Game Based Learning in Science Fiction

Néstor Jaimen Lamas(✉)

Arsgames, Non Profit Organization, c/Sant Adrià 20, 08030 T, Barcelona, Spain
nestor.jaimen@arsgames.net

Abstract. In the following paper, three different science fiction scenarios in which pedagogy and video games meet will be analyzed, considering the aforementioned genre not only as entertainment, but also as an experimental and technoscientific laboratory. In these narratives, different problems will be analyzed with which to approach Game Based Learning in relation with psychometrics, behaviorism and non-directive pedagogies.

Keywords: Game Based Education · Pedagogy · Science Fiction · Video games

1 Introduction

In the following paper, three different science fiction scenarios in which pedagogy and video games meet will be analyzed. We will consider the aforementioned genre not only as entertainment, but also as an experimental and techno scientific lab. In order to do this, we use Gilbert Hottois' definition of technoscience:

> ...its actions and its products, result from the collaboration of a host of agents: research scientists from many disciplines, engineers and entrepreneurs, fundraisers and share-holders, lawyers and economists, commercial and marketing agents, etc. An essential aspect is that the subject of technoscience the actor, the motor and even the inventor – has become irreducibly plural: complex, interactive and inevitably conflictual (Hottois et al. 2018: 130).

That is, science fiction does not explain technology in a practical or neutral sense, but through its social, political and ideological implications.

From an epistemological point of view, according to the renowned science fiction scholar Darko Suvin, science fiction could also be considered "a literary genre whose necessary and sufficient conditions are the presence and interaction of estrangement and cognition" (Suvin 1979). From this other approach, its object is the psychological relationships between mankind and science. However, science fiction does not only deal with cognition. In many cases it produces knowledge itself and has even laid the foundations for modern sciences. C. Clarke is an example of this. In his book The City & The Stars, which came before Stephen Hawking's seminal theory (Clarke 2012), he outlines the concept of black holes; or the laws of robotics by I. Asimov, which constitute a milestone in the development of automatons (Anderson and Anderson 2011). Therefore, we can say that science fiction is a genre which lies between literature and

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science, as recognized by The Oxford Companion to English Literature: "not quite ordinary fiction, not quite science, yet partaking of both" (Birch and Drabble 2009: 892).

Even though science fiction does not comprise quantitative and systematic research, or any other model of scientific verification, it is constantly producing critical hypotheses that draw action routes for experimentation. This aspect attributes the genre futuristic traits. According to Kris Lovekin, science fiction is "the literary genre that describes how we got to the place we are going" (Lovekin 2000), or in George Slusser's, one of the biggest supporters of the genre, more poetic words "it is comparable to the wheel, the first and most important technological invention of the Western world. It gives meaning, reinvented over and over again, on a journey to a place no one has ever been". (cited in Lovekin 2000).

Without a doubt, science fiction goes beyond just mere entertainment. Not only does it constitute a place for technoscientific speculation, as we mentioned at the beginning, but it is an actor itself in the technoscientific plot because of its critical and scientific production. In such a manner, it isn't surprising that pedagogy is a field in which science fiction recreates itself, mainly as a science and technique that conditions other forms of knowledge. There is plenty of bibliography that analyze science fiction in education, as well as education in literature (Gough 1993; Michalsky 1979; Martin-Diaz et al. 1992). Likewise, video games, as a form of leisure and social interaction media, are a common topic among the genre, and its relationships have been studied from different points of view (Tringham 2014; Olson and Torrance 2009; Meskin and Robson 2012).

It is broadly accepted nowadays that video games can generate high motivation levels in kids, and so spark interest in topics which otherwise would be tedious for them (Oblinger 2004). Video games can also develop holistic knowledge (Van Ecke 2006) through mechanisms of trial and error, which are systems that we usually study separately. Although accepting video games in the educational field has gone a long way, much of the acknowledgment it receives barely mentions the practical aspect. We search for answers in science fiction because of its critical perspective.

It was not possible to find specific bibliography about the relationship between video games and education in science fiction, wherewith, the present analysis intends to be simply a revision of the literature that addresses this topic of current interest. It is not my intention to outline a theory on how these representations happen, nor am I sure it would be possible. Science Fiction is such a wide genre, that it can only be approached as a complex and heterogeneous corpus. However, the present study does intend to be a proposal on how to conduct an analysis such as this.

