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Moving Beyond Boundaries: When User-Centered Design meets Sociology

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ABSTRACT

In this paper, we consider the potential of combining design, engineering and sociological perspectives with user perspectives, as part of a user-centered, inclusive design process. Our particular interest lies in the design of inclusive toys and games that disabled and non-disabled children can play together and which foster positive interactions between children across difference. We explore the challenges and opportunities associated with working in a transdisciplinary mode, where knowledge production evolves from dynamic tension between different disciplinary perspectives and those of non-academic stakeholders. We argue that the latter is of particular importance within any design process that seeks to provide accessibility and empower users. Such transdisciplinarity involves an upstream approach to the involvement of non-academic interests in the design process and knowledge production, rather than limiting the engagement of/with users to the dissemination end point stage of research (Barry, forthcoming). The paper draws upon two case studies of projects conducted by the authors. Both projects involve the use of co-operative inquiry [18] with children and we seek to extract the pedagogical implications of both projects for future design, including that within the field of ICT and digital technologies, with and for children.

CCS Concepts

Software development process management, Software development methods

Keywords

Inclusive Design; Interdisciplinarity; User-involvement; Disability; Children.

1. INTRODUCTION

In this paper we explore the potential of combining design, engineering and sociological perspectives, with those of key stakeholders/users as part of an inclusive design process. By inclusive design we mean that users are involved in and actively contribute to the design process. Such design seeks to ensure accessibility and empower the user.

We describe how the perspectives of designers, sociologists and users operate as different frames or discourses, which, when put together into dialogue with each other, can extend our understanding of 'what is going on here?' [2, p. 8], not only in the design situation where users are participating, but also beyond this practice-based context. We explore, in particular, how sociological conceptualizations and analysis might enhance design by identifying additional issues and processes that otherwise might not be considered when designing digital and other technologies. This notion of alternative frames, or framing of a 'problem' and how this shapes the quest for possible solutions within a design process is something that Schon and Rein [32], have usefully described. They argue, with obvious debts to both Goffman and Foucault, that when seeking to address complex issues practitioners from different fields focus their attention on aspects of the problem that they can most easily name and understand. The narrative they then tell about the 'problem' frames the way that they experience and define that problem. The result is a 'frame', a cluster of normative and causal beliefs that people draw upon to provide them with meaning and direction in the design process. As Goffman famously said about 'frames' and 'framing':

'Given their understanding of what it is that is going on, individuals fit their actions to this understanding and ordinarily find that the ongoing world supports this fitting. These organizational premises – sustained both in the mind and in activity – I call the frame of the activity.' [14, p. 247].

To this we would add that users also engage in framing of a problem they face and so when engaging in transdisciplinary research, which brings together different academic disciplines with non-academic stakeholders, there are potentially several competing frames or discourses at work.

What Schon and Rein [32] recommend is a process of 'frame reflective design'. This entails participants in research seeking to put themselves into the shoes of others within the given context and being reflexive about a) their own action frames and b) the

potentially political nature of competing frames/discourses. This is challenging enough when it involves researchers from different disciplines working together on a design project, but becomes even more complex when non-academic stakeholders are also involved because it demands that the academics involved work to put themselves into the shoes of the users and the non-academics work to put themselves into the shoes of the academics. The latter may need particular support to engage in this process since reflexivity is a difficult skill to master. When children are participants in a design process, engaging them in 'frame reflective design' is especially challenging, but it is possible to move towards such a position via processes of co-operative inquiry, as developed most notably by the HCI researcher Druin [14]. Co-operative inquiry entails children becoming co-researchers/co-designers and partners in the research.

User-involvement is a core issue when it comes to user-centered inclusive design with children - whereby the users' needs, wishes and desires are driving forces for the development of technologies, including ICT and digital technologies – selecting the best methods to empower their participation in the design process is a challenge. Traditional methods for involving users may not always be appropriate when designing with and for disabled people. Such methods are often designed with a particular type of user in mind, often the non-disabled, adult user of technology. Such methods do not necessarily lend themselves to inquiries with disabled people in general, but in particular to inquiries with the group that concerns us: disabled children.

Druin's cooperative inquiry approach may, we suggest, provide a way forward. It is grounded in HCI research and theories of cooperative design, participatory design, contextual inquiry, activity theory, and situated action. It is an approach involving three dimensions: first, a multidisciplinary partnership with children (we prefer the term 'transdisciplinary' here); second, fieldwork that emphasizes understanding context, activities and artifacts (a point we will elaborate later in this paper); third, a process of iterative low-tech and high-tech prototyping.

