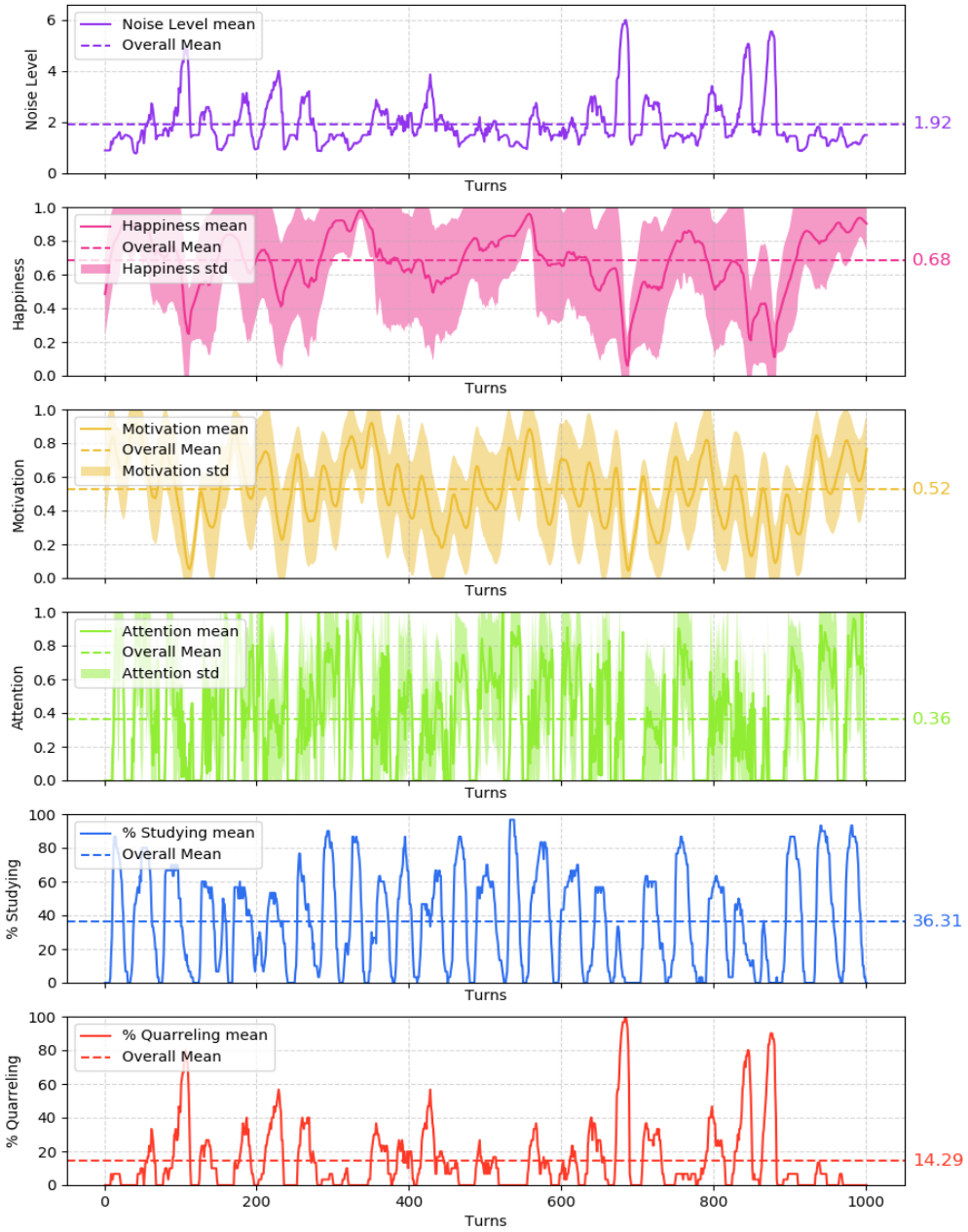
Normal: Openness: 0.75, Conscientiousness: 0.6, Extraversion: 0.55, Agreeableness: 0.65, Neuroticism: 0.5



Total Action Durations



Classroom Info



Experiment

What is the average happiness and attention of a combination of personalities?

