

# Videogames and metaverses as spaces for scientific, cognitive and social change

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Figure: conceptual image of the Pirarucu-Gente metaverse project

## Abstract

This article points to evidence that digital games and metaverses can be used in traditional areas of academic research. Furthermore, we aim to show the advantages of using them as an instrument of change in environments of research and social outreach employing the action research methodology. This methodology at the same time enables knowing a particular environment or object of study and making changes and improvements in this same environment. Digital games and metaverses allow us to recreate elements of a given reality by means of simulations and enable reflective thought on it as well as providing conditions for the actors within this environment to plan and implement significant changes in them.

**Keywords:** games, metaverses, virtual worlds, topophilosophy, action-research, agroecology

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## 1. Introduction

Considered by many only as elements of entertainment, digital games, virtual worlds and metaverses<sup>1</sup> increasingly move in quite unexpected and surprising directions. In recent years, in addition to providing various types of simulation of reality that allow, for example, to train airplane pilots in flight simulators or even train soldiers in

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1 We use here the definition by Davis *et al.* [2009] which says that “Metaverses are immersive three-dimensional virtual worlds in which people interact as avatars with each other and with software agents, using the metaphor of the real world, but without its physical limitations”.

the skills of war, digital games and metaverses have become objects of study as they provide a new horizon for research in both Mathematical sciences and the Humanities, as they create new virtual spaces where people can try out new facets of their identities [Turkle 1997] and develop personal and collaborative skills. The advent of the metaverses, or MMOGs - Massive Multiplayer Online Games, only possible due to important developments in 3D vector computer graphics and network connection via the Internet, has enabled new forms of relationships between real people through their avatars. The Internet and cyberspace have created a culture of simulation "that is affecting our ideas about the mind, the body, self and the machine" [Turkle 1997, p.16]. Cyberspace became an integral part of our daily lives and we modify and are modified by it. The development of computational resources coupled with the Internet has completely revolutionized the way we work, the way we do business and even personal and emotional relationships between people. Now it's time to realize how much all this is changing our cognitive structure and also how we can use digital games and metaverses for scientific research, in outreach activities in areas that we previously considered completely independent from digital games, and, why not, to promote social change.

## 2. Related Work

The conceptual and pragmatic references for thinking games and metaverses as spaces for scientific cognitive and social transformation are many. From the conceptual point of view, they start with the studies by Heim [1993], Negroponte [1995], Turkle [1993, 1997] and Lévy [2010] which point to the fact that living in the digital era brings about a new kind dynamics that promotes the transformation of identities and cognition of humans, as they express their thoughts, feelings and actions through their avatars. Even studies closer to the Brazilian reality such as those by Petry [2010], Pontuschka e Petry [2011] and Pontuschka [2012], locate the perspective of digital life within the context of a new (digital) world view that has at the same time cognitive and phenomenological effects.

Thus, the relational unfoldings that these studies suggest can be grouped within an *angeletical*<sup>2</sup> perspective of cyberspace according to

2 *Angeletics* – the theory of message according to Capurro [2003].

Capurro [2000, 2003], identified by Matheus [2005] as a conceptual basis for a philosophical and theoretical foundation for information science, what enables us to think of communication between individuals in cyberspace in the context of a transformative digital experience. The conceptual studies, such as those by Manovich [2001], have given an impulse on pragmatic efforts to implement proposals of navigable digital environments. Here we have a second front to be considered - the concept that builds an effective digital reality.

From a pragmatic use of digital environments standpoint, we have the work of universities and companies that demonstrate with navigable devices the pragmatic and conceptual possibilities of digital environments, such as games and metaverses for applications related to information, leisure and cognition. Beyond the famous example of *Second Life*, we can mention two other examples of digital environments in cyberspace<sup>3</sup>. The first, which has a direct relationship with the *Gamebryo game engine*<sup>4</sup> is the tour and digital interaction system produced by *vizerra.com*. One of their examples consists of a full view of a navigable environment with avatars and editable elements in the *Vizerra Demo Project*.<sup>5</sup> The second example we bring is produced within the academic research on games and metaverses. It is the *Labirinto Artístico-Filosófico 1260* academic game<sup>6</sup>, which presents in hypermedia and games digital language an interactive reflection on the concept of aesthetic experience and on how thought processes work in the context of digital environments. The academic game starts with ontological assumptions that were developed by authors such as Turkle [1997], Manovich [2001], Kinsman [2002], Murray [2003], Hansen [2004] and Capurro [2009] on the

3 Our reader may object that there are certainly hundreds of examples, and we would readily agree with him/her. We chose two examples here to present two kinds of works: one of them directed to business and the other, closer to us, focuses on the academic perspective.

