Boone Tison – Quiz Notes 4

**Interactions between Agents**

Social ability – agents interact with other agents and possibly humans

**Connecting agents:**

Create nodes (turtles) - *Create-turtles 5*

Optionally give them a label - *Ask turtle 1 [set label “James”]*

Connect the agents - *Ask turtle 1 [create-link-with turtle 2]*

It helps to think of nodes as numbers, because you ask a numbered turtle to link with another numbered turtle

**What is a network:**

A network is a set of objects connected in pairs. A relation can only be between 2 objects. A hypergraph is a set of objects of which subsets can be connected

**Edges:** Can be of different types and that sets the type of the graph too**.** Edges can be directed when the connection isn’t always reciprocal**.** Connections aren’t always reciprocal.

NetLogo uses create-link-to and create-link-from for directed edges

Graphs with directed edges are directed graphs, or digraphs. Graphs with undirected edges are undirected graphs. If the same 2 vertices can be connected by multiple edges (also called parallel edges), you have a multigraph

NetLogo uses “breeds” or “categories” of edges to deal with

The degree d(v) of a vertex v is the number of edges that include or touch it. The out-degree d+(v) is the number of edges with v as origin. The in-degree d-(v) is the number of edges with v as destination

**Degrees in the real-world:** The degree distribution of a graph is the number of nodes (y-axis) having a given degree (x-axis)**.** Many measured phenomena are centered around a particular value**.** There also exists numerous phenomena with a heavy tailed distribution. A network with power-law degree distribution is said to be scale-free

**Finding the important elements:**

***Degree centrality*** – you are more central if the number of people you’re connected to is larger

***Eccentricity*** – minimizes the maximum distance to all others

**Commonly used indices:**

Can distinguish centrality indices in three broad ways.

Access/influence - From that node, is it easy to access others? To impact others?

Visibility/reputation - How likely is it that others are aware of this node?

Mediation/control - Is this node frequently used as a bridge between others?

We can use degrees as centrality indices

***Degree centrality*** is a local measure because it only depends on direct neighbors

Shortest paths - the shortest sequence of edges to take from Node A to Node B

Distance – number of edges on the shortest path

Diameter – the maximum distance between two vertices and we denote it by D

***Eccentricity centrality*** is the inverse of eccentricity (max distance between nodes). The lower the eccentricity, the more central the node

***Total distance*** is the distance from a node to the central node, ***closeness centrality*** is the inverse of the total distance. The lower the total, the more central the node

***Stress centrality*** is the total number of shortest paths going through a node. Doesn’t tell how much control a node has over flow

***Betweenness centrality*** is the fraction of shortest paths that go through a node. Captures the flow

**Selected complications:**

A 2nd measure wouldn’t be informative if its redundant with the first one, for instance by being heavily correlated. If they are correlates, pick the one that uses less processing power and/or the takes the least space

**Article:**

Changing descriptive social norm in health behavior (“how many people are behaving healthy”) has been shown to be effective in promoting healthy eating. We developed an agent-based model to explore the potential of changing social norm in reducing hypertension among the adult population of Los Angeles County. We demonstrate the development of an Agent-Based Model for predictive analytics in health. We use the model to examine interventions for hypertension.

Our ABM captures how individuals consume fruit and vegetable based on (i) their initial preferences, (ii) social norms, and (iii) individual characteristics such as age and gender. A virtual intervention cannot change (i) one’s initial preferences since that cannot be immediately altered, or (iii) characteristics such as age or gender whose dynamics are outside the control of a health policy. Consequently, the intervention can only target (ii) social norms. Nevertheless, it is important to represent (i) and (iii) in the model as they also affect the prevalence of hypertension, which is the target for the intervention.

The demographic variables for the population of our ABM consist of the age category (18–34, 35–54, and over 55), the gender (male or female), and educational attainment (less than high school, high school, some college, or college).

The first or ‘standard’ view is to perform verification (ensure that the software implementation matches the model specification) and validation (ensure that the simulation’s outputs resemble the target). Note that a perfect match between the simulation’s output and the target dataset is neither required nor expected. The second view rejects the possibility of evaluation by considering that there is no perfect ground-truth data. That is, a dataset is a recorded observation, in the same way as the model’s output can be deemed to be an observation. The third view notes that models can be useful without empirical support, and that their validity should be judged by its intended users. In this chapter, we assess the model quality using validation.

Our simulations show a substantial reduction in five-year hypertension incidence with the media campaign for healthy eating, a result that remains robust across different levels of assumed effect size in norm change.

One major limit of our paper is that the model has not yet included a module that simulates the mortality outcome for the population, and thus we have not yet explored the reduction of premature deaths due to increasing fruit and vegetable consumption. We plan to include mortality outcome as well as diseases such as stroke and coronary heart diseases in our next phase of model development. Another major limit of our paper is that we have not yet modeled the race/ethnic difference in risk of hypertension.

The broader significance of our agent-based model lies in the fact that preventing hypertension is not the only health benefit that can result from more fruit and vegetable consumption, and fruit and vegetable consumption is not the only health behavior that can be changed by modifying social norm. Other chronic diseases that can be prevented and controlled by lifestyle modification may use norm-changing interventions, which can be assessed with a validated ABM specifically reflecting the demographic makeup of the local communities [27]. Our modeling approach, then, can be applied in topics where changing descriptive social norm is feasible in improving health outcomes and saving long-term medical expenditures.