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PLAY AND TRANSFORM THE CITY

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Abstract

The research analyzes the use of immersive reality for the involvement of citizens in codesign paths. The aim of the study is to analyze how, through the potential of digital simulation, it is possible to reactivate a path of re-appropriation of the public space as a place of projection of one's identity. The foundation of the research is the observation of the new role of digital squares and the will of involving the youth, increasingly detached from these decision-making processes, in participatory processes. In the anthropological interpretation of the "homo laudens" so structural in the liquid society, the project proposal is configured as a sort of game, where it is possible to transform space into multiple configurations. The pervasive capacity of digital representation thus defines a participation of meanings and it enhances, also with a playful approach, the logic of information and awareness that today are the foundation of the Internet of People and the multidimensional living.

Keywords

Immersive reality, codesign, node representation

1. Introduction

The changes and transformations that characterize our society (Benkler, 2006), the new forms of relationships that the computer culture creates with its digital ubiquity and its multiuniverses (Iansiti & Lakhani, 2015), reflect on the city (Martinelli, 2002). This revolution leads to reflect in the logics of its spaces that same "intelligence" of the environment more and more permeated by digital. Unlike the dreamlike projections of engulfment of machines on man, technology represents an ever-increasing opportunity to focus on the person (Conti, Passarella, & Das, 2017; Goldhagen, 2017; Kuliga, Thrash, Dalton, & Hölscher, 2015).

The city reveals a profound transformation of value and meaning of its spaces, in particular the public places of the community (Carr, 1992; Gehl, 1991; Gehl & Svarre, 2013), through an increasingly substantial disaffection of citizens from these places, as an expression of democracy in history (Touraine, 2008). Despite structural individualism (Wellman, 2001), the need to live the city does not change, neither the need for quality of open places (Bechtel & Churchman, 2002; Corburn, 2004; House, Landis, Umberson, & Umberson, 2007; Lee & Maheswaran, 2011; Leeuw, 1999; Tzoulasa et al., 2007), nor the values of the physical encounter (Badland & Pearce, 2019; Jackson, 2003).

The great challenge that opens up is the care of places (Filippucci, 2011), being able to find new relations of projection of one's own identity (Filippucci & Bianconi, 2017; Norberg Schulz, 1979; Pallasmaa, 1994; Purini, 1992). The city of the past, as our Italian historical centers tell us (Filippucci, 2013), was always the representation and image of its Civitas, the result of demands and of aesthetic, an holistic summation of private architectures studded with spaces and forms of the community.

Today the urban landscape is changing, perhaps only because it remains motionless, without care. Public space is the place of the other, the property of a distant public sphere that sometimes is perceived as hostile (Rosanvallon, 2006). It suffers the crisis of the community (Bauman, 2007), as an expression of the man who lives it, with the complexities that characterize contemporary society. The need to find relations is then aimed at involving the citizen as a leading actor (Ratti & Mattei, 2013), to make a real culture of common goods operational (Berkes, Feeny, McCay, & Acheson, 1989; Gardner, Ostrom, & Walker, 1990; Harvey, 2011; Maddalena & Settis, 2014; Ostrom, 2015; Ostrom, Burger, Field,

Fig. 1: Digital representation of the social pavilion inside the Foibe Park at Perugia

Norgaard, & Policansky, 1999; U. Rossi & Enright, 2016; Settis, 2014; Settis & Mengo, 2013), where private interest is directed towards finding convergences together with the public.

In this context, the participation processes (Ciaffi & Mela, 2006, 2011) stand as a real chance to propose an innovative vision of governance of the participated territory (Fera, 2008; Polizzi & Bassoli, 2011). This is an increasingly cogent need (Friedmann, 1987; Smith, 2009), which, especially in Italy (Bobbio, 2007), despite efforts and partial successes (Sclavi, 2002), founded multiple difficulties (Kreiss, 2015): on one hand too often it was proposed this process almost only to achieve a strengthening of consensus, but, on the other hand the same path is depleted in its substance if there is no interest in living the city and there is no structured perception of being part of the community.

Digital really represents a great chance, a persistent and pervasive instrument (Hampton, 2016) that affects the message (McLuhan, 2008) and, inversely from the past, is "what speaks to the man of today" (Benjamin, 1969), thus favoring new forms of participation (Carpentier, 2011), particularly for young people (Bennett, 2008). Digital technology, through the simplicity of images (Figure 1), favors the knowledge processes by creating new forms of democracy (Coleman & Blumler, 2009; Papacharissi, 2010; Pool, 1983; Sunstein, 2001) and it responds to what Johan Huizinga defines as "homo laudens", placing culture in a close relation with the game, understood as "a function that contains a meaning. The game involves something that goes beyond the immediate instinct to keep life, and that makes sense in the action of playing. (...) However it is considered, it certainly manifests itself with this "intention of the game", an immaterial element in its very essence" (Huizinga, 1946). Indeed the project is always fun, as it claims Le Corbusier himself when he defines architecture as "the wise, rigorous and magnificent play of volumes under the light". And also the representation, in the connections between the model and the game (Bianconi & Filippucci, 2013), is alwaws animated by a playful spirit (Figure 2), so important for the communicative aims.

New media are changing the city (de Waal, 2013) because our communication, amplified through the new virtual net, can guarantee new connections (Shepard, 2011) reshaping social cohesion (Ling, 2008). In this way, it is possible to extend the innovative methodological propouses to the project theme, developed by contemporary architecture, regarding the social design and the bottom-up approach to the project: ”the term social design highlights the concept and activities enacted within participatory approaches to researching, generating, and realising new ways to make change happen towards collective and social ends, rather than predominantly commercial