4 The *Gamebryo game engine* can be found at: [gamebryo.com/index.php](http://gamebryo.com/index.php)

5 The system and the proposal of *Vizerra.com* can be found at: <http://www.vizerra.com>.

6 This was discussed in a paper during SBGames 2011 in Salvador, in which the concept of academic game was presented [Petry 2011b].

side of the digital world researchers and by authors such as Heidegger [1947], Lacan [1996], Gadamer [1999], Elster [2000], Sennett [2009], for example, from the side of the sciences of the spirit. While this second group of thinkers structure an ontological-cognitive basis for thinking the question of man, his existential condition and practical determinations in time and space, the first group applies the same basis to the open field of the digital, on the *waste land* as writes Mannovich quoting a poem by Eliot [1992]<sup>7</sup>.

The ontological core of these two listed productions, as well as of other works in which they are based and that surround them, is the concept of *navigable space* [Mannovich 2001] which was reworked by Petry [2003] from the perspective of a *topophilosophy*. Topophilosophical work is linked to the production process of three-dimensional environments that form digital worlds and the characters that make up *metaverses and games*<sup>8</sup>. It focuses on the notion of space taken from the phenomenological point of view, what means that it is thought in the context of ontological and cognitive perspectives. In this direction, understanding the theme of metaverses and games from a cognitive-phenomenological

7 *Waste land*, is both a poem by T. S. Eliot, published in 1922, and a film that can be found on the Web, ([wastelandmovie.com](http://wastelandmovie.com)) and a concept that indicates the dimension, the solitude and the open space to be explored in the digital, on websites, games and metaverses.

8 From a conceptual point of view topophilosophy is defined as the thought process in three-dimensional digital production. From the Heideggerian concepts of building (Bauen), dwelling (Wohnen) and thinking (Denken), topophilosophy takes the activity of the digital artist as a three-dimensional digital ontological process, in which art and thought walk side by side. In practical processes the activity of modeling three-dimensional characters, objects and worlds, reflective thinking accompanies the creation process, what results in a confluence with Gadamer's [1999] position, which shows that the historical background constitutes a privileged way to the development and promotion of culture in Western civilization. Close to this perspective, topophilosophy works the idea of the origin of art and its determination upon thought [Petry 2011].

perspective, called by us *topophilosophy*, constitutes a new front for scientific research that has a large growth potential<sup>9</sup>.

### 3. A small history of games and their traditional relations with education and research

As products of the *digital spectacles era*<sup>10</sup>, videogames were born in the context of academic and military research. One of the first electronic games created, *Tennis for Two*, was developed in 1958 by William Higinbotham by using an oscilloscope and a system of circuits [Armitage 2006] and it had the first joystick in history<sup>11</sup>. Developed as an activity to entertain visitors in the only day that the military base of *Brookhaven National Laboratory* was open to the visit of civilians, Higinbotham's invention became one of the pioneer experiences in electronic games.

On the other hand, the first steps towards a greater sophistication of electronic games only happened when universities began to use mainframes for academic research and teaching. The first game really developed in a computer was *Spacewar*, created by Steve Russell on a PDP-1 mainframe computer at MIT [Armitage 2006]. The original intention was just to show the capacity of the mainframe to perform complex activities with graphics, hitherto not possible in other mainframes<sup>12</sup>. Deeply influenced by *Spacewar*, Nolan Bushnell, an engineering student at the

9 Our reader will see later on in the paper that we will add the social component from structural anthropology to the topophilosophical perspective.

10 An allusion to the brilliant work of Guy Deborin, *The Society of the Spectacle*. In the XXI century we live in the era of digital spectacle, in which the boundaries between the real, the imaginary and the digital interpenetrate.

11 *Tennis for Two* actually did not use a computer. It used the visual devices of an oscilloscope and was based on calculations of ballistic trajectories that the U.S. military were using at the time.

