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Giuseppe Di Bucchianico *Editor*

Advances in Design for Inclusion

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Editor
Giuseppe Di Bucchianico
Dipartimento di Architettura
University of Chieti-Pescara
Pescara, Italy

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Preface

This book has two underlying messages, the emerging importance of the social issue of inclusion and human diversity in contemporary society, and the increasing awareness that there is no such thing as a 'standard human being.' The first question has to do with inequality and social disparity as a necessary milestone toward economic revival, among other things, while a vital role in the strategies adopted by the European Union's Horizon2020 framework program is played by the ones that focus on strengthening equality, participation, and accessibility for all to goods, services, and what Dahrendorf called 'life chances.' What this means is that the issue of social inclusion of diversity and for equality is firmly on political agendas all over the world, not least because of increasing awareness that new visions, new strategies, new tools, and new approaches are needed, if we are to tackle the challenges arising from recent phenomena of economic and cultural globalization, demographic change; economic migration from poorer countries and an aging population in wealthier countries, a phenomena that are destined to upset the entire planet's micro- and macro-economic and social structures in years to come.

The second issue tackled in this book is more technical in nature, since the paradigm change from 'designing for standards' and 'inclusive products and service design' to the enlightened awareness that there are no such concepts to fit the standard human being, this has immediate, direct repercussions on the specialized dimension of designing. The realization is at last taking hold not only that those individuals are physically, psychologically, and culturally 'diverse,' but they also have widely diversified skills, abilities, aspirations, and desires that make each one of us unique and not at all replicable. Since the diversity of individuals is the rule, not the exception, it makes sense to consider it as a resource, not as a limiting factor or a restriction on design, while equality between individuals, communities, and peoples should be treated as fundamental strategic inputs to the sustainable development of contemporary society, where everybody should have the same opportunities to experience places, products, and services. Numerous design approaches have been adopted to facilitate social and cultural inclusion in recent decades: Design for Disability, Universal Design, Inclusive Design, and Design for All. All of these philosophies, approaches, and methodologies aim to build value on

all aspects of human diversity, from psycho-physical to cultural issues, and to offer equal opportunity to everyone in order to experience places, products, services, and systems. With this in mind, this book sets out to forge a climate conducive to discussion and comparison between these approaches, without any prejudice in favor or against any one of them, but attempting to identify the elements they hold in common and to build each one's heritage of originality, because we are convinced that the true resource of Design for Inclusion may well be found in this very diversity of opinions.

In particular, this book describes the state of the art of recent research conducted in a variety of fields that share the focus on Design for Inclusion and was presented in the second international conference on Design for Inclusion (AHFE 2018, Orlando, Florida). On this occasion, the numerous research papers presented were collected together into four different thematic areas, corresponding to different sections of this book:

Section 1: Design for Inclusive Daily Life and Human Diversity;
Section 2: Design for Inclusive Environments, Materials and Multisensory;
Section 3: Design for Inclusive Transportation, Information and communication technologies;
Section 4: Inclusive Service Design for Education and Learning;

Each section contains research paper that has been reviewed by members of the International Editorial Board. Our sincere thanks and appreciation to the board members as listed below:

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Playgrounds for All: Practical Strategies and Guidelines for Designing Inclusive Play Areas for Children

Alessia Brischetto(✉), Francesca Tosi, and Alessandra Rinaldi

Laboratory of Ergonomics and Design, Department of Architecture, University of Florence, Via Sandro Pertini 93, 50041 Calenzano, Florence, Italy
{alessia.brischetto, francesca.tosi, alessandra.rinaldi}@unifi.it

Abstract. To date, outdoor game equipment and playground facilities worldwide are increasingly oriented towards a wide range of solutions in support to gaming activities for children of any age, independently from their motor, cognitive and social impairments. However, due to the complexity of variables interplaying between product demands and user capabilities, many efforts are still needed for making games and playgrounds as much as possible inclusive. The present work proposes a novel methodology useful to designers and other stakeholders for predicting the degree of user exclusion when performing play activities. User trials, focus groups, interviews together with the analysis of accessibility standards, disability descriptors by ICF, and Task Analysis were used for cross-correlating the required tasks with user capabilities. This led to creating an evaluation tool useful to get an immediate feedback and reliable information on the level of inclusiveness of any type of game equipment and user disability. It revealed to be also effective for assessing personal and environmental factors of interest and identifying design requirements.

