



# Healthcare Devices for Children: Strategies to Improve User Experience

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**Abstract.** Over the time, the concept of caring has undergone many transformations leading to a broader vision of its meaning. In this sense, taking care of oneself and others also implies taking care of the future. There are many aspects connected to the care design from social design to the more specific product design, such as to the design of daily use objects that have the aim of monitoring, improving, facilitating health-related practices and of psycho-physical well-being. The research refers to children as reference public and main users of care devices, because educating them to a good practice from an early age is surely an important aspect to take care of the future.

**Keywords:** Healthcare · Communication · Children · Well-being · Pediatric Hospital

## 1 Introduction: Context of Reference

### 1.1 Healthcare Devices for Children

The nature of children is to be curious; they usually spend a large part of their time playing, having fun, learning and discovering new things. If children feel themselves well, they move continuously all day becoming increasingly tired till they fall asleep. When they are ache or feel not well, they become irritable, they cry easily, and their mood is instable: it is very difficult to comfort them. During illnesses, the use of medical devices both at home and at hospital could become necessary. While at hospital the patient is generally passive in the use of medical devices, at home they have to use them in autonomous and active way. If the patient is a child, the use of device is generally assisted by parents. Their employment could be for monitoring body parameters, for administering a therapy or both, besides, the application for temporary or for life depends on the type of disease. These results come from the Future Health Index 2019. The research was concentrated on the role of digital health technology in improving both the patient care experience and the healthcare professionals. When we refer to children, as main users, it is very difficult to find healthcare devices “children centered design” and therefore the related practices become even more difficult to be carried out.

## 1.2 The User Experience at Pediatric Hospital

During the experience of hospitalization, the child is never left alone. At his side he always has his parents, or the caregiver, in addition to doctors and nurses. However, he finds himself embarking on a very stressful experience, completely different from his daily routine. The child during hospitalization is completely passive, all medical practices are reserved to the medical staff. Inside the hospital the child has to deal, indirectly, with very technical medical equipment, often outdated, and most of the time not designed thinking of small patients, but only to the technicians. It is important, however, that this equipment reassure the child during the medical practice to which he is subjected, so as to make it as less traumatic as possible [1]. The types of hospital experience to which the child may be subjected could be divided into these four categories:

- *Long duration but temporary*. In case the child needs a long recovery in hospital but still limited in a precise period of time. This type of recovery can last weeks or months depending on the case.
- *Lifesaving/chronic*. In this case the hospital environment becomes a constant element in the child's routine.
- *Routine*. The child goes to hospital for routine scheduled checks (growth control, vaccines, sampling). This typology takes place within a few hours or a maximum of one day.
- *Extraordinary*. The child goes to hospital due to unplanned extraordinary events (first aid, hospitalization). This type of recovery can last from one day to one week.

## 1.3 The State of Art

As mentioned above, it is important that healthcare devices are designed taking into account children, as end users of the product, while being purely passive. However, it would be necessary to focus on finding design solutions aimed at making the child autonomous in performing healthcare activities, where possible, in such a way as to make him feel independent and master of the device. Currently there are few examples of healthcare devices “children-oriented”. If on one hand, research increasingly employs new technologies and smart materials in order to make such devices as discreet and performing as possible, the great importance that both the emotional and the entertaining factor have in such devices for small users is still not duly recognized. It should be recognized that more and more attention is being paid to the environment [2], particularly in hospital areas where the most frightening treatments are made. Examples are the numerous TAC and MRI rooms in pediatric hospitals that turn into fantastic worlds where the child becomes a little explorer hero and medical devices his “technological shuttle”. At home the child is a less passive user and can be involved actively, from the age of 3 years, in the activities of healthcare routine. In this regard over the years more and more healthcare devices, connected to smartphone applications, have been designed, through which entertain and at the same time teaching the child about that specific practice. Thanks to the ludic element given by the application, the child has fun while carrying out the routine and he is tempted to do it again. This solution has been experimentally applied also in healthcare devices for the nebulizer treatment.

In their study, Høiseith, Giannakos, Alsos and Asheim propose a concept for a healthcare game to be used before, during and after the nebulizer treatment [3]. Less fun and more informative applications have been developed in order to make the child, more conscious and autonomous about their illness. As instance this is the case of *RheumaBuddy*, an application for easy monitoring rheumatic disease.

## 2 The Aim of the Research

The research aims to propose a new approach in the design of healthcare devices for kids according to their needs and emotion, referring to their collective imaginary and using infantile language, in order to involve them in care activities, necessary for their health. In particular this work tries to define the factors necessary to design families of healthcare products to be used easily, independently and with pleasure by small users during daily life, at home and in pediatric hospital. In order to improve the well-being of children using medical devices, without discomfort in relation to other people and avoiding of feeling ashamed, it is necessary to render those devices more friendly and attractive. The purpose of the research is to guide designers and producers to design healthcare devices for kids able to appear familiar and ludic to interact and entertain children, using languages from their imaginary. Furthermore, the final objective is to offer a series of stimuli and possible points of departure for the birth of a new type of care products able to determine psycho-physical comfort, designed for children, as main users starting from their emotions. The achievement of these goals will also benefit parents who manage to keep calm, helping the child even more and making a better outcome of the monitoring/therapy. Even medical professional and pediatricians will benefit both in their relationship with children and in managing to use more easily and correctly the devices.

