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Communicating the complexity of children's needs and aspirations to the designers of info-graphics

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Abstract. Info-graphics are designed to make complex information accessible. They are visual representations of data designed to convey information in a succinct and efficient way [1] (Newsom and Haynes, 2004; Smiciklas, 2012). An example may be a pictogram or public safety sign designed to warn people of a hazard. Such communication devices are currently developed through designer-centered, adult-led processes. While many adults are able to interpret public signs correctly, [2] Siu et al. (2014) question whether children understand them, even when they are exposed to public signs in child-friendly spaces such as playgrounds or schools.

In a bid to enhance sign design and improve children's understanding of infographics, [3] Siu et al. (2017) make a case for including children in their design, as children's drawings can give new insights. However, the challenges of engaging children as co-designers in infographic research are yet to be addressed. In this paper, the author reflects on her involvement in the Together through Play project [4] (Holt et al., 2014), a three-year, Leverhulme Trust funded project aimed at developing understanding of children's needs and aspirations through the process of co-design.

With the intention of addressing the power imbalance between adults and children in co-design research, the researcher employed and adapted methods of cooperative inquiry, an approach to creating new designs for children, with children [5] (Druin, 1999). This paper focuses specifically on the participatory approaches, strategies and methodologies employed to encourage designers to truly listen to the voices of children, and their relevance to visual design research.

Twenty-two children aged 7 to 11 were recruited to participate in the study from four UK-based mainstream Primary Schools. At least one child participant from each school had a recognised physical impairment and at least one of their co-participants did not. Six disabled children and their non-disabled peers took part in the study, with four of these children having physical impairments relating to cerebral palsy. One child had dyspraxia and one child had a hearing impairment.

Undergraduate students from Product Design and Engineering programmes at the University of Leeds were recruited to work alongside the children as co-designers. Their involvement included realising the children's design ideas as prototypes and producing a series of critical artefacts as tools for discussion.

Through semi-structured interviews with the researcher, the students reflected upon their experience and involvement in the study.

Where focus groups with children have traditionally been used as a means of verifying design solutions, this project aimed to actively engage children in the design process from conception to completion. Rather than focusing on the end product, feedback and interaction with prototypes was used to develop understanding of the barriers encountered by children and their aspirations for inclusive play. It was anticipated that this dialogue would be more insightful than straightforward interviewing alone [6] (Holt et al., 2012).

Previous attempts to include children in research, particularly in the area of childhood studies, have emphasised the pre-existing power differentials between adults and children that lead to the silencing of children's voices [7] (Kay and Tisdall, 2012). However, the Together through Play project identified that many other factors can contribute to the silencing of children's voices in design research, with the attitudes of other children identified as one of the most significant barriers.

In this paper, reflections on the methods employed in the Together through Play project are used to inform a set of guidelines for designers of infographics seeking to work collaboratively with disabled and non-disabled children in the future. It addresses the communication barriers identified that warrant the attention of infographic designers. It also highlights scope for infographics to be used to bring a greater balance of power to co-design projects with children.

Keywords: Infographics/co-design/children

1 Introduction to the Problem

The UN Convention on the Rights of the Child [8] (2005) recognises the right for children to have voice on issues affecting them and to have their views heard. Kay and Tisdall (2012) [7] argue that too little research puts forward the viewpoints of children and values their contributions. Moreover, the term 'children's voice' has distinct disadvantages and exclusionary aspects that frequently act as a camouflage for what actually happens in research.

One dilemma researchers face is that children are considered vulnerable [9] (McIntosh, 2000), and that any degree of harm may, therefore, affect children more than deeply than adults. The imbalance of power between adults and children are well documented, with adult assumptions about childhood contributing to children's marginalised position in society [10] (Punch, 2002). There is a common assumption that children cannot be 'fully informed', therefore they cannot give full consent to participation in research [11] (Posch and Fitzpatrick, 2012). Parents and carers have often been consulted about their children's experiences by proxy, and as a result, children's views have been undervalued and supressed [12] (Garth and Aroni, 2003). Further, adults may overlook the value and potential of children's ideas in design research as their imagination and creativity is often more limited than children's [13] (Almqvist, 1996).