Being a literary examination, the hypothesis is that science fiction literature is an area which deserves being recognized and incorporated into current pedagogy and game based learning studies because of its speculative richness from a technoscience, and not merely utilitarian, viewpoint. Next, three literary works will be analyzed from a pedagogical approach: video games and psychometrics, video games and behaviorism, and video games and non-directive pedagogies. Be aware that for this examination, there will not be a differentiation between "hard" and "soft" science fiction, as it is usually done. On the contrary, it will be accepted that there is no clear boundary between science and fantasy, or technology and fiction, because of the speculative nature of this literary

genre, and that it is precisely such ambiguity which generates the cognitive estrangement that characterizes it, according to Suvin, and provides the genre with the freedom needed to create scientific knowledge from hypothetical fiction. Along these lines we examine science fiction, for the purpose of this analysis, in the broadest possible sense and in all its artistic formats.

2 Video Games and Psychometrics: The Lawnmower Man

At the beginning of the 20th century, psychology was divided into two different trends. On one side, the German school of introspection, based on the subjectivity from a qualitative approach; on the other side, the Anglo-Saxon and American school, based on conduct from a quantitative approach (Pasquali 2017). Psychometrics derives from the second approach: it is the science that studies methods to measure and compare cognitive abilities. In the last few decades, this science has often been controversial (Carroll 1984; Conte 2005), nonetheless, during the 20th century and still these days, it had a major influence in pedagogy and particularly in psychopedagogical orientation by supplying apparently objective methods. In theory: "the incorporation of psychometric tests in the orientation process leads to the use of a scientific method which confirms what was observed, and the use of a measurement system supported by statistics as a way to ensure precision" (Alzina 1996: 97).

Moreover, psychometrics is the inescapable start in one of the fields which creates the highest expectations in cognitive sciences and biotechnology: cognitive enhancement. Firstly, without the possibility to measure an individual's cognitive abilities, it would not be possible to determine successfully its increase:

> An intervention that is aimed at correcting a specific pathology or defect of a cognitive subsystem may be characterized as therapeutic. An enhancement is an intervention that improves a subsystem in some way other than repairing something that is broken or remedying a specific dysfunction. In practice, the distinction between therapy and enhancement is often difficult to discern, and it could be argued that it lacks practical significance (Bostrom and Sandberg 2009).

Often, science fiction deals with both, psychometrics and cognitive improvement (Niccol 1997; Pfister 2014). In that regard, Flowers for Algernon, Daniel Keyes' only Keyes (2006), stands out as one of the most awarded and recognized novels of the genre. The plot tells the story of Charly, a young baker with a serious intellectual handicap, who undergoes an experimental operation to enhance his cognitive abilities. The successful treatment not only enhances Charly's intellectual abilities, but greatly exceeds the intellectual abilities of the people in his life, going from an IQ of 68 to 185. In other words, it's not only therapy. The gradual increase makes him gain language abilities and logical mathematical thinking first, and lastly, realize the abusive relationships he has with his family and alleged work friends, which leads him to an existential crisis.

Flowers for Algernon has been adapted numerous times, in movies (Ralph Nelson 1968), and even on The Simpsons (Anderson 2001). One of these classic interpretations is The Lawnmower (Leonard 1992), a B series movie which takes Keyes' plot but substitutes surgery for a video game and virtual reality therapy. The new premise implies

that virtual reality, and specifically games, can overstimulate the brain to the point of increasing the patient's IQ in a very short time. In this version Charly is played as a gardener with mental retardation, victim of abusive relationships with his mother and alleged friends. As opposed to the novel, where the protagonist's suffering leads him to introspection, the lawnmower is not able to cope with reality after the therapy and uses his super intelligence to get revenge for all his misery. This puts the whole town on the ropes since the lawnmower, whose IQ exceeds any human being's, starts to use his intelligence to continue to increase his cognitive abilities and torment his fellow neighbors through technological control.

