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DESIGN FOR CHILDREN IN THE PERSPECTIVE OF MEDICAL PRODUCTS. REFLECTIONS FROM THE SPECIALIST AREA IN RELATION TO THE DESIGN CHALLENGES OF THE FUTURE

Art research paper

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Abstract

The article deals with the aspect of contemporary directions in the design of products for children, focusing in particular on the equipment for rehabilitation and from the field of medicine for the youngest users. Selected examples and some elements of this vast issue are discussed. The aim of the study is to reflect on the impact of design on the well-being of young patients who face the need to interact with the medical environment. The background of designing this type of solutions is the general topic of designing products for children. These themes are set in the context of contemporary design and the long-term impact of design solutions on people, which is the content of the author's summarising reflections.

Keywords

design for children, rehabilitation products, strategies in design, medical design, attractiveness of children's products, new design challenges

Introduction

If you can assess the child's rejoicing and its intensity, you will readily notice that the supreme joy is that of a difficulty surmounted, a goal attained and a mystery uncovered, the exaltation of triumph and the happiness of independence, proficiency and power.¹

Janusz Korczak

The above quotation can be an interesting inspiration when designing for children. Would it not be great if designed objects had this kind of effect: awakening natural curiosity, presenting the child with well-chosen difficulties that will allow them to build a sense of independence and self-confidence?

It is worth asking ourselves whether these words of Korczak match the direction followed by the design for the youngest. Modernity offers convenient shortcuts in ever new fields of life, regardless of the age of the user. When designing with the children in mind, it is worth taking a special look at the environment of their development. The products they use will influence the way they perceive and react to the world around them (also later as adults).

We produce the tools with which we courageously transform the world, but this does not work one way only. Let us quote Marshall McLuhan, who stated that "we shape our tools and then they shape us".² Consciously or unconsciously, throughout our lives we choose objects that have a real impact on the mental and physical quality of our life: they can stimulate the development or the loss of agility. Particularly important are here the choices made in shaping the developmental environment of children.

Designing for children

Childhood is a learning-oriented period, which means that the influence exerted on a child through design can be significant. Designing toys and educational products is a particular challenge as it requires to take into consideration the physical variability, the user's ability to adapt, the formation of thought processes, skills and the development of cognitive mechanisms. This translates into difficulties but also opportunities. Sometimes, the visual layer of the children's products dominates the design, even though children very actively perceive the world with all their senses. Adults use the sense of sight to identify the surrounding phenomena more quickly, which is due to their previously accumulated experience.

1 J. Korczak, *How to Love a Child. The Child in the Family*, transl. Jerzy Bachrach, <https://www.januszkorczak.ca/legacy/CombinedMaterials.pdf> [accessed: 12/05/2022], s. 130.

2 T. Walczyk, *Poznanie ucieleśnione w rzeczywistości wirtualnej*, "Kultura i Wartości", 21 (2017), p. 106, <https://journals.umcs.pl/kw/article/view/5483/4143> [accessed: 28/01/2022].

Sight separates you from the world, while perception with other senses allows to experience it more deeply³, this is one of the thoughts from the renowned book *The Eyes of the Skin. Architecture and the Senses* by Juhani Pallasmaa. When you look at the children's toys on the shelves in shops, they compete for attention with visual message. The child's interest in a toy at first contact is quite different from the attractiveness of such an object in the long term. Another interesting phenomenon in this context are the so-called timeless toys, which seem invariably attractive to children, regardless of the times. The simple form, usually enabling manipulation and discovering new features of the object, allows for the improvement of skills and the realisation of the children's universal developmental needs.

It is also worth mentioning that some products are considered as not justified by children's real developmental needs. These include, for example, knee pads for crawling, a helmet or cushion (attached behind the child's head) for protection when learning to walk or the baby walker itself, as well as products related to baby nutrition. This group consists of all sorts of eating facilitators, i.e. sets of crockery and cutlery for healthy children, which relieve them of the need to acquire precise grasping skills.