Children are still treated unequally in comparison to adult research participants in research. For example, whereas adults are often remunerated for their participation in research, children are not [7] (Kay and Tisdall, 2012). Moreover, in the development of products aimed at children, children's ideas are not always granted the same respect as those of adult users [14] (Druin and Solomon, 1996). [15] Read and Fredrikson (2011) have focused on the ethics of children's participation in design research and the importance of children being given full information about the designs towards which they contribute. Read et al. (2014) [16] also draw attention to a lack of democracy in research with children, identifying a study undertaken by Iversen and Smith (2012) [17] as the first of its kind to deliberately place democratic processes at the forefront.

One of the benefits of engaging children as design partners in research is their ability to offer 'bluntly honest views of their world' (Druin, et al., 1997, p.1) [18]. However, young children in particular have difficulty verbalising their thoughts (Druin, 2002) [19]. Thus, alternative modes of communication need to be explored in research projects involving children. As children will tend to try to please adult researchers and respond positively when engaging in more favourable activities (Read et al., 2006) [20], strategies employed for working with children as co-designers must also address power imbalances and bring greater equality to the process.

Regarding the involvement of disabled children in research - in childhood studies and disability studies, there has been a tendency for disabled children's experiences to be ignored (Priestley, 1998) [21]. Critics argue that disability research in general is adult-centric and gives little consideration to disabled children (Connors and Stalker, 2007) [22]. For James (2007) [23], rhetoric about 'giving voice to children' masks a number of important problems, since there is a tendency for researcher to avoid asking difficult questions (Badham, 2002) [24]. Not only have the views of disabled children been excluded from existing research, so too has the analysis of their social experiences (Davis, 2005) [25]. Moreover, 'voice' may reproduce understandings that marginalise children, i.e. assuming that the voice as the property of a rational, articulate, knowledgeable individual, capable of speaking for herself (Tisdall et al., 2009) [26].

In the UK, there are currently government guidelines on designing *for* users with additional needs (Home Office Digital, 2014) [27] (see figure 1). However, organisations such as CHANGE, the UK-based human rights charity, advocate working *with* disabled people in the development of accessible information and easy read resources (see figure 2) [28]. Regarding disabled children's engagement in design research, guidance exists on the issue of designing specifically *for* disabled children (Endicott et al., 2010) [29]. However, this research has focused on special adaptations and access provision for disabled children rather than being inclusive of disabled and non-disabled children's needs.

Fig. 1. Home Office Digital, 2014 'Designing for Users with Low Vision' (https://accessibility.blog.gov.uk/2016/09/02/dos-and-donts-on-designing-for-accessibility/).

