GAMES AND CITIZEN SCIENCE

Massively Multiplayer Online Science (AKA MMOS)

David Najjab, Gearbox Entertainment
CITIZEN SCIENCE FOR SERIOUS GAMERS

Massively Multiplayer Online Science purpose is to connect scientific research and video games as a seamless gaming experience.

As amazing as computers are, there still many tasks where humans are much more effective.

By creating mini science games within larger popular games, players can solve puzzles that sort out data where computers are unable to do so.

Converting a small fraction of the billions of hours spent with playing video games will bring an enormous contribution to scientific research.
**PROJECT DISCOVERY**

MMOS created the concept and partnered in the implementation of Project Discovery.

Together with EVE Online, MMOS created a mini-game to analyze microscopic images from the Human Protein Atlas and light-curves of stars from the observatory of the University of Geneva.

Players have submitted over 200 million classifications so far.

The success has been praised by wide press coverage of articles in papers like Nature Methods, Nature Biotech, Wired, Independent, BusinessWeek, The New Yorker, New Scientist, and the Neue Züricher Zeitung...

...more at [http://mmos.ch/#press](http://mmos.ch/#press)
NEXT EXOPLANET OR SOLAR SYSTEM DISCOVERY COULD BE MADE ACCIDENTALLY BY GAMERS, NOT BY NASA
EVE Online gamers will seek real exoplanets in virtual universe

EVE Online play scientists to talk research
WHAT IS A CITIZEN SCIENCE INITIATIVE?

The collection and analysis of data relating to the natural world by members of the general public.

This is typically as part of a collaborative project with professional scientists.

Microbiomes being studied in this project are believed to be linked to many diseases and conditions, from diabetes to autism and anxiety to obesity.

The gut microbiome has also been linked to how individuals respond to certain drugs, including how cancer patients respond to chemotherapy, and it has even, tentatively, been suggested that it could be linked with how well we sleep.
WHY MAKE A CITIZEN SCIENCE INITIATIVE IN OUR GAME?

The computation of accurate multiple sequence alignments is extremely challenging.

The problem is computationally difficult and would require a tremendous amount of computational power to be solved exactly.

There is no universally accepted metric to evaluate the quality of an alignment - thus the “gold standard” for sequence analysis remains the manual refinement of alignments by expert geneticists.

Gearbox’s participation offers access to millions and millions of gamers – a scale never reached by any online citizen science project.
AMELIE BROUILLETTE
GEARBOX ENTERTAINMENT
LEAD PRODUCER

“I love that we are tearing down barriers between video game studios and the academic world and creating something unique that could have a real impact on people’s health.”
“The opportunity to use a videogame to contribute to health science is incredible! Empowering users to actually make an impact on shaping the future of health care is what excites me most about this project.”
HOW DOES IT WORK?

Academic Team

Activity 1
1. Collect and build clean microbiome data sets
2. Leverage results generated from project

Step 1 Filtered sequencing data

R. Knight (co-PL)
D. McDonald

Research Collaborator
(case study)

Activity 2
1. Build puzzles microbiome from data
2. Aggregate solutions to improve alignments
3. Learn customized algorithms from solutions

Step 2 Alignment puzzles

J. Waldispühl (PL)
M. Blanchette (co-PL)

Academic Project Leader

Activity 3
1. Distribute puzzles to gamers
2. Collect puzzle solutions from gamers

Step 3 Ranked puzzles

A. Szantner (PL)

Activity 4

Step 4 Puzzle solutions

Video game design and deployment

Step 5 Packaged puzzle solutions

Amélie Brouillette

Receptor Consortium

Receptor Leader

Step 6 Improved alignments

MMOS

Activity 3

Step 2 Alignment puzzles

Research Collaborator
(case study)
WHY WOULD GAME COMPANIES WANT TO DO THIS?

Because we want to make the world a better place.

We’re entertainers, and hopefully we bring some healthy fun in people’s lives. That’s a good thing. With this game-inside-a-game, our players get to add impact to that fun. That’s a great thing!

It adds a layer of meaning to our work as game developers that elevates our craft as a whole.

It feels good to put our skills to use on something like this.
THE PROJECT
THE GAMEPLAY?

It began with the first version of the game (Phylo)

Players: introduced to a console and vending machine located in Sanctuary 3’s med bay.

Patricia Tannis: main character linked to this machine.

Completing Puzzles: rewards players with currency to use in the vending machine for unique character customization and boosters.

Modified algorithm: simpler and shorter puzzles while keeping scientific relevancy.

Clear Citizen Science video: players can learn about what they are doing.

SUPER TANNIS!
HELLO, SCIENCE LOVERS!
DNA ARCADE MACHINE
**IMPACT SO FAR?**

- **2.315 million active participants** have solved at least one puzzle
- **91.3 million puzzle solutions** from Borderlands Science players
- **204.78 years-worth of game time** spent within Borderlands Science

*Borderlands Science solved more problems/gathered more data in a few hours than Phylo had in the previous 10 years!*
QUESTIONS?