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Co-Designing with children: Collecting and structuring methods

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Abstract
Design research acknowledges the value of allowing users a direct say during product development. Hence, techniques for including users, including children are developing quickly, and children are increasingly taken seriously as a user group as well. Recognising that children are indeed the experts with regards to the products that they use, designers increasingly need to consult them. This paper is based on a literature review focusing on co-design techniques to include children in the design process. A model is presented in order to provide a holistic view of the different design approaches focusing on child user involvement. In addition, a methods matrix is presented which structures different methods that are associated with co-design in research. It presents the essence of each method and refers to relevant literature where further assessments can be found. As such, the matrix can inspire and support designers and researchers in the co-design process in general, and more specifically in such processes together with children.

Keywords: Co-Design, Participatory Design, Cooperative Inquiry, design methodology, Human Computer Interaction, Product Design, child end user

Introduction
Children see the world in a completely different way to adults. This is not just because they are small in size, but also because their cognitive, social and emotional intelligence is developed on a different level compared to adults. Through their curiosity and rich imagination, they are extremely creative and less restricted by reality. Designers can significantly benefit and learn from including children as expert users in cooperative design sessions. Children are honest and playful, and can broaden a designer´s product design horizon. By giving the children a voice in the process of designing child products, they may come up with unimaginable ideas, contribute in design decisions as well as discover physical limitations regarding the product. This paper discusses the inclusion of children in the design process, and addresses issues which require special attention when designing with children. Since the children´s nature and ways of expressing themselves differ to such an extent from the adults´, designers need to employ ways of communicating with children that play to children's strengths. The authors have studied methods to cooperate with children, how to elicit creative responses from them, and how to interpret their multifaceted expressions. This theoretical study has resulted in an extensive collection of co-design methods, offering a foundation of knowledge as a guide to other designers or researchers.

Approach

This paper aims to grasp the essence of techniques used to implement co-design methods with child users in the design process, where co-design is understood to be the collective creativity between designers and people not trained in design working together in the design development process [1]. Following a brief introduction in levels of involvement, the discussion is based on a literature search resulting in a matrix overview of 26 methods relevant for co-design with children. Then, different practical issues are discussed which are important to consider when conducting and planning co-design with children. Findings and results are critically discussed and related to areas for further research.

Levels of Involvement

The performed literature research revealed three main models describing different perspectives on the level of child involvement in design processes. Druin´s well-cited model of child involvement describes the different involvement levels based on the role of the child [2], where the involvement level gradually increases through the roles of *User*, *Tester*, *Informant* and *Design Partner*. Large et al. [3] present a very useful model which exemplifies the different levels of child user involvement by relating them to concrete *Design Methodologies*. Most methodologies used to exemplify the involvement levels are also known for use with adult users. The only methodology singularly focusing on child participation is *Cooperative Inquiry* [4]. Nevertheless, this model is made from the use of these methodologies with child users and should be interpreted with focus on children's participation. Hussain's "The Design Participation Ladder" [5] addresses the child's degree of *Psychological Empowerment* when participating in a design project with varying levels of involvement. The model has been developed through participatory design projects with children in developing countries, but Hussain states that it applies to all design projects undertaken for and with children. It is highly influenced by the fields of psychology and the participation ladder described by Hart [6]. The Design Participation Ladder defines the level of involvement by children's possibilities to influence the project and become empowered, and highlights ethical aspects that designers should be aware of when deciding how to include children in the design process and what opportunities the children have for influencing both the process and the product development. In summary, Druin, Hussain, and Large et al. present different theoretical approaches to address different degrees of child user involvement using three different main parameters: *The Child's Role* (Druin), the child's *Psychological Empowerment* (Hussain) and *Design Methodologies* (Large et al.).