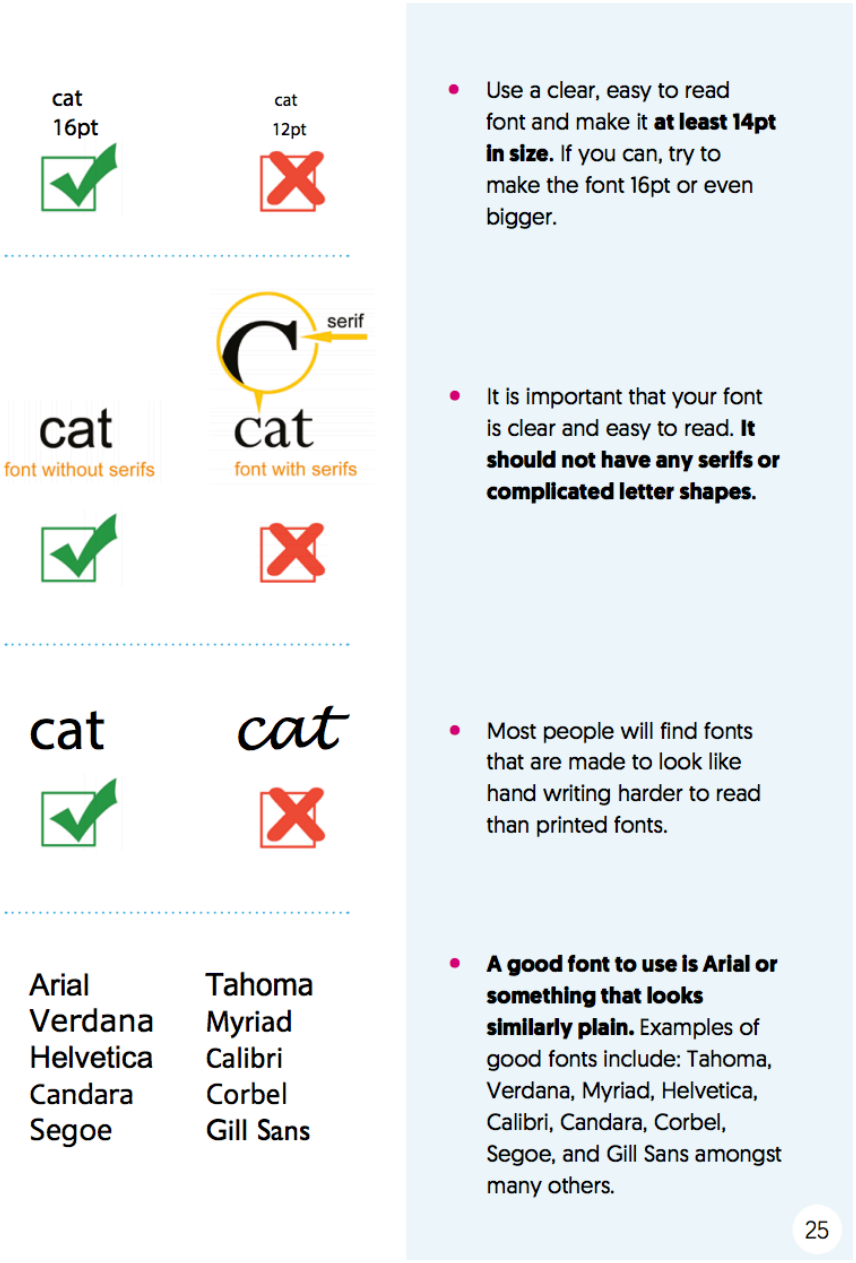

Fig. 2. CHANGE 'Making Information Accessible' Guidelines.

In the field of infographics, designers are responding to children's need for access to information. Infographics in children's books such as those designed by Rogers and Grundy (see figure 3) [30] enable children to access information rather than fictional

stories. It is important for children to be considered in infographic design. As noted by Rogers (2014) [31]:

> *Information belongs to everyone. The world's stories are being told through numbers and facts. But while we treat this as something that only applies to adults, it belongs to everyone. And the younger it starts, the better.*

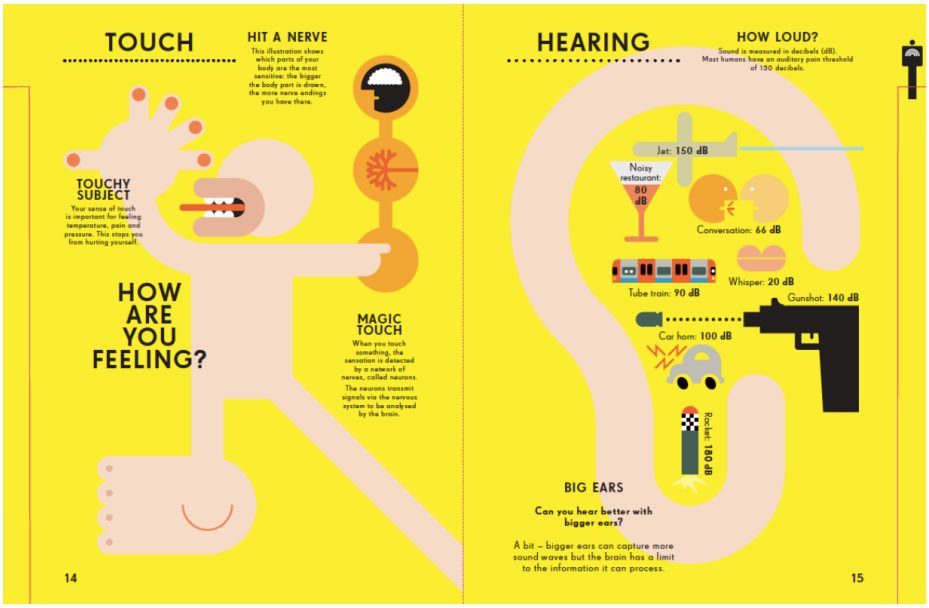

Fig. 3. Infographics: Human Body (Rogers and Grundy, 2014).