Keywords: Playground · Inclusive play · ICF · Disability · Inclusive design Social innovation

1 Introduction

Designing inclusive public open-air playgrounds is an issue of foreground and strategic relevance within the contemporary society, as it can have significant implications on the social dimension of children, especially for that of exerting the right to play. The United Nations Convention on the Rights of the Child (commonly abbreviated as the CRC or UNCRC) provides the following definition regarding the right to play and to play with the others peers: "every child has the right to play, regardless of age, nationality, gender, skin color, social and religious status, physical and intellectual capacity" [1]. Within public play areas such a right is often undermined by the presence of games that are not suitable and inaccessible or even more by the presence of restrictive play solutions for humans. For instance, it is not enough to put ramps in existing games or choose games for disabled children, but we must guarantee the

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possibility of playing for all children in total safety, regardless from any impairments and discrimination [2].

Basically, playing in its widest meaning foresees physical, sensory and relational activities. To date, existing outdoor game equipment and playground facilities worldwide offer a wide range of solutions in support to the above mentioned activities. However, despite the advances achieved in this field, we are still far from making thoroughly inclusive playgrounds. As an example, what are the levels of acceptability of current playground facilities in relation to user needs and their abilities? How is it possible to objectively assess the degree of inclusiveness? What are the variables and the knowledge that the designer must consider to realize inclusive concepts? Surely, the answer to these queries is not immediate and how the contribution of design can foster the implementation of such systems-services is an open question that still deserves further investigation. As reported in the literature, the inclusive design knowledge base involves mainly two distinctive areas. On one hand, understanding end users from many different perspectives (not only in terms of ergonomics), on the other hand, understanding the information needs of the many groups involved in promoting and delivering inclusive design solutions, from politicians and campaigners, through business, design and marketing to strategic planning [3, 4]. A crucial aspect is undoubtedly that of identifying an analytical strategy for understanding the diversity and the release of useful designing inputs in order to satisfy user needs transversally, by considering a plurality of physical, psychic and social conditions in an integrated way. As a matter of fact, the Inclusive Design Cube, which was initially proposed for understanding the link between product demands and user capabilities, was reformulated in the area of playgrounds by adding the social dimension [5, 6]. Nevertheless, whenever facing with the development of playing areas or a single game, the identification of user needs, user abilities, environmental factors together with the analysis of activities to be performed during a specific gaming are key factors for achieving inclusiveness. The representative sketch displayed in Fig. 1 illustrates and summarizes all aspects to consider whenever designing inclusive playground facilities.

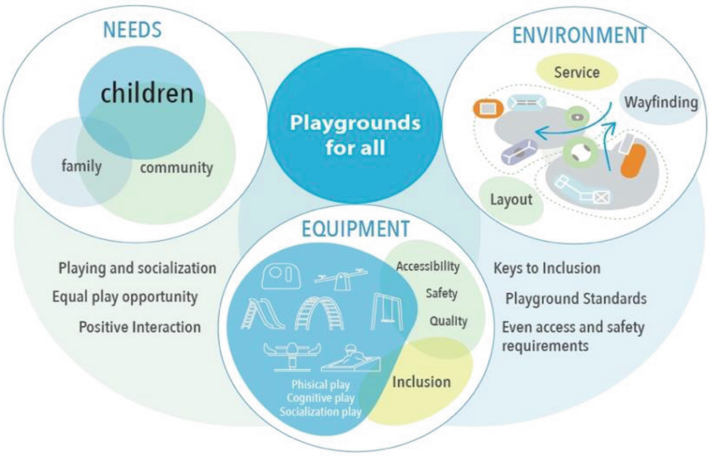

Fig. 1. Key elements for designing inclusive playground facilities

In this work, part of the outcomes presented were achieved during the PIU research project – *Urban Innovation Project*, within which the Laboratory of Ergonomics and Design (LED) of the University of Florence was actively involved. In detail, thanks to a multidisciplinary approach, focus groups, interviews and many other, all the information gathered during the PIU project were used for providing to designers and public institution a methodology to collect keys for designing inclusive playgrounds. The aspects related to those children who use wheelchairs or others scaffolds for mobility, or who have cognitive and sensory disabilities were considered of meaningful importance. The work is therefore finalized to outline practical solutions and specific guidelines, whose objectives are:

- enhancing the children's abilities on the basis of an attentive analysis of user needs
- fostering socialization and collaboration between disabled and non-disabled children;
- promoting communication among relatives and children, even in the presence of early disabilities.