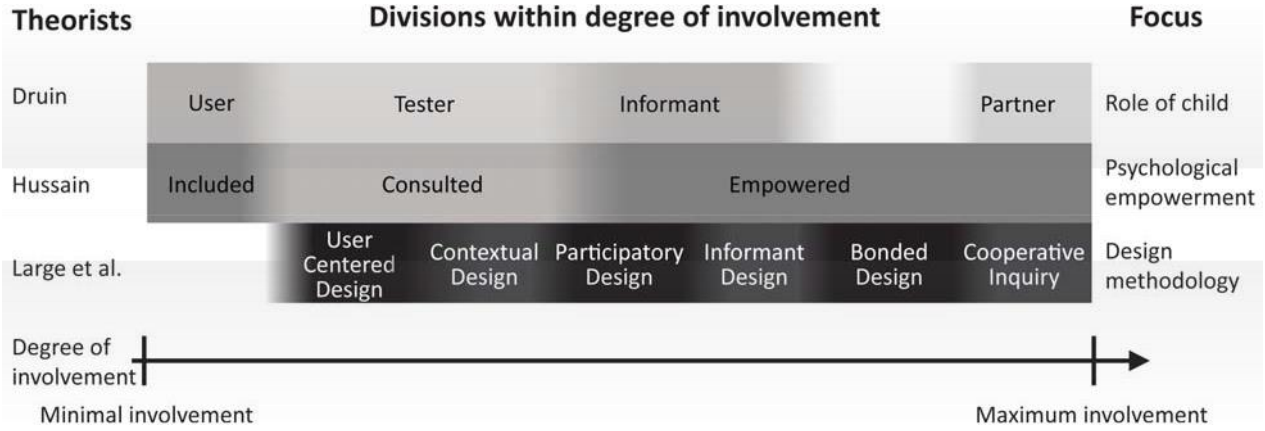

Figure 1: Combination of theoretical approaches to describing characteristics of different degrees of child user involvement.

Together, the three different models present a very descriptive image of the variations within design methodologies involving children. There is a clear division between the involvement levels aligned with the *Empowered*-step of Hussains *Design Participation Ladder* and the previous ones. Both Druin and Large et al. acknowledge this division as the turning point where the users start to directly influence the decisions made, not only as users and testers, but as peer co-designers, expertise contributors and self-advocates. What characterises the methods within this level of involvement is what will be further discussed in the next section. It is not possible to determine exactly where to place the separating line between each methodology and level of involvement, indicated by the blurry transition lines in Figure 1; the figure is not created with the intention to accurately reflect reality, but rather to systematise it to make it easier to grasp. It is the authors' impression that the different methodologies gradually develop and get inspiration from each other. One example is *User-Centered Design.* A quick review of literature shows examples of recent *User-Centered Design* processes where tools similar to the ones used in *Participatory Design* [1] are implemented in the user testing phase [7]. These tools provide the users with alternative means of expressing themselves as well as facilitate more enjoyable design sessions [7].
Figure 1 is illustrated linearly in order to simplify it. Nevertheless it is important to acknowledge that each method or involvement stage often comprises elements which characterise the previous. This is why Druin's model in its original form is visualised by circles where each involvement stage encompasses the previous.

Methods Matrix

A variety of methods for including children in the design process have been described in literature within both Product Design and Human Computer Interaction (HCI). Figure 2 is a simplified overview of design methodologies where children are actively encouraged to be creative, selective and critical. Each method in the matrix originates from different methodologies based on different degrees of user involvement, as described above. Even though their origin is somewhat different, they all focus on the importance of implementing co- design in the earliest stages of the design process (the fuzzy front end), often resulting in initial ideas and low-tech prototypes. The methods matrix presents an overview of methods in a manner that makes it easier to quickly grasp the essence of each of them, even though they may need to be adapted to meet specific requirements and constraints of individual projects. The methods are connected to a variety of categories, which aim to cover the most relevant aspects concerning them. All the methods listed in the leftmost column, have been tried out by designers or other researchers, and are recommended as useful and generating tools. The categories listed on the horizontal axis of the table highlight essential themes that the designer has to consider when planning design activities with children. The matrix outlines the essence of each method and refers to relevant literature where further assessments can be found. In order to give a clearer link to the methods´ origin, the leftmost column divides the methods within the following five categories:

- *Cooperative Inquiry* is a collection of methods developed by Druin [4], which seems to be the most discussed methodology within the field of HCI [e.g. in 3,5,8-14]. Large et al. also use it as an example of the highest degree of user involvement. The overall methodology consists of several single methods presented in the matrix.
- *Mosaic Approach* uses insights from sociology and pedagogy and consists of a variety of observatory and participatory tools [16], implemented into useful techniques for listening to the different ways in which children express themselves by playing to the children's strengths rather than those of the adults.