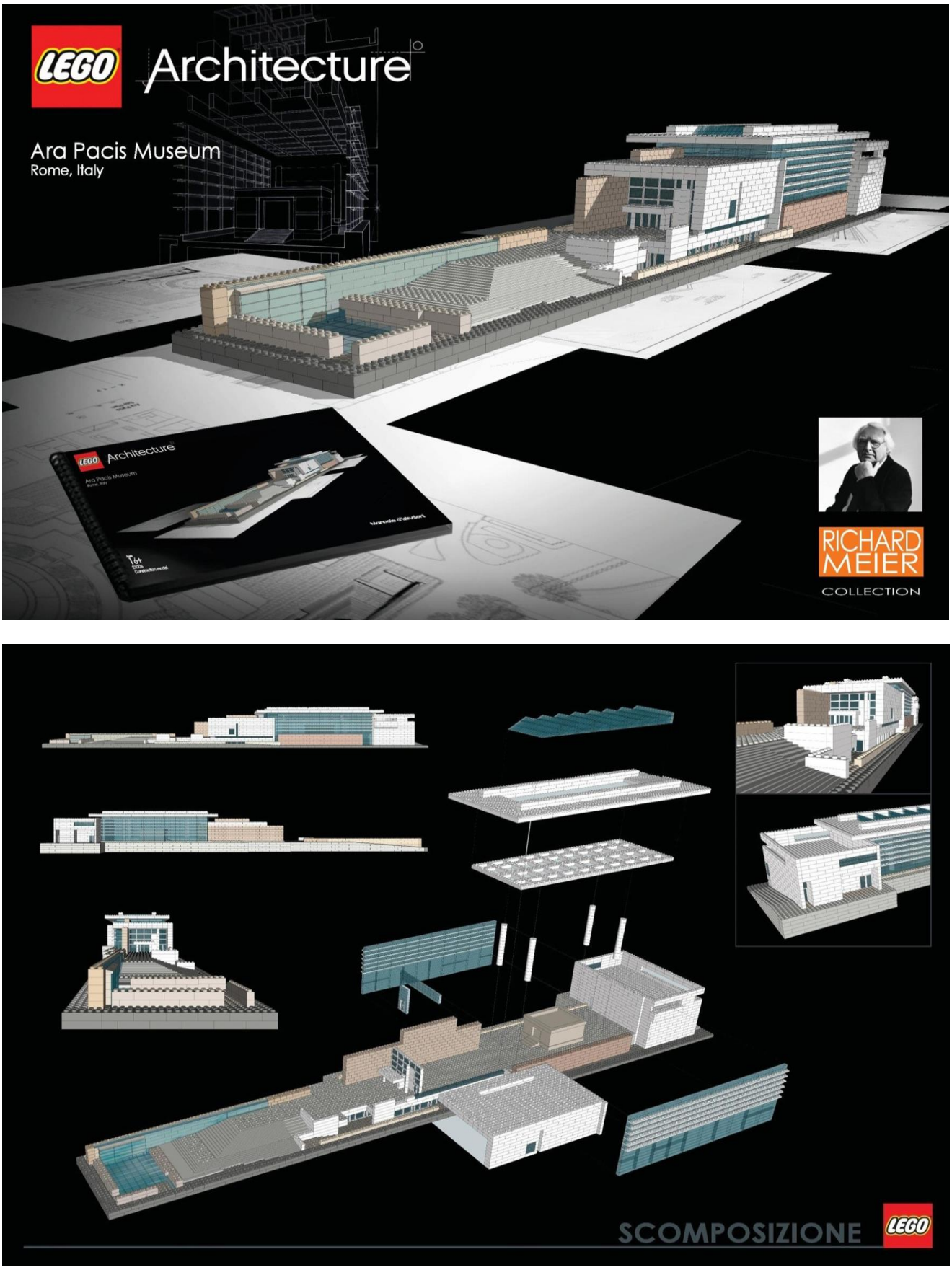

Fig. 2: Learning the digital modelling from the game: digital exercises to compose and decompose the architecturein Lego elements developed during Arcitectural Drawing Course at University of Perugia (academic design, Marta Mencaroni, 2010).

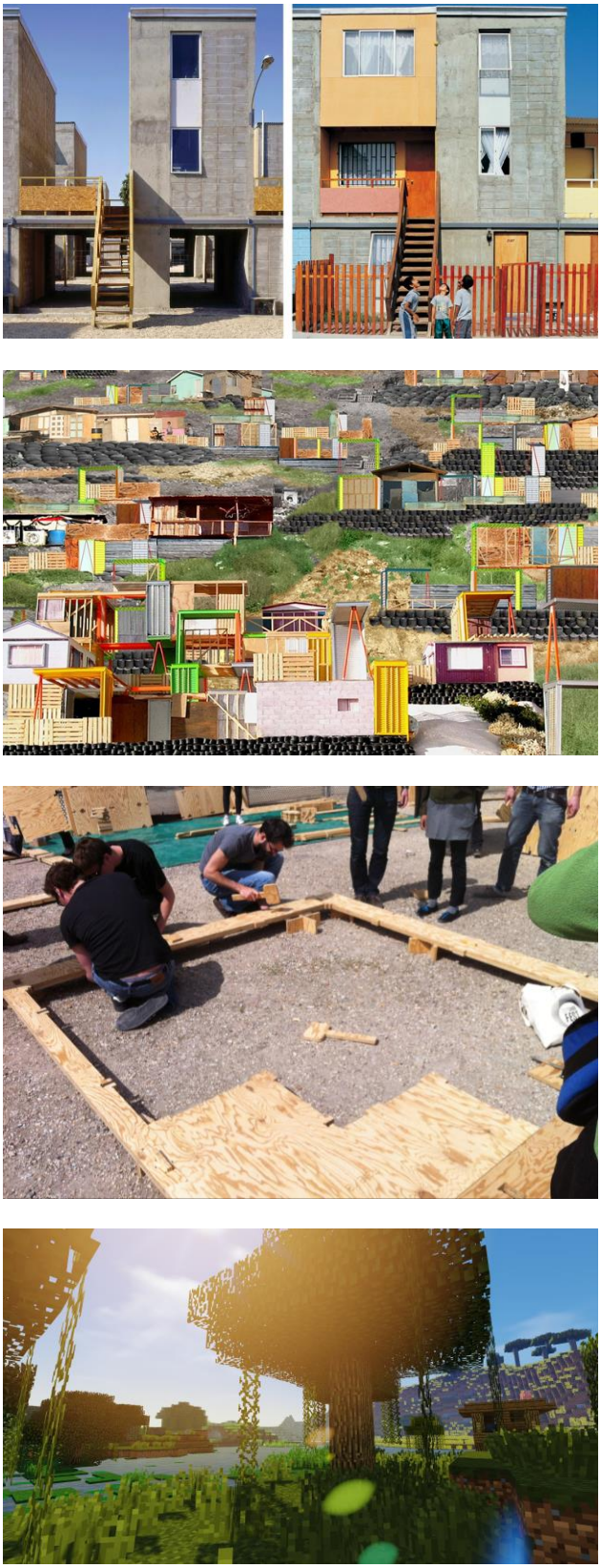

Fig. 3: Community based design and bottom-up approach in Elemental's Quinta Monroy Housing project and the Teddy Cruz Manufacted city similar to the DIY approach of wikihouse project and popular online games.