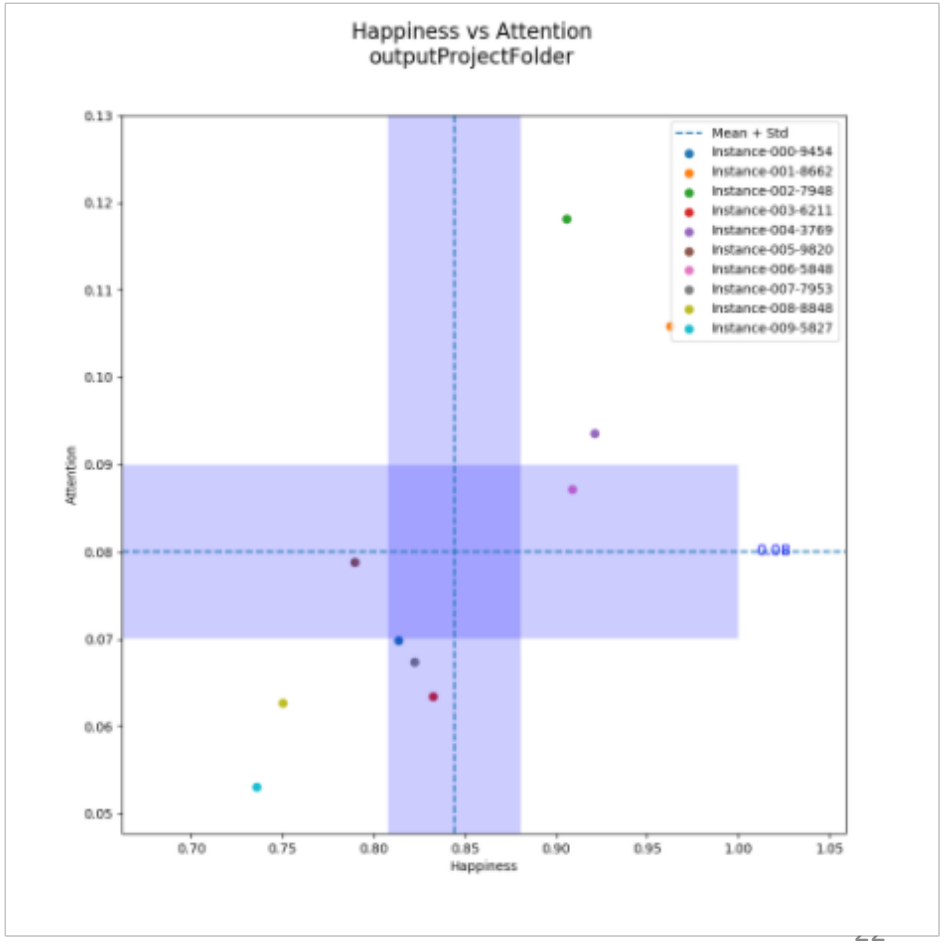
Simulation

+

Randomness

Batch Processing

Average



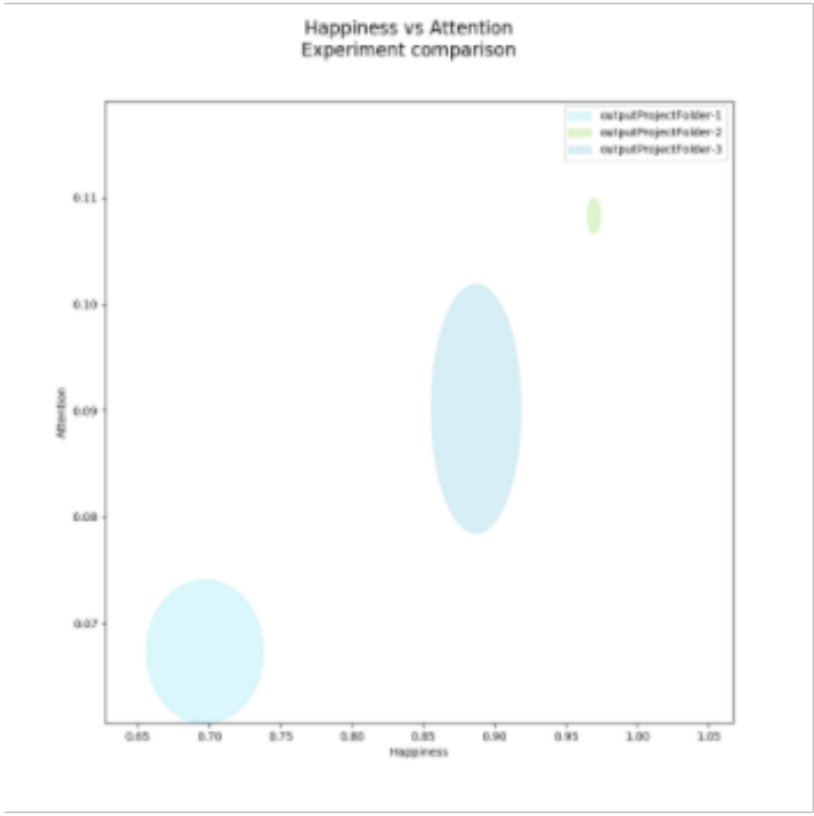
Study

How do different personality combinations compare to each other?

Experiment

Batch Processing

Group comparison



How different personalities effect classroom attention and happiness?

