Catching Wasps and Baking Dinosaurs: Experiences from Co-designing with Children

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Abstract

User-centred product development and design can be carried out with differing degrees of user participation: for users, with users, and by users. A project characterized by a co-design approach, i.e. design 'with' rather than 'for' or 'by' users, was carried out during the spring of 2009. The co-design teams consisted of children (a total of 45, between 10 and 11 years old) and 10 product developers/designers (teachers and students from an industrial design engineering university programme). The overall theme for the co-design exercise was food, eating and health, a theme which the children had researched as co-researchers during the autumn of 2008. The design project followed a structured design process, including problem identification, idea generation, concept development, etc., supported by typical methods and tools such as various brainstorming techniques, formulation of evaluation criteria and concept screening. Working in teams of 3-4 children and one developer/designer, various problems were identified and solutions proposed. The problems included for example "healthy sweets", "keeping wasps away from the lemonade glass", and "how to make washing up more fun". The results from the process consisted of for example a healthy sweets advertising campaign, several "wasp traps", and a new type of dishwasher based on the principle of a record player. However, the results also encompassed experiences from co-designing with users. Some of these experiences were considered the consequence of the fact that the children were indeed children, and are thus considered relevant only for other projects involving children as co-designers. Maintaining focus and concentration, for example, was a key issue. Other experiences are considered more generic, i.e. issues which would emerge as important topics in any co-design process. Communicating an understanding of the product development process and the time required for the solution to develop from idea to prototype were regarded as such generic topics.

Keywords

co-design; participatory design; design with children

User-centred product development and design can be carried out with differing degrees of user participation. One way of categorizing these degrees is in terms of 'for users', 'with users', and 'by users' (cf. Eason, 1988). An approach 'for' indicates a fairly passive role for the user, that of contributing with, for instance, problem descriptions and experiences as a basis for product development. A 'by' approach, on the other hand, would reflect a very active user and a situation where the product developer's/designer's role is to operationalize what has already been specified as the 'design solution'. A 'with' approach, finally, would reflect a participatory design process where users and product developers/ designers bring their respective skills into a common arena and work in a collaborative process, acknowledging each other's contributions to the design process and its outcome(s).

The arguments for participatory design, or co-design, have been for instance that involving those who are affected by the outcome in creating the solution is a way to better fulfil their needs and requirements and for achieving sustainable solutions, i.e. solutions that will be

accepted and adopted by the specific target group. The co-design concept embraces, furthermore, the notion that all people are (or can be enabled to be) creative and that this co-creativity will contribute to innovation.

Co-design has traditionally been applied in projects with the purpose of developing computer systems (e.g. Ehn, 1993; Grønbaek et al. 1993) and workplaces (e.g. Broberg, 2010; Garmer, 2002) but it has also been used in other domains, such as service development (e.g. Albinson et al., 2007) and development of urban design and planning (e.g. Shin, 2009). Co-design has also been carried out involving specific stakeholders, for instance children. Examples include the development of school environments (Ghaziani, 2008; Newman & Thomas, 2008) and new technology (e.g. Farber et al. 2002), as well as school-based intervention studies (e.g. French & Stables 2003; Prell et al. 2005).

Co-design raises, as such, a number of questions but these may be further emphasized in projects which involve children: What is actually the different participants' contributions to the design process? What are the contributions of children? What is required from the process in order to establish ”true” co-creativity and design? Will the children's voices be heard? How can the shift in power, from that of product developers/designers to that of users, be managed? Can and will the children and the adults be collaborating on equal terms?

The purpose of this paper is to present some experiences obtained in a co-design project with children. The project was part of a larger research project, “Children as co-researchers of foodscapes” (Swe: Barn som medforskare i matlandskap, BAMM) with the overall purpose to investigate the feasibility of involving children in searching for deeper knowledge on children's food consumption and their relation to and thoughts on food, eating and health. In a first phase of the project, during the autumn of 2008, the children had taken part in a co-research activity (reported in e.g. Brembeck et al. 2010). The co-design project reported on in this paper constituted the second phase and was carried out during the spring of 2009.

The Case Study

Object

The design object was “food, eating and related items and environments”.