objectives" (Armstrong, Bailey, Julier, & Kimbell, 2014). The participatory approach to the project (Manzini & Rizzo, 2011) is connected to the "social entrepreneurship" and "social innovation", because developing a project, or providing an architectural service, have a social impact in the community. The architecture is not a democratic result, because we are shaped by the built environmental (Goldhagen, 2017). The social role of the architect extend to the community sphere the "sense of fiduciary duty, of something held or given in trust that places the client's interests before those of the professional, and the interest of society above both", which "lies at the heart of all professional activity" (Rowe, 1996).

The history of the contemporary architecture has always developed this approach to the project: Jane Jacobs proposed models of local self-government, with which to foster trust and cooperation among the inhabitants (Jacobs, 1961). In Italy, during the post-war reconstruction, De Carlo is a protagonist of the concept of participatory design, made together with the inhabitants (De Carlo & Marini, 2013). The ethic questions become also aestetics themes for the contemporary architecture: maybe the most important referent is the chilean Alejandro Aravena and his studio Elemental (www.elementalchile.cl), whose attempt to engage in a participatory design process to "work closely with the public and end users". They invite the future residents to participate in the process and together develop an understanding of the problem situation. As an outcome, the future residents were provided with the basics of a house, which left room for the citizens to expand the house themselves. This resulted in the motivation to finish the house and extend it to meet individual preferences and needs. A similar approach is developed by the architect Teddy Cruz, born Guatemala, is one of the leading figures in community based design and bottom-up development strategies, as opposed to state development of real estate, searching of a new civic imagination (Cruz, 2011). In both the cases (Figure 3), it is possible find connections with architectonic open sources project as Wikihouse (Galilee, 2012; Parvin, 2013; Priavolou & Niaros, 2019), but also with really popular games, as Simcity and Minecraft (López Méndez, González Arrieta, Queiruga Dios, Hernández Encinas, & Queiruga-Dios, 2017), where the players are the architects of their digital world in a DIY creative

Fig. 4: The case study of Foibe Park in Perugia Urban Regeneration proposal

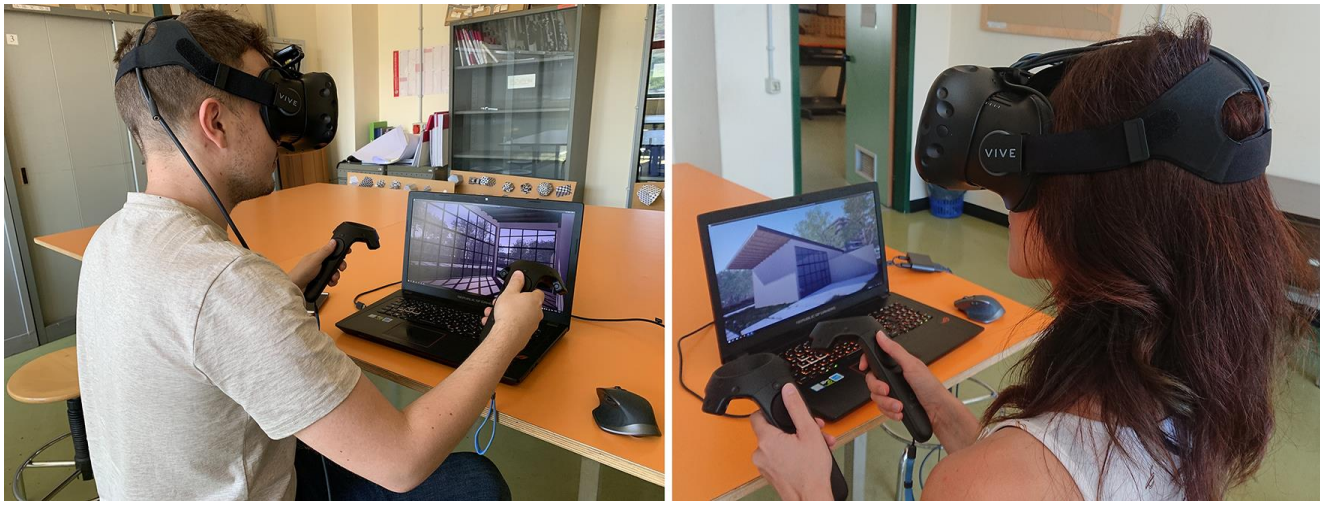

Fig. 5: The immersive interaction with the "game"

approach, interesting expression of our contemporary culture.

2. *The case study*

To show the role of the representation as key element in the analysis, in the project, in the communication, in the engagement, it is reported a paradigmatic case study as first results of a wider field of applications. This case study is developed inside the Perugia's train station district regeneration path financiated by the Italian Government (DPCM n. 127 / 2016), results of the collaboration between Municipality and local University (Bianconi & Filippucci, 2018).

The area under examination was born with the presence of the railway sign and the station (Bianconi, 2016) inaugurated in 1866 (Melelli, 1973). Later it was enriched by the great spaces of Perugina Factory, which placed here its great establishment since 1913 (Sargiacomo, D'Amico, & Di Pietra, 2016, p. 404) until 1959 (Cavallucci, 1990, pp. 41–49), as an attractor of an urban fabric equipped with workers' houses. This sign was practically erased by Aldo Rossi who in 1982 (A. Rossi & Huet, 1984, p. 126) designed the headquarters of Umbrian Region Offices in the area, an element that led to a deep transformation of the urban space. This in fact, is now marked by a new staircase that connects to a neighborhood originally made of popular houses, with unresolved elements due to the lack of modernization, thus favoring the presence of disadvantaged classes and generating security problems in the neighborhood, contrasting with the hypothesized vocation.