The theory the movie supports is no other than Jaron Lainer's, the technological pioneer who first coined the term "virtual reality" in the 80's. Actually, Dr. Lawrence Angelo, co-protagonist in the story, is his alter ego, as declared by the movie director (Carson and Springer 2012: 53):

> VR proselytizer and artist, Jaron Lanier, was fond of suggesting that the goal of VR is the construction of a personal "reality engine", an all purpose simulation device. This is far beyond what the technology can do, but developments far short of this goal may have effects on the amplification of human intelligence. The property of VR, alluded to by Lanier and embodied in this hypothesis, involves two aspects of intelligence augmentation: the attempt to simulate cognitive operations and the expanded experience of objectified semantic structures – exposure to predigested cultural understandings. As Jaron Lanier has observed, "Information is an alienated experience" (Biocca 1996).

Even though Lanier has recently recognized that virtual reality expectations have been modified (Tweedie and Steven 2017), numerous studies continue to confirm the beneficial effects of virtual reality in education (Radu 2012; Wickens 1992) and in psychotherapies (Coelho et al. 2012). In the same way, James R. Flynn in his famous study Are We Getting Smarter?: Rising IQ in the Twenty-First Century, concludes that in the first ten years of the 21st century there has been a general increase of the IQ index, which he calls the "Flynn effect". According to his conclusions, the increase in IQ is due to the greater number of problems to be solved in our modern life, which he claims are to a large extent caused by digital technologies and especially video games: "Video games, popular electronic games, and computer applications require enhanced problem solving in visual and symbolic contexts. If that is so, that kind of enhanced problem solving is necessary if we are fully to enjoy our leisure" (Flynn 2012: p.19).

In the last years, the relationship between video games and psychometrics has become closer: first, we see that children's video games have similar mechanisms to the problems that classic psychometric tests present, for example Raven´s Progressive Matrices; second, in the last few years, we have seen games that collect boys' and girls' data in order to allow parents and teachers to download psychometric analyses; lastly, video games are becoming more popular as a mental exercise in the classroom, and there are plenty of schools who own licenses for educational video games such as Minecraft or Kerbal Space Program (Fig. 1).

Even though these trends in education and game design have confirmed Lanier's theory, they take on a utilitarian approach which, unlike the outcomes suggested in

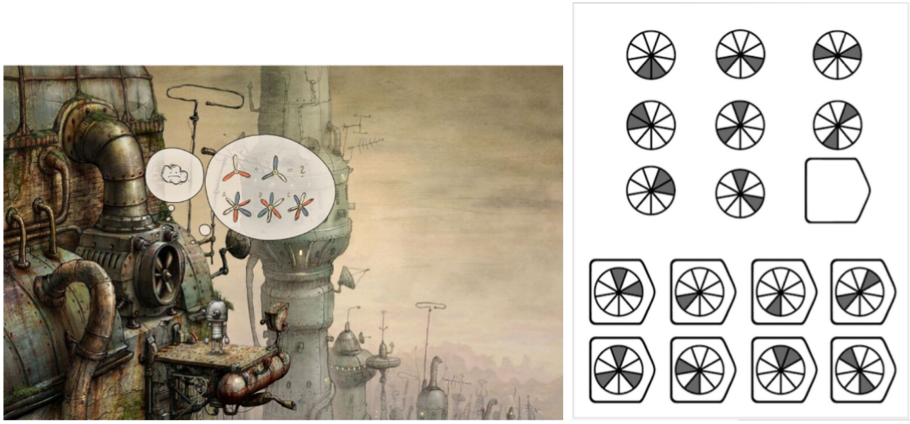

Fig. 1. Machinarium (Amanita Design (2009)) compared to Raven's progressive matrices (Raven et al. 2004)

Leonard's movie, take for granted that psychometric science is a beneficial technology in itself. On the contrary, from the hypothesis of this science fiction plot, measuring and enhancing psychological abilities can generate existential conflicts in an individual, as well as mental and emotional disorders that can originate from a radical, and not gradual, cognitive enhancement, and therefore should be supported with a critical reflection about the value and inclusion of other cognitive abilities. Without taking into consideration these matters, the advances which video games are already generating in the field of education can cause an opposite effect to what we expect: mental disorders and social marginalization, as the extreme case presented in The Lawnmower Man.

3 Video Games and Behaviorism: Ender's Game

Nowadays, learning through video games and computer software is a fact, not only in experimental schools, private and public, but also in well established programs such as the American army. Roger Smith, from the Human Resource Organization for Simulation, Training and Instrumentalization of the army of the USA, reported:

> The military has been using games for training, tactics analysis and mission preparation for centuries. Each generation has had to wrestle with the personal and public image of a game being used for something as serious as planning warfare (in which people's lives are at stake) [...]. For the first years of the 21st century, the industry faced a renewed vision of this matter with the expanded use of computer games taken directly from the entertainment industry (Smith 2010: p.1).

