



MIND GAMES

MIT researchers use crowdsourcing so 'citizen scientists' can help map the human brain

Have you ever tried to sort out a mass of tangled fishing line? At first you enter a Zen-like state as you trace the strand looping under, over and around itself again and again. You feel a slight sense of triumph each time you free another length of line from the gnarled mess. Inevitably, though, frustration takes over, and you grab a knife and cut the line as you curse the impossibility of the task.



KEVIN O'NEILL
InSites

Imagine how much more difficult it would be if there were billions of strands and they were so small they could only be seen with the help of a high-powered electron microscope. This is the challenge researchers at Massachusetts Institute of Technology face as they try to map the connections between the neurons in the brain. The task is so formidable they have enlisted the help of a group of highly focused experts on obsessiveness — online gamers.

Professor Sebastian Seung and his team at MIT's Computational Neuroscience lab have developed **Eyewire.org**, a game that lets anyone with an inter-

net connection help trace the intricate inner workings of the human brain.

The idea behind the game is to employ crowdsourcing to solve a hugely complex puzzle. Crowdsourcing is the contemporary equivalent of the old saying "many hands make light work." Thousands of individuals from around the world all work on a problem independently while sharing their results. In theory, a solution can be reached more quickly by the collaborative masses than by a small team of experts working on the same problem.

Connecting the dots

The brain contains billions of neurons connected to each other by cellular extensions called axons and dendrites. Each neuron can have multiple dendrites connecting it to many other neurons. The cells communicate with each other through these connections to process information and perform functions. This interconnected web is called the connectome.

Professor Seung hypothesizes that memories, personality traits and possibly the causes of some brain disorders are contained within the connectome. He believes that mapping it will help us figure out how it works, leading to break-

throughs in understanding and treatments.

This is where the Eyewire game comes in. Players try to solve the puzzle one tiny piece at a time. They work with a virtual, three-dimensional cube that represents a microscopic segment of an actual brain imaged with a scanning electron microscope. The microscope captures images of thin slices of the brain. The slices are stacked on top of each other to create the cube.

Each cube contains a segment of a neural branch. Players try to discover and fill in the rest of the branch to connect it from one side of the cube to another. The cube can be rotated, panned and zoomed to view the branch from different angles and at different magnifications. Next to the cube is a two-dimensional image depicting the slice you are currently working on in the cube.

Practice makes ... better

When you first start the game, you receive practice cubes with known branch structures. As you connect the branches, the game gives you feedback so you can track your progress and accuracy. The practice cubes help you become familiar with the way branches are constructed.

Once you master the practice cubes, you move on to the real thing. You don't get the feedback on your progress since the structures haven't been pre-mapped, but you do get points for completing cubes. This allows you to compete with other users for in-game awards and bragging rights. There are blogs and forums on the site for players to communicate and share tips. A scoreboard lets you know how you stack up against the competition.

I'm not a big gamer, so I'm not sure how popular Eyewire will be compared to other games. I found I enjoyed the practice cubes a lot more than the actual ones because of the feedback. It was satisfying to know I solved a practice cube, but with the real ones you never know for sure.

You submit your finished cubes to be checked by artificial intelligence software, but you don't get any results other than points in the game. The points are awarded by the AI's comparison of the results of multiple people solving the same cube.

Eyewire is interesting, well designed and serves a noble purpose — but I'd rather be fishing.

KEVIN O'NEILL is a staff artist for The Times-Tribune. Contact him at koneill@timeshamrock.com with your favorite websites and apps.