Participants

The children came from two different classes in the same suburban school, a total of 45 children aged between 10 and 11 years. The product developers/designers were teachers and students from an industrial design engineering university programme. The teachers had differing backgrounds in that some were mechanical engineers and others were industrial designers.

Process and Process Results

The process involved seven sessions over a period of four months.

Session 1: Introduction

The first session was held in December 2008. The purpose of this session was to familiarize the children with the concepts of design problems and problem solving, i.e. the idea that it is possible to change things. A PowerPoint presentation was put together illustrating different ways of changing people's consumption of food, eating and related items through, for instance, marketing, information/education, and/or design and development of new technology. The children were encouraged to contemplate different problems that they would like to find a solution to in the next phase of the project.

Session 2: Identifying problems

The second session, held in February 2009, focused on identifying problems to be addressed. Approximately six children and one teacher/student formed groups which started to generate problems together. The method used was brainstorming, a method that was already familiar to the children. All problems were written down on Post-it notes (sticky notes), one idea per note, and placed on a large sheet of paper. The objective was thus to elicit possible problems to address. In some cases this was also achieved but the line between problems and ideas for solutions, or simply "ideas", proved to be thin.

When the ideas ran out, the Post-it notes were collated and grouped in 'problem areas'. A discussion was initiated on which problems were feasible to approach and which were not. The children had no problem in ranging the problems and ideas as realistic and unrealistic and were often more strict in their assessments than were the designer/developer. 'Cost', i.e. money, for instance, was an issue frequently brought up by the children. The result of the session was a reduced list of problems/ideas that were considered feasible to continue working with.

Session 3: Choice of problem

The problems considered feasible were listed, some additional "problems" were added by the teachers/students, and the completed list was distributed to the children. They were to make a choice of which problem(s) they preferred to work with. The final choices resulted in a total of six different "problems" and in 10 different design team.

- *Healthy sweets*. Sweets are desirable, but they are also "unhealthy". It would be desirable to develop a sweet which tastes as sweets should do, but is not unhealthy to eat.
- *A fruit protection kit*. When fruit is transported in a school-bag, it is often damaged why there is a need to protect the fruit.
- *A wasp (bug) trap*. When lemonade and similar drinks are consumed in the summer, a wasp may end up in the glass. It would be desirable to reduce this risk.
- *'Making washing up more fun'.* Washing up is boring and some solution should be found to make it more fun, something you want to do.
- *The school canteen.* The existing canteen was considered somewhat boring but also inefficient. Two groups worked on the dining area and two groups approached how to make it possible to serve at least two different alternatives every day.
- *The children's supermarket*, which later evolved into the *children's city*, specifically designed to match children's needs rather than adults' needs.

Session 4: Generation of ideas and choice of concept

The design teams were reformed based on the children's choice of problem. Working in teams of 3-4 children and one product developer/designer, ideas were now generated in order to solve the problem chosen. The methods used were some of the various methods taught on the industrial design engineering programme, such as brainstorming, Osborn's idea-spurring checklist, "extreme thinking", association exercises, etc. The result of these idea-generating exercises tended to be either "crazy ideas", such as "tame monkeys working in the school canteen" and "furniture made out of real fruit", or very down-to-earth, even pessimistic: "We could repaint the canteen, but it will probably be too expensive, (the head teacher) won't buy it". To end the session, a list of evaluation criteria was generated as a joint venture between the children and the developer/designer, and the various ideas and concepts were assessed accordingly in order to reduce the total list to one or a few concepts for further development. The method could be described as a simplified Pugh matrix.

Session 5: Concept development

In the next session, the work continued for an entire day in a large facility equipped with tables, chairs, paper, pens, paints, and an arrangement of materials by which physical models could be created. The goal for the day was to conceptualize the concepts, first in terms of sketches and second in terms of physical models.

