Design for Inclusion, Vol. 45, 2022, 45–53
https://doi.org/10.54941/ahfe1001868

PLEINAIR Project: Participatory Methodologies to Validate and Integrate Product Concepts with Young Users

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ABSTRACT

This contribution describes the final part of the development process of PLEINAIR project, a multidisciplinary research project financed by the POR FESR 2014-2020 program regulated by Emilia Romagna Region, Italy. The PLEINAIR project aims to develop a smart outdoor park, specifically designed for encouraging active lifestyles among different generations. The activities were conducted during the Covid pandemic situation, when the Italian lockdown restrictions in public education were temporally less severe. Two co-design workshops were organized involving two schools in Province of Bologna, Italy, to collaboratively validate and refine the PLEINAIR's early concept ideas, together with young users. Considering this, the paper describes the entire design process of the two Co-Design activities performed in both schools. The results produced qualitative data that were difficult to collect during the remote activities. They were used as guidelines to improve many aspects of the User Experience of the PLEINAIR's interconnected system.

Keywords: Human-centered design, Co-design, Health, Outdoor smart objects, Participatory methodologies

INTRODUCTION

This paper describes the last research activities related to PLEINAIR (Free and Inclusive Parks in Networks for Recreational and Physical Intergenerational Activity), a two-years multidisciplinary research project financed by the POR FESR 2014-2020 program regulated by Emilia Romagna Region in Italy. The PLEINAIR project aims to develop a smart outdoor park to promote the adoption of active lifestyles for all and at any stage of their life. This is because, according to World Health Organization (WHO, 2020), sedentary lifestyle is increasing worldwide and it risks of producing more cardiovascular diseases compared to the past, which are creating important consequences on the social and healthcare system of many countries (ISCA, 2015; Dorato, 2020). Again, PLEINAIR aims to encourage positive socio-recreational interactions among different generations because nowadays most of the urban parks are composed of arbitrary and selective areas that do not stimulate interactions between different generations. The purpose of PLEINAIR is to provide real solutions through smart, interactive, and connected products, which are called OSOs (Outdoor Smart Objects). Due

to their interoperability and high computational speed these smart objects are able to act, react, and interact in the real world in a new manner independent of the human agent (Celaschi et al., 2017; Rozendaal et al., 2019). By monitoring a series of parameters – through an IoMT (Internet of Medical Things) infrastructure – related to people's motor or ludic activities, the OSOs can provide the most suitable and customizable motivational strategies to stimulate a positive health lifestyle for any user at any age. One of the peculiarities of these smart objects is the intent to adapt their characteristics and functions to the users' requirements, to increase their physical and cognitive abilities (Mincolelli, 2017; Zannoni, 2018). PLEINAIR is based on a Human-Centered Design approach, and it utilizes participative Co-Design techniques to discover and satisfy the real needs of people. Due to the COVID-19, the first part of the needs analysis was conducted remotely. Despite there were no chances to interact with users in person, the on-line activities collected many insights to develop the early concepts of the OSOs (Mincolelli et al., 2021). However, when the Italian lockdown restrictions in public education were temporally less severe, this research had the chance to organize two Co-Design workshops involving two schools in Province of Bologna, Italy, to collaboratively validate and refine the concept ideas with young users.

DESIGN APPROACH AND ACTIVITIES

We approached the development and implementation of the entire project through the methodology of Human Centered Design (Mincolelli et al., 2020). It is a strategic approach that places people's needs at the center of the analytical and creative design process. In the PLEINAIR project, users were highly diversified as the equipment to be placed in an open space had to increase the level of sociality and encourage the adoption of healthy and active lifestyles by: children, adolescents, adults and elderly people (DiSalvo, Lukens, 2011). Within each macro-area of users there were also different groups on the basis of the different skills, characteristics, cultural and social contexts of each person involved in the project. In a moment of standstill and relative calm due to the COVID-19 pandemic, we were able to organize participatory work days with different users; specifically, primary school children and secondary school teenagers. The different workshops had various objectives and expected results, as well as the application methodologies and the consequent design tools were different. The participatory days carried out will be explained in more detail below.