Experiment

1. Define different Student Types (Personality Trait Profiles)
2. Define Classrooms with different Student Type Distributions
3. Run multiple simulations per Classroom
4. Compare Classrooms

Agents and Classrooms

Personality Trait Profiles

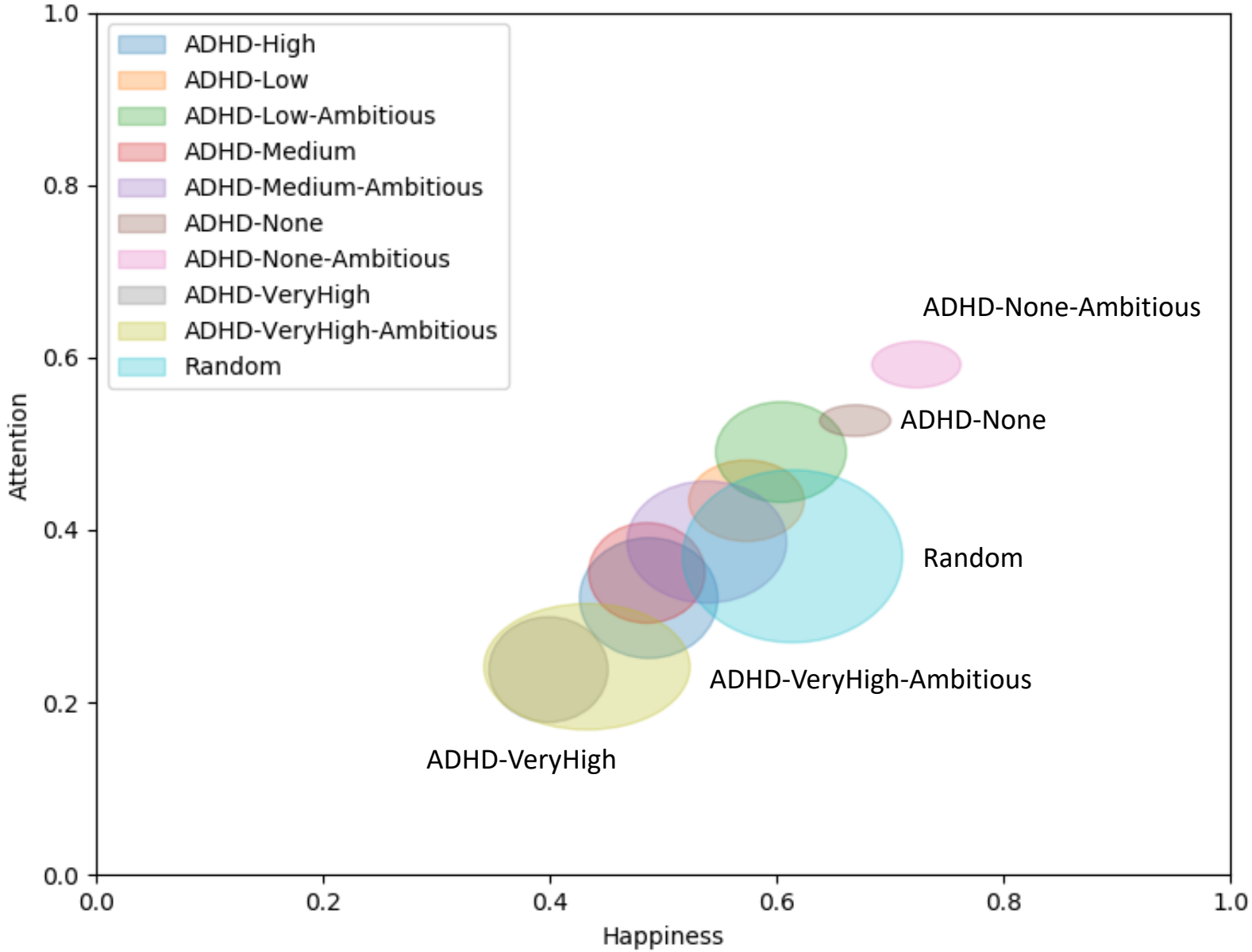
Student Type	O	C	E	A	N
ADHD [1]	RND	0.20	RND	0.20	0.80
Normal	0.75	0.60	0.55	0.65	0.50
Ambitious	0.80	0.80	RND	0.80	0.20
Random	RND	RND	RND	RND	RND

Classroom Profiles

Group	ADHD	Normal	Ambitious	Random
ADHD-Low	7%	93%	0%	0%
ADHD-Medium	17%	83%	0%	0%
ADHD-High	33%	66%	0%	0%
ADHD-VeryHigh	50%	50%	0%	0%
ADHD-None	0%	100%	0%	0%
ADHD-None-Ambitious	0%	50%	50%	0%
ADHD-Low-Ambitious	7%	46%	46%	0%
ADHD-Medium-Ambitious	20%	40%	40%	0%
ADHD-VeryHigh-Ambitious	50%	0%	50%	0%
Random	0%	0%	0%	100%

[1] Nigg, J. T., Blaskey, L. G., Huang-Pollock, C. L., Hinshaw, S. P., John, O. P., Willcutt, E. G., & Pennington, B. (2002). Big five dimensions and ADHD symptoms: Links between personality traits and clinical symptoms. *Journal of Personality and Social Psychology*, *83*(2), 451–469. https://doi.org/10.1037/0022-3514.83.2.451

Results


ADHD-High
ADHD-Low
ADHD-Low-Ambitious
ADHD-Medium
ADHD-Medium-Ambitious
ADHD-None
ADHD-None-Ambitious
ADHD-VeryHigh
ADHD-VeryHigh-Ambitious
Random
ADHD-None-Ambitious
ADHD-None
Random
ADHD-VeryHigh-Ambitious
ADHD-VeryHigh
Attention
Happiness
0.0
0.2
0.4
0.6
0.8
1.0