- The group working with healthy sweets did not have the opportunity to develop an actual product since the premises did not allow working with different food ingredients. A basic concept was, however, a recipe based on corn flakes and chocolate, both considered 'healthy'. One child devoted his time to carving tiny dinosaurs in foam, with the intention that this should be the shape of the sweets. The group worked on different packaging (an example of which is snown in Figure 1), which should contain the sweets, as well as commercial advertising campaigns by which the sweets should be marketed. It was noted that the children came up with ideas for different brand names, and the character and content of the advertisements surprisingly quickly.
- The fruit protection kit resulted in a solution which could be used for different fruits, folding and unfolding depending upon the size and shape of the fruit (Figure 2). Much time was therefore spent on producing models of fruit to try the principle out.
- The wasp trap idea was developed into several different solutions (Figure 3). In this design team, ethics became an important issue and the main goal for the group was to come up with a design that did not actually kill the wasp, but trapped it so that it could be released elsewhere.
- In order to make washing up more fun, the work of the design team resulted in a solution similar to that of an old record player. The idea was to place the dirty plate on a turntable dish and then allow the plate to rotate. A dish glove fitted with pieces of scrub-sponges attached to each fingertip would then be used to actually clean the plate (Figure 4). To the music played through the loudspeakers, the user could use the glove to "scratch" as a real DJ would.
- One of the groups elaborated the idea for a canteen with a jungle theme, with fruit-shaped furniture, lots of foliage, green plants, and jungle motifs on the walls etc. (Figure 5). A second group decided on a more 'classic design', spending their time on deciding on wall colours. A physical model was created (1:10 scale) and the effect of different choices could be studied by putting sheets of paper in different colours on the walls. A third group built a paper model of a conveyor system delivering plates of food (Figure 6) while the fourth group built a model of a more traditional serving station adapted for two main courses (Figure 14).

Figure 1. An idea for a packaging of healthy sweets. The brand name, "Krioxo", is clearly identifiable as well as the elaborated "$\mathscr{K}$"-logo.

Figure 2. A basic concept for the fruit protection kit.

Figure 3. A model of a conceptual wasp trap created from a disposable coffee mug.

Figure 4. Prototyping part of a new type of dish glove to make washing up more fun.

Figure 5. Development of a jungle concept for the school canteen.

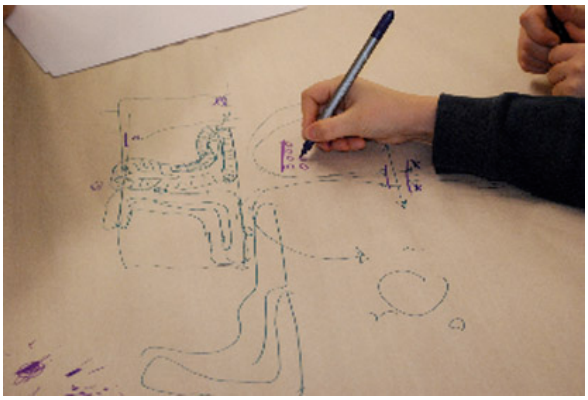

Figure 6. Sketching the conveyor belt solution for the school canteen.

- The children's supermarket became a shop on two floors, the ground floor for the parents and the first floor for the children only, offering an assortment of ice-creams and sweets. The children's consumption should be paid for by bonuses received on the basis of the parents' consumption. However, as a lot of sweets are consumed, this has to be offset by exercise. A sports hall therefore had to be added. The discussion in the design team ended in a children's city with a supermarket, a sports hall, a cinema, large parking areas, a roundabout (an important detail), and a place for events where, each week, a celebrity would turn up to sign autographs.

Session 6: Presentation of 'prototypes'

A week passed between sessions 2 and 3 and between sessions 3 and 4. After the concept development session had been completed, however, three weeks passed during which the product developers/designers continued to work on the concepts. The intention was to reach a 'prototype' level for at least some of the concepts. If a physical prototype was not feasible, a virtual prototype was created.

The final results included two dinosaur-shaped cookie cutters (Figure 7), posters for the different healthy sweets (Figure 8), a functional model (scale 1:1) of the fruit protector in ABS (by rapid prototyping) (Figure 9), computer models of the dish-washing device (Figure 10) and wasp trap (Figure 11), some CAD work on the canteen (Figure 12), a "fruit table" (scale 1:1) (Figure 13) and the city built in Google SketchUp.