Siu et al. (2015) [3] make a case for the inclusion of children in the design of infographics. However, the aim of their research is to enable infographic designers to produce signs *for* children rather than supporting children's ongoing contribution to, and participation in, this process. The Together through Play project was the first of its kind to examine the process of designing *with* disabled and non-disabled children. There is also scope for investigation into special considerations for the inclusion of children with physical or sensory impairments in infographic research.

2 The Together through Play project

In a bid to engage disabled children in the design process, the Together through Play project was an investigation into methods of cooperative inquiry (Druin, 1999) [5] – an approach to participatory research with children as a means of gaining insight to their experiences and exploring their views. It involved a series of iterative cycles, including the following:

1. Observations of children at participating schools;
2. Focus group discussions with children about their experience of play;
3. Co-design activities with children;
4. The development of conceptual games and lo-fidelity prototypes at the University of Leeds, for children's review;
5. The development of hi-fidelity prototypes at the University of Leeds, based on children's feedback;
6. Semi-structured interviews and focus groups with teachers, parents and carers;
7. The selection and refinement of two preferred concepts, for final evaluation

The researcher also sought to examine methods employed by product design teams when attempting to engage disabled and non-disabled children in the process of user-centred design. Therefore, the following iterative cycles were undertaken:

1. A second, more in-depth analysis of the qualitative data collated through the project;
2. Semi-structured interviews and focus groups with undergraduate students responsible for the development of prototype toys and games at the University of Leeds (Moore, 2016) [32].

The theoretical framework for this study was underpinned by sociological methods - drawing on the sociology of childhood (James and Prout, 2015) [33] and disability studies perspectives (Barnes, Barton and Oliver, 2002) [34]. Two common themes unify these perspectives - both seek to transform the position of children and disabled people from objects to subjects of study, and both seek to present children and disabled people as active agents, through a commitment to concepts of rights and participation (Watson, 2012) [35]. The social studies of childhood (Alderson, 1993; Beresford, 1997; Watson et al., 1999 and Connors and Stalker, 2003; 2007) [36], [37], [38], [39], [22], informed the design of this project – in particular, participatory methodologies designed to ensure the voices of disabled children themselves were represented in the research.

Four UK-based mainstream Primary Schools participated in this study. At the discretion of each school, twenty-two children aged 7 to 11 were recruited for participation. There was no restriction on group size, however, the minimum requirement was that at least one child participant had a recognised physical impairment and at least one co-participant did not. Six disabled children and their non-disabled class peers took part in the study, with four of these children having physical impairments relating to cerebral palsy.

The scope of this project was limited to children with physical impairments. The aim was to conduct exploratory research into the views of a specific group of children, rather than conducting a systematic and representative study and to provide insight to the specific play experiences of the disabled and non-disabled children participants. Five undergraduate students from Product Design and Engineering programmes were recruited to participate in the study as co-designers. During semi-structured interviews and focus groups with the researcher, the students reflected on their involvement in the project.

This study employed a research by design approach (Frayling, 1993) [40]. Research by design is a form of action research through which the process of designing and evaluating a product for a situation becomes a vehicle for understanding that situation. An interpretive approach was employed in this study due to its flexible, and inductive nature (Braun & Clarke, 2006) [41]. Inductive analyses primarily have a descriptive and exploratory orientation, which provide insight to individual experiences and allow researchers to develop understanding of issues as they emerge.

3 Findings

Although each of the children found ways in which to participate in the research activities, some encountered social, physical, or psychological barriers to participation, resulting in the silencing of their voices. For disabled children, social barriers were most prominent, particularly in relation to the negative views and behaviours of their non-disabled peers and others. In the worst case, two children experienced name calling and bullying at the hands of their non-disabled co-participants.