## 3 Methods of Research

### 3.1 “Children Centered-Design”: Transdisciplinary Approach

The Design approach starts from the principles of the Human Factor Design, considering children, over three years old, as main users. The research refers to a transdisciplinary approach involving many disciplines as engineering for technical solutions, pedagogy, psychology pediatrics, necessary to understand children behavior. The contributions of each discipline represent the basic knowledge necessary to reach final design results. As described above, the healthcare devices have two main functions: the monitoring of body parameters – as thermometer - and the administering of a therapy – as aerosol -, sometimes they also have both together as glucometer. Besides, the typology of device depends on disease and on user scenario. Children have different skills depending of their age [4], various emotions according to the aspects of the environment, [5] the awareness of what they will have to do, [6] the knowledge of the related modalities and finally their state of health.

As a matter of fact, from the birth to adult age, young people have a continuous development of physical and psychical abilities, necessary to know for designing according to children centered design approach. Children usually live daily experience with objects. Their favorite ones are toys but, very often, they are also attracted by adult's ones as, for instance, ladles and lids of pot, washing machines, sunglasses, ornaments, and all the objects able to attract and interact with them through colors, curved shapes, reflecting surfaces, noises and movements. In conclusion the objects become attractive if they involve children in playing activities. As underlined by Piaget [7], during playing, children show their needs, their own emotions. Besides, also products are able to suggest behaviors directly related to emotional aspects [8] representing the engines of psycho-physical development of children. Certainly, the designers will have to take into account this information when designing healthcare devices for kids. Moreover, the research undertakes a co-design approach that has been experimented as follow:

1. direct observation of children, as patient, at hospital;
2. co-working activity at school to understand children mood and desires if using healthcare devices;
3. meeting with psychologist and pedagogists to investigate what children needs against fear using this kind of devices.

### **3.2 Direct Observation**

Direct observation involving children at pediatric department of AOU in Sassari (Italy), showed how children were interacting with healthcare devices, underlining a set of practices connected to it, with and without parents' help. The method's application points out, that very often children are afraid of the equipment used by medical professionals. The observation also showed that children are less scared if the pediatrician use to entertain or distract them, or if they were more familiar with the treatment.

In fact, in the case of children hospitalized because of chronic diseases, they were quite indifferent to the department routines treatments.

### **3.3 Workshop with Children**

The coworking involved children of selected primary schools in Pisa (Italy). During the activity children (6–11 years old) were asked to tell their experience at hospital as patient. A lot of them told that they were scared during the visits, others were confused by the reason of their presence in the hospital. Besides, children were asked if they were afraid of using medical devices at home. The interviews underlined that children are afraid of using medical devices and they need to be reassured using them both at home and at hospital. After the interviews, a workshop has been organized for two weeks involving students in drawing their own new healthcare device. The purpose of this workshop was to provide feedback from children on designing their favorite device. Children drawings underlined the importance of playful and interactive aspects of devices.

### 3.4 Meeting with Psychologists

This third phase involved a group of developmental psychologists in order to evaluate the results emerged from the two previous phases and to investigate the explicit and implicit needs of children during use of the healthcare devices. Research has highlighted the importance of the ludic element as a form of active distraction [9] for the child while using of the devices, in order to make the activity more appealing.

## 4 Results of the Research

### 4.1 Design Consideration

The present work states that medical devices for children have to be design using signs/elements from their imaginary to facilitate the use in autonomy, to stimulate interaction, entertainment and playing for emotional well-being of children. According to these factors it is necessary to insert ludic elements within care devices, a fundamental factor when designing for children as main user in order to engage, intrigue and make them establish a playful interaction with the product and its functions. Besides child experience, during the use of medical devices, should be such as to gratify the child himself, so as to make him desire repetition, that is desirable in this type of products. As a result, the research proposes a series of consideration, which are easily applicable to design different kind of pediatric devices, to be used both at home and at hospital. The work underlines the need to set specific solutions according to:

1. age of children
2. time for single device use and frequency of use
3. user scenario

All of the above variable elements determine the need of different design solutions. In any case ludic and reassuring aspects are the main peculiarities in common that all of them need to have. It follows that during the interaction/experience with healthcare devices, children need to feel them calm and at ease. It generally could happen if the device has a familiar morphological shape to look like something known in their imaginary. The use of curved shapes, soft touch surfaces, bright colors help to reach these goals. Moreover, the shapes have to be related to their functions, in this way children, over 6/7 years old, could have awareness of the actions they are subjected to, using a healthcare device alone or with the help of an adult and as consequent they are not afraid of it. These strategies, improving child experience, are able to make care devices and their use more “familiar” both at home and in a place never seen before, as the hospital, making the child feels at ease, avoiding or reducing the stress that these practices could bring.

## 5 Conclusion: Workshop with Design Students

In this paper we have identified a set of design considerations to define the healthcare device experience for children, specially according to their emotions. These principles are, at the same time, a conclusion and a starting point. As starting point the research proposed an experimental workshop activity arranged with a group of 50 students attending the third year of the industrial design degree course at the University of Florence, (Italy). During the workshop each student had to design innovative concept of healthcare devices for children 3–11 years old according to the factors above proposed. The projects are in progress and we hope to develop and evaluate some of these ones together with the equip of the Pediatric Hospital in Sassari.

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