**Dynamic Models of Segregation**

* Had both a linear model and 3d model
* There were two different types
  + Immediate neighbors (Spatial proximity model)
  + By zone (Bounded-Neighborhood model)
* As people move to become content with the number of like neighbors that they can handle forces other people to move due to their surroundings not being what they want
* If there’s a minority it becomes even more segregated because all the minority have to cluster in order to meet their color threshold
* Tipping – phenomenon where a new minority enters a neighborhood in sufficient numbers causes the earlier residents to start evacuating

**Generating Textures on Arbitrary Surfaces Using Reaction-Diffusion**

* generate textures and patterns on 3d surfaces
* Chemicals diffuse and interact with each other, promoting or discouraging growth of other chemicals
* Spots pattern
  + Run algorithm and freeze large spots
  + Run again in the open space to create small spots
* Leopard pattern
  + Large spots first
  + Cells are frozen and a and b concentrations -> 4
  + Smaller spots tend to form AROUND large spots due to concentration values
* Lionfish
  + Large stripes formed first
  + Small stripes form in-between “frozen” large stripes
* Giraffe
  + Irregularly shaped spots initially created
  + Stripes form between the spots to create the “web-like pattern called reticulation” [1]
* Mesh Generation
  + The points need to be spread evenly across a 3D object
  + The points repel each other so each has an equal distance from every other point
* Took a very long time to generate reaction-diffusion on 3D surfaces

According to the authors, how can a reaction diffusion process be used to produce the cheetah pattern (large and small spots) in the bottom left image of the figure below?

The reaction diffusion process would first run to create the large spots a certain distance away from each other via repelling. Once the first run is finished, a second reaction diffusion is run with the large spots still in place. It now creates smaller spots which repels off the large spots a certain distance from them.

**The Dissemination of Culture**

* Tries to explain why people become more similar over time, but don’t become completely similar
  + Uses culture as its base
* Goes over how people become similar:
  + State formation – national state where everyone is alike due to their nationality
  + Succession conflicts – when one society wins a war over another and forces their culture on them
  + Transnation integration – agreements for free trade and travel, so people from other cultures move in, move to other cultures
  + Domestic cleavages – politics of democracies
* Goes over how they grow apart
  + Social differentiation – groups actively distance themselves from each other. Ethnic groups as an example
  + Fads and fashion – an attempt to be different from the norm
  + Preference for extreme views – views that are very different from the norm
  + Drift – random changes in individual traits can lead to differences between subgroups. Such as languages evolving
  + Specialization – weird interests that could be resistant to social influence
  + Changing environment or technology
* Uses agent based models to model culture
* Model has attributes that are modeled by a list of numbers
* People have matching ‘cultures’ if the position in the array is the same number
* People who are similar to each other become more similar to each other over time
* With probability similar to the # of similar traits it will change one trait of its 4 neighbors
* Over time all areas become the same except for stable regions where there are 0 common traits
* Shows how some traits can survive social influence
* Shows when there are few key aspects to a culture it’s easy for all to become the same, but when there are lots of key aspects it becomes difficult

According to the paper, cultural zones consist of contiguous sites each of which has at least one neighboring site to whom they are able to interact. The sites along the border of a cultural zone are unable to interact with the sites along the border of a neighboring cultural zone. How then are the number of cultural zones able to decrease during a simulation run?

Every cell in the simulation has features and each feature has traits. When at least one feature and trait match for a cell and one of its neighboring cells then that opens them up to interact. So, if there are 5 features for a cell and 1 feature is matching between two neighboring cells, then there is a 1/5 chance that they will interact that iteration. When two cells interact one trait from one cell is copied to the other cell. This then in turn makes those two cells more similar and gives them a higher chance of interacting next iteration. This pattern continues and cells become more and more similar to their neighboring cells thus decreasing cultural zones. Over time, compatible features within a zone can eventually diffuse to the edge, thus dissolving the border.

**Self-organized Shortcuts in the Argentine Ant**

* Argentine ant continuously finds a short path between its nest and the food
* Set up an experiment to prove this
* Have multiple paths that lead to food
* All paths have a Y shape as to not dissuade ants from taking either path
* At the beginning each path has 50% chance of taking it
* Ants leave pheromone as they go towards a path and after they come back
* All ants can only follow pheromone, otherwise they walk around randomly
* Eventually all ants take the short path
  + They will take that path even if a shorter path is introduced later since it is established with pheromone
* Visual Memory: Similar experiment performed under red light gave similar result, which implies there is no visual memory in effect.
* Directional memory: Initially marked the shorter path ants with color, and then changing paths with newer one (without trail). Marked ants followed both paths randomly.
* Temporal Memory: repetition of the experiment on same nests did not change the distribution of outcomes.

In laboratory experiments, the authors observed that, while the ants initially choose equally from among the two paths, they quickly converge upon the shorter path. According to the authors, why does this happen?