These products are intended to serve the child, usually by protecting them and offering support. Judging by the wide offer of such products on the market, there is a considerable demand for them. However, it is worth noting that they are criticised by the pedagogical community as regards the validity of their functions. Manufacturers exploit the strong natural urge of parents to protect their children and provide them with the best conditions for development. This is why articles for healthy children are often full of solutions that are overly relieving and easing, which, as a result, delays the little user's development. Overcoming age-appropriate difficulties is the foundation of acquiring new skills, while avoiding them translates into problems in the child's normal development. The abundance that children are nowadays surrounded puts down their motivation to act.

The design of objects for children is aimed at obtaining the most attractive appearance possible (no matter if it is about a cup, a toy or a piece of furniture), which results in an oversaturation of stimuli. It has been proved that a large number of toys in a child's environment extinguish the desire for discovery, exploration of the environment and inventiveness. Children who are overwhelmed by an excessive number of stimuli do not develop proper cognitive mechanisms.⁴

3 See J. Pallasmaa, *Oczy skóry. Architektura i zmysły*, transl. M. Choptiany, Kraków 2012, pp. 30, 33.

4 See M. Kielar-Turska, *Obraz dziecka w rozwoju*, <https://p54waw.szkołnastrona.pl/index.php?c=getfile&id=70>, s. 9, [accessed: 13/03/2022].

Medical products for children

This special area of design requires interdisciplinary design teams. Tangible benefits have been observed from adapting products as well as medical and waiting rooms to the children's needs. It is recommended that this type of premises reminds the child of familiar spaces (e.g. nursery playrooms), so to reduce the uncertainty when confronted with unfamiliar medical procedures. Allowing children to play makes them fill the waiting time for appointments and shortens its perceived duration. Elements of interior design that can increase emotional reactions, such as large colour contrasts and lighting, are reduced. Disturbing noises from medical equipment in offices are also avoided.⁵ Moreover, attempts are being made to adapt medical equipment to the specific perception of the child. This approach may seem impractical, but it has a reasonable basis. The child, who is at the stage of building up their experiences, experiences situations that are new to them in an intense and emotional way. Good childhood experiences can reduce aversion to medical facilities and their future avoidance by adults, which can translate into benefits for the preventive health care.

When looking at different solutions in the area of child-directed medicine, different design strategies can be noted, which will be presented below together with some illustrating examples.

Examples of designing for children with disabilities

One of the design practices in the sphere of medical products is to not only ensure that the function of the product is met but also to take into account the well-being of the child, so that they do not feel inferior because of their disability and are not excluded from their peer group. Giving a medical device intense colours or a form resembling a toy allows such devices to be accepted in the child's everyday life, as they can then represent an attractive 'gadget' for the peer group.

5 See *Stomatologia wieku rozwojowego. Psychologiczne aspekty kontaktu lekarz stomatolog–pacjent dziecięcy*, M. Szpringer-Nodzak, M. Wochna-Sobańska (eds.), Warsaw 2003, p. 248.



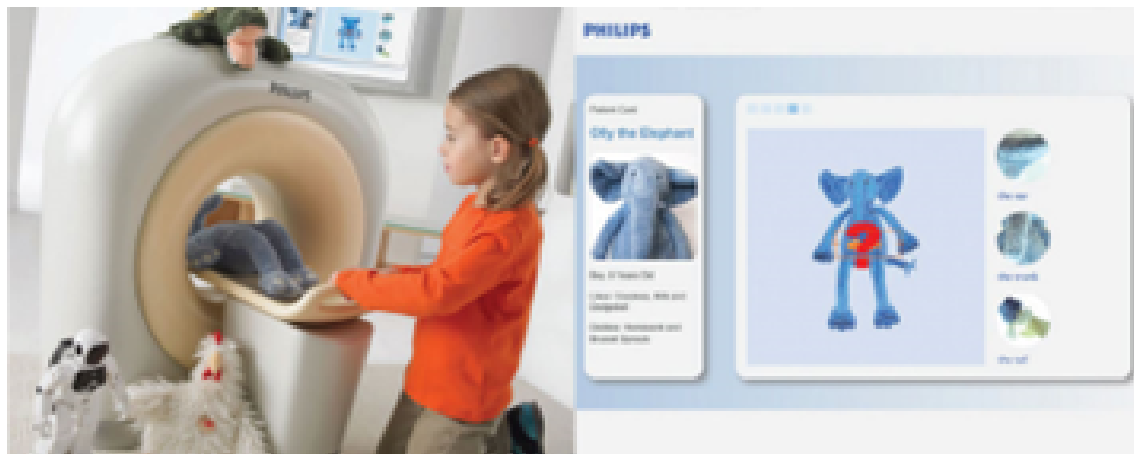
Il. 1. Personalised hearing aid for a child Westone Company NWSDHH; these types of products are often personalised, e.g. by carers; they are not a mass-produced item, www.northwestschool.com/files/2016/09/Ear-Gear-Protection-Devices.pdf [accessed: 14 January 2022].