First Workshop: Involving Primary School Children

The first Co-design workshop was organized in collaboration with one of the classes presented at the Bruno Munari primary school, located in Baricella (BO), Italy. The workshop involved 21 children and it lasted 4 hours. Due to the anti-covid regulations, the class was divided into 2 working groups (2 hours each). The activities expected to validate a series of OSOs' early concepts that had been conceived during the first research activities (Mincolelli et al., 2021). In addition, the first workshop aimed to acquire several needs and expectations associated with the outdoor park experience

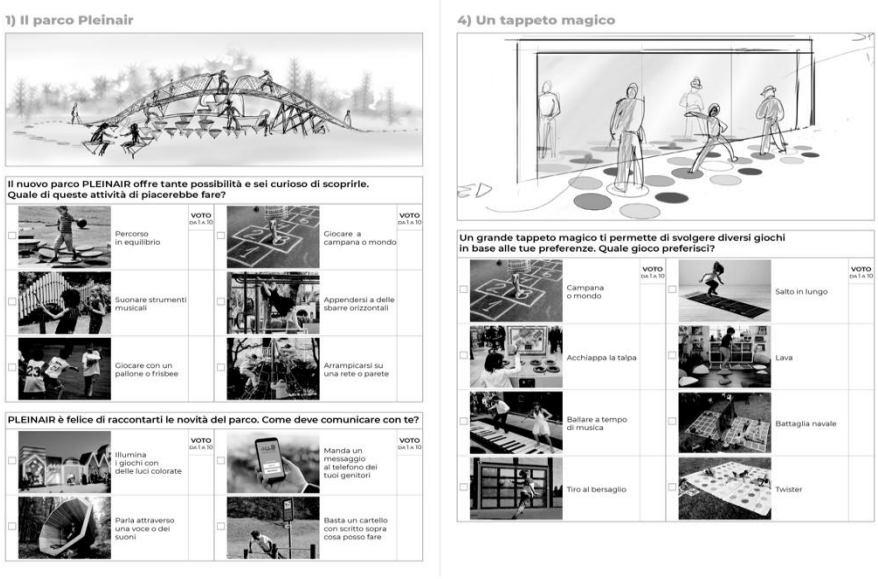

Figure 1: The first and the fourth queries of the questionnaire used in the first workshop.

from the perspective of the younger users, as their generation was less involved during the early research activities, which were concerned in an online, survey because of the pandemic situation (Mincolelli et al., 2021). According to the research objectives, the workshop activities were divided into two main parts for each workgroup.

The first stage collected the children's considerations and expectations about the OSOs' early concepts through a visual questionnaire. The second stage used a free-drawing session to acquire new insights for implementing the functionalities of the OSOs by interpreting the children's personal concepts of PLEINAIR outdoor park. The questionnaire was structured only in 5 main questions, each of them formulated for acquire data on specific characteristics and functions of the park and the OSOs (Figure 1). For facilitating the children's decision-making process, each question was composed by 4, 6 or 8 multiple choices, in which every textual option was accompanied by an evocative image. For each question, the child had the chance to select, at least one or two options, to which assign a vote from 1 to 10. This approach was utilized as a quantitative parameter to hierarchize all the choices of the entire class. The first question was composed of two queries that asked children what types of activity the PLEINAIR park should offer (balancing structures, climbing walls, monkey bars, musical instruments, hopscotch, or classic ball games) and what multimedia aspects should be utilized to communicate and interact with them (analogic informative posts, mobile app, sound, or speech synthesizer). The second question asked children what activities they would act if PLAINAIR explored the opportunity of having a multifloor playground (for example climbing, sliding, running over it, jumping on interactive stairs, observing nature from the top, or relaxing in a private spot). The other remaining questions focused on the characteristics of the

PLEINAIR's structure and its OSOs. Specifically, the third query explored the functionalities of a tubular structure as a compositive and interactive element of PLEINAIR's playground. In that case, the question asked children for what kind of playful or interactive functions the tube should act (for example as a sitting, a hanging or a climbing system, or as a light, binocular, megaphone, speaker or basket). The fourth questions focused on a key element of the project, which is an interactive carpet, composed of modular smart and interconnected tiles. Considering this, the query asked children what game they would play with that OSO (for example, "catch the mole", "the floor is lava", battleship, target shooting, twister, tap piano, hopscotch or long jump). In addition, the question asked children for what functions the games should offer (for example, changing the difficulty level, create challenges, inviting friends to play, or evaluating my performance statistics), and for what person they would invite to share the activities (for example, the parents, grandparents, friends or other children to make new friendships). At the end, the last question investigated new interactive functions of an outdoor smart chair. Regarding this, the query asked children what types of activity they would perform by interacting with that smart chair (for example, playing music, swinging, balancing, listening to a story, jumping on it or simply sitting and relaxing on it). Instead, the second part of the workshop consisted of a free-drawing session, in which the children were free to design and interpreter the idea of their personal playground based both on their personal experiences at the park and on the information acquired from the questionnaire. The children did not been affected by any design constraints in order to offer them more freedom on expressing themselves. At the end of the workshop, the research team analyzed all the children's questionnaires and drawings, and the insights coming from their expectations were used to refine and implement the OSOs' early prototypes.