12 The creators of *Spacewar* could not imagine that it would attract so much attention. Since that time it was possible to experience how a game could be addictive, even with very simple graphics and no audio.

University of Utah, had the idea of creating arcade game machines with electronic games like *Spacewar* where people would pay to play. He started with the *Computer Space* project in 1971, making an adaptation of *Spacewar*, and later founded the famous *Atari*. As described by Rabin [2012], from then on the path to the development of videogame consoles, PCs, Macintosh and all other derivatives was open.

But probably the first online community of the world was organized around the PLATO system (Programmed Logic for Automated Teaching Operations) in 1960 at the University of Illinois. Developed on mainframe computers manufactured by Control Data Corporation [Armitage 2006] with the support from the U.S. government, it became the first online community in the world, even before the advent of the Internet [Woolley 1994]. The project lasted 40 years and included many of the tools that we know today, such as an e-mail system, chat channels, harboring many online games and numerous multimedia capabilities bringing together thousands of users in a spontaneous community.

The relationship between PLATO and games and metaverses is the fact that many multiplayer games were developed for PLATO during the 1970s and 1980s, such as *Empire* (a multiplayer game based on *Star Trek*), *Airfight* (a precursor of flight simulators), *Panther* (a vector graphics game based on a theme of tanks, forerunner of Atari's *Battle zone*), and several games such as the 1975 role-playing game *Dungeons & Dragons* (DnD). It is then that we have the advent of MUDs<sup>13</sup> with massive online gatherings of people opening doors to the future developments that would lead to virtual worlds and metaverses.

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13 MUDs - Multiple User Dungeons - were a popular form of text adventure games. The origin of MUDs is based on two multiplayer text games: *Colossal Cave Adventure* in 1976 and *Zork in 1977* [Bartle 1990]. These were the first "adventure games" in history. The first MUD itself was simply called "MUD" and was written in 1978 by Roy Trubshaw, a student at Essex University in England, MACRO-10 language for a computer DECsystem-10. The "MUD" was the first adventure game to support multiple players. The success of promoting the game ended up creating a number of other similar games in the university shared mainframe environment.

Just as gigantic and fun chats, MUDs provided the first effective virtual environment where users could interact with a narrative world and with each other - elements present in numerous videogames today that use the concept of *Sandbox*<sup>14</sup>, also present in various multiplayer games and metaverses. MUDs comprised a navigable structure with elements of gameplay in which there was a multiplicity of imaginary "places" to which players could move, but the multiplayer component then allowed players to interact with each other and help to create a new dynamics for these navigable places and a type of non-linear narrative. The players could include more structures to the world by adding new content to the main database of the MUD. This is what Turkle [1997] tells us, showing the role that technology (in university research centers) have had in shaping a new social and cultural sensitivity, and producing new subjectivities and identities that were driven by the shared use of computer technology and indeed the invention of virtual environments. The studies by Turkle refer to a time when metaverses with graphical user interfaces did not exist. MUD worlds were created only through texts. Still, the changes in the lifestyle of its users were large and led to interesting and important changes in the identity of those who used them<sup>15</sup>.

Everything takes place in the threshold of cultural aesthetics, in which we move from a *modern aesthetics* to a *postmodern aesthetics*, passing from a "culture of calculation" to a "culture of simulation" [Turkle 1997]. This technological and cultural transformation performs a toggle operation in which we move from a "*what the computer can do for us*" mindset to a new social, cultural and cognitive place where we begin to realize "*what the computer does in us*". Thus we increasingly realize that the "world of bits" is present in our everyday life [Petry 2012] and, with Negroponte [1995] we can see that "informatics has

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14 *Sandbox* is an open virtual world concept that implies a design concept in computer games in which the player is given the possibility of walking around freely in the virtual world and make modifications to it and take advantage of the persistence attributes of this world.

15 It is in this sense that Turkle tells us about the "intense relationships people have with computers and how these relationships are changing the way we think and feel" [Turkle 1997, p. 32].

nothing to do with computers. It's all about people's lives."

By realizing that there is a subjective element in computers and especially in games, computers and its corresponding videogame forms step into the space of human sciences, opening up new and fruitful fields of research and a variety of possibilities: education, business, entertainment, research, in culture as a whole.

