**Fun with science: games as interactive and dynamic tools for sharing freshwater ecology concepts.**

There is an increased expectation on people to be aware and involved in the environmental issues our world is facing today and will face tomorrow. However the understanding of the problems often requires expert knowledge, which eventually can lead to make people losing interest and get bored. As many scientists realized, one of the challenges lies in explaining complex issues in a simple and understandable way to an unspecialized audience. As young and enthusiastic scientists, we thought that games could develop into a nice informal science learning to deliver knowledge. Indeed, play is the first form of learning we all experienced and it is very popular in our culture. Board games, for example, often recall socially important moments of shared entertainment with friends and family. From a “scientist” point of view, games have many advantages. They are dynamic and interactive, and therefore they increase the player engagement and its knowledge retention. Furthermore, through the immersion into a world with given boundaries, the player discovers and activity takes part at a virtual environment. Following a quest, he has to face challenges and thus he develops a strategy and needs to indentify the crucial moments.

In this context, our objective is to use the features of a game to develop tools to transmit the basic concepts of freshwater ecology, more specifically fish ecology. We choose to focus on a classical board game and on a computer based game as they are complementary in the public targeted (groups versus online gamers) and the possibilities offered, in particular interactions between players and time incorporation.

Material and methods

The methodology followed basically relies on our past and present experience of games complemented with knowledge acquired during our specialization in ecotoxicology and (?? Mets ce qui te concerne!!). The major step were: (1) selection of fish species (criteria: ecological relevance, interaction); (2) definition of interactions between players (predation, competition); (3) incorporation of environmental stressors (biotic and abiotic), (4) design and construction of the interface.

Results

General development

Both games are based on the same general rules, even if slight modifications have to be expected in the final version. Here a presentation of what could be the story:

“You, little fish, just reached a new lake after an extremely intense rain event. The new lake is to be conquered. But you are not the only one: 3 other fish species arrived. Which species will find its territory first? Which of you will reproduce fast enough to reach a stable population level that will allow the species to remain forever and ever in the lake? Be carefull ! Nature is often hostile and might stay in your way. You will need to use strategy to avoid enemies, to compete for resources, to grow up and eventually to reproduce … in order to become the next master of water!”

Rational: The virtual ecosystem is presented from a fish perpective. Each player is a fish with 4 species represented: je me rapelle plus les noms anglais…. There are carnivors predators (perche soleil and sander) as well as smaller fish living in shoal (Roach and ablette), highlighting local and invasine species (perche soleil) with different ecology. Indeed, each fish has its specific resources attributed represented either on the board or on the screen. Each resource (crustaceans, plants, small fish, insects…) provides a specific amount of energy. With this energy, the fish can reproduce, and then the juvenile fish will look for resources again to become an adult. The game ends when one player reached his objective of adults and juvenile fish. Interactions between players are represented as follow:

<Petit arbre avec qui mange qui >

Futhermore some “events” could occur and affect the virtual ecosystem, those events represent the “outside” world, the stressors fish could face in the lake. They are thought to favor or defavor directly or indirectly some player. Some example of what could be an event:

* “ It is the full moon, you see as clear as if it were a day light: play again!”
* “The agriculture season of pesticids uses just started: no more plants for 2 turns” (seasonal chemical pollution, with direct effects for herbivores and bottom up effects for fish feeding on herbivores)
* “The fishing season of “sander et perche soleil” just started, you just lost one adult…”
* “The temperature of the lake increases drastically this sommer, if you are a perche soleil, the time you need to reproduce is divided by two, in other case it is increased by two. (advantage of being an invasive species)
* Water scarcity

The events are thought to represent abiotic and biotic factors affecting the environment. They include classical pollution, but not only such parasites, nutrients, anthropic activity (fisherman, diving excursion…) as well as pollution, but not only. The aim here is to make aware the player that from a fish perspective, everything impacting the environment matters.

Perspectives:

* To run both games several times to refine the rules and the interactions between players and to test with volonteers (online for every body available, the board game with friends and family).
* To develop a nice design to make the game attractive
* If we reach the stage of funny, entertaining, beautiful board and computer based games, why not using crowdfunding platform and dedicated exhibitions to diffuse
* The player is then immerged into a world with given rules and boundaries. He discovers and actively takes part at a virtual environment. Facing challenges to progress and to accomplish a quest lead the player to develop a strategy and accordingly, to identify crucial moments.