Employing an inclusive design approach to technological development, where users contribute to the definition and design of digital and other technologies necessitates not only the selection of appropriate methodologies for involving users and identifying relevant technical components, however, but also requires that the designer understands complex social and cultural elements to enable creations of meaningful systems [27]. Hence, designers have recently begun to engage with contemporary social, technological and political conditions and to seek outputs that reframe the view of users as individuals and collectives situated in complex sociocultural and political settings. Again, this is reflected in Druin's approach.

These moves within the design community reflect an understanding of the relationship between the social and the technological that has developed within Science and Technology Studies (STS), particularly within more sociological perspectives in STS. It is now widely agreed that technologies are best understood as social practices, or as inserted *into* social practices. Technology and social relations operate as assemblages. This notion of an assemblage is a useful way to help us to understand the various factors (systems, technologies, bodies, communities, policies, legal structures), concepts, practices and relations that constitute an 'event', whatever that might be.

Researchers working in Game Studies have recognized the utility of this concept of 'assemblage' for understanding play 'events' or play moments. As one such author, Taylor, comments:

'Games, and their play, are constituted by the interrelations between (to name just a few) technologies (including the imagined player embedded in them), the material world (including the bodies of the players), the space of the game, the type of genre and its histories, the social worlds that infuse the game and situate us inside/outside of it, the emergent practices of communities, our interior lives, personal histories, and aesthetic experience, institutional structures that shape the game and our activity as players, legal structures, and indeed the broader culture around us with its conceptual frames and tropes.' [34, p. 332].

This more nuanced understanding of the position of technology within a complex system of interrelationships whereby technologies are tools that drive society as much as they are a reflection of society has implications for research and development, requiring the researcher to examine this interaction between technology and social relations. This is challenging. Excitingly, however, it also increases the range of possible solutions, encouraging exploration of how technological 'gadgets' are but one element – but often an important element - in a cluster of institutions, regulations, types of knowledge, materials and practices that can be brought to bear when seeking solutions to a 'problem'. In the case of our work, the 'problem' is that of play for disabled children. By problem we do not mean that disabled children's play is problematic, but rather that their exclusion from play is a social problem in need of redress.

Approaching user-centered, inclusive design from such a perspective becomes a way to materialize ethics. It does not only require a different appropriation of technologies, but also necessitates that we find new ways of learning, analyzing, working together and communicating when conducting an inclusive design process, cf. [16]. Consequently, inclusive design is about more than a focus on users' capabilities and guidelines for the design of technologies, products or services. In line with [39, p. 90], this paper argues that technologies are never neutral but are in fact a medium between humans and reality, addressing ethical issues. He locates morality not just within the actions of users, but also within the interaction between humans and their machines and, importantly for us, he also argues that designers need to engage with the morality of their designs. He encourages us to consider how designers can 'build in' particular forms of morality into their designs. The 'artifacts they design will inevitably play mediating roles in people's actions and experiences' and will have impact on their quality of life. Designers are thus 'practical ethicists'.

In line with the above [7; 31], we therefore argue that user-centered inclusive design requires an approach that

a) accommodates different perspectives – designer/academic and user/non-academic on the problem to be addressed;

b) recognizes and deals with inherent social and cultural complexities, understanding the complex relationship between technology and social relations;

c) acknowledges the moral dimension of design.

The latter issue – that of the moral dimension of the design process – is of particular importance when undertaking research with and for oppressed or marginalized groups. Disabled children are one such group. Within the interdisciplinary field known as 'Disability Studies' (DS) traditional research that has excluded the voices of disabled people, and prioritized the perspectives of 'experts' (not recognizing that disabled people are the best 'experts' in matters of their lives) has been much criticized. Further, academics in this

field have highlighted how too much research into disability has employed an individual, deficit-model explanation of disability, effectively reaffirming traditional negative assumptions about disabled people, their 'incapacity' and the idea that the causes of disablement lie within the mind/bodies of individuals and not, as they would argue, within a disabling society. From this critique emerged, in the 1990s, the concept of emancipatory research. Such research requires researchers to fully involve disabled people in all aspects of the research process. Its primary goal is to empower disabled people and challenge disabling barriers and processes. Such an approach has not, of course, gone unchallenged, see [4]; nevertheless, for many within DS it remains a moral horizon that they work towards.