The powerful and real psychological workshops of MUDs as described by Turkle, where players could experience multiple identities and roles, landed on the beach of an online universe in which a great deal of our lives becomes digital [Negroponte, 1995] - converging into a cyberspace populated by humans and *bots* that influence each other. This universe of possibilities comes with the dawn of Massive Multiplayer Online Games and dominates the scenes of human life, especially the Internet, culminating in the development of this new human environment that we call cyberspace. Our encounter with cyberspace will inevitably be in the form of a digital space, and above all, within a navigable space [Manovich 2001, Petry 2003]<sup>16</sup>.

If videogames dominate our attention it is because they focus on two key elements that the notion of play (*Spiel*)<sup>17</sup> opens for man: a space in

16 Jumping from one site to another through their links, the human subject goes from one point to another in culture, moving through thousands of places within the cultural, political and geographical boundaries of a web that "promises" to bring humanity together in a collaborative and shared discourse [Manovich 2001; Murray 2003]. This constitutes an important facet of cyberspace, which leads us quietly and subtly to the context of fully immersive, massive and persistent virtual environments, called here metaverses.

17 For a broader philosophical concept of game, we refer our reader to how the term "game" is treated in the context of the Western tradition and its relevance to the narrative world of games. With this concept we can see that "the act of playing a game (jogar) and playing (brincar) can be considered a kind of virtual simulation characterized by staging (encenação), which can be instigated by both the search for mastery of something as by the chaos, and generated "by competition (*agon*), for fun (*áthirma*) and/or *paidiá* (what is proper

which both the *ludic/playful action* and the universe of narrative (fantasy) are in work together in the production of subjectivities. As we could see in MUDs, the precursors of metaverses, inside them the concept of *game* is shaped in a natural, almost invisible, way.

#### 4. on the concept of virtual worlds and metaverses

The definition that we consider most simple and comprehensive of metaverse is provided by Davis et al. [2009]:

"Metaverses are immersive three-dimensional virtual worlds in which people interact as avatars with each other and with software agents, using the metaphor of the real world, but without its physical limitations."

Here we should make a note on the difference between virtual worlds and metaverses. There are virtual worlds that are not multiuser. Examples would be games having a navigable 2D or 3D virtual topology but that do not comprise a multi-user system. In the definition of Petry [2011], they are "protometaverses" as they have almost all the characteristics of a metaverse, but lack the multiuser component. In these, each user interacts with and modifies the environment, but only relates to NPCs (non-player characters) developed through Artificial Intelligence (AI). Thus, we understand that virtual worlds are immersive navigable worlds, no matter if they are multiuser or not. We can have a virtual world in a MMOG, in a MMORPG or in a game in standalone mode, as the wonderful virtual world in the game *Shadow of the Colossus* [2003] for PlayStation 2 and 3, which has no multiplayer mode.

Below we present the definitions of virtual world, protometaverses and metaverses as organized by Pontuschka [2012] from an original formulation by Petry [2011]:

**Virtual Worlds:** are immersive navigable 2D or 3D digital worlds. They may exist within metaverses or in single or multiplayer games. Examples of virtual worlds can be found in: the

of the child, but not unique to him/her), the act of playing a game (jogar) and play (brincar) provides a broad space for the expression of whatever is possible to imagine in the field of human thought" [Petry, A.S. 2011].

virtual world of *Shadow of the Colossus*, the virtual world of *Second Life*, the virtual world of *Entropia Universe*.

**Protometaverses:** are formed by three-dimensional immersive virtual worlds where people interact only with software agents, using the metaphor of the real world, but without its physical limitations. The limiting feature is that it is multiplayer. Examples of protometaverses can be found in: *Zork* and *Myst Series*, *Heavy Rain*, *LA Noire*, *GTA*, *Ilha Cabu*, *Labirinto Artístico Filosófico 1260*, *Alletsator*.

**Metaverses:** are formed by three-dimensional immersive virtual worlds where people interact with each other and with software agents, using the metaphor of the real world, but without its physical limitations. Features a multiplayer system. Examples of metaverses are: *Second Life*, *Entropia Universe*, *Myst Online Uru Live*, *World of Warcraft*.