Children with upper limb and motor impairments found written tasks difficult and some topics were too sensitive for others to discuss in a focus group scenario. Non-disabled children also encountered barriers to participation in focus group discussions and mind mapping activities, due to concentration-loss; disengagement with written tasks and limited time or resources.

The disabled children gained voice when they were able to express themselves through self-initiated research methods and participate in the research in more nuanced ways. They developed their own techniques for evaluating toys and games and at times, deviated from the research schedule, in order to discuss topics of significance to them. For example, in addition to verbalising their views on the prototype toys and games, some chose to act out their gameplay suggestions (see figure 4).

Fig. 4. Prototype evaluation session at school participating in the Together through Play project.

Some children used infographics to express their views and experiences (see figure 5). When emphasising the importance of inclusion, some felt that signs should be used to reinforce key messages, particularly in relation to bullying. However, self-initiated research methods were not applied consistently, nor were these methods shared between groups. Children at each participating school also expressed the need for a greater sense of autonomy over, and participation in, the design process. Some were also keen to find out how their ideas had been used to inform the design of the prototypes - highlighting the need for more transparency in the process of participatory design research with children.

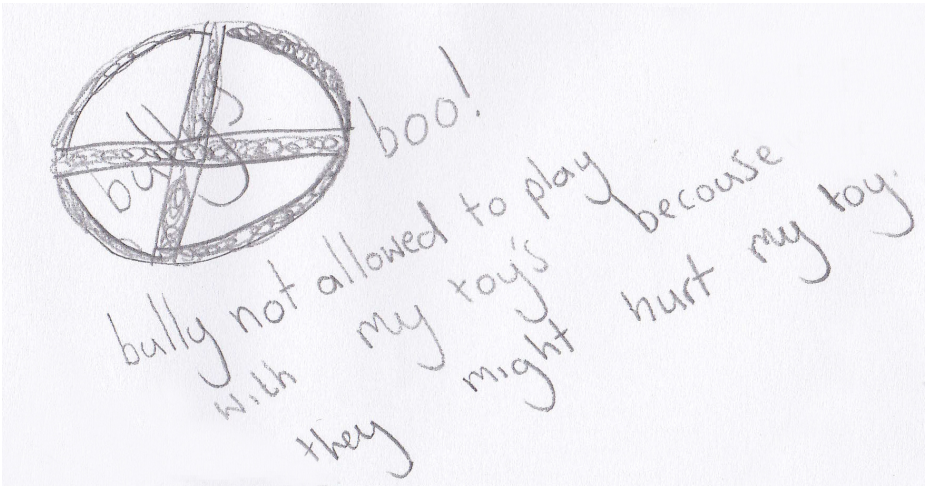

Fig. 5. Info-graphic developed by child participant engaged in the Together through Play project.

In their review of existing games and prototype games developed through the project, the communication of information was identified as one of the most significant barriers to play for child participants. A number of children expressed a preference for autonomous play and opportunities to learn or develop new skills through play. Suggested improvements included access to information, the communication of instructions, rule setting and guidance on how to play games. Each of these aspects could potentially benefit from the contribution of infographics designers. During observations, game rules tended to be communicated verbally between the children – a factor that was particularly exclusionary for the child participating with a hearing impairment.

Undergraduate students developed visual examples for some of their design concepts and incorporated the design of logos, symbols and colour coding into the design of some of the games. However, as children tended to take the visuals literally, some elements needed further development and refinement (e.g. an image of a player standing was taken as instruction to stand in order to play the game, and any errors in colour coding were noted by the children).

Student experience of the co-design process

One of the challenges encountered by the undergraduate students included managing and filtering the vast amount of qualitative data generated through the project, without losing its richness. As the children expressed such a variety of preferences in their feedback, the students found the data overwhelming. Furthermore, the students had to be critical about some of the suggestions made by the children. Not all of the children's suggestions would support inclusion. For example, reliance on verbal instructions in a game, as suggested by one of the non-disabled children would exclude children with hearing impairments. Some of the children's views and suggestions conflicted - for example, there were disagreements on timings, levels of difficulty, themes, plus there was a tension between their desire for inclusivity as well as exclusivity. As the students were unable to observe the children interacting with the prototypes, due to safeguarding measures set by the University, and participating schools, they felt that they did not gain enough detailed feedback. Furthermore, the limited availability of participating schools meant that the iterative process was slow and that many of the students' questions went unanswered - highlighting the need for tools to enable quick idea iteration.