Since a great part of the army's learning process must, for security reasons, be simulated and can't be rehearsed until the situation demands it, video games are logically incredibly useful. Thanks to this, the army not only has managed to simulate extreme conditions, but has also become a way to educate millions of people, much before their enrollment. Games that are published on commercial platforms, like Call of Duty

(Arem 2003), or America's Army, developed by the US army themselves (United States Army. 2002), show that video games teach, regardless of their primary entertainment intention. Military skills such as tactical thinking, fine psychomotricity, concentration and mere weaponry knowledge, have become 'normal' baggage for enjoying these and other games. It doesn't mean that these video games can be labeled as educational, but that they have an influence on their users', mainly young kids, formation. This is why many have indicated their primary intention as propaganda.

Ender's Game, the novel that put Orson Scott Card (1991) on the map, predicted these trends in a time when video games could not generate such complex and realistic experiences yet. The plot is based on a historical war between humans and *insectors*, an alien race, and develops in a military space station with advanced educational technologies. Throughout the story the author shows his military knowledge and offers an ample repertoire of possible applications of game based learning that mold the behavior of children soldiers. Scott Card's merit consists in having comprehensively dealt with military psychology within an educational framework: motivation, emotion management, cognitive abilities, and psychological tests.

Broadly speaking, games and video games are applied in three different ways in Battle School where the protagonist character goes: 'battle', 'recreational game' and 'free game'. The first one is the center of all education in Battle School. It consists of a competitive sport which takes place in special zero gravity rooms. During training and competitions in these rooms, kids learn through theory, experiments, and mainly strategy. The second application, the 'recreational game', takes place in the arcade near the dining hall, where boys and girls measure their abilities and compete in various games. In theory, these games are purely for leisure, however, they are actually studied by the professors to find out which abilities stand out. Lastly, the 'free game' happens through an application installed in each of the tablets that are handed out to the students in the academy. This game reads the mind of the student and adapts to it. It presents challenges and roads in which they have to face particular situations or solve problems according to their psychological needs of the moment. The main goal of this type of game is to develop through positive reinforcement all of the student's potential without arriving at an emotional breaking point. It is supposed to be accompaniment and help, but it is also a psychometric test that teachers can use to get to know, examine and adapt their methods to the maturation process of the cadet's mind itself. Several scenes in the novel show how head school directors use these tablets openly as a form of surveillance, monitoring and manipulation of each soldier.

The 'battle' as well as the 'recreational games', are based on the same psychometric principles from The Lawnmower Man, as tools to measure and train the mind. Also 'free play' is an intentional psychometric test, but it is complemented with a different psychological science: behaviorism. According to the founder of this psychological school, John B. Watson: "Psychology, as the behaviorist views, is a purely objective experimental branch of natural science. Its theoretical goal is the prediction and control of behavior" (Watson 1913). Following this precept literally, 'free play' is a technique that allows tutors to know the behavior of his students and manipulate it through reinforcement, that is, with prizes that unconsciously reward the students for behaving the

way their tutors expect them to. All of this in order to make war heroes from soldier kids.

The first person to use behaviorism in science fiction was, curiously, Burrhus Frederic Skinner, one of the most important theorists of the science of behavior. In one of his first works, Walden II, inspired by Henry David Thoreau's experiment, he builds a self-managed utopia based on behavior science and its techniques as a way to teach the inhabitants to be utterly happy. The protagonist of the story is one of the founders of this fictional community, doctor Frazier, who takes a group of students on a guided tour to show them around the place. It is he who guides the reader through Walden II and presents its good sides, although at some point he also mentions its risks. Frazier says: "When you have once grasped the principle of positive reinforcement, you can enjoy a sense of unlimited power. It's enough to satisfy the thirstiest of tyrants" (Skinner 1969: 248). This sentence shows clearly that behaviorism can be a powerful manipulation tool, as also shown in Ender´s Game.

