



We walk the line: Icons provisional appearances on virtual whiteboards trigger elaborative dialogue and creativity



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ABSTRACT

Collaborative groupwork is a key creativity tool in industry. Digital Creativity Support Systems (CSS) have become a critical catalyst of distributed creative processes. Under laboratory conditions, this interaction design study uses an experiment to investigate the impact of apparent icon finishedness as a social affordance for elaborative dialogue, and enhanced creativity. The experiment examines the idea generation processes of 37 pairs of active managers using a synchronous CSS. Apparent finishedness is a purely presentational factor - it is completely separate from the actual substance of an idea. The results show that presenting ideas with icons made of sketchy natural lines with low perceived finishedness encourages elaborative dialogue and creativity. Low perceived finishedness icons functioned as a social affordance - they afforded the social behaviour of building upon each other's ideas as well as more creative idea generation. This is the first study to quantitatively examine the perceived finishedness of icons. This study shows that minor changes in visual treatments significantly impact creative processes and outcomes. As co-constructive interaction is central to many collaborative behaviours across working and learning, this study has clear implications for the subtle encouragement of co-construction in computer-mediated communication.

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1. Introduction

A growing number of practitioners prefer using Creativity Support Systems over meeting face-to-face (Samuel, 2015) - not only for logistical reasons, but also because "Brainstorming works better online" (Chamorro-Premuzic, 2015). However, the promise of a replenishing creative well is far from always realised (Espinosa, Cummings, & Pickering, 2012; Gibson & Gibbs, 2006). The interface which connects distant specialists is decisive. Experts' time is treasured, so bringing experts together in physical or virtual spaces is expensive (Rogelberg, Shanock, & Scott, 2011). CSS technologies have the potential to save much valuable time and unleash radical innovations. These are specialised software environments that enable collaboration on knowledge work in spite of geographic separation. Despite the best intentions, CSS designed to bring team members' thoughts together can actually keep them apart. As Kreijns, Kirschner and Vermeulen state "Simply enabling social interaction is not enough, it must be stimulated" (2013: 230). With

this in mind, this study investigates the visual appearance of ideas on virtual whiteboards as a social affordance for elaborative dialogue in computer-mediated ideation and a means to increase the quality of creative output.

To generate creative ideas, project teams now knit together knowledgeable specialists from around the globe. The combination of disparate ideas is a key contributor to creativity (Koestler, 1964; Thagard & Stewart, 2011) so the cognitive diversity of distributed experts promises high potential creativity. The precise mechanism at work is the combination of highly diverse ideas which results in highly original, but often unfeasible ideas (Chan & Schuun, 2015). Iterative modification rounds bring feasibility to these original ideas (Chan & Schuun, 2015). Iterative modifications of ideas are fostered by elaborative dialogue - the combinatory motor which enables the emergence of ideas that are simultaneously highly unique and feasible. Hogan, Nastasi and Pressley succinctly describe elaboration as "a gauge of the amount of detail that is added to subtopics that are brought up" (1999: 398). Within the scope of this study, elaboration is externalised engagement with the ideas of others.

The heart of this study examines the apparent finishedness of ideas' presentation functioning as a social affordance (Kreijns,

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Kirschner, & Vermeulen, 2013) – an invitation to socially interact and elaborate on each other idea – in CSS. The visual, presentational factor is a completely separate dimension to the actual substance of an idea. An object's appearance of being finished or unfinished is a matter of perception, therefore the term "Perceived Finishedness" (PF) is used (Bresciani & Eppler, 2013). Anything regarded as being finished dissuades change from its current state.

The aim of the present work is to investigate whether the sketchy visual appearance of ideas on a virtual whiteboard can prompt distributed dyads to start building on each another's ideas. This study is a direct answer to calls for research by Kreijns et al. (2013) and Michinov, Jamet, Natacha, and Le Hénaff (2015) into effective social affordances and idea exposure as stimulation. The specific research question is: Does the perceived finishedness appearance of icons used as placeholders of ideas positively affect creativity and the amount of elaborative dialogue during computer-mediated ideation?

The research question is investigated through a lab experiment with 74 subjects. Results show that elaborative dialogue and creativity can be encouraged by presenting ideas in a less finished manner. Indeed, this study drills down to identify the type of line to use in order to promote the elaboration of ideas and their creativity. This is a simple means for practitioners to increase elaborative dialogue and creativity levels in computer-mediated communication.

The paper is organized as follows: the next Section introduces the study literature background and hypotheses. The third Section presents the experimental methodology, while the fourth Section is a presentation of the results, before their significance and relevance to practitioners and researchers is discussed in the fifth Section.