The ants use pheromones to direct other ants down a path. The more pheromones that are on a path then the more likely an ant will travel down that path. The shorter path is converged upon because the ants drop pheromones both when traveling down a path and when returning from a path. So, the shorter path will have more pheromones collected on it much quicker, due to the ants returning faster. Thus, more ants will travel down the shorter path.

**Ant System: Optimization by a Colony of Cooperating Agents**

* Tries to find an algorithm for finding shortest path based on ants
* Ants in the algorithm
  + Chooses next town according to trail + distance
  + Cannot revisit towns
  + Lays trail after completing tour
* Is tabu heuristic based
  + The objective for the Tabu Search algorithm is to constrain an embedded heuristic from returning to recently visited areas of the search space, referred to as cycling. The strategy of the approach is to maintain a short term memory of the specific changes of recent moves within the search space and preventing future moves from undoing those changes. Additional intermediate-term memory structures may be introduced to bias moves toward promising areas of the search space, as well as longer-term memory structures that promote a general diversity in the search across the search space.
* heuristic is used for algorithms which find solutions among all possible ones ,but they do not guarantee that the best will be found,therefore they may be considered as approximately and not accurate algorithm
* Synergistic effects
  + Best results when # agents = # nodes
* Initialization
  + Uniform distribution better than all ants starting on same node
* Got within 3.3% of optimum
* Ants choose the next city to visit with a probability that is a function of the distance to the city and the amount of pheromone on the path to that city
* After completing a tour, the ant can leave a pre-determined amount of pheromone on any path it has visited, and can sense the amount of pheromone present on any adjacent path
* Ants are forced to make complete tours by storing previously visited locations in a tabu

In the main ant system algorithm that they describe, the ant-cycle algorithm, the transistion probability is the probability than an ant will move from town I to town j. What two aspects of the solution does the transistion probability attempt to balance?

Transistion probability tries to balance the suspected probable route and the most used route. It takes both the shortest distance and most traveled routes into account, trail intensity. This allows for the possibility that the shortest path isn’t always the fastest.

**Individual Experience Alone Can Generate Lasting Division of Labor in Ants**

* As ants succeed in foraging, the ants want to continue
* Here we will show that, all else being equal, ant workers engage in distinct functions in accordance with their previous experience
* Trained ants by foraging experience
  + Track successful and non-successful ants
* Chose Cerapachys biroi breed of ant
  + Phasic reproduction - New generation of workers occur synchronously every 34 days
  + Thelytoky Parthenogenesis - Form of asexual reproduction - full/half clones
  + Same cohort = Same age, size, shape & development conditions
  + Homogeneity helps for control
  + Birth>Foraging>Statary(Pupating & Laying)>Foraging
* Ants successful in foraging were more likely to forage
* Ants that failed in foraging were more likely to do brood work

What two measures do the authors use to compare the behaviors of successful and unsuccessful foragers? Explain what each measure measures.

1. Mean foraging rate - the number of foraging attempts / number of training sessions
2. Mean exit delay - the time elapsed between the opening of the nest chamber and the exit of the workers. Successful explorers exhibited higher exit rates than did workers who systematically explored in vain. Whereas successful explorers presented short exit delay, the unsuccessful ants were less and less likely to leave the nest with repeated foraging failures.

**Dynamic Scheduling and Division of Labor in Social Insects**

* The paper involving painting a truck
* Agents bid for resources and the agent with the highest bid gets the resource
  + This is used for paint stations to paint a truck
    - The paint station with the highest bid gets to paint the truck
    - Bids higher if the truck is the same color as the last truck in its queue
* Insect colonies kind of bid for tasks to do based on factors such as:
  + Food availability
  + Predation
  + Climatic conditions
  + Phase of colony development
  + Time of year
* All insects have thresholds for doing a certain task
  + The ones that are good at the task, or are motivated due to one of the above conditions will act first
  + Other insects will eventually do the task if it reaches their threshold, thus covering when it’s needed
  + This makes it so all insects aren’t doing the same things at the same time
* Market based approach to the painting trucks problem
  + Try to take another truck the same color as current color
  + Take important jobs (high priority)
  + Take any job to stay busy
  + Do not take another job if queue is full
  + Booths bid based on their ability to do the job efficiently, low cose, minimal delay
  + Resulted in 10% reduction in paint usage and half as many paint changovers
* Ant based approach
  + Instead of bidding a demand is given for each color given by the sum of priorities of the unassigned trucks in each particular color
  + Once a truck is assigned that booth’s demand for that color increases where every other booth’s demand decreases
* Conclusion
  + Need more research to see if ant approach is efficient
  + They don’t know how it competes with the market approach since they don’t actually know how it works since it’s not a public algorithm

In the ant based algorithm presented in this paper, how do the booths learn to specialize on a paint color?