The studies developed in the field of representation become the essential tool to redesigning the relation between man and the environment in the centrality of perception, a central topic in the analysis of the area (Bianconi & Filippucci, 2019; Bianconi, Filippucci, & Seccaroni, 2019).

The present case study is inserted in this context, which sees a design declination within the redevelopment of the green area of the Foibe Park, object of interest of the financed project (Figure 4). The course therefore presents itself as an experimental path designed to promote participation in reality through virtual and communicative impact of an interactive simulation. The proposed path has its value in the proposed methodology, which in the case study finds its first declination to solve or answer specific questions to the single context.

The focus of the proposal is to determine a process of codesign for a citizenship pavilion located within the park. The goal is to promote a participation on the sense and meanings, leaving the choices to the designer, while managing to find systems that can really be the expression of a democratic process, an instrumental way to activate the citizens' interest on the identity value of the places. In order to guarantee a simple and accessible language for all, the communication of the architectural environment wants to find in the value of simulation, which is analogous to the

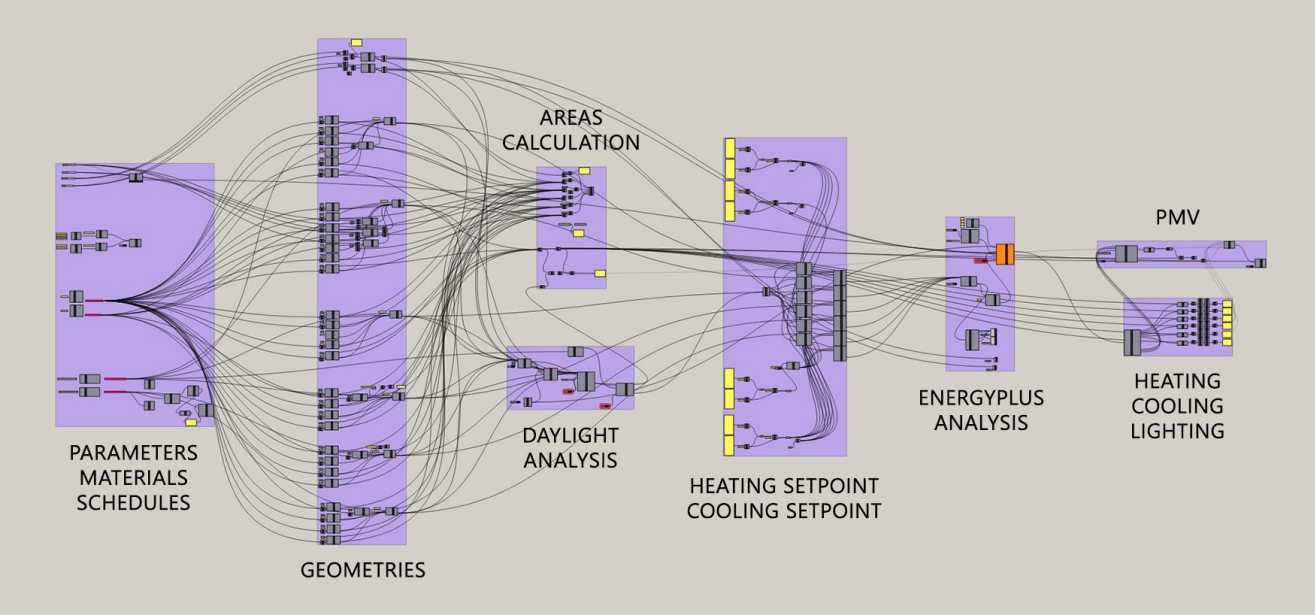

Fig. 6: Algorithm created in Grasshopper as nodal modeling for parameterization and energetic analysis

communication logic of gaming, the meeting ground to promote a dialogue with the "digital natives" and with whom animates such virtual squares. For this reason, the path is developed as a virtual reconstruction but also in the immersive environment (Figure 5), to involve fully the subject and to affect in all the senses.

The experimentation is connected to a possible development of the project and it liks to the financied proposed, but it is indipendent. It was planned as an experimentation useful to understand what and how is central in codesign digital path. The prototype phase of the research aimes at understanding the validity of this path for participation aims, analyzing the value of simulations and information. The scope is to share the meanings, researching the reasons of participative choices. The issue of “ownership” in architecture, is linked to the role of protagonist given to the user, to the citizen, called to dispute around shared issues of concern and to determine the meaning of the places, with the need to lay the foundation of knowledge and awareness but also approaching these topics with a playful attitude (Nijholt, 2017). In fact, the risks of these paths are determined by the evaluations of the values of the signs that the designers are, and must remain, responsible for, as both the technical and aesthetic aspects of design choices are the result of a process of knowledge and experiences.

3. Materials and methods

3.1 Methodological approach in simulation issues

The research developed by the writer is based on a first project of the pavilion that responds to the indications presented in the funded proposal of the announcement. This architectural space is designed in multiple configurations by varying its formal solutions, using generative approach and instrument, firstly Grasshopper and his add-on (Figure 6). In particular, 28 architectural forms were designed, parametrically elaborated by varying 5 elements of the structure (Figure 7). For example, the user can choose the height of the glazing of the main body between two values, just as he can decide his preferences on the presence or absence of openings on the main elevation. These include sunshade screens to cover any windows, the type of cover with or without overhang, and the shape of the window frame, the only purely aesthetic parameter.

During the design phase, a reference shape grammar logic was defined for the calculation of the possible combinations, leading to binary variables with dependence links between them. For example, the choice of the application of the sunscreen on the main window is linked to the presence of the same. For this reason, 32 final possibilities are not obtained (result of 2^5) as 4

configurations have been rejected for congruence with the logic set.