2 Research Stages

On the basis of the main research goal to be achieved, the work was organized according to the four steps illustrated in Fig. 2. The first phase was dedicated to critically reviewing the reference literature and technical standards in order to get preliminary information on playgrounds (i.e. dimensional and safety requirements, inclusion parameters, layout, type and quality of equipment). In the step 2, user needs including physical, sensory and social activities were identified through a series of specific methodologies, especially focus groups and interviews. These information together with the use of ICF taxonomy and Task analysis allowed estimating the level of user exclusion (point 3). In the step 4, the whole process was then translated in a smart evaluation tool which allows to the designer and other stakeholders to put immediately in relation children's abilities to tasks required during play activities. More details about each research step are explained in the following sections.

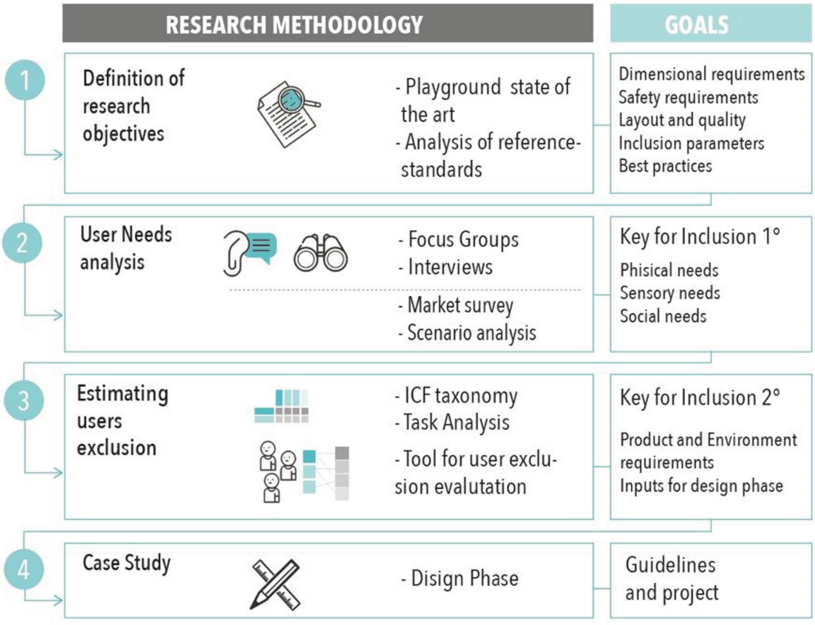

Fig. 2. Sketch showing for each stage the applied methodology and correlated research goals

2.1 Definition of Research Objectives

The research objectives were formulated by carefully reviewing the reference literature and the sector regulations. In detail, the following European and American safety standards related to public playground environments, playground equipment and surfacing standards were analyzed [7–11]. Among the most accredited guidelines one may find: Me2: 7 Principles of Inclusive Playground Design™ [12, 13], Inclusive play design guide by Playworld's [14], Let's play Toolkit [15] and Public playground safety handbook [16].

During this phase, the best design practices along with technical and environmental specifications regarding safety, mobility (accessibility and use of equipment), and compliance requirements of gaming activities were identified. According to the dimensional and safety requirements, a detailed classification of all the activities related to each type of play (i.e. physical, sensory and social activities/interactions) is proposed in Fig. 3, and it includes also a further subdivision for age groups. This classification was useful for evaluating the game equipment present in playgrounds and in market worldwide. Moreover, it was exploited to draw and plan the following user needs analysis phase and hence designing a method for assessing the degree of exclusion.

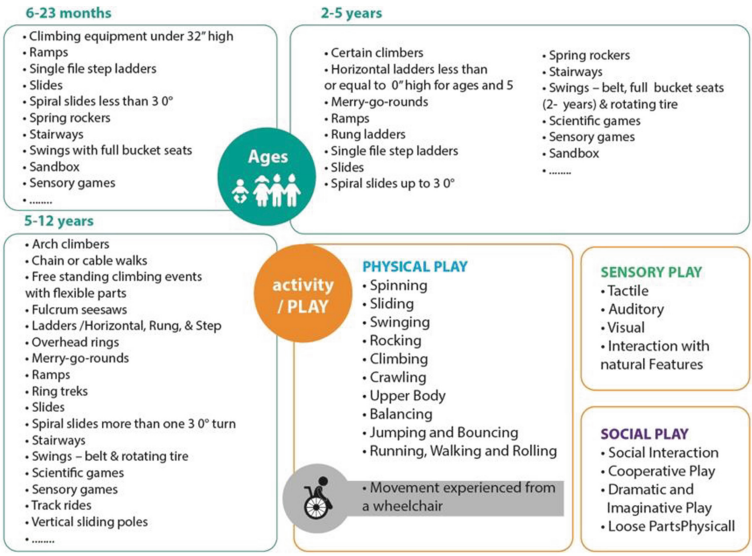

Fig. 3. Classification of gaming activities for age groups and for different type of play Public Playground Safety Handbook [16] Inclusive Play Design Guide by Playworld's [15]

