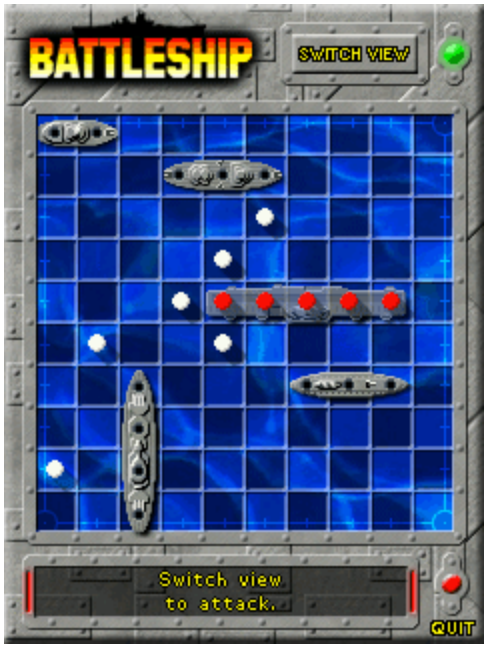
Brainstorming

We continued the brainstorming process from last week. Our objective at this phase is to develop a list of possible topics for our own development over the course of the project, as well as conjectural ideas that might be a useful deliverable.

Several ideas have emerged as frontrunners at the moment:

Pathfinding & Navigation

Frequently, players need to make decisions about how to navigate through an area, whether it's a multiplayer map in *Call of Duty* or the mazes of *Pac-Man*. Especially for the prior example, understanding where an opponent is likely to go can be especially useful.



Hidden Information Games

Some games, like Battleship, involve at least a certain amount of information that is only known to one player, but which the other player wants to find out - in this example, the position of a player's ships. On the surface, these choices appear arbitrary; but are they, really? We can try to predict tendencies in player strategy when trying to hide information from another player.

Color & Music Theory

There has been substantial research into the psychological effects of both music and color. This gives us a basis for understanding how this might affect the choices an opponent makes. Do players play against a red-colored enemy differently than a blue-colored one? Or while soothing music is playing? These sort of subconscious responses to one's environment can be very powerful. Perhaps we can predict a player's choices based on factors that they don't even know they are taking into account.

A more complete list of many of our ideas, including those that have for the moment been passed over, is included as an appendix to this newsletter.

First Steps

After a lengthy meeting with Jesse, we decided to move forward with a few early experiments. We feel that it is necessary to test this space a little for ourselves, to better define our abilities to explore it.

One small experiment is to collect data on random number picking: that is, if we ask some number of people to pick a number from 1 to 100, what sort of spread will we get? This will also double as a simple test for how we can go about collecting large quantities of data quickly, probably through a service like Mechanical Turk.

The second, larger experiment is a maze-navigation game, which we plan to use over the next few weeks to explore the navigation problem discussed in the previous section. The game is a simple "navigate this maze" task, but we are building in the ability to collect data about the route a player takes through it. Based on this, we can attempt to build a

predictive AI for maze navigation, and test it on different structures.

Infrastructure

To assist these tasks, we have requested server space on ETC servers and are in the process of setting up our own web server and database server in that space. Being able to easily collect, organize, and analyze data will likely prove critical to the project, whatever shape it ultimately takes.

Next Week...

We will continue to build our maze game prototype. This prototype should be complete early to mid week. After that, will commence data collection with it to build a control group.

Resources

AI

- *AI Game Programming Wisdom 2*
- *AI Game Programming Wisdom 3*

Color Theory

"The Impact of Color on Learning", Engelbrecht

Dynamic Adversarial Gaming

"Heuristic Planning in Adversarial Dynamic Domains", Chamberland & Kabanza

Maze Navigation

- "Brain Activation During Human Navigation: Gender-Different Neural Networks as Substrate of Performance", Grön *et al.*
- "Navigation in a 'Virtual' Maze: Sex Differences and Correlation with Psychometric Measures in Humans", Moffat *et al.*

Music Theory

Notes and Neurons

Pathfinding

- A* Pathfinding Project
- AngryAnt.com: Path Project
- "Fixing Pathfinding Once and for All"

Risk-Taking

"A Survey Study of Factors Influencing Risk-Taking Behavior in Real-World Decisions Under Uncertainty", Baucells & Rata

Rock-Paper-Scissors

- "How to Win Rock-Paper-Scissors Every Time"
- "Rock-Paper-Scissors: You vs. the Computer"

Stress

Stress: Portrait of a Killer, National Geographic

APPENDIX: BRAINSTORM IDEAS

Below is a list of many of the ideas we discussed over the week. Some are ideas for topics, others for implementations.

Omitted are some of the ideas discussed above.

Advertising

There's certainly no doubt that advertising is concerned with predicting how people will react to stimuli; perhaps through crowdsourcing methods (maybe a business simulation game), we could possibly try to predict this "adversary".

If anything, though, our concern would be finding anything new or novel to do in this area.

Avatar Choosing

What do our choices at the beginning of a game - the aesthetic decisions we make - say about our tendencies? From fighting over who gets to be the race car in Monopoly to the intricate avatar creation systems in modern games like *Fallout 3*, are these aesthetic choices predictors of player strategy?