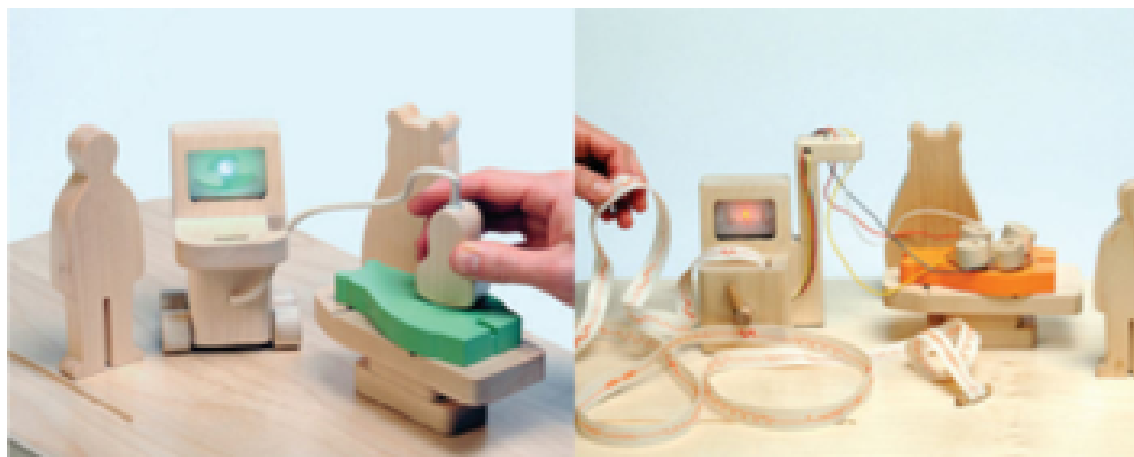
Il. 2. Atomic Lab – 3D printed mechanical hands and arms. A project called Limbs, which supplied more than 800 prostheses worldwide between 2016 and 2018, www.livescience.com/49939-3d-printed-organs-and-prosthetics-reconstruct-healthcare.html [accessed: 29 January 2022].

Examples of toy objects used to make the medical procedures more familiar

These products are characterised by their scale tailored to the child, giving a sense of control. This procedure satisfies the natural need for playful repetition, imitation of a situation transferred from reality. The use of symbolic objects enables to familiarise the child with the subsequent stages of a medical procedure. The child can thus control the given situation (on a modified scale and with roles reversed).



Il. 3. A scaled-down model of a CT scanner: a product designed for use in a hospital together with four 'plush patients' is an educational kit that explains the principle of operation of this diagnostic device. KittenScanner for paediatric patients at UCSF Benioff Children's Hospital in Mission Bay, placed in the radiology department waiting room as part of the Ambient Experience project, www.radiology.ucsf.edu/blog/ucsf-introduces-kittenscanner-pediatric-patients [accessed: 13 December 2021].



Il. 4. Set of wooden toys: a product designed for Advocate Hope Children's Hospital in Oak Lawn, Illinois by Hikaru Imamura, www.core77.com/posts/23057/hikaru-imamuras-toys-make-hospitals-a-little-less-scary-23057 [accessed: 20 December 2021].