Result interpretation

1. ADHD and ambitious students, move average group happiness and attention in opposite directions
2. ADHD students have a far strong effect on the group than ambitious students

Conclusion

1. Breakfastclub implements an agent based model of a virtual classroom
2. Agent and group behavior is strongly effected by Personality Profiles
3. Simulating different classrooms profiles produce consistent behavior

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Thank you

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(Supervisor)

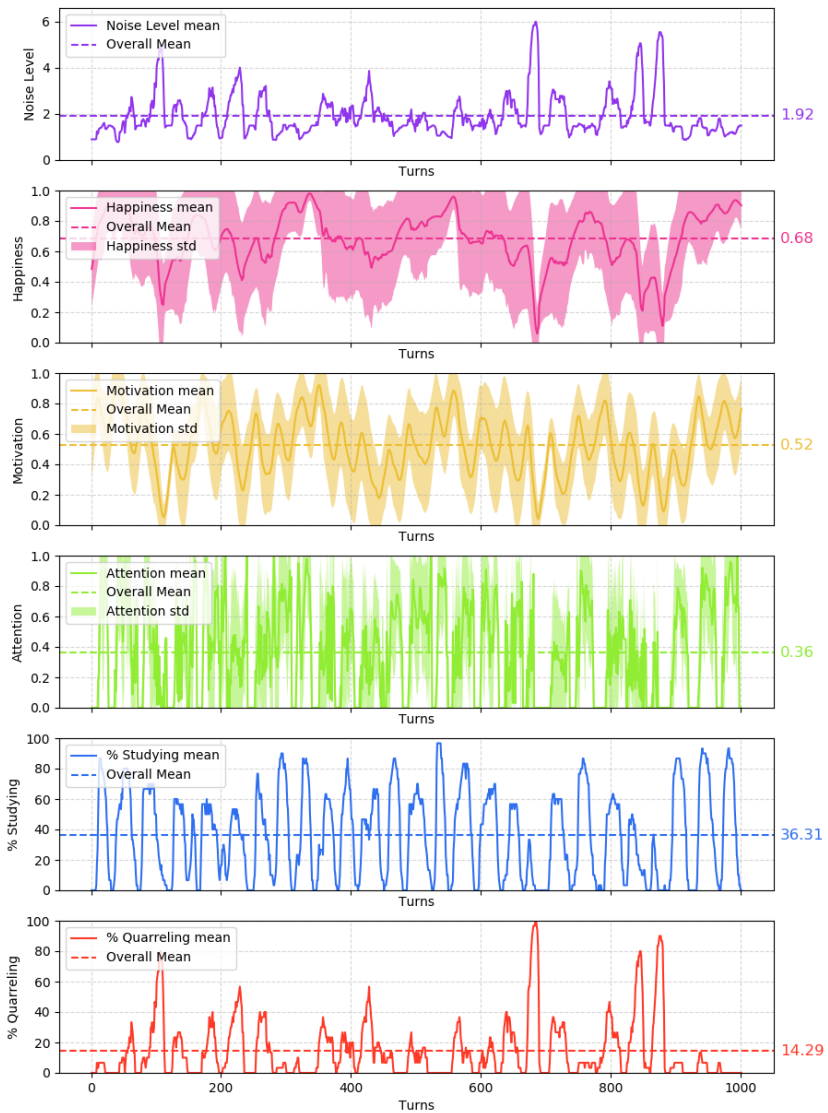
Prof. Elena Verdu Perez
(Supervisor)

Felix Meissl
(Art Work)