4 Discussion and Conclusions

The Together through Play project was the first of its kind to examine co-design with groups of children including children with additional needs. Having established the barriers to engagement with co-design processes for adult design researchers and children, there is scope for investigation into ways in which designers of infographics might aid the research process and address some of the barriers identified. Moreover, addressing issues of inclusion in co-design research is beneficial to disabled and non-disabled children. From this study, we can conclude that all children are unique, and it is important for design researchers to tailor research methods to children's individual needs.

Guidelines for designers of infographics seeking to work collaboratively with disabled and non-disabled children in the future

Skills sharing

This project highlighted the need to equip both children and adults with the relevant skills and experience to participate in co-design teams. In order to support children's involvement in co-design, adult design intervention may be required, in the form of technical demonstrations, scaffolded design tasks or divergent thinking strategies to help children overcome barriers to creativity. Collaborative work between designers and children towards defining inclusion is also recommended. As undergraduate

students involved in this study had a tendency to focus on issues of accessibility for disabled children, rather than the interactions that made play meaningful to the child participants, their understanding of inclusion required further development. This paper encourages teams of adult and child co-designers to establish shared values, in order to bring a greater balance of power to future collaborative design projects.

Transparency

As discussed in section 1, Read and Fredrikson (2011) [15] emphasise the ethics of children's participation in design research, making a case for children being given full information about the potential use of designs towards which they contribute. As undergraduate students involved in the Together through Play project found their methods 'wishy-washy' and 'intuitive', there is scope to bring greater transparency to the process by using info-graphics to chart decision-making processes and evidence where children's ideas and feedback are used. Arguably, such resources could be used to enable or support member checks with children, ultimately giving children voice in the verification of design decisions.

Communication barriers identified that warrant the attention of infographic designers

In focus group discussion transcripts from disabled and non-disabled children, negative attitudes towards disabled people were identified as a significant barrier to engagement for disabled children. As infographic design projects can be used to develop children's critical-thinking skills (Krauss, 2012) [42], there is the potential for infographics to be used to challenge negative assumptions about disabled children and their role in design research.

Research tools

This study emphasised the need to enable children to contribute to the development of research tools used in co-design projects. As some of the child participants used self-initiated research methods to express their views and experiences, there is scope for info-graphics to be used to help realise and organise self-initiated research methods and alternative forms of expression for children.

Focusing on voice alone favours comprehendible verbal utterances over alternative communication forms, which can potentially exclude children who communicate with few or no words through speech (Komulainen, 2007) [43] or those who stay silent or respond to a researcher's questions with laughter (Lewis, 2010; Nairn et al., 2005) [44], [45]. Focusing on verbal communication can restrict the use of other

communication methods, ranging from drawing to role-play - established methods for engaging with a diversity of children (Kay and Tisdall, 2012) [7].

Meeting children's individual needs through accessible infographics could potentially include the provision of easy read documents or visual flash cards. This project also highlighted the need for research into quick iterative techniques amongst co-design teams, in order to enable more meaningful dialogue. The field of infographics has the potential to make a positive contribution to this area in the future – for example, through the development of more effective evaluation tools.

Communication of research aims and findings

As verbal and written research proposals given at the point of ethical consent did not complete the children's understanding of the research, there is scope for investigation into ways in which child-friendly infographics such as the diagram featured below might develop children's understanding of the research process. Children involved in this study expressed a desire for access to information – such as finding out more about the undergraduate designers, children at other participating schools and the origin of some of the design ideas. Infographics are often used in research for publication and dissemination purposes. Arguably, infographics such as figure 6 could be used to help inform children and designers about their fellow co-designers in ways that are more accessible to them. Similarly, as the undergraduate students found much of the qualitative data overwhelming, infographics such as this one may also have been used to help them grasp a better understanding of the children involved in the project. Infographics can be a highly efficient and effective way to convey large amounts of information in a visual manner (Majoon et al., 2017) [46]. However, striking the balance between making data accessible and manageable, whilst avoiding diluting the rich information collated or stereotyping is a potential challenge for infographic designers.