In the remaining sections of this article we extend all aspects of the discussion so far by exploring two issues: first, how conceptualizing disability in a manner that reflects the perspective of disabled people ('disability politics') and sociological perspectives on disability might inform a transdisciplinary approach to inclusive design; second, how sociological understandings of disability in childhood might inform such a design process; third, we briefly consider two design projects, both involving disabled children. Both projects involved the use of an approach akin to co-operative inquiry [15]. We seek to extract the pedagogical implications of both projects for future design, including that within the field of ICT and digital technologies, with and for children.

2. CONCEPTUALIZING DISABILITY

How the 'problem' of disability is understood within a design process matters. Within Disability Studies there is no one universally agreed approach to conceptualizing disability. Most authors in this field unite, however, in their opposition to an 'individual model' of disability [30] and versions of this – i.e. 'medical' and 'personal tragedy' models – which view disability as a personal predicament. Whilst not denying the existence or impact of impairments, Disability Studies considers the 'problem' of disability to reside within society, not within individual minds or bodies. From a Disability Studies perspective, disability is a form of social oppression, not simply restricted activity (however caused), resulting from actions on the part of the non-disabled majority. These actions – through social structures, organizations, professional practice and interpersonal interaction – impact negatively on the lives of people with disabilities. Disability is a social relational category – an effect and quality of relationships of power and exclusion between groups in our societies [35].

To adopt such an understanding of disability involves acknowledging that disability is a social construct and a social pathology [40]. It is a public issue, not simply a personal trouble [8]. The British Social Model of Disability rests on this understanding of disability as a social construction or creation and a social justice issue. This influential model distinguishes between impairment and disability, understanding the former as any long-term limitation in a person's physical, mental or sensory function; the latter as resulting from the way in which society is organized and various barriers – e.g. physical, social, political, cultural – restrict the life-choices and chances of people with impairments [37]. Importantly, advocates of the Social Model have used the model as an 'oppositional device' [5] to highlight the many disabling barriers and practices that people with impairments encounter within their social environments.

The Social Model is contested and is not the only important model of disability. Other models have, for example, emerged within North America (the Civil-rights/Minority-group Model) and Scandinavia (the Nordic Relational Model). Whilst important differences exist between them, they all view disability as resulting from an interaction between the characteristics of a person and those of their social environment. This understanding can also be found within the ICF framework [40] WHO/ICF, 2001) The ICF takes into account aspects of the Social Model – principally the concept of a 'disabling' social environment. It also, however, takes into account aspects of the 'medical' model, recognizing that 'persons with disabilities can often experience problems arising from their health condition' [41, p. 28]. The ICF seeks to synthesize the two models into a bio-psycho-social model, viewing disability 'as a dynamic interaction between health conditions and contextual factors' [8, p. 8).

Importantly, both the Social Model and ICF's concept of environmental factors can be operated within a design process to highlight barriers external to the minds/bodies of individuals and provide pointers towards environmental interventions/solutions [21]. As such they are useful models to aid analysis of disability within any context, including childhood. In relation to play for disabled children – the issue that concerns us in particular - the concept of 'disabling barriers' (Social Model) or 'environmental factors' (ICF) can be used to identify barriers which exist beyond the minds/bodies of children and impact negatively on their opportunities for and experiences of play – in other words, to identify barriers that create 'participation restrictions' in relation to their play. The concept of 'enabling environments' (Social Model) or 'environmental factors' (but this time viewed as facilitators [ICF]) can then be used to identify the various facilitators of play for disabled children.

2.1 Researching Disability within Childhood

Traditionally, much of the research into disability within childhood has focused upon the views of parents and professionals on the impact of disability upon children. It is only in the last 10-15 years that efforts have begun to be made to seek children's views on their lives. During the late 1990s authors within the interdisciplinary field of Disability Studies began to challenge traditional approaches to disability in childhood. Priestley [29], Shakespeare [33] and other leading authors in this field called for an approach informed by new Disability Studies approaches to understanding disability and by the so-called new Sociology of Childhood that was emerging at this time. Neither approach is of course 'new' any longer and neither has gone uncontested (see [36] for useful discussion on this point), nevertheless the idea that it was important to move away from research agendas preoccupied with the 'impairment, vulnerability and service usage' of disabled children, and towards research which recognized children with disabilities as 'social actors, negotiating complex identities within a disabling environment' [29] – as the true 'experts' about their lives - caught on. Increasingly, research has sought to understand the perspectives of disabled children themselves, the way they negotiate their daily lives and the relationships, environments and structures that shape their experiences.

