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Development and application of a framework for comparing early design methods for young children

R.J.W. Sluis-Thiescheffer [a,*], M.M. Bekker [a], J.H. Eggen [a], A.P.O.S. Vermeeren [b], H. de Ridder [b]

[a] Eindhoven University of Technology, Department of Industrial Design, Den Dolech 2, 5600 MB Eindhoven, The Netherlands
[b] Delft University of Technology, Faculty Industrial Design Engineering, Landbergstraat 15, 2628 CE, Stevinweg 1, 2628 CN Delft, The Netherlands

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ABSTRACT

When designing with young children, designers usually select user centred design methods based on the children's required level of engagement and the inspiration expected to be created according to the designer. User centred design methods should be selected for their suitability for children and for the quality of the output of the design method. To understand the suitability of design methods, a framework was developed to describe design methods in terms of required design skills as identified by the Theory of Multiple Intelligences. The proposed framework could provide the basis for a tool to compare design methods and to generate hypotheses about what design method would work optimally with children in a specific school grade. The initial examination of the viability of the framework is a comparison of design methods by the number of skills involved; earlier work showed that the involvement of more skills (as with, e.g. low-fi prototyping) could result in more options for a design problem than the involvement of fewer skills (as with e.g. brainstorming). Options and Criteria were counted to understand the quality of the method in terms of the amount of design-information. The results of the current paper indicate that 8-to-10-year-old children generate significantly more options in prototyping sessions than when they are involved in sessions applying a Nominal Group Technique. The paper indicates that (a) with the framework we can generate hypotheses to compare design methods with children and (b) that the outcome of various design methods, which might lead to very different representations, can be compared in terms of Options and Criteria. Further usage of the framework is expected to result in empirical support for selecting a design method to be applied with young children.

1. Introduction

Until recently, the focus in the field of designing with children was mostly on acquiring methodological knowledge, examining the question *how* to design with children, through product evaluation or product design (Druin, 1999b; Jensen and Skov, 2005). Now that the field has described the role of children in the design process, the focus in literature starts to shift from *how* to apply a design method, to *why* to apply a specific design method, to find justification for the choice for a certain method. Markopoulos and Bekker (2003) propose criteria for comparative assessment of methods for children. They suggest to assess methods on three dimensions: (1) the components that constitute the method (e.g. the number of participants, the procedure, data capture, etc.), (2) the measures for assessing a method (e.g. robustness, reliability and efficiency) and (3) the special characteristics of children as test participants (e.g. verbalization skills, concentration span and gender differences). Their conclusion is that many comparisons are based on the usage of the first two dimensions, but the characteristics of the target user group (i.e. the children) are hardly ever taken into account. This paper proposes a framework for comparing design methods based on relating characteristics of children with characteristics of design methods. Subsequently, the paper describes a study that examines a hypothesis based on the framework.

1.1. Children's characteristics affecting design sessions lack a framework

In the literature on designing with children, evidence is reported on how children's characteristics may affect design sessions. For example, *gender* has an effect on the design methods, as boys have a different behaviour than girls, and also, their behaviour in one-gender groups differs from that in mixed-gender groups (Hou et al., 2006; Isomursu and Still, 2004; Stienstra, 2003). Furthermore, gender-based behaviours differ per age group.

* Corresponding author. Address: Eindhoven University of Technology, Department of Industrial Design, Den Dolech 2, 5600 MB Eindhoven, The Netherlands. Tel.: +31 641396021.

E-mail addresses: r.j.w.sluis@tue.nl (R.J.W. Sluis-Thiescheffer), m.m.bekker@tue.nl (M.M. Bekker), j.h.eggen@tue.nl (J.H. Eggen), a.p.o.s.vermeeren@tud.nl (A.P.O.S. Vermeeren), h.deridder@tud.nl (H. de Ridder).