Visual modification of medical devices

This design strategy consists in modifying the visual character of medical devices, for example through appropriate styling that draws the child into a game: a play scenario, in which the rules are aligned to the plan of the medical procedure, so that the procedure run smoothly and spare the patient the fear of the unknown. The aim is to guide the child's behaviour during the examination.



Il. 5. GE Adventure Series: a product of the American company GE Healthcare. The project consisted not only of the appearance of the CT scanners, but also involved the introduction of play scenarios in which the children were encouraged to remain still during the examination. The child played at hiding from the pirates by remaining completely motionless. This enabled obtaining a valuable examination result, which eliminated the need to administer sedative drugs. The pilot project at UPMC Children's Hospital in Pittsburgh, USA, was successful, www.resonate.com/reimagining-medical-imaging-with-experience-design/ [accessed: 23 January 2022].



Il. 6. Mobilett Mira: a mobile X-ray machine equipped with a Siemens wireless detector. It is presented as one of the smallest mobile x-ray systems on the market, which is why it is often assigned to be used in the paediatric wards. The company has prepared a version that is designed in a more child-friendly manner, www.medgadget.com/2011/03/mobilett_mira_mobile_wireless_xray_from_siemens.html [accessed: 23 January 2022].

The examples of designing for children in the medical field include also some controversial cases. The boundary of styling is sometimes difficult to be clearly defined, as it depends on individual sensitivity or circumstances of use.

In the author's opinion, particular doubts may be raised by solutions, which concern, for example, the juxtaposition of negative stimuli, such as pain connected with the procedure, with positive stimuli

presented in the visual layer of products. This applies to toy-like objects that are actually instruments for performing the treatment (e.g. syringes shaped like airplanes or catheters with animal-like attachments). As a result, the child prepared to play experiences pain. Similar concerns may be raised by medical masks with smiles printed on them. Here, the invariability of the expressed emotions communicated by means of graphics may prove grossly inadequate to the situation of the child and their emotional state changing due to the circumstances.

In the author's opinion, the above examples of product styling expose the child to the loss of confidence and increased number of anxiogenic situations. In conclusion, it is not the objects themselves, but the objects in the hands of people with the right attitude and knowledge, that can help the child cope with difficult situations.

Exercise and rehabilitation products for children: design strategies

A special feature of rehabilitation products is that they are used for long periods of time filled with effort and discomfort or pain sensations that occur during exercise with the particular device. Apart from the physical discomfort, there is also the question of monotony of repetitive and long-lasting activities, which is definitely contrary to the children's nature. This may be problematic when it comes to engage the young patient in therapeutic activities. In addition, the effectiveness of the exercises may be affected by the mood of the day, the child's disposition or the place of exercise (home or facility). These difficulties are faced by the physiotherapists and carers on a daily basis. It is worth looking for solutions, i.e. tools that would help strengthen the children's motivation. Play is an effective way of encouraging exercise, but it must not be too strenuous or time-consuming for the staff.

The visual appeal of the item alone is not enough when the aim is to keep the exercises regular. The first feeling on contact with the object, which was important in the medical products presented earlier, loses its importance in this context. In the case of the rehabilitation products, contact with the user must be considered from a long-term perspective. Any qualities that can enhance the positive emotions associated with exercise will matter. This area promotes the design focused on human in a holistic way, i.e. taking into account not only the physical aspect of exercise, but also the emotions that they provoke.

An interesting attempt to address the problem of children's lack of motivation for rehabilitation exercises is described in the article *How to Use Low-Cost Devices as Teaching Materials for Children with Different Disabilities*.⁶

⁶ See Ch. Lin, *How to Use Low-Cost Devices as Teaching Materials for Children with Different Disabilities*, [in:] *Assistive Technologies*, ed. F. Auat Cheein, 2012, <https://www.intechopen.com/books/assistive-technologies/application-of-interactive-design-as-teaching-materials> [accessed: 6/02/2022].