This project highlighted the need for designers to consider ways in which research data might be communicated to be more inclusive of users with different needs, for example, with the inclusion of multi-sensory elements. There is scope for investigation into ways in which infographics might be used to support the needs of children and people with sensory impairments through the process of co-design. As highlighted by Barratt (2014) [47], information design has the potential to cross boundaries of experience design and art, bringing participants together in more nuanced ways (see figure 7).

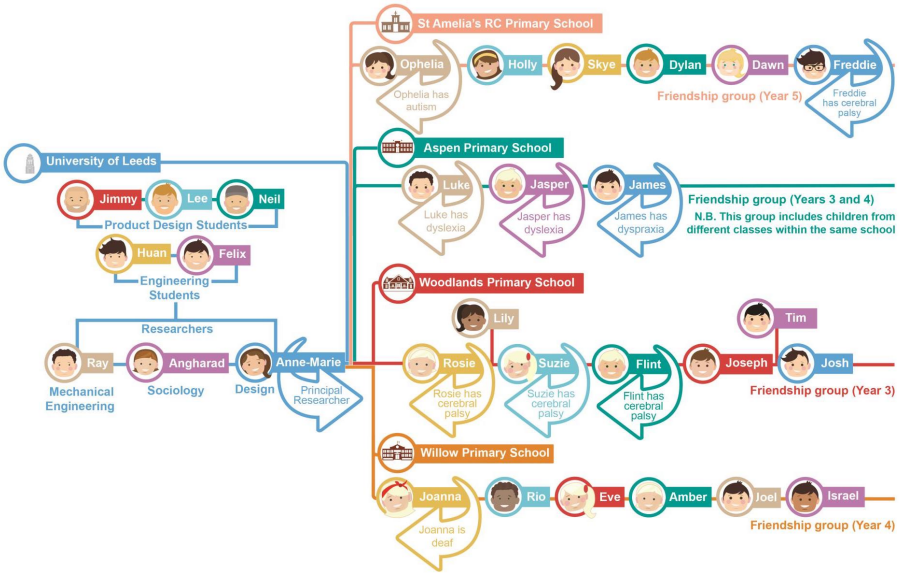

Fig. 6. Participant information diagram – Together through Play project.

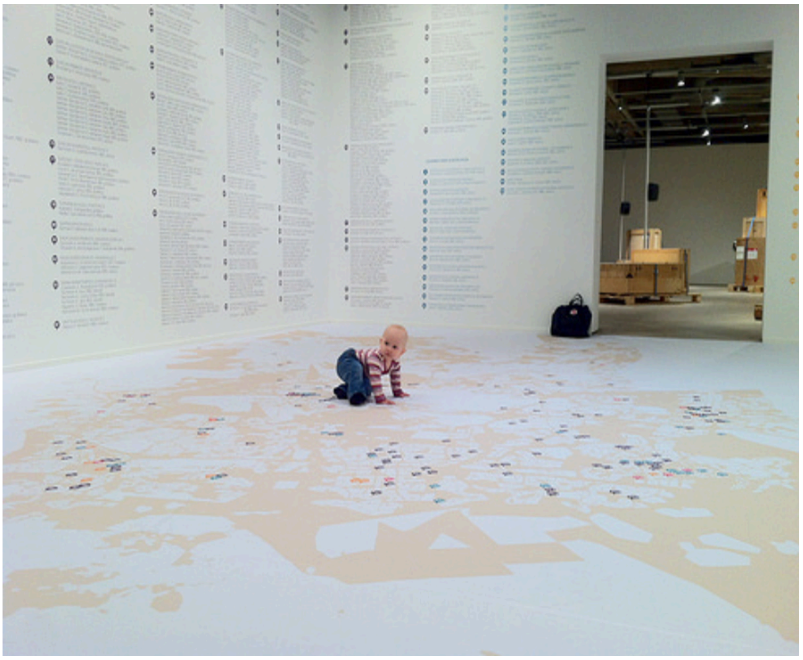

Fig. 7. Guide to the distributed collection of the Easpoo Museum of Modern Art. Courtesy of Stefania Passera [47].

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