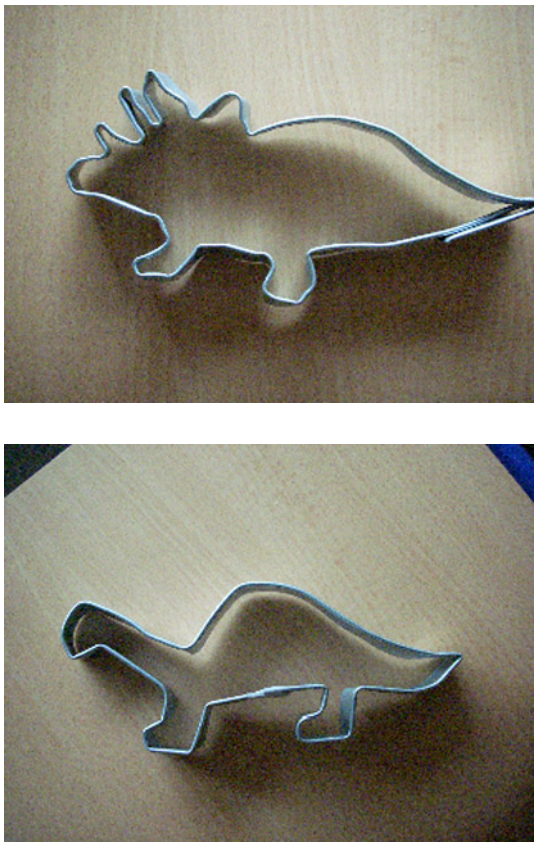

Figure 7. Cookie cutters shaped as a dinosaurs.

Figure 8. The advertising campaigns for “Rodeo”, “Rundat” (rounded), “Perstron” (a mix of “**per**sika” (peach) and “hall**on**” (raspberry), and “Krioxo”, argued to be “healthy sweets”.

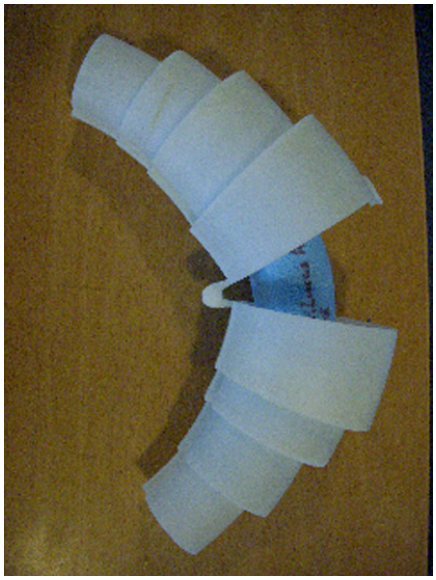

Figure 9. The foldable, and unfoldable, fruit protection kit.

Figure 10. The washing-up device in different versions.