The authors of the project aimed to create a low-cost rehabilitation programme based on interaction. The study was conducted on children with infantile cerebral palsy who required daily rehabilitation. A device of very simple structure and using commonly available, low-cost electronic components was designed to provide positive feedback during exercise. The device was a wireless computer control system made up of emitters and a controller. Emitters were attached, for example, to a cap or band placed on a limb in need of rehabilitation. By performing a therapeutic movement, the child could control the images displayed on the monitor (switch personalised slides with graphic material). The results of the study definitely confirmed the increase in motivation for physical activity and the effectiveness of the daily rehabilitation programme thus implemented. The solution was aimed at the possibility of individualising the programme's operation and keeping its costs as low as possible (below USD 35).

Similar solutions are entering the commercial market for rehabilitation products. They are also being studied at the Polish universities. An interesting example for that is the research project *Interactive devices for lower limb rehabilitation* ran at the Silesian University of Technology. This time rehabilitation was based on a play: a computer game controlled by specially constructed pedals.⁷

Research into rehabilitation games is an emerging field offering significant benefits. It combines the paths of interdisciplinary areas that can help create solutions that are more effective than those used to date. When applied to electronic technology, it makes it a precious ally. There is a specialisation in this direction, namely the product concept that is specifically aimed at the so-called biofeedback. It seems to be breaking new ground in the area of the communication of human with high-tech environments. Importantly, it allows to respect the individual psychophysical conditions of each user. Below is an example of a research conducted in this area. It is not specifically aimed at the child user, but the principle of its operation (in the author's opinion) provides an interesting solution for users of all ages. The project, described in the article *Calm Technology for Biofeedback: Why and How?* is dedicated to an unusual piece of furniture: an interactive product that facilitates relaxation through breathing practice.⁸ Its designers were looking for a way of the product-user communication other than the visual one.

7 See D. Tejszerska, M. Gzik, W. Wolański, D. Gąsiorek, B. Gzik-Zroska, *Interaktywne urządzenia do rehabilitacji kończyn dolnych*, "Modelowanie Inżynierskie", 38 (2009), pp. 244, 247.

8 L. Feijs, F. Delbressine, *Calm Technology for Biofeedback: Why and How*, Proceedings from the DeSForM conference Semantics of Form and Movement, Sense and Sensitivity, Eindhoven 2017, <https://pure.tue.nl/ws/portalfiles/portal/79502233/calm.pdf> [accessed: 16/05/2021] pp. 17, 18, 21.



Il. 7. Research project *Calm Technology for Biofeedback: Why and How?* by L. Feijs and F. Delbressine, Department of Industrial Design, Eindhoven University of Technology, <https://pure.tue.nl/ws/portalfiles/portal/79502233/calm.pdf> [accessed: 27 February 2022].

The interactive system is built into a table, the top of which serves as a kind of interface. It allows to visualise the breathing cycle by subtly changing the shape of the tabletop plane by moving up and down the spirally arranged modules. The user observes the changing shape of the tabletop and the rhythm of the subtly moving surface; places their hand on it, closes their eyes and feels the gentle movement. Initially, the breathing is adapted to the rhythm of the moving tabletop surface, and then the system gradually, automatically, moves into feedback mode. The sensor clip attached to the user's finger records changes in heart rate, which increases on inhalation and decreases slightly on exhalation. Based on this data, the system adjusts the course of the breathing session. The amplitude of movement of the tabletop segments increases when the heart rate is slower, which means greater calm. The user exercise is aimed at maximising the amplitude of the tabletop movement. The table was designed by Sander Lucas and is produced by the LUCAS & LUCAS studio in Eindhoven.

The direction shown with these projects offers new possibilities and an alternative to the current solutions based on visual messages, for example through the omnipresent touch screens, which contribute to overloading the user with visual stimuli.