There is a global demand established for each color, given by the sum of the priorities of the unassigned trucks in each particular color. Which means adding the priorities of any truck of the same color in storage plus the one just added off the assembly line. Next the booths consider the demand of the color the truck needs to be painted. The threshold a booth k has for a color is compared to the other booths and the largest one is assigned the truck. The threshold for that color is increased for the booth that got it and lowered for the booths that did not.

**Effective Choice in the Prisoner’s Dilemma**

* I know a lot about this one
* Niceness was good
* Ways to win
  + Niceness
  + Forgiveness
  + Scores against the kingsmakers types
* Kingsmakers were the aggressive types

According to the author, why did the not-nice rules perform so poorly in the tournament?

The reason that the not-nice rules performed poorly can mostly be attributed to the high amount of nice rules that existed in the tournament. When two nice rules go against each other they’ll get an automatic score of 600 since the will continuously collaborate with each other. A not-nice rule will decide to attack and often times are met with retaliation. Depending on how the rules were created, the two rules could potentially endlessly attach each other, resulting in only 1 point per turn. Thus, not0nice did poorly due to the nice rules getting a large amount of points with eachother and endless retaliation.

**Reputation Helps Solve the Tragedy of the Commons**

* Tragedy of the commons is that if a public resource is free some people will overuse that resource making it hard to sustain
* Had an experiment where they had a public goods game and an indirect reciprocity game
* Public goods game
  + People donated to a game that all of them shared the wealth
  + The people running the experiment would double the amount people gave to the game
  + People started with $5
  + They had to donate a portion of the $5 to be shared by the group
* Indirect reciprocity game
  + People knew the amount people donated in the public goods game
  + They could give money to people in this game
  + People tended to give more money if they gave more in the public goods game
* Researchers found that people would donate more in the public goods game if they knew other people would know what they donated in the indirect reciprocity game
* Everyone used an anonymous pseudo name

This paper finds that interleaving the public goods game with the indirect reciprocity game improves cooperation in the public goods game. According to the authors, why does that occur?

This happens because by interleaving the public goods game and indirect reciprocity game the participants need to maintain their reputation. The participants in the indirect reciprocity game give money based off the amount people gave in the public goods game. So, the participants had an incentive to maintain their reputation, so they would receive donations in the indirect reciprocity game. In the experiments where the public goods games were at the end, there was a large decline in contributions for those games.

**Emergence of Scaling in Random Networks**

* I did this one

According to the authors, what growth process may be used to grow scale free networks? Please explain how it works.

According to the authors the process of preferential treatment of vertices can be used to grow scale free networks. This process works by having each vertex a percent chance to connect to another vertex based on how many edges that vertex has. Meaning, if one vertex has a relatively high number of edges, other vertices have a higher chance to connect to that vertex.

**Toward a Containment Strategy for Smallpox Bioterror: An Individual-Based Computational Approach**

* Made a model about smallpox spreading through a community
* Everyone is assumed to not have a natural immunity to smallpox
* Check spread based on family units and going to school/work as well as the hospital
* Also had a morgue for all that died
* Mass vaccination – preemptive measure to vaccinate everyone before a possible outbreak
  + Risky since 1/1000000 people will die from it
  + Some people cannot get it since they have weak immune systems
* Trace vaccination – vaccinate everyone who had contact with a person infected
  + Reactive measure
  + Hard to find all of the people
* Results and what is recommended
  + 100% family trace vaccination
  + 60% mass vaccination (portion of population unlikely to experience negative side effects)
  + 100% of hospital workers
  + Quarantine of infected individuals

The authors indicate that the goal of their work is to find alternatives to the then-current vaccination strategies under consideration: trace vaccination and mass vaccination. Explain how each of those strategies works.

Trace vaccination works by tacking a person affected with smallpox and going back and vaccinating every person that they might have had contact with. Mass vaccination is simply vaccinating everyone prior to an outbreak.

**The untapped potential of virtual game worlds to shed light on real world epidemics**

* WoW had a ‘virus’ spread in the game
* Potential for using MMOs for studying outbreak spread
* People started in the capital cities then it extended out, with the NPCs being constant spreaders
* Positives of using an MMO
  + Real-people controlling, so more accurate results
  + Unexpected results
* Negatives of using an MMO
  + No morality, people might intentionally spread the virus
  + Takes a long time to simulate
  + Cannot have as many subjects as a completely simulated experiment
* Hearth stones and releasing pets that still have the virus then releasing them later

The authors discuss human agent simulations, where humans control a virtual agent in a virtual world, and purely computational agent simulations as alternative approaches to studying epidemic spread. These methods have limitations, as pointed out by the authors. Name one limitation that is discussed in the paper and explain why the author considers it a limitation.

The computer simulation can experiment on large-scale virtual population. However, it lacks the ability to mimic the human behaviors in real outbreak scenarios

In the human simulations, compared to other studies with real-people can have a larger number of agents. The human behaviors are similar to the real-world. However, the actions in games can be different from the real world. Also, the computational consumption and the limitation of the subscriber base it’s hard to reach the scale of a computational simulation.