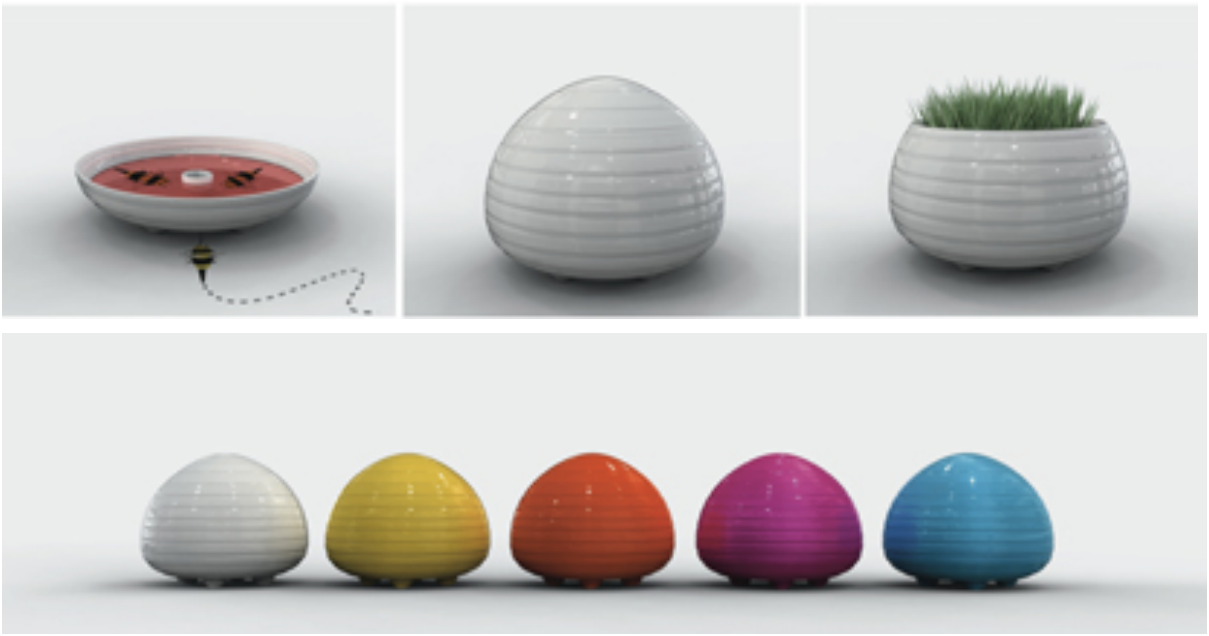

Figure 11. The wasp trap.

Figure 12. One of the design proposals for the school canteen had a jungle theme, here represented in CAD.

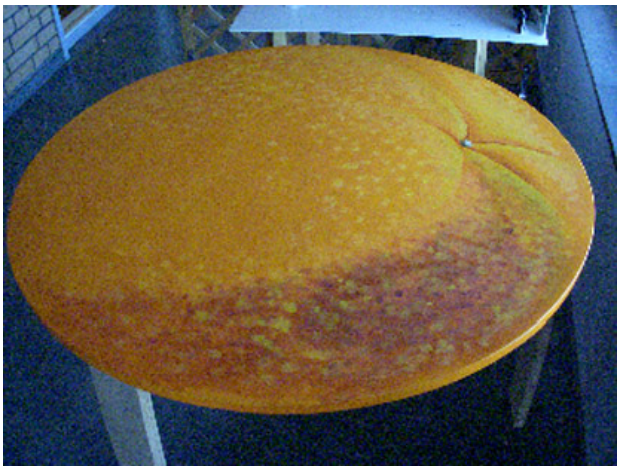

Figure 13. The “fruit table” produced in scale 1:1

The results of the prototyping work were presented to the children to gather their comments and impressions of the work. Did the concepts turn out according to their expectations? The discussion proved less dynamic than anticipated, however, and the children did not appear to relate to the prototypes as part of and/or the results of their work. The only prototype in which the children demonstrated a real interest was the virtual city in Google SketchUp which allowed them to interact with the software and make changes to the virtual representation for instance in terms of changing colours and perspectives.

Session 7: Communicating the project

Finally, in the sixth and last session, a small exhibition of the prototypes was arranged in order to communicate the results to other pupils at the school and to the children’s families. For the exhibition, posters were made illustrating the process in each design team, from ideas and early sketches to the final concepts. This time the children appeared more

engaged than in the former session, taking part in completing the exhibition (an example shown in Figure 14) and even producing new product representations to further illustrate their work (Figure 15).

Figure 14. A model of the way food could be served in the school canteen.

Figure 15. A representation of one of the canteen solutions, the conveyor belt, produced by two children in GoogleSketchUp. The text reads approximately (with some spelling mistakes) "*The change of the food distribution in the school canteen"*

Evaluation

The project was evaluated and both children and product developers/designers were involved. The children were asked to write down their thoughts on the co-design project and what they had learnt. Overall the comments were that they had enjoyed taking part in the project as a whole (i.e. the autumn and the spring). Some children had preferred the earlier co-research activity, while others had found the co-design phase the most rewarding. Being able to "create" or "make" things had been "fun". However, there were also children who had found the co-design activity negative as they were not satisfied with their design solution (or the representation of the design solution).