Of course, the question of how to achieve this enabling of the perspective of the child, or 'voice' of the child as it is often termed – i.e. giving them a 'seat at the table' within the design process - is not an easy task, especially when undertaking research with disabled children. What, precisely, do we mean by 'voice' and participation in this regard? As Lewis and Porter [25] state, there are (as yet) no universally agreed answers, 'universal solutions' or

'perfect methodology' yet been devised which addresses this problem completely. We need to be continuously developing 'innovative methods' [25]. One thing is widely agreed, however, that if we are going to take the task of researching with, rather than on children seriously, our research will take longer and require a much greater level of commitment than that of a "hit and run" researcher [25]. In the next section we explore some possible ways forward in this regard, returning to the concept of co-operative inquiry and exploring its potential.

2.2 Designing with Children: Case Studies

In the field of user-centered design, interaction design with children and child-computer interaction are emerging fields (cf. 15; 38; 2; 23), where design researchers strive to meet some of the challenges of designing for and with disabled children. [2] highlight that current literature often neglects to consider the importance of the gatekeepers as well as the context and space of the inquiries that is unique to studies concerning child-computer interaction. Moreover, researchers only very occasionally work with younger and disabled children and thus are less familiar with their abilities and needs.

When including children in a design process [15] there are arguably four roles the children can inhabit: user, tester, informant, and design partner. The main difference between these is the distribution of power between the children and the researchers. The first two roles [13] constitute children as reactive users. It includes methods such as video probes [22], children observing other children [15], play sessions [26], peer tutoring [24], co-discovery [10], and post-task interviews [3].

The last two roles, informant and design partner, [13] constitute children as participant users, co-researchers and co-designers. The design process from this perspective includes techniques such as cooperative low-tech prototyping [13], drawings [38], technology immersion [15], and mixing ideas [20]. Iversen and Dindler [23]emphasize that participation is not necessarily equal to actual generation of knowledge but the term also covers 'a means to end of exchanging and negotiating values among participants in a highly dialogic and iterative process facilitated by designers.' ([23], p. 26). In this sense children come to understand not only their own values, but also the perspectives of their peers, and we suggest potentially of the adults involved in the design process.

2.3 Together Through Play

Our first case study is that of a Leverhulme Funded research project undertaken by Holt, Beckett and colleagues. This project investigated Facilitating Meaningful Play for Disabled Children through Participatory Design. The research involved working with disabled children (four with cerebral palsy (CP); one with impaired hearing; and one with dyspraxia) and their friends (who were mostly non-disabled children) to elicit their ideas for improving positive play between disabled and non-disabled children. The project then sought to prototype and evaluate a number of conceptual designs, developed with children as co-designers and finally to derive guidelines for the design of toys/games that facilitate play between disabled and non-disabled children.

The application of sociological perspectives on disabled children's play impacted in particular ways upon the research. Play is often assumed to be an arena of relative freedom and equality. Disability Studies, however, recognizes the 'politics' of play and, in particular, the potentially exclusionary nature of play. As Goodley and Runswick-Cole [19] have commented: 'play is pivotal to practices that centre the normal and push disabled children to the periphery' ([19], p. 500). Rather than allowing children to engage in 'play for play's sake', disabled children's play experiences can be restricted and overly prescribed. All too often their play becomes their 'work', as play is used as a vehicle for their education, rehabilitation or therapy. Whilst these goals may be laudable, when they come to dominate 'play for the sake of play', then this is distinctly problematic. From the outset, the designers involved in this project adopted this understanding of the potentially exclusionary and problematic construction of play for disabled children.

They also adopted, however, again from sociological studies, an understanding of disabled children as active agents who are not passive in the face of their exclusion. They are often 'creative agents who self-monitor, make choices and exert control over their play' [11, p. 978]. Their position as 'tragic victims' of their impairment, or of their treatment by adults was not therefore presumed. They resist!

