Agent models in Unity
The covid-19 pandemic
Agent based simulation

- Prediction
- Explanation
- Description
- Theoretical exploration
- Illustration
- Analogy
- Social learning
Agent based simulation

Prediction
Explanation
Description
Theoretical exploration
Illustration
Analogy
Social learning
Agent based social simulation

Sandbox
Agent based social simulation

Prediction
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Social learning

Behaviour
Policy
More stakeholder involvement = better models
ASSOCC
Agent-based Social Simulation of the Coronavirus Crisis

Model the spread of Covid-19

- Policy
- Culture
- Needs
- Demographics
Agent-based Social Simulation of the Coronavirus Crisis

**Testing**
This scenario looks at the effects of testing people on the spread of the disease. Based on the current implementation of the model, we want to evaluate four aspects: 1) testing frequency of sick persons, 2) testing colleagues of sick persons, 3) random tests, and 4) a single full-scale test.

**Smart testing**
The goal of this scenario is to test different testing policies to inform policymakers about their potential effects on the number of infections, number deceased, and hospitalization. For smarter testing, certain groups can be prioritized.

**Tracking app**
This scenario looks at the effect of using apps to track, trace, and limit the spread of the infection relative to the percentage of app users in the population.

**School closures**
Examination of the direct and indirect effect on the spread of the virus when schools are closed. We consider that schools will be closed as soon as a certain amount of infected people within the city has been reached. Different thresholds are scaled.

**Economic effects**
With this scenario, we demonstrate the relation between the pandemic, health measures, and the economy. This shows the complex and interconnected nature of the situation. With the scenario, we enable users to explore the model and come to a conclusion themselves.

**Exit strategies**
This scenario shows you how to experiment with strategies for phasing out various pandemic containment measures. You can set conditions and timing, and parameterize some of the measures.
### Setup exit strategy scenario

#### Crisis detection

- **Acknowledge crisis**
  - **Ratio infected**: 7.6%

- **Phase snap-back?**
  - Yes

- **Only setup customized measures?**
  - No

#### Exit phase

- **Condition for moving to the next phase**
  - **35 days quarantine**

- **Min days between phases**: 7

- **Day gap**: 3

- **Condition percentage**: 25%

#### Capacities

- **Buses per time slot**: 2

- **Max people per bus**: 25%

- **Percentage private leisure reopen**: 30.5%

- **End half bus capacity**: Phase 3

- **End isolation of retirees**: Never

- **Allow migration**: Never

#### Setup measures

- **Open schools**: Phase 3

- **Open universities**: Phase 2

- **Open workplaces**: Never

- **End work from home**: Phase 2

- **Open non-essential shops**: Never

- **Partial opening of private leisure**: Never

- **Fully open private leisure**: Never

- **Open public leisure**: Never

- **End social distancing**: Never

- **End half bus capacity**: Phase 3

- **End isolation of retirees**: Never

- **Allow migration**: Never
Person: 44
Age: worker
Infected by: 432 when in bus
89% workers infected
Engineering useful frameworks

Fast prototyping

• + scaling
Engineering useful frameworks

Fuzzy cognitive concepts

- Norms
- Values
- Needs
- Identity

- Social practices
- Habits
- Motivations
- Roles
Engineering useful frameworks

Fuzzy cognitive concepts

Norms
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Engineering useful frameworks

Fast prototyping
• + scaling

Aggregate architecture
• Agents = empty shells
• Cognitive elements = building blocks
### NormativeAgentProfile

<table>
<thead>
<tr>
<th>Entity Archetypes</th>
<th>NormativeAgentProfile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vessel</td>
<td>Vessel (Archetype)</td>
</tr>
<tr>
<td>Catch</td>
<td>Catch (Archetype)</td>
</tr>
<tr>
<td>Loan</td>
<td>Loan (Archetype)</td>
</tr>
<tr>
<td>Agent</td>
<td>Agent (Archetype)</td>
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<tr>
<td>Debts</td>
<td>Debts (Archetype)</td>
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<tr>
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<td>LivingCosts</td>
<td>LivingCosts (Archetype)</td>
</tr>
<tr>
<td>Place</td>
<td>Place (Archetype)</td>
</tr>
</tbody>
</table>

#### Actions

- Fish (ModelAction)
- GetLoan (ModelAction)
- UpgradeVesselEfficiency (ModelAction)
- SellFish (ModelAction)
- PayDebts (ModelAction)
- Leave (ModelAction)
- SpendTimeOnShore (ModelAction)

#### Goals

- DoJobNormative (Goal)
- GetPaid (Goal)
- PayCosts (Goal)
- Upgrade (Goal)
- StaySolvent (Goal)

**Prefab**: Agent (UnityEngine.GameObject)
Engineering useful frameworks

- Fuzzy cognitive concepts
- Norms
- Values
- Needs
- Identity
- Social practices
- Habits
- Motivations
- Roles
Conclusions

• In some agent simulations, the results are not nearly as interesting as the process, especially when the point is to study and understand the behaviour of a population and the effects of new policy.

• More input from more stakeholders makes the models richer, more informative and more useful. Involving them in as many steps of the process as possible can only increase the quality of the research.

• Designing and implementing people-friendly frameworks and UIs is time consuming and far from trivial, but it’s high time we tried.
Future work?
Thank you!

Questions?