Most of the variables record different values in the energy and comfort analyzes, which were performed for each of the possible configurations. The data taken into consideration for the study are the energy required for cooling, annual heating and lighting, DayLight Autonomy (DLA) and Predicted Mean Vote (PMV). These last two values are data relating to comfort. The first indicates the percentage of hours of occupation in which the interior spaces reach a certain threshold of illuminance (300 lux for the present study). The second value is an indicator of thermal comfort which assigns a value of 0 if in the internal spaces the detected thermal conditions are optimal and differs both positively and negatively if the temperatures are too hot or cold, respectively, up to a value of + 3 or -3.

Through the interactive dynamic representation, the study wants to obtain navigable forms where the individual user can interact with the architectural forms by changing them and verifying multiple configurations. Kiviat diagrams show the main characteristics of energy consumption and comfort, as well as the related construction and maintenance costs, with the aim of providing the cyber users with tools to evaluate their choices. It is then a matter of defining a project integrated in a model, capable of collecting and describing the various factors that anticipate the future of living.

The wide involvement is guaranteed by the possibility of sharing in the network the simulation environment, which is digitally collected in an executable file.

3.2 Instrument and digital processes

The architectonic shape is modeled through the parametric representation with an integrated approach and in the use of immersive reality, in an environment enriched by a process of identifying users and recording choices, which effectively allows cataloging and evaluating different experiences.

The procedure begins with the modeling of the different configurations of the pavilion with Rhinoceros and Grasshopper, in order to render the parametric composition. The algorithm created allows changing the geometry of the structure by simply changing the parameters previously described.

Fig. 7: Representation of the 28 configurations of the pavilion

To perform energy and confort analyzes, Ladybug and Honeybee were used within Grasshopper, all based on OpenStudio and Energy + systems in the parametric environment. The Colibri plugin is also important in this phase, for through it, it is possible to perform the analysis of all the configurations in a simplified model, in order to make the path less heavy, and save the images and the energy data in a text file in an interactive way.

Subsequently from the simplified configurations, it was necessary to realize all the geometries to be displayed during the exploration. At first all the "fixed" parts, those that do not undergo any variation, were drawn, to then add those geometries, necessarily overlapping, which represent the elements to be displayed or hidden in relation to the different configurations.

The model, exported in .fbx or .obj, is imported into a numerical modeling software for generating UV coordinates (3D Studio), necessary for the correct positioning of light maps, and to assign to the mesh faces different IDs material to allow assigning different textures to the polygons of the same element.

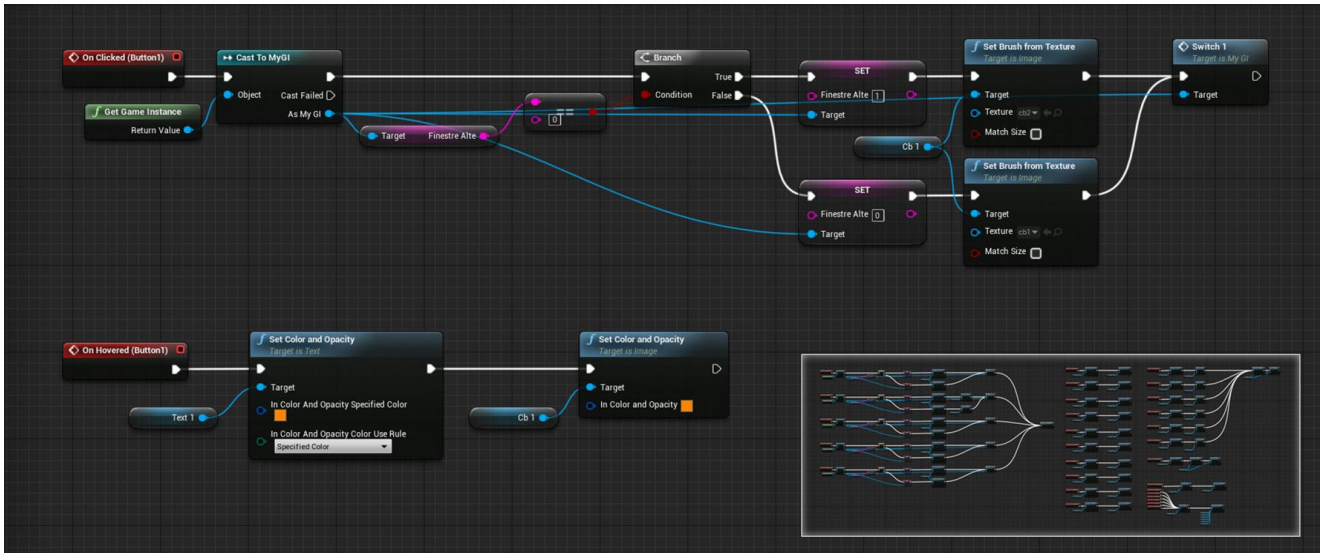

Fig. 8: Algorithm created in Unreal as nodal modeling for gaming and codesign

The geometries are then inserted into the Unreal Engine environment for the realization of the interactive virtual model. This graphic engine offers templates to simplify the initial settings assigned to the project and the decision was to start from the "First person" configuration, which automatically generates all the elements for an exploration of an immersive environment. However, as regards all the other features that are needed to obtain a complex virtual experience like the one in question, many other scenarios need to be programmed. To do this it is possible to take advantage of the nodal programming offered by the software, called Blueprints (Figure 8).

Just like in pure programming, through the nodes of the blueprints it is possible to create a network made up of subjects and actions, which, linked together by cause-effect logics, form a succession of rules called *functions*. The main advantage of functions is reusability: when a function is defined, the software creates a special node in which the actions are hidden and the input values are highlighted. This means that it is possible to use the same logic, the same path infinite times, simply changing the input values to be assigned to the function, such as the geometries of a project.

The functions created for the virtual experience are many: any variation within the scene must be programmed, with the exception of the user's movement, which is already active thanks to the Unreal Engine preset. The main blueprints developed are therefore the one to log in or to register the user, those to hide and display the appropriate meshes based on the user's selections, one for each interaction button, the one for updating data and of the interface graphic and finally the one for the automatic opening of the doors when the user approaches.