2. Background and hypotheses

The visual triggering of elaborative dialogue and creativity in distributed creative work is an unstudied area which lies at the intersection of research on CSS, group creativity (Glăveanu, 2011), and visualisation (Eppler, 2013). CSS has come to refer to "computer-based systems that support individual- and group-level problem solving in an effort to enhance creative outcomes" (Garfield, 2008, p.746). Group level CSS offer software environments where more than one user can interact. User behaviours and interactions are "embedded in and shaped by" the material context of CSS (Gaver, 1996, p. 111). Ideally, creativity should arise in two-way interaction between CSS technology, users and their ideas (Peschl & Fundneider, 2014).

2.1. Perceived finishedness

Interaction via CSS is unescapably visual (Zhang & Norman, 1994). Externally visualising a thought widens the possibility of reflection upon it – by ourselves or others (Schön, 1983). An externally-visualised thought could vary along a multitude of visual dimensions: differences in one or some of these dimensions could lead to changes in interactional patterns (Bresciani & Eppler, 2013; Bresciani, Blackwell, & Eppler, 2008). Bresciani and Eppler (2013) have developed a theoretically-based framework of the collaborative dimensions of visualisation, which describes seven key factors of visualisation that impact on collaboration. The dimension of Perceived Finishedness (Bresciani & Eppler, 2013; Bresciani et al., 2008) is particularly relevant for the context of creativity because the finishedness appearance of an idea invites or hinders elaboration. Visual cues suggest whether an object appears unfinished and possibly in need of completion or if it appears finished and is thus not to be tampered with (Bresciani & Eppler, 2013; Bresciani et al., 2008). This presentational factor runs without regard, or even

contrary, to actual potential for modification.

Sketches exemplify low PF. Low PF is interpreted as elasticity, provisionality or modifiability (Bresciani & Eppler, 2013). High PF is interpreted as static rigidity. Engineering schematics exemplify high PF. The vast majority of corporate communications to the general public, such as advertising, use high PF.

PF is theorised to influence a group willingness to interact, question or modify a notation (Bresciani & Eppler, 2013). This concept is based upon the work of Green and Petre (1996), Ewenstein and Whyte (2007), Tversky (2005), and Whyte, Ewenstein, Hales, and Tidd (2007). It was observed that using a sketchy style, even highly thought-out engineering plans can convey low PF (Henderson, 1991), and give the impression that they can be improved upon. Whyte et al. (2007) respectively refer to fluid versus frozen objects to describe the low and high perceived finishedness of visualizations they observed in their ethnographic study.

Oldham and Da Silva (2015) have recently pointed out the value of feedback in a diverse environment; however the impetus to give feedback or modify an idea is surprisingly delicate. Plimmer and Apperley (2005) found empirical evidence that groups designing digital forms revised more often when given a sketchy low PF form than a tidy high PF form.

It is not enough for virtual whiteboards to make ideas permanently accessible (Suthers, 2001), they must also invite interaction. Low PF interfaces can invite interaction. Previous research has found that social interaction is otherwise difficult to invoke via mnemonics (Hausmann, 2005) and self-aware behavioural management (Sweller, 1988). The social affordance of low PF icons cannot be ignored or forgotten, because it is an implicit cue that sets the tone of interaction. Affordances (Gibson, 1977) are properties of an object within its environment that invite a particular action. Social affordances invite social interaction. Kreijns, Kirschner and Vermeulen state that "When perceived, social affordances may initiate, encourage and sustain social interaction" (2013, p. 233).

At a fundamental level, writing and diagrams on virtual whiteboards consist of white space, dots and lines (Bradley, 2013). Low PF computer- and hand-drawn knowledge recordings share one common central presentational factor which separates them from more formal, finished-looking visuals – natural lines.

Line ontologies distinguish between natural and artificial lines (Bradley, 2013). Fig. 1 gives an example of an artificial and a natural line. Natural lines are imperfect; artificial lines are absolutely straight and uniform in width. Bradley writes that "Long perfectly even lines feel artificial. Nature is not perfectly straight. The more variation a line has, the more natural it feels" (2013, p. 61). Natural lines convey lower PF than artificial lines. By their very nature, sketches employ natural lines.

As the figure illustrates, artificial lines are perfectly uniform while natural lines contain irregularities. Natural lines have low PF, artificial lines have high PF.

Current studies on perceived finishedness are either theoretical (Bresciani & Eppler, 2013; Tversky, 2005) or based on qualitative or ethnographic methodologies (Ewenstein & Whyte, 2007; Henderson, 1991; Stigliani & Ravasi, 2012; Whyte et al., 2007). No empirical studies have yet tested the theorized Perceived Finishedness effect: this study aims to start filling this research gap by conducting an experiment to test the effects of Perceived Finishedness on elaborative dialogue and creativity within a CSS.

2.2. Effects of perceived finishedness on creativity

Creativity is widely understood to constitute the production of ideas which are original, feasible and instrumental. In other words

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