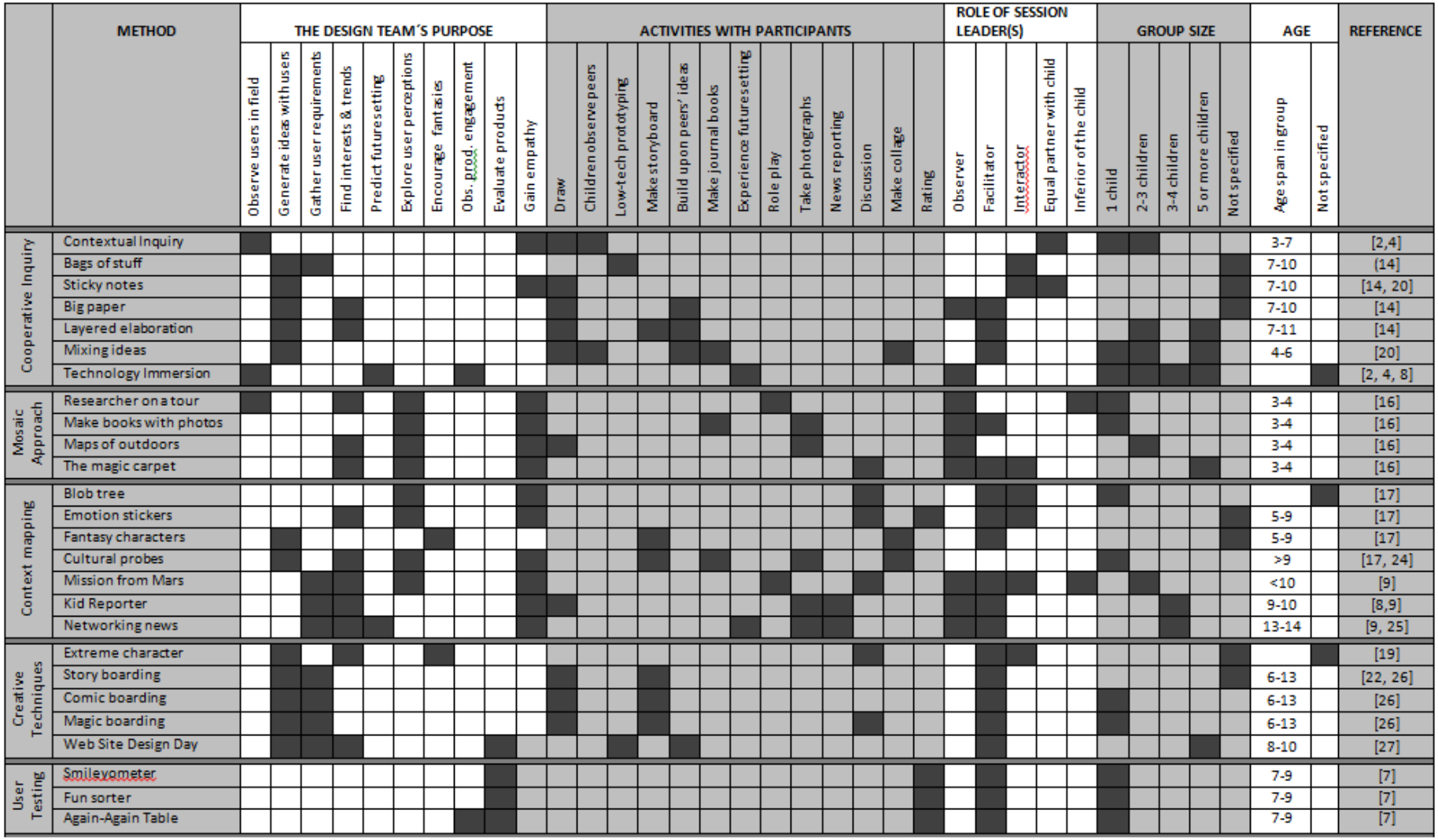

*Figure 2: Full scale version of the **methods** matrix.*

- *Context Mapping* involves users in the very first stage of identifying everyday contexts of product use, offering a deeper insight into dreams and needs of prospective users [17,18]. Sessions with context mapping techniques generate varied and rich views, anecdotes and explanations about the explored context which include users' concerns, memories, feelings, and experiences surrounding it [18]. Designers should try to put themselves mentally in the place of the child and try to understand their concerns and motivations in a cognitive and emotional way [19]. Context mapping is well suited to help designers explore the children´s world, and can give inspiration even before having decided what product to develop [19].
- *Creative Techniques* primarily focus on involving users in early generative sessions aimed at creating ideas that can inspire the design of a product, to generate initial ideas as well as further on, revising existing ideas. Creative sessions often result in a variety of adaptations and reworked concepts, from which the best ones can be selected, combined or used as inspiration for another concept [17].
- *User Testing* techniques can enhance and enrich ways in which users express themselves when sharing thoughts and concerns about the tested product. While the *Context Mapping* and *Creative Techniques* aim to create ideas and low-tech prototypes, *User Testing* is an efficient activity for receiving feedback on already developed prototypes [2,3].

Horizontally, a number of aspects are listed which are decisive when choosing activities to plan for design sessions with children.

- **The design team´s purpose:** The listed purposes can be seen as ways of approaching the desired focus areas of their project. In some situations it is most beneficial to observe the children, while in other situations the most interesting results are found when for instance encouraging the children to generate ideas.
- **Activities with the participants:** The listed activities are meant to encourage children to be creative while simultaneously documenting their thoughts. Most of the activities in the matrix are well known such as *Low-tech Prototyping*, *Make Collage*, and *Role Play. Experience Future Setting* and *Technology Immersion* are activities where children are placed in a possible futuristic scenario, or immersed in technological devices, to observe what children prefer and do under these constructed