Biometrics

With the equipment used by the Physion project in Spring 2010, we have access to some biometric data for players. We could possibly use that as predictive data.

Criminal Behavior

Criminology is an old field, and criminal profiling an important part of modern crime-solving efforts. Is there something here we can use to predict certain kinds of player activity?

Dogfighting

The flight simulation genre is an old one, as game genres go. The complex aerial acrobatics that go into these games involve numerous snap decisions on the part of players. Anticipating your opponent can be as important as out-flying him.

Situations like this - real-time, complex conditions - can be very hard to predict procedurally, however, since it is difficult to establish states for the AI to work with. Still, this area, or one like it, may be worth engaging if we can find an approach.

Gambling

Classic casino card games could provide us with solid, ready-made models of player activity, especially in regards to bluffing and risk-taking: can we predict when a player is bluffing in poker, in a novel way? Or how likely a player is to take another card in blackjack when the odds are against him?

While the games are structurally fairly simple and recognizable, the prominent human element in gambling games make them both a compelling and difficult area to work in.

Emotion

As a predictor, emotion may seem obvious: players who are angry or irritated are more likely to act quickly without thinking things through, for example. Still, perhaps this question is worth asking; moreover, how does the *opponent*'s disposition prompt certain responses from a player. If we implemented an "emotive" computer opponent (that is, one that would act "happy" when it was winning, or angry when it was losing), could we predict player response to that AI?

On a broader but related scale, can we crowdsource sites like Twitter and Facebook to try to engage the issue of "gross national happiness", a measure started in Bhutan. Can a sweeping happiness metric predict the collective actions of a nation's people?

Hidden Items

Video games have long included some sort of collectible item, like coins or rings. A large subset of these include especially valuable hidden items. Can we predict a player's search

pattern, or how thorough they will be in finding such things?

Moral Games

Increasingly, moral choice is a feature in certain game genres. Can we predict which side of the good/evil divide a player will fall on? Based on this, can we predict anything else?

This area might be slightly dubious, since many players might play a game several times: a "good" play and an "evil" play. This might invalidate the significance of such a choice somewhat.

Psychics and Cold Readings

Whether or not one believes in psychic phenomena, there are definitely people who make a living of cold reading - taking subtle cues and crafty guesses to create the illusion of psychic abilities. This is, amongst other things, a tried-and-true stage act.

Can an AI be trained to do "cold reads" on a player? Perhaps not for the player's deceased grandmother's name or anything, but for purposes of anticipating player strategy and action.

Real-Time/Simultaneous Play

Predicting action in real-time games is substantially more difficult than turn-based games. The latter have discrete states by necessity; the former do not.

Simultaneous (but not real-time) play may be a good middle ground; games like Wings of War involve players choosing their moves and then revealing their action simultaneously. Players have to plan their actions according to what they *think* their opponent might do.

Then again, perhaps this situation is not fundamentally different from traditional turn-based play.

Risk-Taking

How likely is a player to take a risk, and if he does, how big of one? Being able to predict the tendency towards significant risk could be valuable in predicting an opponent.

This could, potentially, be analyzed with an existing game easily enough: many games require players to weigh risks when choosing what actions to take. A simple turn-based game could also let us get straight to the topic at hand by offering the player discrete actions with different costs and probabilities of success.

A player more prone to risk-taking is more likely to defy "conventional wisdom" about safe and secure moves.

Rock, Paper, Scissors

The game of Rock, Paper, Scissors offers a simple and discrete realm for prediction: and, indeed, AIs have been built to guess against a player.

Systematic prediction based on pattern recognition has been done, but perhaps there are other variables which we can used to predict strategy; do males and females use each option equally? Old and young?

Alternately, we could try to go in the opposite direction: construct an AI that, given a certain number of rounds playing against a player, can predict certain things about the player.

Roleplaying Game Classes

Games like *World of Warcraft*, *Dragon Age: Origins*, and, of course, tabletop counterparts like Dungeons & Dragons ask players to choose a class to play, a role to fill. Can we make meaningful predictions about what class a player might choose? Based upon that choice, can we make predictions about how a player will approach the game (beyond the obvious)?

For tabletop games, at least, this could potentially predict things like teamwork and social tendencies for the player, since the players are present in the room together. This is possible, but less prevalent, in electronic games like *World of Warcraft*, and nonexistent in single-player experiences like *Dragon Age*.

Social Games

Facebook games (and games on other social platforms) are extremely popular. Can we make broad, crowdsourcing-like predictions based on the play habits of the social game audience?

Or, could we design a social game that could essentially crowdsource to predict significant changes in the real world - for instance, the outcome of elections?

Stock Market

Can we use a gamelike simulation (as discussed in the previous topic), crowdsourcing via Twitter, or other broad metrics to predict the ups and downs of the stock market?

Perhaps more interestingly, could a swarmlike AI system predict the actions of stock market traders, and thus the market itself? (Evan dubbed this idea "Investoids", after the Boids model.)

Stress

Numerous factors have lately been shown to influence stress, and stress is, to a degree, a predictor of things like lifespan and economic status. Stress can even be bred before birth.

Can we, therefore, predict stress-related symptoms based on a player's origin? Economic status? Would this be a useful ability?