Design for Inclusion, Gamification and Learning Experience

edited by
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Alessia Brischetto, Ester Iacono**

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Contents

II PART / GAME AND GAMIFICATION EXPERIENCE

III PART / DESIGN FOR LEARNING

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POLIMI – Department of Design, Milano, Italy

TH OWL - OWL University of Applied Sciences and Arts, Department Detmold School of Architecture and Interior Architecture, Germany

UNIFI – Department of Architecture, University of Florence, Florence, Italy

PARTNER NGOs

SERCEV – The Association for Well-being of Children with Cerebral Palsy, Ankara, Turkey

OccuTherapy – The Occupational Therapy Association of Turkey, Ankara, Turkey

16. Tiles and Patterns. Modular Concept in PUDCAD Learning Game Scenario

by Giorgio Buratti, Fiammetta Costa, Michela Rossi

Abstract

PUDCAD is a project involving several European university institutes, supported by the European Erasmus + Program, that promotes specific skills acquisition and the improvement of students and young workers preparation levels to increase their ability to operate in UE. By developing a ludic application, configured not only as a tool for digital drawing but as a real learning software, PUDCAD intends to educate university Design students about Universal Design, an ergonomic approach that provides for the use of environments and products regardless of age, social conditions and user's physical skills.

The Politecnico di Milano team conducted a research in secondary schools, evolving a modular process capable of implementing precise features. The use of a module (from the Latin modus, "measure") in any design activity involves the definition of a basic unit assigned by the designer, from which all parts of a complex descend by multiplication or division. The same module can be developed in different patterns, but regardless of the formal result, purpose of the composition rules is to support and order the parts in a coordinated whole. Similarly the game, an occupation that usually suggests nice and apparently disordered conditions, is an activity always regulated by internal principles, perhaps not always responding to rational needs, but essential to establish an order that involves the end of the playful principle if violated.

In the same way, the PUDCAD application development of game environments is based on a pattern aimed at spreading the principles of Universal Design and in acquiring appropriate design practices. This paper illustrates the methodological path and the conceptual tools adopted in the interactive game development.

Keywords: *Gamification, Universal Design, Inclusion, Game Pattern.*

16.1 Introduction

Designing a digital application requires a method that allows to document, to evaluate and to plane choices. At dawn of videogame design, in the late Sixties, game-designers as well as using inspiration necessary in a brand new sector, deepened the mechanics of board games and other existing entertaining activities. In implementing this new digital products were also borrowed traditional media' narrative tools and techniques such as cinematography, television and scripting.

The real computer-based programs construction also made necessary the formal rigor of mathematics, not only in algorithms writing, the computer system engine, but also in creating schemes that allow a logic and consistency with human.

The first applications benefited from Games Theory researches, discipline of mathematics whose main purpose is to analyze conflictual situations, starting from the assumption that a final outcome of a dispute depends on choices made by contenders and therefore seeking cooperative and competitive solutions by studying individual decisions.

The exponential success of sales and distribution that occurred over the next fifty years determined the intrinsic difficulty in framing video-game in a theoretical context. As often happens with a new media introduction, the exaltation for the available possibilities, not least economic reasons, produced a proliferation of products without at the same time developing a real definition lexicon or establishing disciplinary boundaries. This is also due to the intrinsic nature of the video game, which has unique features.

Despite the historical link with previous entertainment media, a video game cannot be considered as a simple film or interactive novel. A video game does not tell a story, but it's the player who tells and creates it through his/her performances[1]. In a painting, a song, a film or a book, the user cannot change the outcome or act actively on the artwork, while the video-gamer modifies the result with his/her actions, since he/she is simultaneously a spectator and an actor. "The idea of including the viewer in a representation, introducing him to experiment an experience that transcends real world, is prerogative of all artistic manifestations since the dawn of humankind [...] however it's only with the advent of computer that this effect has achieved the most significant outcomes, allowing user "physical" inclusion with the ability to interact with images"[2].

In the new digital device the possible answers to the same situation are ideally endless, and it is through the player actions that these possibilities materialize in a sequence of events and precise activities that determine the gaming experience.As extended the possible variables must be connected by internal

DESIGNING FOR INCLUSION, GAMIFICATION AND LEARNING EXPERIENCE

principles, essential to establish an order that if violated involves the end of the playful principle.