circumstances. This allows designers to capture preferences, activity patterns or roles that might otherwise be overlooked [4]. Because children develop cognitively, emotionally and socially at a different rate, and may prefer different skills to express themselves, it can be challenging for session leaders to discover how each child can communicate their thoughts and ideas in the best way [5,16,20] Therefore, it is beneficial to support the participants with a range of multisensory tools to cover the span of their strengths and abilities [16], and to include simple variations in activities during the creative design sessions can motivate the children to add more to their artwork and generate more ideas [20].
- **Role of session leader:** Several authors emphasise the importance of the session leader's role by presenting guidelines as to what is a preferable behaviour style depending on the method used [e.g. 7,13,17,18,21,22]. The category *Role of Session Leader* is divided into *Observer*, *Facilitator, Interactor, Equal Design Partner,* and *Inferior of the Child* which all require different attitudes and levels of interaction, and depend on the method used. For example, the *Mosaic Approach*-activity called *Maps of Outdoor* is an activity where children work on their own using their own pictures and drawings, creating 2D presentations of the relevant site [16]. The designers observe while the children work independently. Instead of the children interacting directly with the observers, they are able to communicate through their creations. In most of the *Context Mapping* methods, the session leader adapts the role *Facilitator*, seeking to assist the children as much as they can without imposing their own ideas on them [18]. Between the role *Facilitator* and *Equal Design Partner,* is the *Interactor,*

who interacts with children, initiates discussions and asks questions whilst avoiding taking notes to prevent children from feeling uncomfortable while being observed as if they were on stage [4]. As an *Equal Design Partner* the session leader participates in the activity on an equal level as the child participants, requiring finding ways of levelling with them [2]. This role can be linked to the highest level of child involvement defined as *Design Partner* in Figure 1. The *Cooperative Inquiry*-activity *Sticky Notes*, where children draw their thoughts in pictures while adults use words to write down ideas, is a good example of children and adults working together as equals on a design team [14,20].