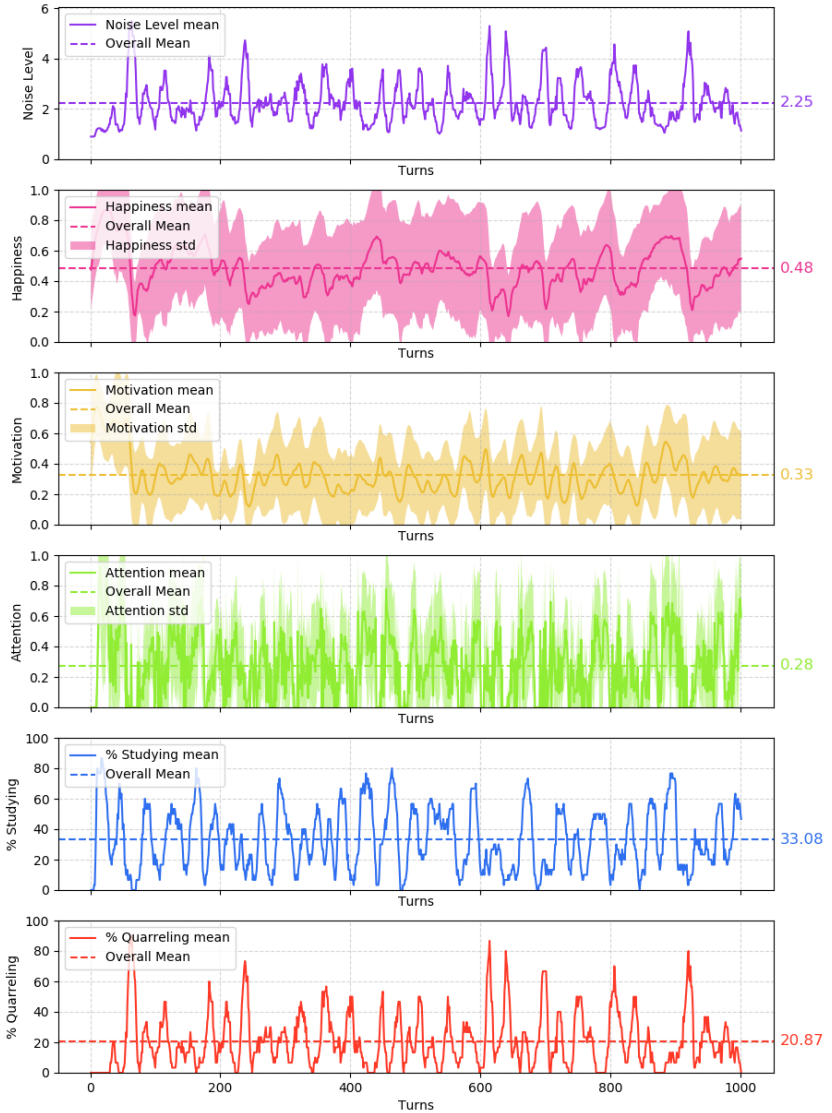
Outlook

1. Improve classroom aggregates analysis
2. Interactive Simulation
3. Include a Teacher Agent

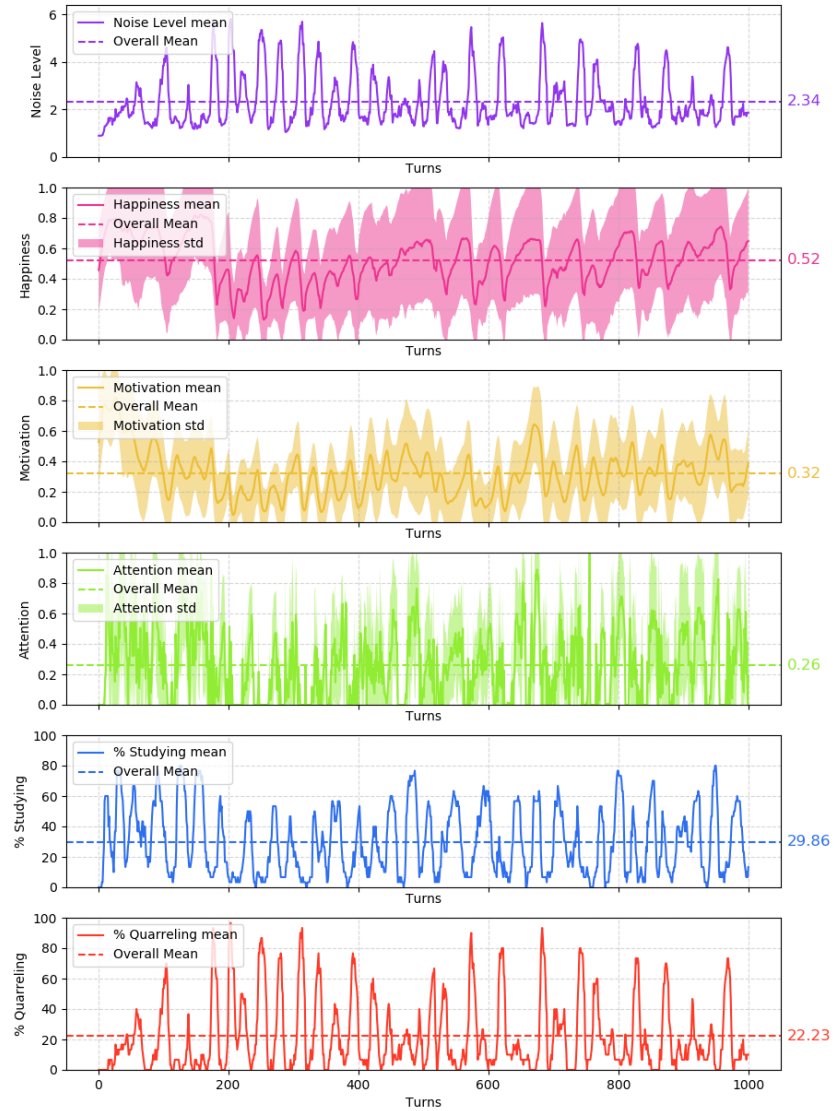
ADHD-None



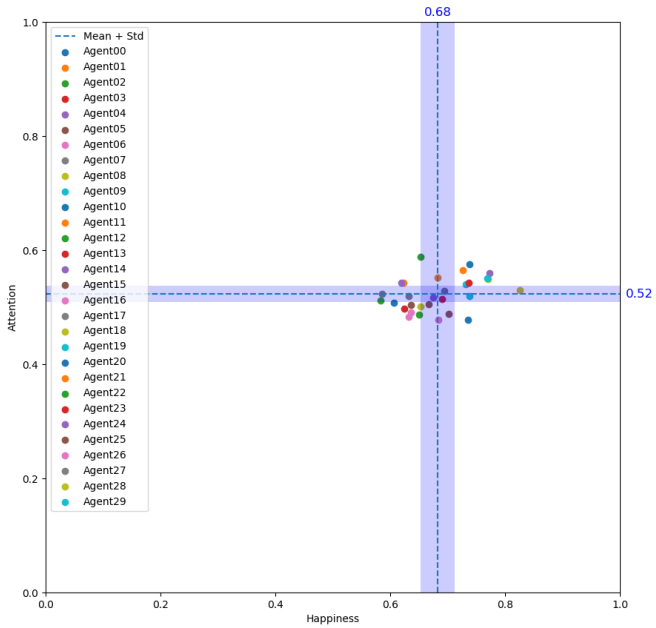
ADHD-Medium



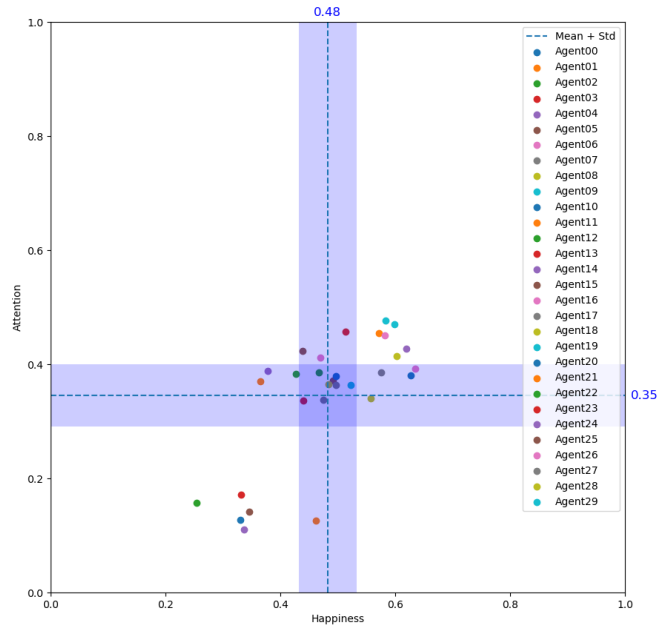
ADHD-Medium-Ambitious



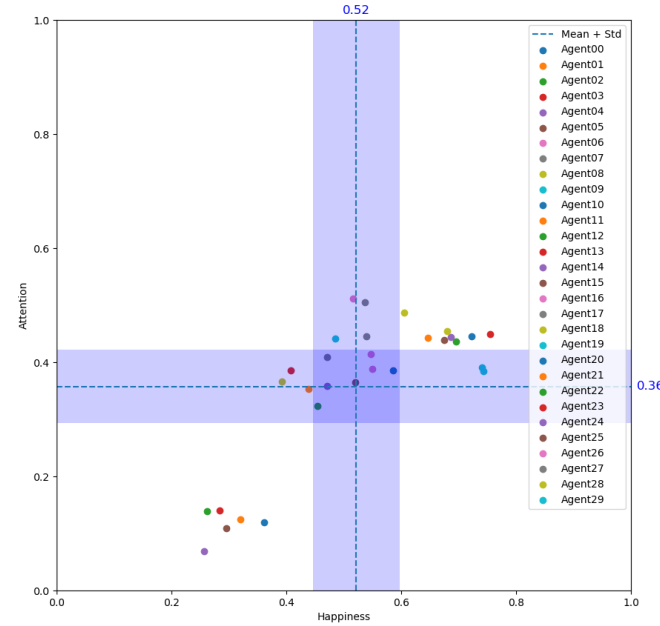
ADHD-None



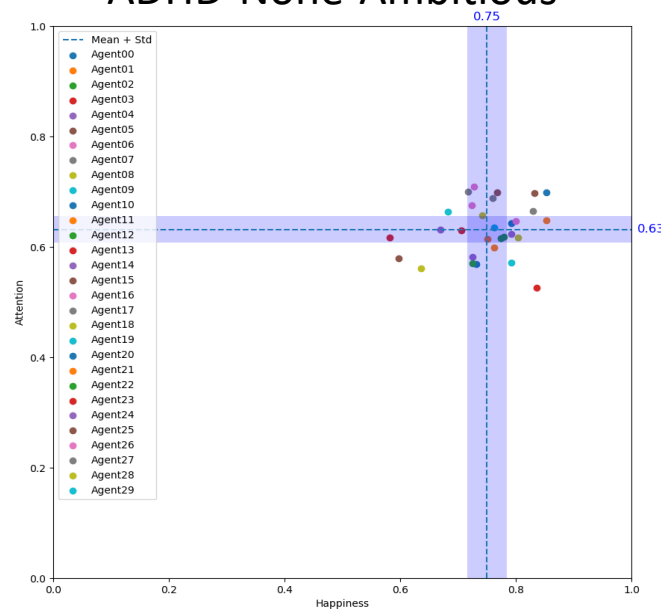
ADHD-Medium

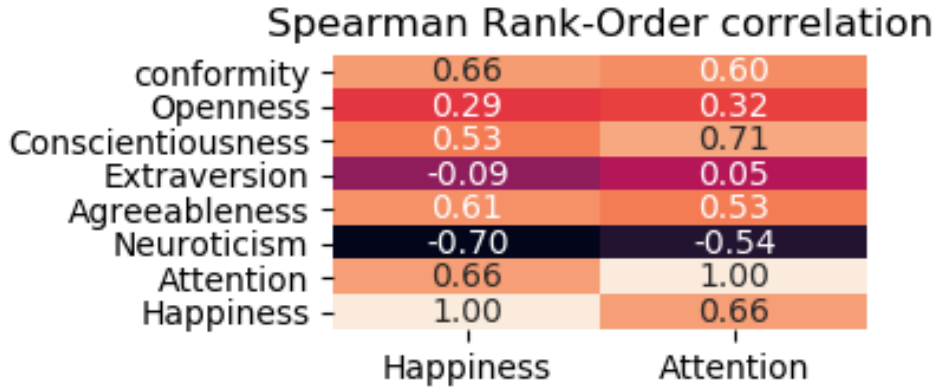