The power that Skinner is talking about is the same that the directors of the school use to deliberately manipulate Ender and his mates. Thus, what they call 'free play' in the book, is far from actually being free, it satisfies the most hierarchical of military structures. As a lot of modern research concludes, in the novel behaviorist reinforcement actually causes the opposite effect to freedom: emotional dependency and lack of initiative:

> Grades, prizes and punishment, and authoritarianism in general, only eliminates the intrinsic motivation of the teaching-learning process itself and it in its place is substituted with extrinsic motivation that aims at receiving positive reinforcement (prizes, good grades, etc.) or avoiding negative reinforcement (punishment, bad grades, etc.) and at the same time reduces the responsibility of the students (Cabañes 2016).

Lastly, the 'free play' video console in Ender's Game is overwhelmingly similar to Skinner's Teaching Machine (Fig. 2), an automatic device that teaches children through behaviorism. Compared to today´s educational game, strongly influenced by reinforcement techniques, this could be considered the first educational video game in history. And so, we see that what comes as simple fiction in Ender's Game, has its origins in a previous fiction that is actually science, produced by one of the most radical of behaviorists.

Nevertheless, the novel has a critical point of view towards this. Throughout the plot, young Ender comes to realize his superiors are leading him to a crisis with their psychological games, which later results in an anxiety meltdown. In the end, the protagonist becomes fully aware of the level of manipulation he has been subject to throughout his military career and that, even when he is the hero in the story, his life turns into an existentialist tragedy on the verge of suicide.

Fig. 2. Skinner's teaching machine (Clark-Wilson et al. 2017)

4 Video Games and Non-directive Pedagogies: The Veldt

Non directive-pedagogies, also known as progressive pedagogies, are those in which students make their own choices and take responsibility over the learning process. More than a pedagogical technique, it is a branch of education models that are based on shared libertarian values:

> In the face of authority, the ongoing maturation of freedom that each stage of development is capable of reaching. In the face of competitiveness, the development of individual abilities and personal effort that each being aims at reaching. In the face of conductism, liberation and acknowledgement of responsibility without guilt. In the face of punishment, reasoned dialogue. In the face of pre established programs, a rational and practical culture considering the maturation, interest and development of every individual. In the face of memory, understanding. In the face of stereotypes, creativity. In the face of subjugation, rebellion. (Luengo 1990:17-18).

More and more often, non-directive pedagogies are looking for a return to nature and matter, distancing themselves from technology (Cabañes and Rubio 2013). Their humanistic approach to childhood is often opposite to the trends in technological education. As we saw in the previous examples, virtual reality and video games constantly meet with psychometrics and behaviorism to create from education a more exact and quantifiable science, not always taking in consideration the students' needs, other than making them more intelligent and more well-behaved.

Nevertheless, in science fiction technological education is often seen as a detonator of these pedagogical models, as is so in The City And The Star (Clarke 2012), or The Fun They Had (Asimov and Conklin 1997). In Isaac Asimov's words, from his famous interview with Bill Moyers 1988:

> Today, what people call learning is forced on you. Everyone is forced to learn the same thing on the same day at the same speed in class. But everyone is different. For some, class goes too fast, for some too slow, for some in the wrong direction. But give everyone a chance, in addition to school, to follow up their own bent from the start, to find out about whatever they're interested in by looking it up in their own homes, at their own speed, in their own time, and everyone will enjoy learning (Moyers 1988).

Following Asimov's train of thought, Information and Communication Technologies would have the same positive value to allow multiple educational paths according to the interest of every individual. In this way, someone that is more inclined to sports can give free rein to his interest, which necessarily takes him to other areas of interest, such as maths or physics. Most important of all, the learning process of an individual would respect his own pace and boost motivation.

Also The Veldt, by Ray Bradbury (Bradbury 2012), has a similar approach. First published in 1950 under the title of The World the Children Made (1950), this short story is especially interesting because it discusses a central matter for all nondirective pedagogies: the role of the tutors. A problem which arises when students are free. ¿How much are the tutors worth? Which should be their role? Or, how should they handle the students' learning process? According to Cabañes & Rubio:

> The role of the teachers in traditional pedagogy set on an essentialist anthropological concept, is based on the expert-pupil relationship. In this way, it stands by the idea that a school is the place where Knowledge is transmitted (Knowledge with a capital K, which means knowledge that is institutionalized, regulated and approved by a committee of experts who decide what is important, fundamental, and the basic knowledge that children should acquire during the mandatory school years before they reach adulthood and get a job) [...] Therefore, maintaining the role of teachers in free pedagogies is harmful because it reproduces the hierarchical relationships we keep trying to avoid (Cabañes and Rubio 2013: 73).