2.2 User Needs Analysis

With aim of assessing user needs, focus groups and interviews were conducted within the PIU research project framework. The main activity of the LED group of University of Florence was that of outlining design guidelines for accessibility, urban ergonomics, and wayfinding for the school village of the city of Cecina (Tuscany, Italy). Basically, focus groups and interviews were attended by citizenship, design experts, educators and individuals involved in social assistance to families. The focus groups were planned by targeting general issues including public space, safety, current services, and the problems mostly related to the needs of relatives of children with physical and cognitive disabilities. Subsequently, a set of interviews were conducted with families of disabled children, and the team of designers who designed one of the most popular inclusive playgrounds in Italy: "All aboard Rimini". The interviews were focused on to understand the level of acceptability of the spatial and environmental elements that characterize an inclusive playground. In particular, it was requested to tell the experiences that children and their families have experienced in the use of traditional games, and which elements of the analyzed park have actually amplified the level of access and inclusion for children.

2.3 Estimating User Exclusion

Generally, for estimating the level of exclusion the following steps revealed to be essential: (1) understand the capability demand made by a product within its operating environment; (2) define a specification for and collect new population based capability

data; (3) calculate levels of product exclusion and difficulty; and (4) present such data in an accessible and useful way [17–19]. Here, to make predictions about the product exclusion we defined the type of disability according to the ICF classification, the international standard to describe and measure health and disability (World Health Organization 2001). The ICF provides a classification of body function and disability composed of three lists called Body Functions, Body Structures and Activity and Participation (see Fig. 3). Furthermore, to classify contextual factors, it offers another two lists called 'Environmental Factors' and 'Personal Factors'. Each domain is structured into chapters where each item can have up to four levels of depth. Thus, the ICF offers about 1500 descriptors in its taxonomy [20]. Besides the tree-like structure of ICF, Fig. 4 shows some of the reliable disability descriptors which were selected for assessing exclusion when practicing play activities.

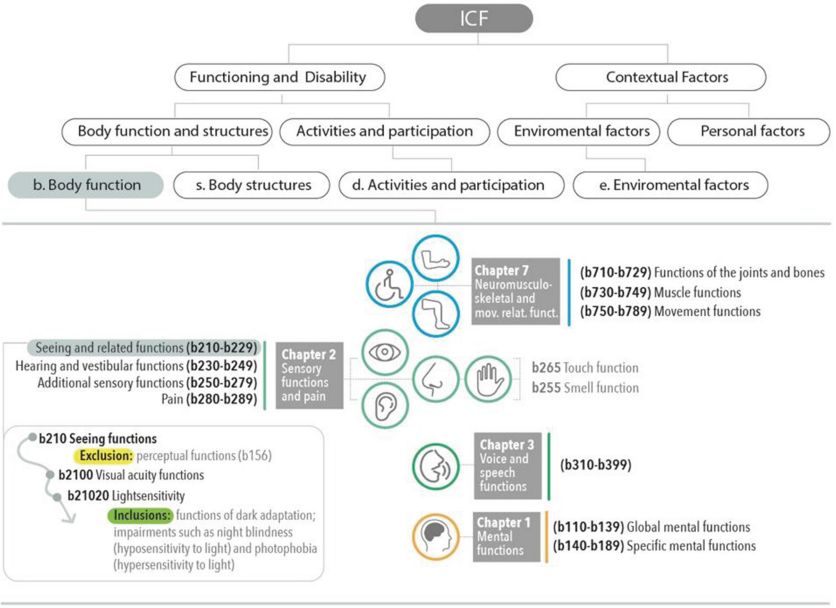

Fig. 4. Tree-like structure of ICF and disability descriptors related to physical, sensory and communication functions

The disabilities taken into consideration were those corresponding to the highest levels of impairment, thus between 96 and 100% of the ICF functions qualifier. This choice was adopted to consider the most extreme level of the exclusion scale (low capability), which means designing for all.