All the functions created are available to users through the launch of an executable file where the interaction screen is juxtaposed with a description of the impact of the proposed selection, schemes that the user can recall at any time of the experience by pressing the right button. This screen contains five buttons for selecting the configuration and the energy data, which update instantly while changing the settings and which are summarized in diagrams easily readable by the users (Figure 9).

The graphic choice of inserting a summary scheme of impact and continuously updated with the configuration variations, was dictated by the idea of supporting the rational reality of the data, useful but cold, with something capable of stimulating the emotional sphere of the user. The typical involvement of the immersive reality, capable of touching the right emotional strings to strengthen the motivation and sensations felt, is therefore supported by the graphic interface, also thanks to the choice of color: orange, in fact, is often used as a symbol of creativity, change and energy, three values strongly involved in this virtual experience.

To memorize users' choices, it was decided to use an online database managed through MySQL and populated with PHP language functions. To

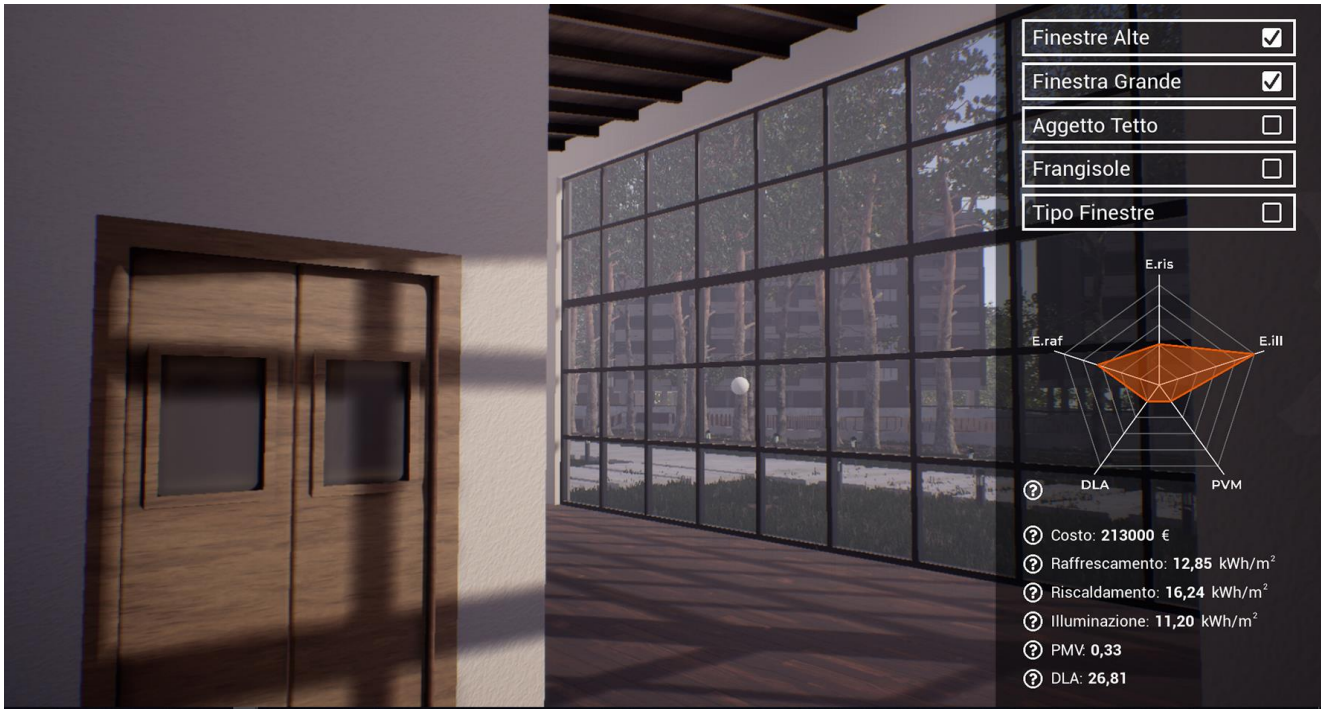

Fig. 9: Screenshot of the virtual experience inside the pavilion with the interface for selecting the open configuration and the tooltip of the activated graph

execute the necessary code from the graphic engine it is essential to install a free plugin called VaREST, which allows making REST requests during the immersive experience. These requests point to files uploaded to the server, which contain the functions needed for storing the data deriving from the user's choices, thus adding a new line of information each time a user registers or changes the appropriate line, when a user had already completed the experience before.

4. Results

Up to today, as prototypic version, the path has seen a first experiment involving about 32 users, in a case study connected to a pavilion located in a park in requalification, a path that already shows the centrality of immaterial energy information in the choices of preferred configurations. The users have navigated using their computers through the installation of the executable file created, or in reality immersive using a virtual reality headset (HTC Vive) placed in the university for experimentation (Figure 11).

The sampling was therefore of a simple probabilistic type and the result is a sample equally divided as regards sex, but mostly formed by individuals under the age of 40 years

The number of selectable configurations that differ in terms of energy and confort are twelve, and among the possible forms, there are four that have noticeably better characteristics than the rest and due to the pentagon area in Kiviat's diagram are easier to identify. Gathered the data in the database, through the analysis it appears that the most selected configuration is not among the best from the point of view of energy and confort, but it is probably among the most interesting as regards aesthetics. It should be noted, however, that the four most efficient configurations collected only half of the users' preferences, while the other half selected the eight configurations with the worst performance.