Finally, the designers involved in this project employed sociological analysis to understand and articulate a concept of 'positive play' between disabled and non-disabled children that reflected the views expressed by the children involved in the project. Thematic analysis of the qualitative data arising from focus group discussions with children (as part of the design process) allowed the team to articulate such play as possessing certain 'benefits' for disabled and non-disabled children:

- For disabled children: conscientization (as a person who has particular needs and the right to play), positive self-identity, liberation from the 'tyranny of the norm' (from understandings of 'normal' play that rest upon the abilities and attainments of the 'typically developing child') and thus personal empowerment;

- For non-disabled children: the opportunity to learn how to be a better friend and 'ally' to their disabled friends, how to be supportive and not exclude disabled peers, and to be similarly liberated from the 'tyranny of norm' which can be as oppressive for children who are not disabled, as it is for those who are.

As one of the disabled children ('Luke', aged 8) involved in the research commented, 'positive' play for him would entail:

> "…understand(ing), imagination, guessing our differences and similarities (…) and (…) cooperating (…). That's the beauty of playing with other people."

The method adopted in this project combined Druin's [14] cooperative inquiry with sociological analysis of children's perspectives. Children worked with a professional designer, as co-designers, to generate ideas for toys and games that they would like to play together. They were encouraged to consider the feasibility of their ideas (wanting to fly, for example, was one idea from children that the designer found rather difficult to achieve in practice). Sociological analysis, however, allowed the designer to consider what 'experience' children were hoping to achieve – for example 'liberation' from certain restrictions associated with impairment - even from the most unfeasible of 'desires' and where possible, to capture this in designs that could be achieved/built. Prototypes of games/toys that drew upon their ideas were then developed and they were responsible for their evaluation. The prototypes became a prompt for further discussion, allowing the designer to gain additional insights into the barriers and facilitators of inclusive play and to feed this knowledge back into the design process.

Initially low fidelity prototypes were made, which whilst not fully functional, could be used to simulate play. These were tested with the children. Five concepts were then refined into fully functional prototypes for more detailed testing. This prototyping was achieved using 3-D printers and low-cost electronic platforms such as Arduino and Raspberry Pi. Space does not permit the description of all five prototypes developed, so two are described here which best demonstrate the understanding gained through this collaborative design process:

Battle Balls: inspired by 'conkers', large 'monster' heads are swung at each other, with the aim of detaching the opponent's head from its string. The children with CP had expressed frustration that they were not able to play conkers, because they found it difficult to control the string and move their conker. Battle balls was designed so that 'monster' heads could be clipped or strapped to the forearm or to a table, requiring just one hand and less fine movement to play, making them more accessible to the children with arm impairments. This toy proved popular with both the disabled and non-disabled children, who particularly liked the idea of being able to customize their Monster.

Button Bash: This was initially conceived as a videogame where a hovercraft is steered around a race course by pressing buttons embedded in a floormat. Lo-fidelity testing made it clear that the children with CP found the game difficult to access due to the fixed positioning of buttons. The game was redesigned as a video game controlled using large, highly sensitive access switches which can be positioned flexibly and pressed using any body part, and the game play shifted to a "whack-a-mole" like game, where buttons had to be hit to shoot a corresponding alien as it appeared on the screen. The revised version was more accessible, but the inclusion of individual scores meant the children played against rather than with one another. For those children with slightly slower in reflexes (particularly, but not exclusively those with CP and dyspraxia) this was particularly problematic. Following the children's feedback, the game was therefore modified to become a team-game, which involved children working together to navigate a maze, each having a 'button' that moved the character either 'right', 'left', 'up' or 'down'. This more 'cooperative game', as suggested by one of the disabled children, proved very popular.

What was learnt from the project, therefore, was that whilst physical barriers to inclusive play are important, of equal, perhaps even greater significance are the social barriers. Even when the games developed were physically accessible, the behavior of the players determined whether or not they were truly inclusive, and often undermined the inclusivity of the toy/game. We also learnt, however, that by working, over an extended period of time with children, that even these more challenging social barriers can be overcome, or at least lessened, by careful design. This, however, took time and involved a level of sociological analysis of the qualitative data emerging from discussions with children that perhaps goes beyond that which is undertaken as part of a 'usual' design process.

2.4 Designing for Playful Learning

The Playful Learning – Innovation and Knowledge project financed by UC Southern Denmark and the Danish Ministry of Higher Education and Science represents our second case study. This was undertaken by Brooks and colleagues. The project investigated how children (disabled – attention and concentration difficulties - and non-disabled) in early years' education in Denmark explore and play with digital technology and electronic playware, to let this knowledge feed into practice-based designs of a technology-enhanced playful learning environment created together with the children. 55 children between 3-5 years of age participated in the study. In a strong wish to contribute to wider pedagogical reflections and change, the research also included teachers from the field as well as teacher educators and student teachers as stakeholders of the project.