The participating university teachers and students were interviewed regarding their experiences. Overall the response to participating in the co-design project was positive, but it had also involved some challenges. Excerpts from the interviews are presented below:

- " *… it was exciting. I thought it was fun to observe the creative ability of the children. ...// … They are very positive and unrestrained ...//…Then, of course, there are also problems associated with being unrestrained*."
- "*… The children could become extremely focused on a particular idea. …//…If this happened you had to put an end to it, well, I tried to broaden their thinking*."
- *"… I tried to capture their ideas as much as possible but at the same time one could feel that one was restraining them."*
- *"… to begin with it felt as though we have drifted away from the task and it felt as something negative as one is used to finishing a task if a task has been given. But then one had to say to onself that, well, what will this turn out to be? And if one doesn't end up with a store but with a house, I suppose that that is a result too."*

- *"I don't think they understood the process. I got the feeling that when they do something at school …//… you ask them if they have an idea. And then one tries to realize the idea…//… You move directly from idea to final product. One doesn't work in an iterative process, with evaluations, etc."*

Reflections and Lessons Learned

One outcome of the project consists of different problems and ideas for solutions to these problems. "Creating positive experiences" appear to be the "continuing thread".

Another result, which is the topic for this paper, includes experiences of co-designing with users. Some of these lessons learned are believed to be a consequence of the fact that the users were children, and may therefore be relevant only for other projects involving children as co-designers. How to maintain focus and concentration was, for instance, such an issue. Other experiences are considered more generic, i.e. issues which could emerge as important topics in any co-design process. Communicating an understanding of the product development process and the time and resources required for the product to develop from idea to prototype were considered such a generic topic.

Distribution of power and responsibilities

A first question to be posed is whether or not the project was, indeed, a co-design activity, i.e. a synergy of different skills. A related question concerns the allocation, or distribution, of power between the children (as users) and the adults (as product development/designers) in the project. The product developers/designer predominately worked with the children at their school, in the children's regular classrooms. It became evident that the adults, in the eyes of the children, were synonymous with "teachers" and hence the children accepted being told, but also to some degree expected to be told, "what to do". A slightly different relation was developed when the children and the product developers/designers during session 5 met on a more neutral arena. Hence, *the physical context should probably be considered* in these types of projects. The same concern has been raised, for instance, by Druin (2002), Jones et al. (2003) and Vaajakallio et al. (2009).

A factor contributing to the product developer/designer becoming the "teacher" or "supervisor" rather than the moderator was probably *the size of the team*. In the early phase of the project the design teams were fairly large with one senior product developer/designer and 7-8 children in each team. In the later phases of the project, the total number of product developers/designers was increased and the number of children per team therefore decreased. This not only helped balance the team, but also contributed to maintaining the design team members' involvement and focus. This issue has also been discussed by Druin (2002), Jones et al. (2003) as well as Vaajakallio et al. (2009), the concluding suggestion being that "*… a lot of resources including many adult facilitators … //… are needed when working with children*" (Vaajakallio et al. 2009, p. 247)

Furthermore, a fundamental idea behind the project was that the children were to participate with their knowledge of, and with references to, being children. The product developers/ designers were to participate with their knowledge of design methods, skills in visualizing ideas etc. This could mean a drift in power, from the children to the developers/designers, a concern that was raised in the interviews with the product developers/designers. In co-design process it is, however, important that the respective participants are valued for and can play on their respective strengths. The designers' ability to sketch actually played an important role in facilitating co-creation in that the designers could rapidly visualize ideas, including the children's ideas, and these sketches could be used to discuss different issues within the team. The sketches thus became mediating tools, or enablers, for the design team as a whole.

Overall, the project proceeded as intended but not all design teams developed in the same way. It appeared unavoidable that the product developer/designer (i.e. the adult) took, or had to take, the role of “project leader” and/or “design team manager” but in doing so he/she also had to be aware of allowing the children's voices to be heard and to make a difference. The role could thus also be described as that of a moderator or facilitator. In the wasp trap team, the children participated actively and came up with different concepts. The designer developed the concept quite far from the early model in terms of how it looked but, nevertheless, the basic idea remained and the children recognized their “thinking” in the final product. The same holds true for the dish-washing device. In both cases the product developer/designer took control of the process, while still working hard to keep the children involved. In the healthy sweets team, on the other hand, the result of the process was that each child worked on his or her individual idea and the product developer/designer became the supervisor, or tutor, rather than a participant in the team. Hereby, the fundamental idea of co-creation was lost.