The construction of game environment is therefore not a single aesthetic choice, but a formal representation of the system of rules. The definition of PUDCAD's interaction space instantiates a process capable of guiding the user in knowing and attributing the correct meaning to the signs by a feedback systems related to interaction between the players and the game itself.

16.2 Edutainment, Gamification and Learning

Considering the playful artifact as a coherent project and starting research in this field it's a fairly recent practice. For just over a decade, since video games have established themselves as one of the most pervasive communication media, the need to investigate related themes has been highlighted.

New theory related to different scientific branches and new definitions have appeared. Edutainment[3] for example, a term derived from publishing, recognizes the ability to produce meaningful experiences in playful forms of communication. Gamification[4], on the other hand, is a term closer to the digital media industry, which approximately proposes the same concepts placing emphasis on the practice of game. Although there is no a single definition yet, but a related concepts stratification, the most used definition in academic world means by gamification the transfer of playful dynamics to activities that do not directly deal with game[5]. A significant number of authors also tend to the definition Serious Game or Applied Games if the primary purpose is not pure entertainment, but an educational or training goal. Regardless of the nomenclature, the general objective of these systems is to convey information, favoring the active interest of users in order to increase their knowledge, skills or change their behavior. Although the term gamification has a broader meaning than video games, it is through the video game forms that the link between learning and technology is made explicit. Personalization and speed of the message promote a more efficient active participation because by dynamic behaviors implementation meanings connect to an action supporting experiential learning[6].

16.3 Implementation of Game Environment

We have already described how the design of PUDCAD ludic application followed a very specific procedural flow which considered fundamental parameters such as game mechanics, dynamics, targets and resources[7].

Definition of the game environment is part of mechanics implementation, the category that includes actions and processes used to create the basis of entire application logical structure. In other words what establishes the constraints and limits summarized in the term "game pattern".

The game pattern is a procedure based on the rules that define the playful activity and that, starting from a common root, can be developed in a multiplicity of declinations and variants that can be traced back to the initial scheme. For example, in the classic game Chutes and Ladders the winner is the first player who arrive with his own marker at the end of a path, while in Monopoly is essential to be the first to build constructions in specific spaces. In both cases, the game pattern is to achieve a specific goal first, a purpose that can be traced back to the archetypal game of run, played in early childhood.

In the case of PUDCAD the components of immersiveness and interactivity should expand and enhance the learning experience, by an "*immersion in a simulated world regulated by technical laws in which the active user's actions are theologically oriented*"[8]. Here we enter in the peculiar video games paradigm, the only playful activity that does not require to learn the rules beforehand. In fact, the player only discovers by trial and error what he has to do and, as the simulation progresses, he comes to understand the goal and decode the game rules. The game space is investigated and the information code creates the constraints, guiding the learning user by studying what the game allows to do and how it responds to inputs. There is therefore a significant playful essence in which representation part coincides with different functional and organizational levels, able to enhance and transmit significant symbolic contents. As underlined by Huiziga:

"*All play moves and has its being within a playground marked off beforehand either materially or ideally, deliberately or as a matter of course. […] The arena, the card-table, the magic circle, the temple, the stage, the screen, the tennis court, the court of justice, etc., are all in form and function play-grounds, i.e. forbidden spots, isolated, hedged round, hallowed, within which special rules obtain. All are temporary worlds within the ordinary world, dedicated to the performance of an act apart*"[9].