The level of interaction between the game and the group of users analyzed were assessed through the systematic analysis of individual games (i.e. physical, sensory and social plays). For each of them a Task Analysis was developed and for each test and sub-task identified were analyzed the levels of potential interaction, referring to specific users' physical, cognitive and sensory conditions [21, 22]. As an example,

Fig. 5 put in correlation the macro-tasks related to the traditional swing and sensory games, with the level of interaction required to accomplish a specific task (Physical, Cognitive, Social).

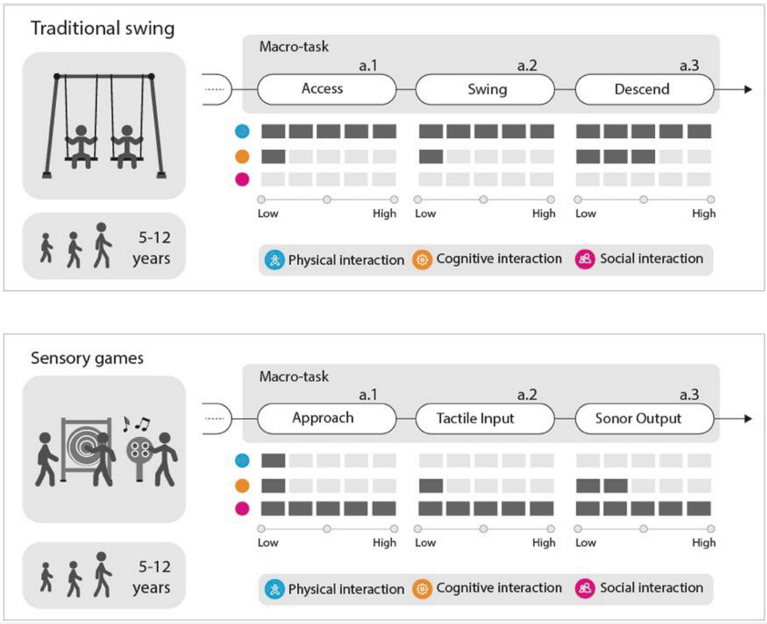

Fig. 5. Level of physical, cognitive and social interaction respective to the tasks required when using traditional swings and sensory games. Age group considered 5–12 years.

The cross-correlation between macro-tasks and the levels of capability, as quantified by ICF descriptors, allowed to create an evaluation tool for predicting the degree of user exclusion when performing play activities. The exclusion was evaluated in relation to the following items: (1) the user, (2) the product, (3) the environment or context (4) the activities and tasks that constitute the interaction over time.

3 Results and Discussion

The assessments carried out within the PIU project and the subsequent developed methodology allowed the creation of an experimental cross-correlation system between the product demands/tasks and user capabilities identified through the ICF taxonomy.

The tool provides an immediate feedback on the level of inclusiveness of any type of game equipment. As an example, Fig. 6 shows the degree of exclusion of 5 games, 4 different types of swings and a sensory game.

Fig. 6. Cross-correlation diagram illustrating the degree of user exclusion during gaming activities

In the case of the swing evaluation, the analysis of the related tasks (i.e. access, swinging, descending phase) shows, in reference to the first four columns, the need for support activities by an accompanying persons, especially in the presence of the physical disabilities shown in the first four lines of the Fig. 6. In the case of limited or complete body functions disability (upper/lower limbs, wheelchair users), the participation of an accompanying person is strictly required for the transfer and/or for assistance activity. During the swinging phase (a.2), if there are children with severe visual and cognitive impairments, assistance and physical contact with an accompanying person is needed. However, the level of exclusion for wheelchair-bound children which can not be transferred on remains high.

The cage swing (play in the fourth column) designed for children in wheelchairs, is certainly accessible for them but turns out to be a dedicated solution that excludes the participation of other children in the game activity. Moreover, these systems are dangerous and require block systems to prevent improper use of other children.

For children aged between 2 and 5 years, to increase the level of socialization, it is recommended the installation of solutions that allow the activity of swinging together with parents. Some solutions are the double seat, with the possibility of looking at each other, or the types of swing implemented with child restraint systems equipped with a backrest and side supports and safety front panels.

Therefore, the results of cross-correlation show that the most suitable swing is the shape of a basket, especially regarding the issue of socialization. This type of swing offers play opportunities to children with disabilities, who can sit or lie down, swinging alone or with other children.