The MMOGs (Massive Multiplayer Online Games) would be the main category of what we call metaverses. The term "massive" refers to the fact that they are persistent virtual worlds that are populated by hundreds, maybe even thousands, of simultaneous players over the Internet. The term persistent refers to the fact that the virtual world remains there even when we are not online, that is, events continue to happen, and other people can interact with and modify the environment until we are connected again. In games that are not persistent, the virtual world ceases to exist when we disconnect.

### 5. Games, metaverses and collaboration in academic research projects

The potential of virtual worlds, most notably metaverses, for scientific research has already been pointed out by Bainbridge [2007] by saying that virtual worlds (metaverses) "have great potential as sites for research in the social, behavioral, and economic sciences" as well as studies in computer and information science. *Second Life* and *World of Warcraft* inspired research that introduced a number of research methodologies, including formal experimentation, observational ethnography, and quantitative analysis of economic markets or social networks into the cyberspace. Bainbridge points out some interesting lines of study that can be worked with the use of metaverses, namely 1) the line of virtual laboratory experiments, 2) research in observational social and economic science and 3) computer and information Science.

The line of virtual laboratory experiments in metaverses refers to the creation of virtual buildings in which virtual educational and research activities are developed, allowing a series of experiments<sup>18</sup>. These labs help advanced students to replicate classic experiments in the metaverse, and also help to develop skills in young students. One of the interesting issues in this regard is that these laboratories, as they are accessible via Internet, can be integrated into the curriculum of undergraduate institutions that are not in major research centers, and thus significantly improve the quality of education at these sites. In this regard, several groups have designed so-called "collaboratories" [Teasley 2001] whose efforts generate cooperation between researchers in different universities and shared use of databases and experiments as teaching tools.

The second line of study for metaverses would be in the area of observational social and economic science [Bainbridge 2007] which consists in doing research in the metaverses and using them as environments to do scientific socio-economic research. This is an example of how the metaverses can show trends and some metaverses serve as "hatcheries" of new cultural movements. This line would comprise also similar studies to those conducted by Turkle on the issue of identity and "self" in cyberspace and other matters of psychological nature<sup>19</sup>.

The third research line pointed out by Bainbridge [2007] would treat the possibilities related to computer and information science and to the challenges of providing increasingly complex experiences based on the limitations of current Internet technology, in particular problems of latency and bandwidth that can greatly limit the

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18 *Second Life*, for example, provides environments and tools that allow users to create online laboratories that have the potential to work thousands of research subjects for many months at a reduced cost, using scripting and graphics tools that allow anyone to build a virtual laboratory building and functioning equipment to run experiments [Bainbridge 2007].

19 Other issues such as copyright, intellectual property, ownership of land in virtual worlds and theft of objects and virtual currencies create heated debates in the real world forcing the creation of specific legislation for the area.

experience especially in the case of online multiplayer action games<sup>20</sup>. Within this line would be studies on AI, for example, on how to improve the NPCs (non-player characters) to make them more realistic and perform specific tasks in metaverses. Another issue that can be worked in this line of study is the area of human-computer interaction, for example, the development of new interfaces and information visualization methods in order to create more immersive ways than those the current virtual reality and augmented reality technologies provide.

In addition to the possible lines of scientific studies in games and metaverses, we see an area in which all lines of study above can be used for the transformation of society, not only overcoming the barriers of cyberspace but also using cyberspace activities to improve conditions of life in the real world. These would be proposals of study based on the methodology of action research, as we will see ahead.

### **6. Action-research possibilities in games and metaverses for the transformation of society**

Action research<sup>21</sup> is a kind of empirically based social research that is designed, conceived and carried out towards an action to solve a collective problem in which researchers and participants from the community become involved in a cooperative

20 Other issues within this line of study could be better ways to control the client-server and peer-to-peer experiences to provide increasingly faster and satisfactory experiences to the users of metaverses and multiplayer online games for consoles that use the Internet to connect players.