Analyzing the individual items of the diagram (table 3) it can be seen that the two indices relating to comfort have a low impact on the choices of users. These are equally divided between optimized and non-optimized choices (with a slight advantage of less comfortable choices), suggesting a carelessness or a lack of understanding of the meaning of these apparently abstract values. The influence of the costs of cooling and lighting is very similar to that of the data on comfort and they reflect a failure to evaluate these aspects during the configuration of

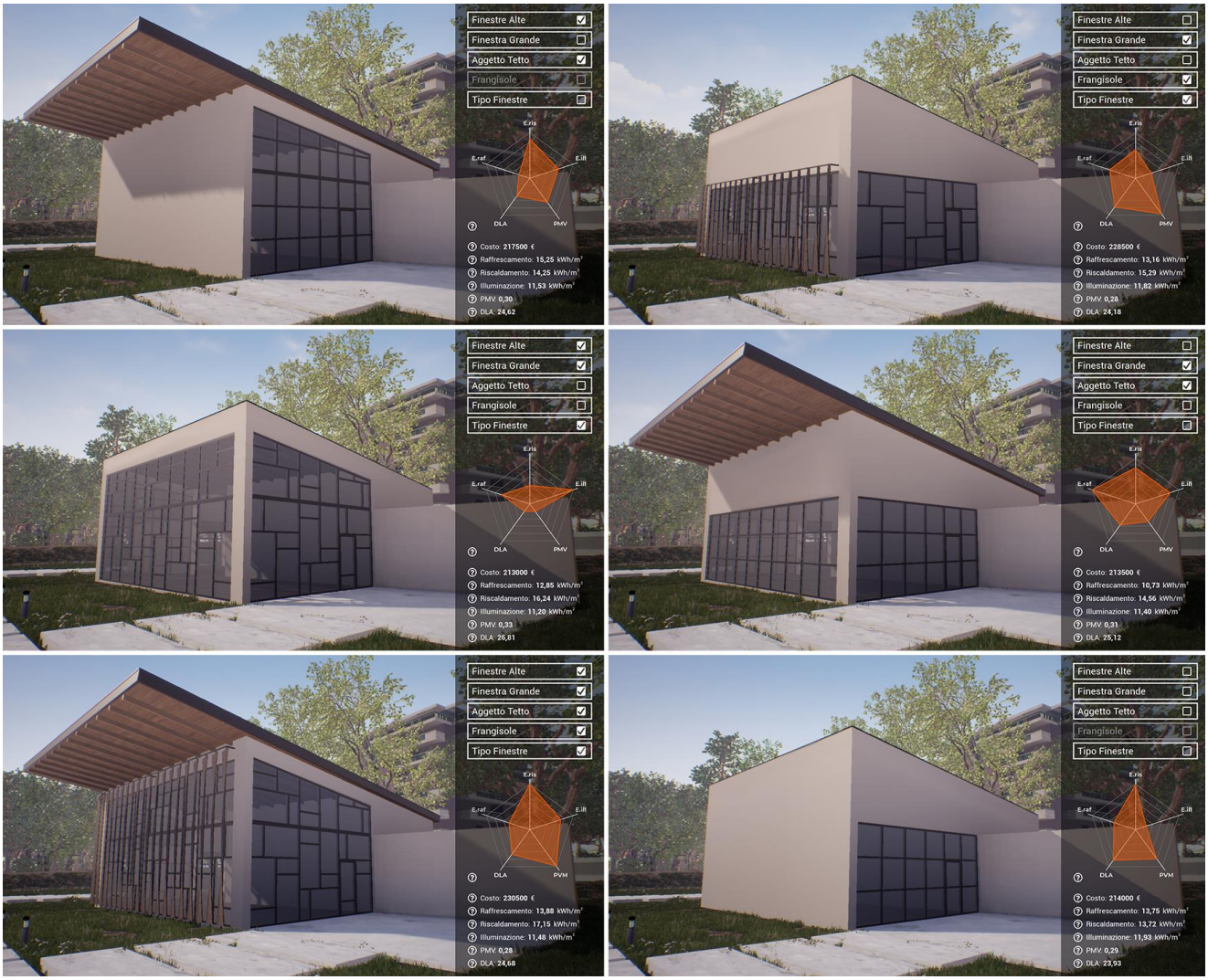

Fig. 10: Screenshots extracted from the virtual experience captured from a location outside the pavilion according to the different transformations

the pavilion, probably due to a voluntary choice of the user, who preferred to give more weight to other values. The two data on which attention has been focused most are the cost of construction and the cost of heating, certainly the two most immediate and known values. If, in fact, the choices of the configuration with greater aesthetic appeal are excluded, it can be seen how large is the portion of users who preferred an optimized pavilion as regards these two items (17 out of 27 for the construction cost, 16 out of 27 for the cost of heating). Therefore, it can be said that the average user has let himself be guided both by the harmony of shapes and by a particular attention to costs, at least those closest to everyday experience.

5. Conclusions

The research path highlights how, through digital technology, it is possible to be able to involve the new inhabitants of digital squares to make considerations and express choices about reality. The approach described is then proposed as integrative of a codesign strategy, based on image and simulation, on the possibility of interacting freely but within a social network. The space of the game, the modes more than known to the current generation, offer an implicitly "normal" simulation, which does not create a gap between the instruments and the expression of the evaluations. These paths then show the communicative and training potential inherent in their own statute, with the results that reveal the