Within this space it is necessary for the players to be provided with a shared linguistic sign context, designed so that the player receives information with a simple glance. PUDCAD is an application that involves the design of a school environment, through the identification of some Inclusive Design fundamental parameters that will be the basis of game mechanics. The semantic system was tested in a didactic experience that simulated the PUDCAD digital application.
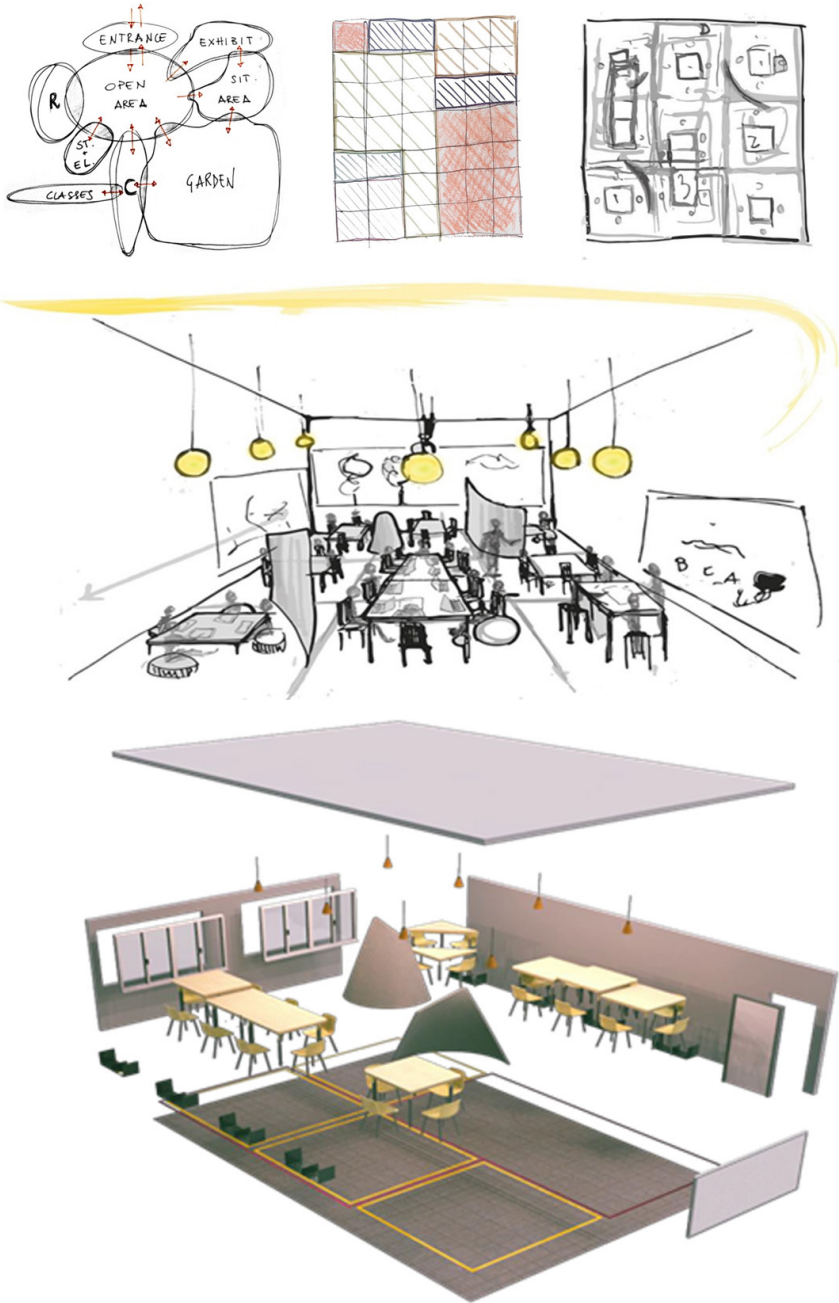
Fig. 16.1 - From the concept to the gaming environment. Design development of an educational classroom starting from the modular grid

Students had to design modular school spaces, based on construction and furnishing elements composition with standardized dimensions, established on multiples and sub-multiples of a design grid basic module (Fig. 16.1). Each student work-team has therefore developed its own set of elements that can be inserted into a modular grid of side 3m, which defines the standard surfaces of different environments, organized around a common distribution space.

The next task was to individually recompose the different school space functions in order to optimize the environments usability for the school population, consisting of students and teaching and support staff.

The modular logic of school buildings composition and the application of the BIM[10] model construction logic offers the conceptual reference for the game definition.

The modular grid becomes the pattern of a board similar to that of Scrabble and the constructive elements are the cards available to the players/designers, which can be combined according to logical and/or quantitative rules, in a similar way to what happens with Domino tiles.

A set of scores and game mechanics will provide information on the spatial organization's adherence to the principles of Universal Design, while increasing levels of difficulty may be connected to greater complexity in the space articulation of modular building.