The latest design solutions are inspired by the holistic knowledge about human. Thanks to the significant technological opportunities, this can be a source of greater changes in the approach to design, which would be beneficial especially in the case of the for long-term user contact with a given product. Designing responsive objects and environments requires a deep understanding of the physical and mental aspects involved in shaping the human environment. This is why it makes sense to take into consideration the close contact between the designer and the material from the very beginning of the creative process, as the first contacts with the form under development give access to a valuable resource of knowledge.

Contemporary design direction: reflections based on the area in question

Every object that we ‘add’ to our reality begins to affect us also in the areas for which it was not initially designed. This is why an interdisciplinary approach to design is growing in importance, and the direction of design in the recent years can be described as human-centred. Is this really the case? Although user research is gaining in popularity, but it is focused mainly on consumer needs. Design puts at its heart people’s needs, or rather their desires, which does not always match with what is really beneficial to them. Technological solutions are usually aimed at making things faster and easier. Design thus seeks to reduce the effort involved in human functioning in the world in a visible and measurable way. If something can be done more simply, people will generally do it that way. This mechanism allowed us, in the process of evolution, to save energy and minimise the biological costs of the activities undertaken. It is also a powerful motivation for invention of all kinds. We can assume that the results of consumer research, that are the basis for the future design of products and services, will contain user preferences for reduced involvement in everyday activities. However, this is where the paradox comes in, as the body needs an effort optimised to individual capabilities.

In nature, there are many mechanisms of adaptation to periodic resource scarcity and the need for effort. A demanding environment mobilises the body’s strengths, recovery capacity and resilience. In the long run, people perform worse in affluence and deprived of the need of motivation, i.e. in the state we actually all strive to achieve. This is why the excess and overproduction, typical for modern times, hit a weak spot in our evolutionary adaptation. The phenomenon of civilisational diseases should serve as a warning in this sphere. Indeed, the current design trend focuses on people, but mostly on their comfort. Is this the very purpose for which we need science, technology and design? What we use to call the “user’s needs” often take the form of cravings. In the book by D.A. Norman entitled *Emotional Design: Why We Love (or Hate) Everyday Things* we can read that cravings are sometimes stronger than the need.⁹ Perhaps it is indeed worth asking ourselves: what are the needs of modern human?

In the context of sustainable development and the humanisation of technology, we can refer also to the famous formulation of Victor Papanek: “There are professions more harmful than industrial design, but only a few.”¹⁰

The author is convinced that design can actually save us, but only if it does not serve only to satisfy the cravings and build shortcuts that bring short-term benefits. This is not a voice against development. It should be noted that the essence here is a deeper, holistic view of the real needs of human beings

9 Cf. D.A. Norman, *Wzornictwo i emocje. Dlaczego kochamy lub nienawidzimy rzeczy powszednie*, transl. D.Skalska-Stefańska, Warsaw 2015, p. 43.

10 V. Papanek, *Design for the Real World: Human Ecology and Social Change*.

and the diversity of ways in which people function in the world. There are and will be no ready-made answers or templates; what there is, instead, is a space for designers and technology development.

Special attention should be paid to design related to products designed for children, the elderly or for the purposes of rehabilitation. In these areas, design brings a particular experience that can be extended to design in general, and serves as an interesting source of innovation. When designing for the above-mentioned groups, there is a need to take particular account of the issues from the sphere of psychology, psychophysiology, ergonomics and the individuality of the user. The research area of product-user relations is important also in the longer term. The perspective of the consequences of using the given product in the long term allows to discover an interesting design area. It is then that the product actually starts to respond to the users' needs. These are elements that will be a good and probably necessary complement to the use of high technology solutions. The humanistic aspect of design plays a significant role here. It is often marginalised faced with the technical dimension associated with innovation. However, overlooking this side of design results in creating human-unfriendly environments. The strength and value of design relies on the coexistence and balance of both these aspects.

Summary

The intention of the author of this article was to present selected examples from a specialist area that can inspire thinking about the challenges of the future faced by the designers. Products in these areas will engage the user in long-term, often arduous activities, which will show clearly how important is good design in this domain. This is interesting, as human attention and time are currently the particularly desirable values when it comes to design.

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