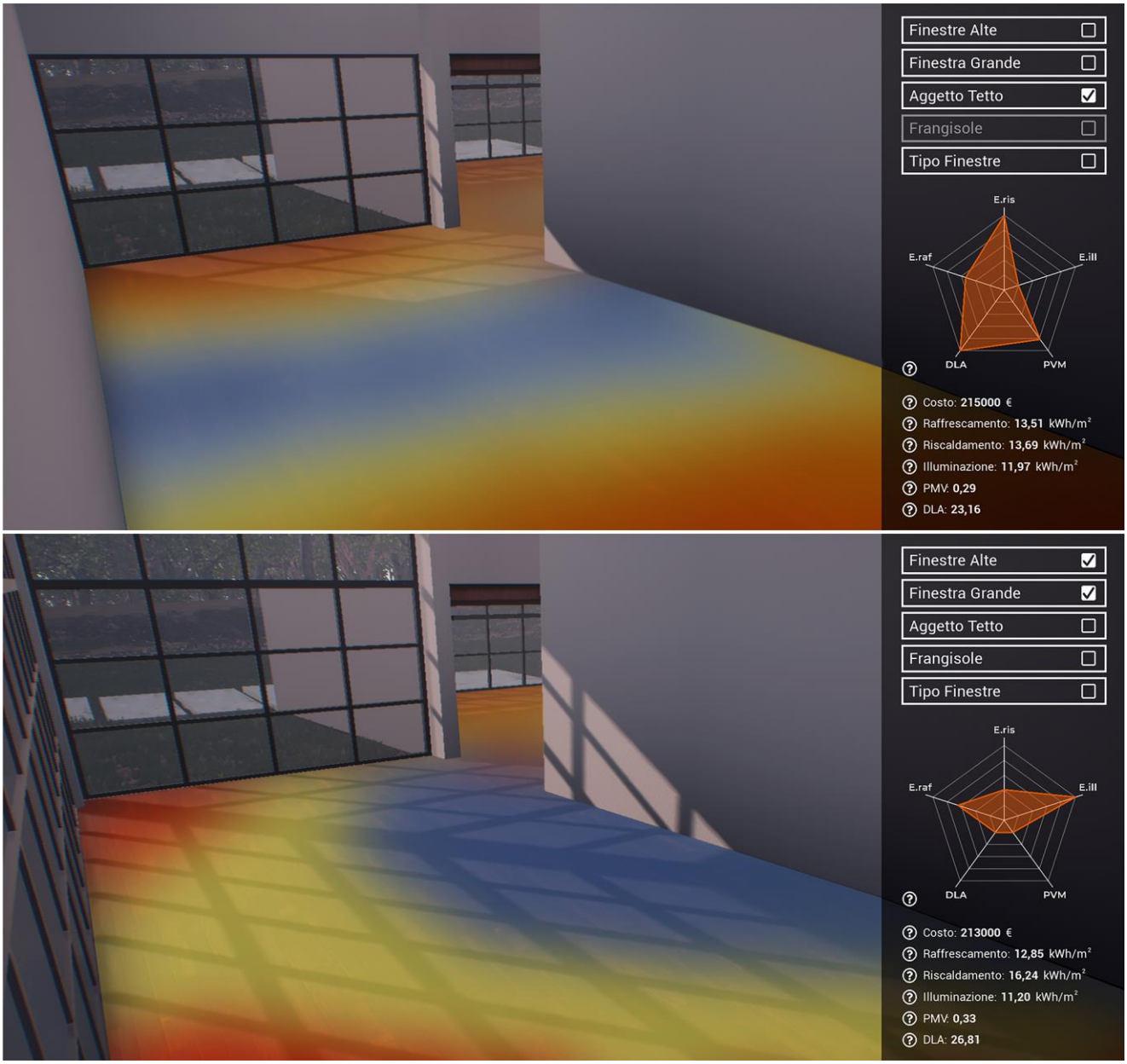

Fig. 11: Representation of daylight and data in Kiviat's diagram inside the pavillion according to two different scenarios

implementation of a path of awareness of the users, informed of the impact of the choices. Clearly, the image, in a system based on images themselves, prevails over the considerations inherent in the value of the services, but it impresses the attention offered by most digital users. The involvement and enjoyment of the game make the offered freedom appear not by virtue of the actually substantial constraints, but in correspondence with the importance left to the individual.

The path reveals itself as a first possible beginning of the potential of digital tools in creating knowledge, participation and care, showing its potential, which is possible to extend to cultural heritage in a broad sense. The centrality of man remains, the importance that the tools can give, in a democratic and uniform way to all, involving them in thinking and drawing the next city. The case study is a paradigma of a wider approach to the digital path as the place of the information: the model is the synthesis of different paths of knowledge and the form, so close to the image, is a transdisciplinary language understandable to all. The same approach is extendable to a wider context, not only architectural and building, to verify the effectiveness of the co-design tool in the design

Tab. 1: Summary table of data collected from user experience

Configuration Code	Choices Number	Construction Cost [€]	Kiviat's Area
1	5	230500	3.79
2	4	214500	14.39
3	4	213500	15.51
4	4	212000	17.03
5	3	217500	7.84
6	2	229500	4.65
7	2	229500	5.08
8	2	216000	8.37
9	2	215000	5.07
10	2	213000	17.03
11	1	228500	5.17
12	1	214000	5.83

Tab. 2: Analysis of data collected from user experience

Cooling ener. [kWh/m²]		Heating ener. [kWh/m²]		Lighting ener. [kWh/m²]		PMV		DLA		Construction Cost [€]	
n.	value	n.	value	n.	value	n.	value	n.	value	n.	value
4	10.73	2	13.69	2	11.2	5	0.28	2	23.16	4	212000
4	11.41	1	13.72	4	11.3	2	0.28	2	23.32	2	213000
4	12.17	3	14.25	4	11.33	1	0.28	1	23.93	4	213500
2	12.82	2	14.29	4	11.4	2	0.29	1	24.18	1	214000
2	12.9	4	14.54	2	11.41	2	0.29	3	24.62	4	214500
1	13.16	4	14.56	5	11.48	1	0.29	5	24.68	2	215000
2	13.51	2	15.28	2	11.49	3	0.3	4	25.12	2	216000
1	13.75	1	15.29	3	11.53	2	0.3	2	25.4	3	217500
5	13.88	2	16.24	2	11.81	4	0.31	2	25.58	1	228500
2	14.94	4	16.25	1	11.82	4	0.32	4	25.76	2	229500
3	15.25	2	17.11	1	11.93	4	0.32	4	25.93	2	229500
2	15.55	5	17.15	2	11.97	2	0.33	2	26.81	5	230500

field of application, introducing further parameters of environmental perception and well-being and a dictionary of selectable design elements, set up ad hoc. The possibility to survey the sensations, the emotions and what acctract the eyes can be integrated to this methodology (Bianconi, Filippucci, & Felicini, 2019; Bianconi, Filippucci, & Seccaroni, 2020). The path, in fact, demonstrates how the representation is always an evocatic path: it is not central the realism, but the essence is the engagment of the subject in a history, the possibility to affect the future. The digital tools can combat the general cynicism so widespread among young people too often resigned to not counting in design. The case study described is then proposed as a pioneering path on a new role of representation that poses itself as a social medium, enhancing in a new way that communicative value always inherent in the project.

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