For what concerns the sensory games, always illustrated in Fig. 6 (column 5), it has been found that they make it possible to work simultaneously on several levels, so as to better satisfy inclusion. These games help children to become aware of their senses and

develop them further. These aspects are therefore of fundamental importance for the growth of cognitive, tactile, sensory-motor, social and linguistic abilities. A further positive aspect of sensory games is also due to the interaction between parents and children, as there may be cases in which the parent may reside in the disabled condition. Also, think about the activities that grandparents may want to undertake with their grandchildren.

In the category of sensory games we also find sound games. In this type of games, the attention must be paid to subjects with cognitive and/or autistic disabilities. These subjects may be bothered by such games, so it is advisable to use not too high sound tones or to place, where possible, elements/materials that act as acoustic isolators. According to recently published studies [23–25], almost half of the children with autism spectrum disorder (ASD) try to move from a safe and controlled place to more open areas. In the absence of places to shelter, half of these children tend to get lost. Therefore, solutions with shell structures or small houses may be more suitable in cases of ASD. In fact, these last solutions can have a double function, the first one concerns the possibility for ASD subjects to isolate themselves in order to observe the environment. By doing so, they can decide the most opportune moment to open up to relationships and any socialization activities. The second reason concerns the need of these subjects to identify in these structures a safe place and protection.

Another fundamental aspect for ASD subjects is to look for playgrounds that have a wide pathway around the playing area. The perimeter path is often requested by ASD children because it offers a quiet space away from the game action. It may therefore be useful to install protection systems, such as houses, tunnels or domes, near the perimeter areas. Another disturbing factor for ASD children, and in general for all children, is the presence of saturated and bright colors of the games. In addition, the flooring is important to allow the child in a wheelchair to easily reach the game and make any task required by the game. The child in a wheelchair must be able to approach the game effectively and perform the necessary actions. Moreover, the possibility of using the game by children of different height must be provided. Usually, these games are used for learning activity, in a fun and engaging way. For instance, some fundamental notions of dynamic physics, optics and other categories of scientific knowledge can be learned. In particular the latter category of sensory games gives an active role to the player who, depending on the game, can act individually in collaboration with other players.

Finally, the proposed methodology and the related considerations allowed to formulate new project scenarios and specific guidelines. This phase was followed by a planning phase, within which the LED group and the public administration of the city of Cecina are currently working on the creation of the “playground for all”.

4 Conclusions

The approach adopted in this work has provided a reliable strategy to take proper ethical choices during the designing phase of playgrounds, by accounting for human diversity, social inclusion and equality. User trials, focus groups, interviews together with the analysis of accessibility standards, disability descriptors by ICF, and Task

analysis were used for assessing the product demands and user capabilities. In particular, the cross-correlation between macro-tasks and the levels of physical, cognitive and social capabilities allowed creating an evaluation tool for predicting the degree of user exclusion when performing play activities.

The proposed methodology allowed to get immediate feedback and reliable information on the level of inclusiveness of any type of equipment. It was also useful for assessing personal and environmental factors of interest and identifying design requirements (regulatory and procedural). In particular, the methodology presented will be further validated within similar experiments as an evaluation tool for the verification of the executive project. At the current state of research, the work has shown that among the types of games analyzed, the category of sensory games is the most inclusive, as it favors collective and collaborative modes of play, valorizing individual diversity and the exchange of knowledge and experience diversified.

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La sottoscritta **Alessia Brischetto**, nata a Catania il 22/9/1986, residente a Firenze (FI), via Vittorio Emanuele II n.32, 50134, alessia.brischetto@unifi.it;

La sottoscritta **Francesca Tosi**, nata a Firenze il 04/10/1961, residente a Firenze (FI), via Cavour 104, e-mail: francesca.tosi@unifi.it;

La sottoscritta **Alessandra Rinaldi**, nata a Viterbo il 23/01/1962, residente a Firenze (FI), via Suor Maria Celeste 13, e-mail: alessandra.rinaldi@unifi.it;

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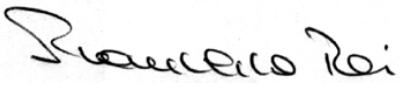
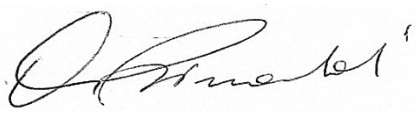
Alessia Brischetto

Francesca Tosi 

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