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EECS 372 – Uri Wilensky

Final Project Proposal

**Big Picture**

Overcrowding in emergency evacuation situations.

**Rationale**

During emergency evacuations, each person exhibits interesting behavior that they don’t exhibit normally. For example, some people who might not be familiar with a building tend to try to go out the way they came in, even if it is not the closest exit. These individual behaviors result in emergent behaviors for groups, sometimes resulting in pushing, shoving, crowding, and even blocking, trampling.

**Driving Question**

What features of a building’s architecture or layout most greatly encourage crowding and blocking?

Another possible question could look at different people-behaviors, as different personality types exhibit different behaviors in emergency situations. Namely leader-types and panic-types. However, since people behavior is not something designers can control, the first question may be a better choice.

**Possible Reference Patterns**

|  |  |
| --- | --- |
| **Pattern** | **Possible Reference Model** |
| Panicked Path Finding | Pac-Man (?) |
| Flocking / Herding | Flocking Model |
| Blocking / Collision | GasLab Circular Particles |

**Agents**

|  |  |
| --- | --- |
| **Agent Kind** | **Representation** |
| turtle | people |
| patch | walls / doors |
| links | connects people who know each other |

*Note*: I sporadically thought of a possibility for links while writing this – they aren’t necessary for this project and certainly wouldn’t be implemented in early stages.

**Agent Properties**

Underlined properties are ones I consider “essential.” Others may be interesting to implement after the foundation is complete. These properties are also conceptual, and not every property may need a corresponding variable. Turtle properties are based on this paper: (<https://bit.ly/2IpyOd6>)

Turtle

* Speed
* Health (?)
* Vision
* Knowledge (of building layout)
* Collaboration
* Insistence

Patches only need to know what they are and won’t change.

*Note*: One case I can think of in which they might change is if we allow the emergency to change the layout of the building. For example, if a fire burns the building or an earthquake shakes it. This is probably not desirable for this model, but if it is, it would be implemented near the end.

**Agent Behaviors**

Turtle-patch interactions are relatively simple. Turtles cannot pass through walls or obstacles, but they can pass through doors. Turtle-turtle interactions are more interesting. For the most basic model, turtles attempt to exit the building, but they can collide with and block each other. Turtles also exhibit a flocking behavior, where they follow others in hopes that those others are also headed toward an exit.

**Core Parameters**

People parameters

* Number
* Speed

Building parameters

* Spaciousness (ratio of open space to obstacles)
* Max space wideness (largest permissible wideness of some open space)

*Note:* I do not feel confident about my building parameters at all. I was hoping there might be a way to randomly generate buildings based on some key parameters, but maybe the best way is to design a few buildings manually and just use those as building types.

**Measures**

* Total evacuation time
* Average individual evacuation time
* Number of people evacuated (If there is a spreading disaster, maybe not everyone evacuates in time, or maybe blocking can occur in a way that prevents all further progress.)
* Time wasted (It might be possible to calculate some expected time of evacuation in setup based on if people exited the building in the most efficient way possible by considering closest exits. Then we can calculate time wasted by taking a simple difference.)