# Collaborative Diffusion: Game AI for Kids

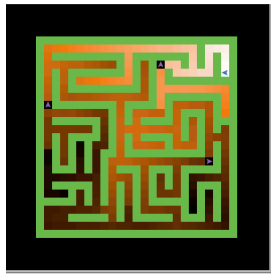
## Motivation

Collaborative diffusion is a simple but powerful method for agents to work together in pursuit of a target. With a few simple rules, complex behavior results. It is a great way to teach middle and high school students about computer science, modeling, and artificial intelligence. This lesson plan for middle and high school students includes three models, plus student and teacher guides to expose students to STEM disciplines.

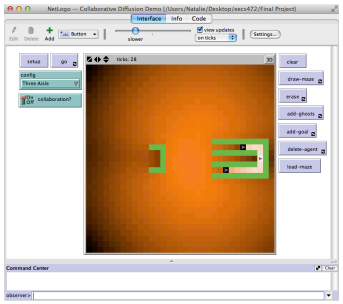
## Collaborative Diffusion

- Goal emits a scent through map
- Agents follow scent to goal
- Agents dampen scent around them
  - Encourages other agents to take different paths

Ex. Agents all take separate paths to reach the goal in the maze



## Model 1: Collaborative Diffusion Demo

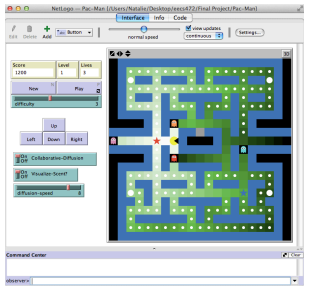


- Simple illustration of collaborative diffusion
- Three purple agents search for blue star
- Orange represents strength of scent
- At each tick turtles move to neighboring patch with strongest scent

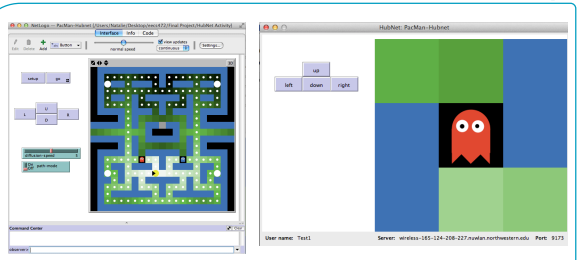
Model Features:
- Scent visualization to illustrate scent gradient
- Draw your own maze feature lets students experiment with different mazes and 'obstacle courses'

## Model 2: Pac-Man

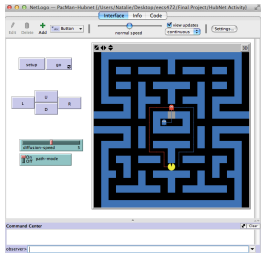
- Simple and intuitive application of collaborative diffusion
- Ghosts search for Pac-Man via collaborative diffusion
- Ghosts take different paths and try to surround Pac-Man



## Model 3: Pac-Man HubNet Activity



- Participatory Pac-Man simulation
- Instructor controls Pac-Man, students control ghosts
- Ghosts only have local information and follow scent
- Illustrates to students how ghosts work together to catch Pac-Man based on limited information
- Option for ghosts to trace paths allows students to see the paths they all took at end of simulation
- Drives home concept of collaborative diffusion by putting the students in the perspective of the ghosts and having them wok together to find Pac-Man with limited information




**References:**
- "Collaborative Diffusion." Scalable Game Design.<http://scalablegamedesign.cs.colorado.edu/wiki/Collaborative_Diffusion>
- Repenning, Alexander. "Collaborative Diffusion: Programming Antiobjects." University ofColorado, Boulder. 2006. <http://www.cs.colorado.edu/~ralex/papers/PDF/OOPSLA06antiobjects.pdf
- Wilensky, U. (2001). NetLogo Pac-Man model. http://ccl.northwestern.edu/netlogo/models/PacMan. Center for Connected Learning and Computer-Based Modeling, Northwestern Institute on Complex Systems, Northwestern University, Evanston, IL.



**EECS 472: Multi-Agent Modeling**
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