The game could develop by the modelling of the school in the digital space, room after room, over a pattern grid that rules the building growth, without any prefixed goal, but the maximum score of the winner team. In this case the game cards are the elements that build each room (classrooms, canteen, laboratories, library, entrance hall…).

Different building tiles should have different values, with several generic cards, some special cards, and may be a Joker. The square module is a basic concept in design and in table games: modular patterns on regular grids are a common and recurring feature both in games and in building design. It is furthermore implicit in school architecture that is always a modular building because of the repetitive layout of classrooms (Fig. 16.2). Otherwise players can move with dice into the digital space, which is ruled by the same pattern of the building, discovering the school and living the architecture with the limitation of a physical disability they draw lots with cards or they find on their path. The game scenario is anyway a school with classrooms and other special spaces, built on a regular lattice that rule each play action:
- modular building tiles allow the (partially) random combination elements in always different architectures;
- modular grid of the game pattern rules the building and the players action inside the school.
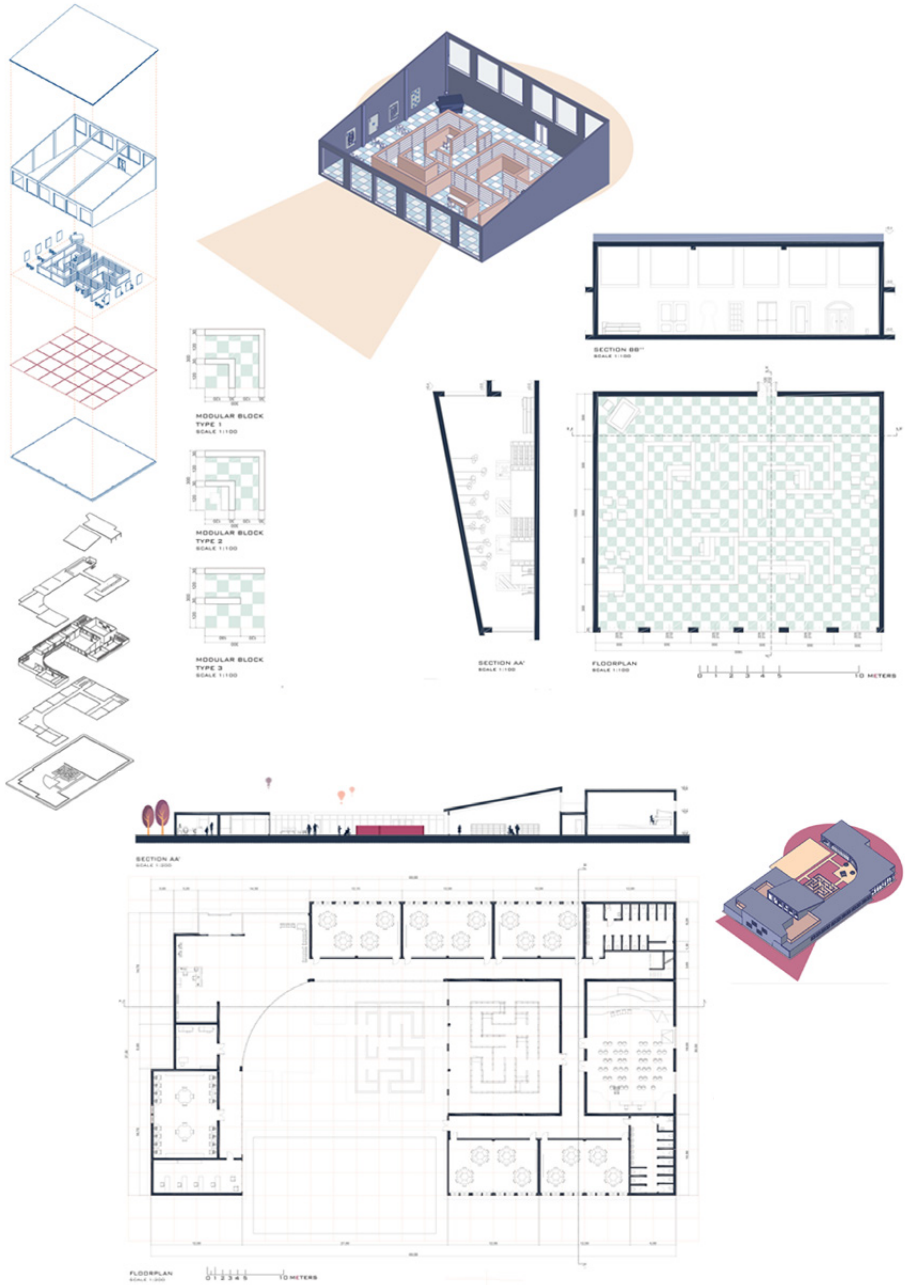
Fig. 16.2 - One of the patterns properties is that the multiplicity that distinguishes them can be distributed on different levels, each one characterized by different behavior. In this case the square module rules the furniture, the classroom space and the whole school environment