The study was carried out following a Design-Based Research framework (DBR). DBR, originally coined by Brown [9] as design experiments, emphasizes a merging of research, practice and design into one entity aimed towards extending current methodologies and theories in educational science. DBR underlines an iterative design process and allows for flexible and mixed methods [1]. This study drew on experiences from methods applied in the field of interaction design for children (in particular focusing on younger children between 3-5 years of age), which bear commonalities with DBR when it comes to the design process. In interaction design there is an emphasis on a user-centered design approach to inform the iterative design process. A crucial aspect of the study was to identify and apply adequate methods to get to know the children and hence be able to design together with them and to understand their conceptual frameworks.

The data was gathered through a set of field studies, which was derived into design requirements and design guidelines in an iterative way. The children were included in the design through a number of creative methods for designing with children adapted from Cooperative Inquiry [14; 15]. Moreover, we put efforts into setting the scene for each of the design sessions to foster the children's understanding of what was going on.

Space does not permit the description of all methods that were adapted and applied, so in the following text the lessons learned from two methods that facilitated the above-mentioned 'setting the scene' are described.

Establishing a Common Ground: 'All collective actions are built on common ground and its accumulations.' [12, p. 127]. The researchers spent time watching children's television, reading children's books, learning children's songs and scouted out what was trending in the toy and app industry. This was done in order to ease the establishment of a common ground when talking with the children and also to aid the analysis and understanding of children talking with children. The experience was that when the children realized that the researchers were aware of their universe they more easily opened up and discussed. In the sessions where the children played freely with technology, it was key to understand their frameworks in order to understand their play. The children's play was often bound in the physical world meaning that it was initiated from the objects at hand, but the play frame the children engaged in was not spontaneous, but merely initiated from existing frames of the children. The children would evolve their stories around existing characters from children's literature and television. In one example, a group of children were playing in a Kinect-based system developed for the project where the children were able to draw interactive objects on the wall. The children stated that their creation was a character from a Danish children's novel. In the book a boy is able to draw with crayon on the wall and everything he draws comes to life. The association between the system and the book was not far-fetched and if the researcher had failed to recognize the child's association we would also have failed to recognize that the young child actually had a good understanding of the system features.

The Magical Suitcase: The Magical Suitcase draws heavily on the brainstorming technique from Cooperative Inquiry [13] often

referred to as the Bags of Stuff technique. Originally adapted from Bjerknes, Ehn and Kyng [6] the technique aims towards creating lo-fi prototypes in teams; children and adults together. The goal is to get as many solutions as possible. The groups are provided with several types of art supplies and presented with a problem that needs solving. Typically, the technique has been used with children between 7 to 11 years of age. Given that the participants who took part in the case described here, were younger children between 3-5 years of age, the use of the Bags of Stuff technique was accommodated accordingly. The Magical Suitcase was a suitcase filled with not only art supplies but also different objects with assigned meaning, e.g. a couple of sunglasses to play with, which were 'magical' and encouraged imaginative play. The intention was that instead of focusing on building actual lo-fi prototypes, instead the materials provided should open up for different types of play than the children would not usually engage in. In addition, the hope was that the material would open discussions between the children and the researchers regarding the possibilities and limitations with technology-enhanced play. A challenge was that the stories built around the different objects did not have enough depth to engage the children. It was wrongfully anticipated that when young children were told that e.g. a potion or a set of glasses were magical, it would spur enough interest for them to start exploring and playing with the objects. Instead they most often wanted the background story about how these object became magical and similar questions before being intrigued into the play.

The two above-described methods were intended for the children to build ownership of the process. The experience was that neither of the methods should stand alone. The 'establishing a common ground' was beneficial for building trust and a relationship between the children and the preschool teacher students. The children quickly seemed to feel comfortable with the new adults present in the preschool. The 'magical suitcase' proved efficient as it gave the children initiative and a "voice" and hence sparked communication. The children understood that there was a task at hand that they could help solving, which in return, again, supported a sense of ownership and empowerment through the process. The experience was supported by feedback from the parents of the children, who expressed that the children were very proud of their participation and that they talked a lot about the process at home.