21 The pioneer reference is the work of German psychologist Kurt Lewin at MIT, in his 1944 work, "Action Research and Minority Problems". It is a comparative study of the conditions and effects of various forms of social action and research aimed at social action" that use "a spiral of steps, each of which consisting of a cycle of planning, action and identification of the results of this action" [Lewin 1944]. Other authors that are Worth noting in action research are Fals Borda [1959 and 1981], Paulo Freire [1983, 1999], Maritza Montero [1984], Gabarrón and Hernandez Landa [1994] and Villasante, [2003, 2004].

or participative way [Thiollent 1996, p.14], differing clearly from traditional research, which radically separates the actors from study objects.

Both action research and participatory action research are alternatives to standard conventional research whose main concern is the quantification of empirical results. In conventional research "there is no involvement of researchers with users or people involved in a situation under study" [Thiollent 1996, p. 19]. Moreover, there is always a gap between the results of a conventional research and possible decisions or actions that could be taken on a specific setting. In conventional research people that are the subject of study are only informants of a given situation, whereas in action research, we assume the participation and effective action of those who are the object of study, and these are considered "actors" within a specific context, and methodology makes it possible to study the dynamics of the relationship between different types of actors in a given context.

The methodology can be used in a range of areas, not necessarily focused on social issues such as organizational areas, in health and technology to enhance any project or institution [Thiollent 1999, p. 14]. It seeks to survey the situation, formulate strategies and practical actions that represent solutions to certain problem situations. The solutions are chosen according to different criteria depending on the interests of the actors in the community.

The type of research conducted by action research promotes social inclusion and uses an empirical analysis of concrete situations for the construction of themes and selection of issues to be studied, in order to establish, along with those involved, the priorities for intervention and action aimed at solving the detected problems. Due to its *sui generis* characteristics it is ideal for use in projects in which both researchers and other players are in the same environment, such as the virtual universe, a game or metaverse. For Thiollent [2011] participatory action research has been conceived as an instrument that can be adapted to the study that accompanies the introduction of new technologies, especially computer-based ones.

This process opens up new possibilities for information circulation and collective learning. According to Barbier [2007], in action research, data is relayed to the community, to ascertain their perception of reality and allowing a more

appropriate assessment of the problems detected. The examination of data aims at redefining the problem and finding solutions.

In this sense, the establishment of "online collaboratories" in a metaverse can provide a venue for discussion and a virtual repository of study material for analyzing the problems, finding appropriate solutions to them and, at the same time, providing an inventory of all these solutions that can be useful to all users, everything in the context of participatory action research.

A kind of "online collaboratory", as mentioned by Teasley [2001], is in development in Brazil. It is within the Pirarucu-Gente Project<sup>22</sup>, subproject *Sementes dos Saberes* (Seeds of knowledge). The Pirarucu-Gente is a project of technical assistance and rural extension that works with family-based rural workers, fishermen and fish farmers, besides technicians, researchers, professors and students of the university, for the study and development of agroecological best practices using the action research methodology.

The creation of the metaverse is a partnership between the Department of Fisheries Engineering and Aquaculture of Universidade Federal de Rondônia (UNIR) and the Departments of Computer Science and Digital Games of Pontifícia Universidade Católica de São Paulo (PUCSP), Brazil. In Rondônia, the research team is responsible for defining the content of the metaverse and what best practices should be promoted through them. The team at PUCSP is responsible for programming the multi-user virtual world and creating the 3D components and characters in cooperation with the team at UNIR.

In the case of the Pirarucu-Gente Project the purpose of action research work is three-fold: 1) working social issues, seeking to support fishermen, fish farmers and family-based rural-workers to improve their living conditions and earnings by means of agroecological practices and social and digital inclusion and socialization of methods, approaches and tools, 2) to improve the organizational structures of fishermen's and rural workers' associations to improve their services and

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22 The initial proposal for the Pirarucu-Gente metaverse project was presented during the SBGames 2011 by Pontuschka and Petry [2011] and can be found in the proceedings of the symposium.

professionalize their operations and 3) to introduce the academic community to these issues and provide a rich theoretical and practical material of study to researchers, professors and students of the university that may, at the same time, contribute to scientific knowledge and provide improvements and changes in the social environment in which the university is inserted.

All the work began off-line, along with the initial research with rural workers, fishermen and aquaculturists during the "problematization" stage to try to define which areas needed to be urgently addressed. Being a study involving rural technical assistance, each team of each of the eleven municipalities involved pointed out a specific topic that most needed attention. However, three issues were most frequently reported: a) the issue of deforestation and the devastating effect on the rivers and water sources. Many simply dried b) the issue of poverty and lack of variety of food for small family rural units and c) the issue of rural exodus by young people who feel a lack of options of work and leisure in the countryside.