Maintaining focus and interest

Certain phases and tasks in a product development and design process require dedicated, focused labour in order to be successful. This can be assumed to apply also to the co-design process. The product developers/designers were, evidently, based on earlier experiences well aware of this and could consequently allocate the necessary resources. The children did not always manage, but there were large differences between the individuals. Some children were able to focus for a long time (even several hours) if they found the task interesting and meaningful. Two children, both boys, for instance spent four hours learning Google SketchUp and produced a usable drawing of their design concept, since they found that the product developer/designer had not accomplished this when developing the “prototypes”. Other children appeared to be able to focus for short periods of time, if at all, and the process had to be managed accordingly. Being able to understand the rationale behind a task, such as structured idea generation or assessment according to criteria, was identified as a key issue in maintaining the children's motivation.

However, in becoming unfocused or uninterested the children also communicated a self-projected inability to contribute to the work or contribute in a way they judged “good enough”. Most of the children appeared to face problems visualizing what they wanted, the way they wanted, on paper and in those cases where the model-making became too complicated for the children to be able to contribute substantially, their enthusiasm regarding the task clearly decreased. Evidently, the requirements on the participants in a co-design project must match their abilities and skills, and if the participants involve children particular care must be taken (cf. Vaajakallio et al., 2009). The question is, though, how much time should be dedicated to encouraging the participants of a co-design project if the process is based on the idea of ‘equal input’?

Focusing on and maintaining interest for particular design tasks were thus one issue. Maintaining the children's interest over time was another. The time lapses between the sessions were one to three weeks and each session, apart from session four, lasted for approximately 1½ hours. A week is most probably perceived differently by a child compared to an adult: a lot of things happened between weekly design activities, things which became more interesting and more urgent than the co-design project. In retrospect, more concentrated work where the teams had met every day or every other day but for a shorter time might have helped to maintain focus and interest over time.

Grasping process and methods

Various methods and tools were used for idea generation, evaluation of ideas, concept development, etc. These were examples of methods and tools typically taught to design students. The underlying thought was that children as a whole are no more creative than

adults, and hence need support in terms of mediating tools. This assumption proved correct in that some children were very creative, while other children were not. However, based on the experiences obtained in the project, children and adults may have somewhat different needs when it comes to design methods. The children were noticed to, at times, become very focused on a particular idea and did not understand why further idea-generation was necessary why they needed encouragement to think further. However, methods devised to "free ones mind" and "think out of the box" did not always prove useful. A substantial number of "crazy ideas" emerged without any support and what was needed in these vases was instead methods and tools which maintained creativity but at a "working" level.

It was obvious that the children had, in most cases, very high expectations of what could be achieved during each session and in the few weeks allocated to the project. They did not appear to consider the results of the idea-generating session, or the concept development session, to be "results". They had possibly expected "real products" or at least more realistic products to be the end result. This may be one reason why the computer generated images in general appeared to receive a better response than did the physical prototypes – the computer images probably looked more "real". The fruit protection kit, on the other hand, did not impress the children at all even though it was developed into a working prototype in ABS, something that from an engineering perspective is quite impressive. It simply lacked the glossy plastic surface of injection-moulded plastic and it broke after half an hour.

It is most probably very difficult for someone not professionally involved in product development and design work to estimate the amount of time and technical problems associated with developing an idea into a completed product. Even though the development process, and its different stages, had been briefly introduced in session 1: Introduction, communication of the different design phases and their respective purposes and outcomes should probably have been given more time in order for all team members to fully grasp the progress. It is also possible that the co-design process per se should have been "co-designed" to a greater extent in order for the different phases to be comprehensible to all those participating in the design work.

In conclusion, the project provided further evidence that co-design with children is a workable endeavour, with much the same opportunities and problems as co-designing with other categories of users. Nevertheless, some particular issues have to be considered: additional resources is needed in terms of adult facilitators, the requirements on the children as co-designers must match their abilities, and ways must be found by which focus and motivation can be maintained over time.

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