What was learnt from this part of the project was that the creative methods utilized for the cooperative design process were transferred to the target group with difficulty. Such a modification of the techniques can potentially add value to the design process, however more work has to be put into the narratives behind the objects in order to engage the children and thus generate the type of rich qualitative data which can be analyzed, sociologically, to bring greater depth of understanding of user needs and desires, as part of a design process.

2.5 Designing with Children: Lessons Learnt

In the case studies we encouraged the children to become 'junior designers' together with the researchers, however, the children's ability to communicate through the different techniques differed and hence the sense of skill and ability changed the motivation the children had towards the task. Moreover, the children found it difficult to create something from free imagination and the help of adults can easily affect the direction of the children's creation. In other words, while engaging in different kinds of co-operative inquiries together with the participating children, several challenges occurred which sometimes jeopardized the 'ethical' or 'political' dimension of the design activities, which were intended to engage children as our 'co-designers'. For example, children

sometimes experienced frustration about not being able to express themselves through the prototypes or within the design activities. By employing the trans-disciplinary competencies of the two research teams (engineers, social scientists, educational experts), however, it was possible to in-action identify these critical incidents and, thereby 'build in' forms of morality/research ethics into the designs and design activities.

Based on this, the overall lesson learnt from the two case studies presented above, is that when children participate in processes of 'creative methods' and 'frame reflective practices' they need to learn about the design process as such and understand the inherent opportunities and constraints to be able to, on equal basis, fully engage in participative design sessions. Furthermore, the trans-disciplinary team approach became a resource that generated or designed relevant solutions and processes. Here, the different knowledge domains converged to a communicative space and mindset enabling different frames to engage in a joint playful dance.

3. CONCLUSIONS

The overarching goal of this paper was to elaborate on the potential of combining design, engineering and sociological perspectives, with those of children as key stakeholders and participants in a user-centered inclusive design process. The information was provided through two case studies, where sociological and interaction design for children conceptualizations were explored to identify additional issues and processes in the design process when designing with children. The case studies show how the children were included in the design through a number of creative methods for designing with children adapted from Cooperative Inquiry [14]. From the analysis, the following reflections emerged:

a) To accommodate different perspectives, the process of 'frame reflective practice' includes the necessity for creating a common ground where the children learn about the design process and understand the opportunities and constraints within such a process. Moreover, it is crucial for the researchers (designers and sociologists) to learn about the children's worlds and conceptual frameworks in order to understand their play.

b) The different skills, their position within social relations and interests expressed by the children in a design process need to be recognized and accommodated by competent facilitators to acknowledge children as competent 'junior designers'.

c) The techniques and props used when designing with children are differently coded; however carefully considered pedagogical frameworks can decode strongly coded tools used in the design process to unfold the complexity of children's frameworks.

A design process built upon trans-disciplinary participation including stakeholders, can be framed so that the participants respectfully 'learn from each other'. The case studies showed how sociologists learnt that the design process is a valuable vehicle for exploring a 'problem' in a new way, whereas the engineers and designers learnt that user-centered, inclusive design processes benefit from considering the wider context, i.e. to move beyond the practice-based 'situation' into sociological understandings. Finally, applying an ethical approach to the children involved in the design process enables them to understand what is going on and thereby

they can participate in the design process as competent 'junior designers'.

In conclusion, a design cycle evolved, including different iterative phases of learning where the activity of creating something new is acknowledged as well as reflections on moral and ethical dimensions of the designs and the design activities (Figure 1). The cooperative inquiries allowed and supported the participants (engineers, designers, sociologists, preschool teacher students as well as the children) to ask questions and investigate specific issues at hand, for example regarding children's play preferences. With this as a foundation, a creative phase was initiated where the children together with the engineers and designers created prototypes (e.g. toys and games) and engaged in designer-ly activities (e.g. the magical suitcase play scenarios), which they could later reflect upon.
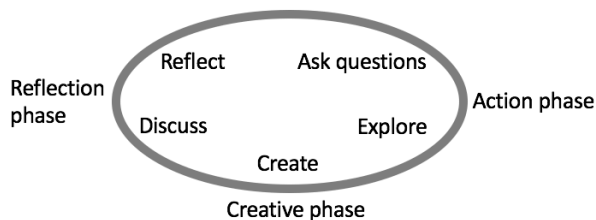

Figure 1. Design-based learning cycle.

4. ACKNOWLEDGMENTS

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