The role as *Inferior of the Child* can be achieved by engaging the children in some type of role play or creating a fictional setting where the child takes on the role of an expert. This can best be described by examples such as *Researcher on a Tour* and *Mission from Mars*. *Researcher on a tour* is an activity within the *Mosaic Approach* where the child is asked to guide and give the researcher a tour around the kindergarten [16]. *Mission from Mars* [9] establishes a shared narrative space by leading the children to believe they are communicating with a Martian (controlled by one of the session leaders located in another room), presenting and explaining things from their everyday lives. The Martian's lack of knowledge allows the children to take on the roles as true experts of their life on earth. By interacting with the children through the Martian, researchers become inferior to the child.

- **Group size and age:** To get the most out of creative design activities with children, composing groups that will work well together is essential. Each method generally comes with a suggestion for number of participants, age, gender combination, personal relationships within the group, available time, and child-to-adult ratio [17]. The creative technique *Comic Boarding* for example is best conducted with one session leader per child as the session leader has to actively interact and visualise the child´s ideas through drawings [22]. In contrast, the method *Big Paper* requires that children work in groups to get inspired by building upon each other's ideas [14]. It is important to remember that age alone may misrepresent the true picture of the participants' developmental stage [15] as children develop at different rates within each age group.

Discussion and conclusions

Extensive amounts of literature documents methods and experiences about including children in design and research. This is of great use to both experienced and inexperienced designers conducting workshops with children, but it is argued here that an overview as presented in this paper makes this literature base easier accessible by structuring and presenting the essence of the methods. This way, designers in search for inspiration easily know where to look and can benefit from others' practical experiences on what to be aware of, to expect, and how to behave as a session leader. The matrix presented in Figure 2 should however not be considered as exhaustive, but rather as a starting point for easy access to and suggestions for using appropriate methods depending on the type of design project at hand.

Designers work within a multidisciplinary profession and need to take into account several fields of expertise such as psychology, sociology, anthropology and pedagogy when involving users. Insight in interdisciplinary research and cooperation within product design, aesthetics, physiology, psychology and pedagogy is crucial for designers to understand children's special needs and being able to develop high-value products that take children seriously [17,23]. The *Mosaic Approach* is a perfect example of an approach developed with a strong influence from sociology, psychology and pedagogy. It does not relate to any design methodology but is clearly relevant to place in the methods matrix. Hence the matrix stands out as an effective tool, not only to designers, but to every researcher working and cooperating with children.

By allowing children to take an active part in the design process, designers do not only benefit from aspects such as gaining better insight into the users' perceptions, preferences and needs. It could also be an effective way of improving the designers' creativity. It is evident that children

perceive the world differently to adults, both physically and metaphorically [15]. From cooperating and levelling with children, designers can gain valuable knowledge in terms of how to address a problem in a creative way. Children tend to approach creative assignments in surprising ways that adult researchers themselves may never think of.

With the exception of Clark [16], the aspect of actively using documenting tools in a way that is beneficial for interaction between workshop participants seems to be rarely discussed in literature. Rather, the challenges related to the documenting tools creating a disruptive element dominate discussions. Also, the further process of how to apply and translate findings from cooperative sessions into concrete decisions concerning design and product requirements is a very interesting subject. The literature review suggests that the documentation of this part of the process is minimal compared to the thorough descriptions of the methods applied. This may be due to confidentiality issues limiting possibilities for publishing. Another reason may be the challenges related to documenting this stage in the design process due to its fuzzy nature.

Ethical concerns with including children are important to consider in all aspects of the design process. Designers must ensure that children participate out of their own free will, feel motivated, included, secure, and respected. The child's wellbeing and the importance of the children profiting from being included, is a prerequisite for the co-design sessions to succeed.

The authors wish to accentuate the fact that while this paper is encouraging designers to seek for appropriate ways to include children in the design process; it is not meant to justify the exclusion of all secondary users of the products such as parents and carers. Even if the product to be designed is a toy which is only going to require a minimum amount of interaction by an adult, purchasing will still be done by their parents, teachers, and carers. These may also provide unique knowledge based on their interaction with children.

All in all, the inclusion of children through co-designing is an area of design research and development comprising a lot of aspects that can provide the designer with rich input and inspiration. Co-design methods provide designers with tools to elicit creative responses and interpret children's multifaceted expressions. Nevertheless, for this information to be useful, easy access to structured information is essential. The methods matrix presented in this paper is, also by the authors' own experience, a very useful starting point to make this realisable.

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