Second Workshop: Involving Secondary School Teenagers

In order to validate the design phase, two further co-design workshops were held with four fourth grade classes of the Belluzzi-Fioravanti secondary school in Bologna. The participatory days were held on April 20th and 22nd 2021 and involved about a hundred students. Design research methodologies were used such as card sorting, focus groups, storyboards (Mincolelli et al. 2017). This activity was important to gather the latest useful information (OSO-User interfaces and interactions) to develop the shared project brief with detailed description of all OSOs and their instructions for use. The final goal of these meetings was to refine the concepts and ideas so far achieved within the project and to have first feedback from the possible final users. Each single workshop was structured in three thematic tables. Around 7–10 people took part in each thematic table. Each table had approximately 30 minutes to develop the specific theme. Once the pre-established time was over, each group of students started examining in depth the theme of the next thematic table. The methodology applied throughout the days of participatory work, was the co-design; therefore experimental, playful, highly manual and graphic days in which students had the opportunity to interact with the prepared material.

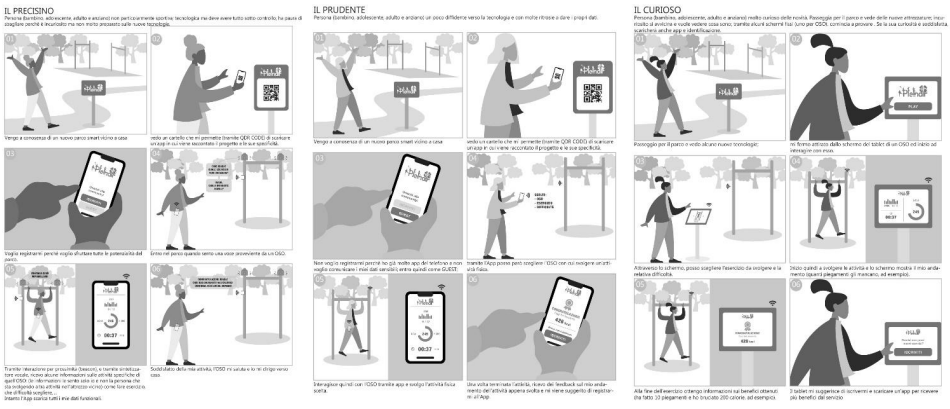

Figure 2: Example of storyboard used for the first thematic table.

The first thematic table was focused on the possible interactions between the smart outdoor equipment and the users. The operational and design tool used in this thematic table was the graphic one of the storytelling (Franklin, 2021) and storyboard (Figure 2).

Graphic tables of possible users with different systems of interaction between man and OSO were previously created. The hypothesized users (the sportsman, the competitive, the curious, the suspicious, the prudent and the precise) and the proposed technologies (QR code in play tools, fixed tablets next to each OSO, dedicated App with different customization options and integrated headphones, RFDI system) were specifically very contrasting and different from each other. The objective of the table was to investigate which technological tools would produce the most inclusive and performing experience of fitness or socialization within an outdoor park. The final outputs of this table expressed the teenagers' need to have a fast, immediate and above all customizable interaction. Unlike elderly users, teenagers are very familiar with apps and smartphones and therefore it is not a problem for them to have this type of human-machine interaction.

The focus of the second thematic table was dedicated to the study and research of the graphic interface and the content of a hypothetical App for the management, even remotely, of the data and results performed on the OSOs of the PLEINAIR project. For this table we worked and created the graphical interface of the App together with the students. Various smartphone mock-ups were created and adhesive icons, post-it or graphic diagrams could be added as well as the related content or observations. Given the specific target of the table, we explored the diverse App on the market in order to suppose the design effects of an App that would inform people about their fitness performance, any improvements made in a specific activity, tutorials that best explain how to perform a certain physical exercise safely. The goal was therefore to customize the graphical interface, creating home screens to set up the personal account (initial configuration of the service), on the basis of the physical characteristics (age, height, weight, etc.) and the preferences on the activities proposed by the system.