16.4 Conclusion

The experimented modular design approach, integrated with different research units results, will be the input for the last step of the PUDCAD project: the final game realization. However, the development and sharing of experiences and knowledge among the various research groups allows some considerations to be made. The relationship between gamification and teaching opens up new experiences where learning is not based on the ability to remember and repeat information, but on the capacity to find information, evaluate and use it coherently in the right context. Teachers have the possibility to incorporate didactic notions in a narrative context, start the learning process by providing a problem for the participant starting from an elementary level to a progressively more difficult tasks and finally evaluating the expected results

Using of pattern is as a methodological instrument able at creating structure and coherence between the various aspects of game design and overseeing its various levels. Modular patterns create and configure relations between entities, they are abstract representations that identify the organisation and qualitative aspect of a game structure, enabling its realisation and recognition. In the final analysis, it is possible to assert that patterns are the configuration of the relations between the components of the ludic application, which determine its essential characteristics. The revolution inherent design of ludic digital tools is the way they transformed design discipline from iconic representation to the representation of relations and processes. Far too many people still consider the video game as a simple commodity or a form of entertainment, while it would be necessary to understand that it's a cultural artifact endowed with recognizable linguistic, iconographic and thematic codes, whose potential is still to be investigated.

In this paper Giorgio Buratti has dealt with gamification processes in defining the game space; Michela Rossi analyzed the relationship between modularity and game environment and Fiammetta Costa defined Universal Design standard for the school environment.

NOTES

[1] De Koven B.D, *Fun is Fine, Toward a Philosophy of Game Design*, on www.finegamedesign.com.

[2] Bittanti M. (2002), *Per una cultura dei videogames: Teorie e prassi del video giocare,* Edizioni Unicopli, Milano. Translations made by the authors.

[3] Combination of educational and entertainment. Neologism coined by Bob Heyman while producing documenta-

ries for National Geographic. The term was initially used to indicate the forms of playful communication aimed at teaching. The concept has been extended to all that can be communicated, thanks to a game, in a nice and productive way.

[4] The term was proposed by the English game programmer Nick Pelling in 2002 and has acquired relative autonomy since 2010.

[5] Desmet A., Van Ryckeghem D., Compernolle S., Baranowski T.,Thompson D., Crombez G., Poels K.,Van Lippevelde W., Bastiaensens S.,Van Cleemput K., Vandebosch H., De Bourdeaudhuij I., Hospital G., Street T., Gard T., Hoge E.A., Kerr C. (2014), "A meta-analysis of serious digital games", *Preventive Medicine*, Baltim, 69: 95-107.

[6] Felicia P. (2011), *What evidence is there that digital games can be better than traditional methods to motivate and teach students?* Waterford Institute of Technology.   https://pdfs.semanticscholar. org.

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[8] Accordi R.M. (2014), *Storia del videogioco: Dagli anni Cinquanta a oggi*, Carocci, Roma (p. 7). Translations made by the authors.

[9] Huizinga J. (1949), *Homo Ludens. A Study Of The Play-Element In Culture, Routledge and Kegan Paul*, Boston And Henley, London (p. 10).

[10] Building information modeling (BIM) is a process supported by various tools and technologies involving the generation and management of digital representations of physical and functional characteristics of places. Using an integrate 3D model-based process it's possible to give architecture, engineering, and construction (AEC) professionals the insight and tools to more efficiently plan, design, construct, and manage buildings and infrastructure.

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