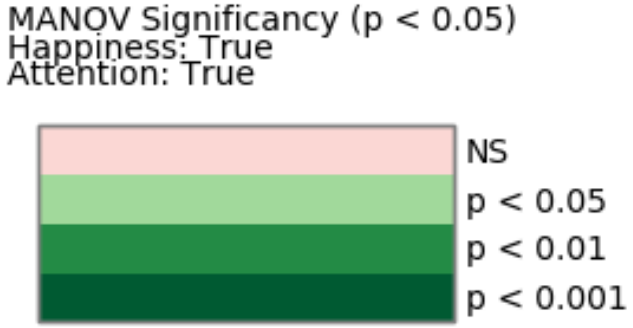
ADHD-Medium-Ambitious

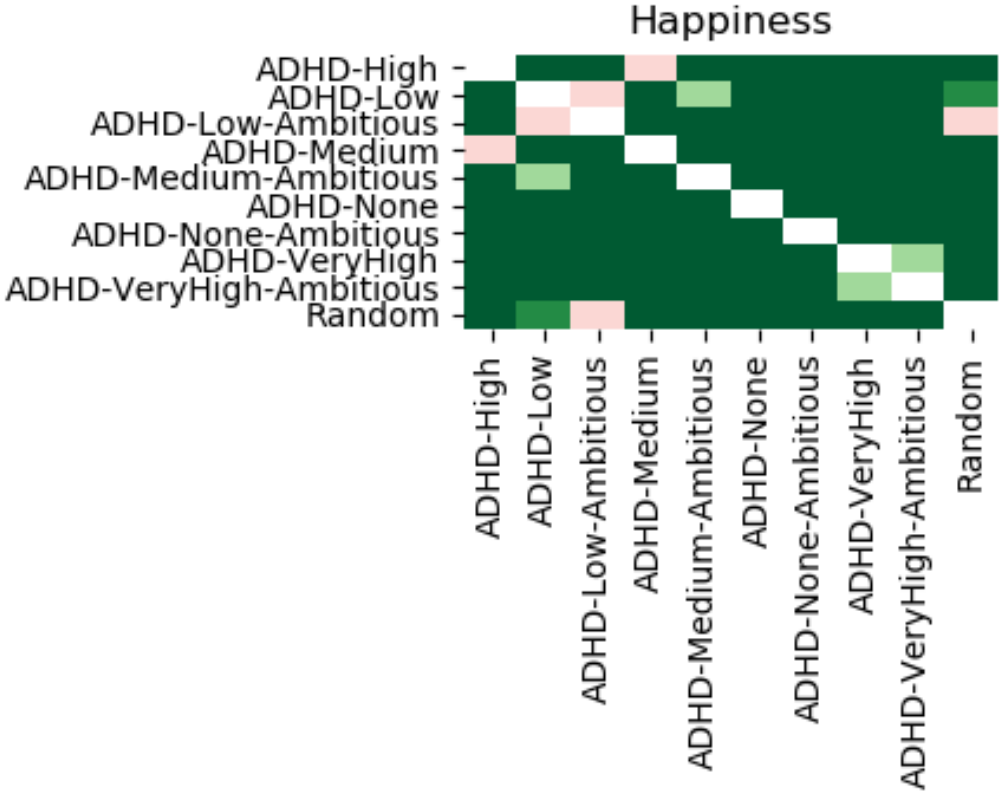


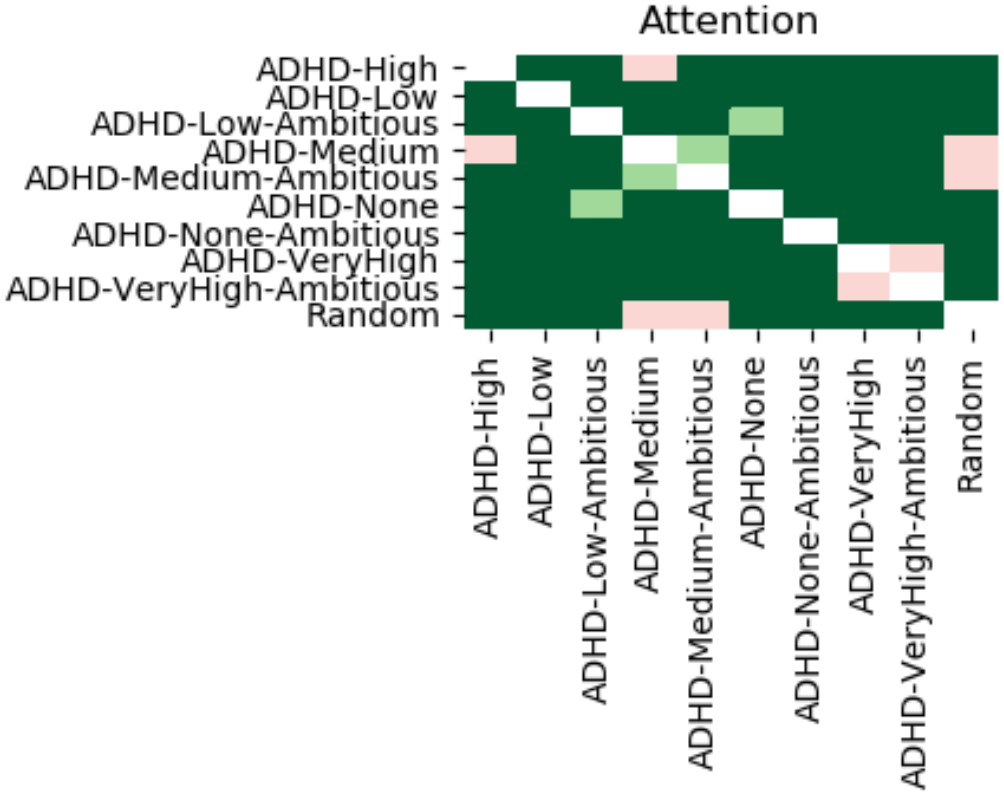
ADHD-None-Ambitious




Spearman Rank-Order correlation
conformity
Openness
Conscientiousness
Extraversion
Agreeableness
Neuroticism
Attention
Happiness
0.66
0.60
0.29
0.32
0.53
0.71
-0.09
0.05
0.61
0.53
-0.70
-0.54
0.66
1.00
1.00
0.66
Happiness
Attention


MANOV Significancy (p < 0.05)
Happiness: True
Attention: True
