

Measuring and comparing novelty for design solutions generated by young children through different design methods



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When involving children in the design process, it is important to understand the novelty of their design solutions. This paper reviews the applicability of an often cited novelty metric Shah et al. (2003) for the comparison of two design methods conducted with 8–10 year old children. The novelty metric is applied to data that is different for a number of parameters, such as a different design phase (exploratory instead of conceptual), size and variety. The results yielded by this novelty metric are not straightforward. This paper describes the difficulties encountered and introduces an alternative approach. The alternative approach leads to better results for any amount of data, for an exploratory phase. Additionally the paper explains how this approach increases the sensitivity for detecting differences in novelty when comparing design methods.

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Children are increasingly involved in the development of services and products. Since the beginning of this millennium, designing with children has become a recognized field, embodied in the annual ACM conference ‘Interaction Design and Children’ (since 2002). The field has reported many design methods that involve children in a design process (for example, [Druin, 1999](#); [Markopoulos, Read, MacFarlane, Hoysniemi, & Hysniemi, 2008](#)). The success of these methods has often been defined in terms of a successful process; reporting the parameters that keep children engaged and productive in generating ideas. Examples of such parameters are engagement and fun ([Bekker, Beusmans, Keyson, & Lloyd, 2003](#)), gender ([Hou, Komlodi, Lutters, Boot, & Cotton, 2006](#); [Stienstra, 2003](#)), group size ([Heary & Hennessy, 2002](#)) and power structures ([Heary & Hennessy, 2002](#);

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Pardo, Vetere, & Howard, 2005). The value of these methods in terms of the effectiveness of the ideas that children generate is often left unanswered. As the field of interaction design and children matures, it becomes relevant to evaluate the effectiveness of ideation methods for children. The purpose of involving children in the design process is, after all, to find innovative and relevant design directions for products that suit children in the best possible way.

Creativity is widely regarded as a key driver behind successful, innovative designs (Sarkar & Chakrabarti, 2011). The definition of creativity varies greatly and there is not one generally accepted definition. In the field of engineering design there is agreement over creativity as a problem solving skill (Galindo-Rueda & Millot, 2015; Hernandez, Shah, & Smith, 2010; López-Mesa, Mulet, Vidal, & Thompson, 2011). For a design solution to be regarded as a creative solution, novelty is considered a key aspect (Brown, 2014; Grace & Maher, 2014). Therefore, this paper focuses on novelty as a measure for creative value of design solutions. A method that inspires children to generate novel ideas is therefore considered more effective than a method that does not do that.

The proposed novelty metric in Shah, Vargaz-Hernandez, and Smith (2003) is part of a foundational and recognized work on ideation effectiveness. The work describes four metrics in total (novelty, variety, quality and quantity). The work of Shah et al. (2003) is widely adopted and has inspired researchers to propose further refinements and variations to the metrics, for example for the novelty metric (Hernandez et al., 2010; López-Mesa et al., 2011; Verhaegen, Peeters, Vandevenne, Dewulf, & Dufloy, 2011; Wilson, Rosen, Nelson, & Yen, 2010) and the variety metric (Nelson, Wilson, Rosen, & Yen, 2009). These refinements consider additional levels of novelty (Verhaegen et al., 2011), the types of expectedness in novelty (novelty, surprise and transformational creativity, (Grace & Maher, 2014)) or add an aspect of review in the process of determining the novelty of an artifact (Sarkar & Chakrabarti, 2011). Brown (2014) explored the metric for application in the field of computational creativity. He found however that the metric is limited to Engineering Design, mainly because of elements included in the metric that rely on human assessment.

This paper describes the application of this novelty metric to compare the design solutions generated by children using two design methods, the nominal group technique (a form of brainstorming) and prototyping. The data was generated in a study reported in Sluis-Thiescheffer, Bekker, Eggen, Vermeeren, and De Ridder (2011). Interestingly, the metric proposed in Shah et al. (2003) only seems applicable to small datasets. Using the large dataset from Sluis-Thiescheffer et al. (2011) revealed two problems with the metric,

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