Faced with these three main problems mentioned by participants, the group decided to study areas that could provide solutions to these major problems: 1) how to recover water sources and riparian forests in order to increase the supply of water, especially during the dry season, for family-based agriculture and 2) study techniques for creating *agroecological vegetable gardens*<sup>23</sup> without the use of pesticides to make optimal use of scarce water resources and provide a higher variety of vegetables, fruits and animal protein for rural families as well as to provide some species of spices and medicinal plants, ensuring food security for them. In addition to that, any excess production could be sold at street markets in nearby cities as "organic" or "agroecological" vegetables, ensuring

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23 *Agroecological vegetable gardens* are cropping and livestock production systems based on a mandala format, resembling the form of the galaxy or the form of the atom. The idea is to use the surroundings of rural family homes to support the development of multiple activities, focused on water conservation and use them as a primary source of life. Surrounding the nucleus of the vegetable gardens, orchards are raised, containing vegetables, medicinal and ornamental plants. The system also comprises the creation of small animals such as bees, fish, chickens, ducks, turkeys, among others.

an extra income for families. 3) To develop strategies for young people to stay in rural areas, enjoy the benefits of technology, have access to education and leisure. Once these fields of study were defined, the teams began to research these issues and to collect material in order to share it with the whole group both online and in face-to-face workshops. Until now workshops were held on the recovery techniques of water sources and on the agroecological production.

Teams at UNIR and PUCSP are currently establishing the requirements document and the GDD - Game Design Document for the creation of the main metaverse that will host the main "collaboratory" and the creation of the first mini-games related to the content of the selected priority areas. Once the GDD for the main metaverse is finalized, the team at PUCSP will start working on the 3D character rigging and programming of the virtual world. At the same time, the GDDs for two initial mini-games related to the first two priority themes are being prepared. The first is a mini-game that combines the knowledge gathered in the study on how to recover water sources and riparian forests. The second will be on agroecological vegetable gardens building techniques, suitable plant species and low cost irrigation techniques.

The process of creation of both the main metaverse and the mini-games that will be part of it, works as a think tank for problem analysis and solving. In order to create the metaverse and the mini-games, it is necessary to study the subject in depth and propose solutions that can be applied to each of these situations. While defining the concept of "topophilosophy", Petry [2003] recommends that, while modeling a virtual world by means of 3D object creation, we are thinking the object itself and how it fits into the world. In the context of action research that is of even greater importance, because action research starts from an analysis of the reality of the actors who are part of the research and seeks to rework and act on this reality to promote change. Well, the fact of recreating a virtual world based on the real world, but as an improved alternate reality of it is exactly what the participatory action research process intends to do in the real world. It is equivalent to the procedure described by Freire [1999] as moving away from reality in order to better think about it and then act on it. The thought processes of action research and the one proposed by topophilosophy are similar, parallel and not exclusive. The real determines and defines the virtual, and the virtual modifies the real.

As noted above, the action research work integrated in metaverses can become a powerful tool for education, participatory research and for social and community transformation. The community should be connected online and play, not just for leisure, but towards discussing local issues and transform their practices through dialogue in order to construct better living conditions.

## 9. Conclusion: our option for G4C

Studies on games and metaverses and how these can be used in activities to change society are just beginning. In this article we offer a conceptual and methodological framework that guides an important project funded by CNPq and by Ministério do Desenvolvimento Agrário of Brazil, showing the links that participatory action research approaches focused on rural population contexts, quality rural education and agroecological principles have in common with the *Games for Change* (G4C) movement. We believe that all real research is always participatory and continuous. To the extent that democratic access to broadband Internet becomes increasingly widespread and pervasive in Brazil, more people across the country can put themselves in the position of knowledge builders, and may become educators and agents of knowledge and research. This is the greater meaning of this article that brings together two universities and two research teams.

## Acknowledgements

The authors would like to thank CNPq - *Conselho Nacional de Desenvolvimento Científico e Tecnológico* and *Ministério do Desenvolvimento Agrário* for providing financial support to make this work possible.

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