The Veldt is set in a completely automatized house. In this futuristic home, part of the children's education takes place in a virtual reality room which has the ability to read the user's mind and interpret with images, smells and sounds whatever it is he is imagining. The problem comes when Wendy and Peter, the two children using the room, repeatedly insists imagining an African savannah with two lions eating his most recent kill. Their obsession with this game alerts the parents, who are terrified and worried about the implications and the insubordination of their children. The situation escalates up to a psychological paranoid tension between the members of the family. In the middle of this conflict, the parents try to punish their children without the use of the virtual reality room, which produces an even more violent reaction.

To try to solve the problem, the parents agree to ask a psychologist specialized in analyzing the data collected by the system in the game. As in Ender's Game and The Lawnmower Man, we see again the concept of video games as a psychometric and data recovery method. However, Dr. Doolittle's answer is not the answer of a behaviorist, but of a psychotherapist concerned about his patients' personal relationships. On the contrary, he recommends the parents to spend more time with his children and not expect that the virtual reality room does his job as a family and educators, which is far from being an easy solution.

In conclusion, Bradbury offers a critique of technological solutionism which contraveys the expectations that video games produce as non-directive pedagogies in writers like Asimov or C. Clarke. Even thought Bradbury was also a defender of technological mediated education, he underlines the risks of non critical implementation, as if technologies where an instant solution.

Even though the story was written in 1950, in a time without video games, it is ahead of his time in regards to the relationship between virtual reality, games and violence and the increase of compulsive behavior, two problems that are widely studied these days (Delisi et al. 2012; Kuczmierczyk et al. 1987). It does so by showing game mostly as a means of symbolic construction. Maria Eugenia Villalobos points out in her article "The role of the teacher in the symbolic construction of children's play":

> Play is a favorable setting for development, since it allows the child to access the symbolic function [Piaget 1961]. When a child has access to the representational possibility, he is able to create alternative worlds to the real one, where transformation of his life experiences is allowed and new significance arises [...] There [during play] surges polysemy, transcending the literal world, static, rigid, when building significance of cultural worlds about previous semiotic processes of collective worlds. Hence the importance of the role of an adult that can offer children the thread that helps knit the senses (Villalobos 2009).

Henceforth, The Veldt is a warning to not leave a child to unattended play. It tells parents and educators that when they don't pay attention to their children's symbolic play, they become blind to their interpretations of the world, and might realize a bit too late that they show loneliness and resentment towards them.

5 Conclusions

In the last few years video games have been applied to education and game based learning, and have been shaped as a great psychometric and behavioral tool. Science fiction has been also speculating for over a century about the possibilities and often offers a critical vision that is not always taken into consideration in education practices.

The literary texts that were analyzed lay on the table how the benefits of video games in education settings can be diminished if the existentialist and semiotic dimension of the student is not acknowledged. In this way, uncritical manipulation of the behavior and cognitive training, without the proper guidance of an adult, and without taking into consideration the emotional dimensions of the student, are potentially detonators of emotional and psychopathic crises. This does not imply that video games are a useless

educational tool. On the contrary, because it is such a powerful tool it requires an updated understanding of the roles of the teacher and tutor in order to make the most of it. Lastly, each case study brings to light that, in the research for a happy childhood and an education full of libertarian and human values, an unholistic vision of intelligence leads to planning counterproductive educational objectives.

Lastly the Veldt by Ray Bradbury gives us a different insight on non directive-pedagogies, and warns us not to rely on technologies as substitute tutors for the youngest. Even more, it addresses the constructivist role of the game process, making symbolic constructions, which is not often taken into consideration if education is reduced to intelligence and behavior. The results from these three analyses shows what we expected, that Science Fiction is a meaningful corpus where we can find critical and deep technoscience hypotheses. Regardless how old these books may feel, all three works analyzed showed that their primary intention wasn't just to fantasize with new fascinating technologies, but to outline crucial questions concerning education and its existentialist and psychological implications. Questions that, until this day, should be taken into consideration in education and video games developing process.

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