NS
p < 0.05
p < 0.01
p < 0.001


Happiness
ADHD-High
ADHD-Low
ADHD-Low-Ambitious
ADHD-Medium
ADHD-Medium-Ambitious
ADHD-None
ADHD-None-Ambitious
ADHD-VeryHigh
ADHD-VeryHigh-Ambitious
Random


Attention
ADHD-High
ADHD-Low
ADHD-Low-Ambitious
ADHD-Medium
ADHD-Medium-Ambitious
ADHD-None
ADHD-None-Ambitious
ADHD-VeryHigh
ADHD-VeryHigh-Ambitious
Random

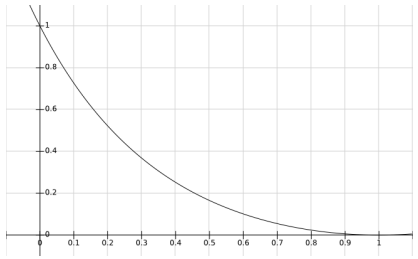
Action Scores

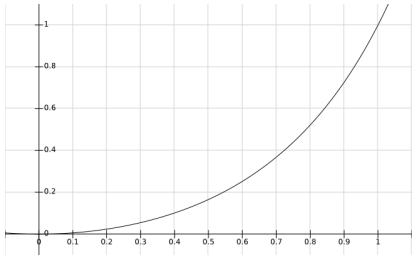
$$\alpha = personality * w_0 + \mu(motivation) * w_1 + \gamma(happiness) * w_2$$

$$\alpha_{bias} = \beta * e^{-(1.0-conscientousness)*\lambda*t}$$

Add bias to current action, subtract bias from previous action.

γ,μ: E_D: $\frac{e^{(1-x)^2}-1}{e-1}$ E_G: $\frac{e^{x^2}-1}{e-1}$





- **Break**: 1.0 - extraversion, E_D, E_G
- **Chat**: extraversion, E_D, E_G
- **Study Alone**: 1.0 - extraversion, E_G, E_G
- **Study Group**: extraversion, E_G, E_G
- **Quarrel**: agreeableness, E_G, E_D