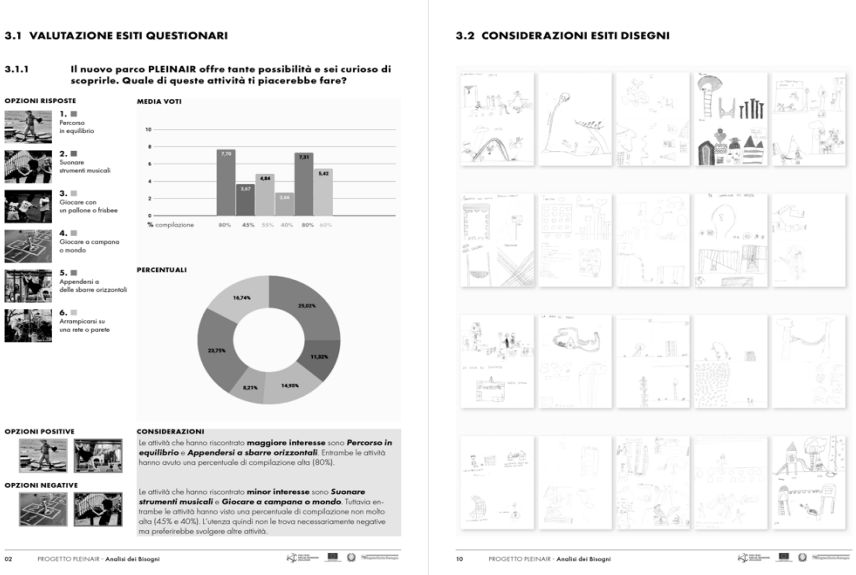

Figure 3: Some outputs of the questionnaire and the drawing collected from the first workshop.

The third thematic table was instead focused on possible motivational strategies to encourage people to do physical activities at the park or just have the opportunity to interact with other users in order to improve their psychophysical state. The research activities carried out within this table were divided into two parts: in the first part the students were asked to carry out a short questionnaire with open and closed questions. The questionnaire focused on expressing appreciation feedback to twelve messages of hypothetical motivational strategies; these messages differed in content, graphic or sound representation. In the second part of the specific activity of this table, students were asked to express an opinion and possibly to integrate each strategic motivation hypothesized previously. An in-depth work was carried out on what the term motivational strategy means and how to make it effectively performative for the specific user adolescents

RESULTS

The evaluations coming from the first workshop allowed the research to understand what ludic activities and functionalities should be adopted by the OSOs to satisfy the expectations of the younger users. In particular, the more appreciated ludic activities were the balancing structures, monkey bars and climbing walls (Figure 3). The same activities were confirmed by interpreting the children's drawings because most of them expressed the willingness of performing those games on a multi-floor playground. The drawings also outlined the willingness of having a strong bounding with nature. The children appreciated the use of colorful lighting systems for interacting with the OSOs, instead of reading an analogic informative post, using a mobile application or a speech synthesizer.

Figure 4: App GUI mockup with directions from teenagers.

Regarding the interactive carpet, the most preferred activities were "the floor is lava" and tap dancing. The children also appreciated the option of changing the difficulty of the game based on their skills and the opportunity to invite friends to play together in multiplayer activities. Moreover, compared to the questionary, the drawings showed new and alternative games to interact with the smart tiles, such as walking through a labyrinth, composing words or playing math games.

Referring to the participatory research days carried out with the secondary school students, we can share the results hereinafter. In the first thematic table (human-OSO interaction), the choice of the types and characteristics of users and the mode of representation were crucial aspects for the success of the project. The portray of each possible user in a detailed and specific manner allowed the establishment of an emotional and confidential relationship between students and the hypothesized users. The design tools helped students to identify with users or to find character and empathic correspondences with people they know. This process launched a rich and stimulating debate that allowed to examine every single significant data of the user experience. In the second table (App interfaces) various aspects related to the App content evaluated: the possibility of having performance results rankings for each OSO; the management of notifications; the personalization of the homepage; the management of specific activities related to OSOs (Figure 4). These results were important for designing an inclusive App that took into account the needs of the specific user who could most benefit from the App and an outdoor park for playful, socializing and fitness activities.

In the third table, eight motivational strategies were examined: award or reward, competition, sharing and sociality, organized activities, progressive difficulty of the physical exercise, resulting benefits, customization of content and interfaces, performance monitoring. The strategies with the greatest interest were those concerning competition, challenge and monitoring (even remotely) of one's performance. The activity produced a large number of

considerations, useful for developing an inclusive experience at the park, in the best possible way.

CONCLUSION

We can state and confirm that applying approaches, tools and methodologies typical of the Human Centered Design, the analysis and related concepts are of good quality. The planning and project of participatory meetings, aimed at developing a needs analysis or confirmations/integrations of hypothesized concepts (co-design), can also be carried out in periods when contact between people is reduced due to hindrance of force majeure. Definitely, it is necessary to develop and innovate the design tools to be proposed to users, trying to develop shared work strategies even remotely or in the absence of close contact without affecting the emotional, creative and innovative participation of students and moderators.

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