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Greenbaum (1988) suggests that at a young age (under 8 years of age) boys and girls do not like each other enough to cooperate well in a design session. However, when they grow older to become teenagers, they may pay too much attention to each other thereby again disturbing the design sessions. As far as we are aware, Greenbaum's suggestion has not been investigated in relation to design studies. Reported observations in a design study with small groups of young children (two to three) used single-gender groups to begin with (e.g. Ruland et al., 2006; Scaife et al., 1997). In design studies with larger groups (e.g. Verhaegh et al., 2006; Bekker et al., 2003) this observation has not been reported as far as we know, neither was gender mentioned as a problem by Druin in "The design of children's technology" (Druin, 1999a). *Group size* is another point of attention. The advantage of designing with one child, or with a small group is that a sufficient amount of attention can be paid to each participant and less effort is required to structure the design session (Heary and Hennessy, 2002). *Power structures* could also play a role in design sessions. Power structures (like in an adult–child relationship) have an influence as some children are more likely to speak freely in for example friendship groups (Heary and Hennessy, 2002). However, the literature is not conclusive as power structures do not seem to have a negative effect when talking about technology (Pardo et al., 2005). Speeking freely and generating ideas in design sessions might be affected by *cultural differences*. For example Moraveji et al. (2007) indicates that the effectiveness of brainstorming with young children might be subject to cultural practices in rural China. Also the choice of involving children as *co-designers or informants* determines how design sessions are held. Druin (1999b) proposes to involve children in different roles, for example as co-designers, giving them responsibility over a part of the design process, e.g. in concept development or requirements gathering. As co-designers the children are actively involved. Scaife et al. (1997) report that children can better be involved as informants than as co-designers. As an informant the child is more distantly involved, for which different methods are more optimal than for a role as a co-designer. *Fun and motivation* is investigated in a study on the design method called KidReporter (Bekker et al., 2003). This study assumes that children who can choose from a set of design activities, will have more fun and show more motivation than children who cannot choose a preferred design activity. Looking into the *cognitive development* of children is suggested in studies by for example Antle (2007), Gelderblom (2004) and Wyeth et al. (2003). Especially in Gelderblom (2004) and Antle (2007) it is argued that designers need to be informed about the cognitive development of young children to reach informed design decisions when designing *for* children. However, the developmental issues raised in Antle (2007) and Gelderblom (2004) are not yet further developed into practical guidelines for how to design *with* children. This article describes the development of a framework, that matches children's capabilities to skills required for design activities. Inspired by theories from developmental psychology, the framework is a basis for creating hypotheses about the expected outcome of design methods in relation to the developmental characteristics of children in a specific age group.

1.2. Assessment of early design methods is not explicit enough

The studies on designing with *children* can also be improved in terms of better defined measures for the assessment of the output of *early design methods*. Early design methods are idea generation methods used early in the design process. In the early phases of design, the main objective is typically an exploration of the design space (Sas and Dix, 2006), a generative phase or information gathering phase (Sanders and Stappers, 2008) neatly summarized as the "fuzzy front end" of a design process (Sanders, 2005).

For *adult designers*, there are examples of measures for describing output of design sessions. For example MacLean et al. (1996) created a method to describe conversations between GUI-designers during a product development process. Another example is the work of Shah et al. (2003), who explain in much detail measurements to assess ideation effectiveness. In the field of designing with children, we only found examples of measures in studies on *usability evaluation methods*. For example the use of verbal or non-verbal behaviour in detecting usability problems is studied by Barendregt and Bekker (2005) and Donker and Reitsma (2004). We have not found such an explicit and replicable assessment of children's output for the early stages of design. This is coherent with Jensen and Skov (2005), who found that most research on designing with children is done on engineering and evaluation.

Bekker et al. (2003) studied the quality and the characteristics of the output of design methods, depending on the engagement of the children in KidReporter. Despite the systematic approach of the study, they only assessed the output by the implicit criteria of only one designer. Kelly et al. (2006) developed Bluebells to optimize the relation between designers and children as co-designers. They show that a more iterative involvement of children in short co-design activities is perceived by designers as more informative and/or inspirational, than one or two larger design sessions. Nevertheless, the criteria on which the designers decided that the activities were more informative or inspirational were not made explicit.

The present article applies the work on Questions, Options and Criteria of MacLean et al. (1996) to design conversations with children. MacLean et al. (1996) found that discussions between designers can be analyzed in terms of Options and Criteria. Olson et al. (1992) found that designers explore the design rationale by bringing up Options for a design solution and evaluating those Options by questioning them and evaluating them with Criteria (further referred to as the QOC-model). In designing with children, we assume the designer (a grown-up) to feed the design conversation with questions about design ideas. Although the children will inevitably ask each other questions too, we focus on the answers of the children. We explore whether the answers can also be described in terms of Options and Criteria and whether design methods have a measurable effect on the design conversations with children in terms of Options and Criteria.

1.3. Development and assessment of a framework for design sessions with children

Section 1.1 describes several studies that examined parameters affecting design sessions with children. However, these assessments were all based on the success of *the process*of designing with the children, rather than the success of *the output* of designing with children. Kelly et al. (2006) stress the importance of a framework that describes the effectiveness of different design methods and the context in which these methods are useful. Inspired by theories on developmental psychology, we take a developmental approach to propose a framework that describes design methods in terms of skills required for design. The framework uses terminology based on the Theory of Multiple Intelligences by Gardner (1999). By matching the skills required to execute a certain design method with the children's skills, we can create hypotheses about the suitability of design methods for particular age groups. In the following sections, the framework and its development process are presented. Furthermore we explain how the framework can be used to generate hypotheses to study the output of early design methods. Finally, the framework's use is illustrated with a study that compares the outcome of nominal-group-technique (NGT) sessions with the outcome of prototyping sessions.