How can Computers Support, Enrich, and Transform Collaborative Creativity?

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Abstract
The aim of the workshop is to examine and discuss how computers can support, enrich, and transform collaborative creative processes. By exploring and combining methodological, theoretical, and design-oriented perspectives, we wish to examine the implications, potentials, and limitations of different approaches to providing digital support for collaborative creativity. Participation in the workshop requires participants to actively document and identify salient themes in one or more examples of computer-supported collaborative creativity, and the resulting material will serve as the empirical grounding for workshop discussions.

Author Keywords
Creativity Studies; Computer-Supported Creativity; Collaborative Creativity; Ideation; Design.

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

Introduction
How do digital tools influence and transform collaborative creativity?
Many work practices in the creative industries are

Workshop format

We propose a highly participatory workshop with short and concise presentations and several group work sessions.

We will begin with short cycles of case/methods presentation (10-15 minutes each), focusing on insights and findings from the obligatory documentation and study of salient themes in one or more examples of computer-supported collaborative creativity. This is followed by joint discussions in which we identify and articulate key themes, challenges, and potentials. After this, a rapid explorative design exercise, in which groups of participants develop a concept for a novel tool or system based on the discussions. We will end with a dialogue on how to establish a community around the topic of collaborative creativity support, and on the potentials of editing a special issue on the topic.

collaborative, as professionals with different competences and roles work towards a shared goal. Digital tools play an increasingly central role in this domain, in which they have transformed many practices of collaborative creative work in disciplines such as design, fashion, and architecture. As digital tools evolve, so do creative practices, and the two become increasingly intertwined. For instance, many designers now use digital sketching, 3D modelling software, hardware prototyping, and 3D printing as an integral part of their creative work processes. In spite this, we have limited knowledge of how and why collaborative creativity, for better or worse, is influenced and transformed by digital tools.

We tend to focus on the new opportunities afforded by digital tools, but they also bring new challenges, especially because they often offer poor support for collaborative creative work. Firstly, many of these tools have been developed with insufficient understanding of the creative processes in which they are employed; secondly, they have predominantly been designed to support individual use, rather than collaboration. For instance, very few digital tools directly support collaborative creative sessions such as joint concept development, and most of the software that designers use for sketching, modelling, and prototyping only allows one person using one computer to work on a file at a time; sharing it with others implies a string of tasks that break the creative flow. Although the creative industries are a major driver of growth [7], research into the role and nature of digital tools in collaborative creativity in professional practices is scarce and scattered. In short, *we know little about how, when, and why digital tools hinder and/or benefit collaborative creativity*, and as a result, digital tools employed in practice are seldom well-suited to support collaborative creativity. While this is clearly problematic, it also represents a highly relevant research challenge with potential for major impact.

In this workshop, we will therefore explore and combine methodological, theoretical, and design-oriented perspectives in order to examine the implications, potentials, and limitations of different approaches to providing digital support for collaborative creativity.

Related Work

Guilford's address to the American Psychological Association [10] is widely regarded as the beginning of modern creativity studies. It resulted in a series of studies that predominantly examined creativity as an individual, cognitive capability - an "intramental" perspective, in the terminology of Gedenryd [9]. The primary research approach was to study these capabilities through problem-solving tests in controlled lab experiments. In the 1980s and 1990s, a new wave of research emerged, looking beyond the individual in isolation and towards cultural and social aspects of creativity [1;3]. Along these lines of research, studies into collaborative ideation shows the potential of joint ideation and demonstrates that creative processes shift between individual and collaborative phases [4;11]. Related studies have demonstrated that team-based creativity holds great, yet underexplored, potential [23], and that individual and social creativity can be beneficially combined [8]. A prominent theoretical influence in this work has been the development of the *distributed cognition* perspective [14], which posits that cognition can be studied as a phenomenon distributed

across people, environment, and tools, rather than as a solely individual and intramental property.

Much research in IT-supported creativity focuses on the properties of specific products and systems, rather than on how use of these tools unfolds in practice, but there are notable exceptions, including work from prominent figures in the *Creativity and Cognition* community [e.g. 6;15;24]. In terms of studying collaborative IT in practice, the field of Computer-Supported Cooperative Work (CSCW) specifically examines how IT can support joint work. This includes creative aspects of collaborative work, e.g. joint sketching [12] and design meetings [13]. While this field has yielded many insights into the interplay between IT and collaboration, the fact remains that in practice the vast majority of IT systems have been developed as single-user interfaces on individual devices. Even the most widely known collaborative tool, Google Docs, is in essence a single-user interface akin to Microsoft Word overlaid with functions for collaboration.

However, recent pioneering work on *Blended Interaction* [17] shows the potentials of supporting more dynamic flows between individual and collaborative interfaces. Similarly, *Shareable Dynamic Media* [19], demonstrates the feasibility of creating web-based tools, in which collaboration is the norm rather than the exception. These approaches are initially aimed at supporting team collaboration, whereas other studies have explored the potential of systems and processes that in various ways enable and exploit crowd-sourcing in creative processes. One such example, which combines individual and collaborative efforts, is found in *Ensemble* [18], a web-based collaborative writing system that employs crowd-sourcing input based on a lead authors prompts. Chan et al. [2] have similarly examined how facilitators can improve crowd-based creative processes, and Luther et al. [21] have demonstrated the benefits of crowd-sourcing design critique to improve designers' work.

In our own work, we have among other things developed digital ideation support systems such as *iCard*, a multi surface collaborative ideation system, the *Process Reflection Tool* [5], an online system for documenting and collaborating on creative design projects, and explored and developed novel formats and setups to support collaborative design and involvement of end users, e.g. via *Dialogue Labs* [20].

Key themes and questions of the workshop

Based on the themes identified in related work, and on our findings from previous and ongoing research projects, we propose to explore the following four themes pertaining to methodological, theoretical, use-oriented, and design-oriented challenges. We remain open to incorporating further themes from participants based on their position papers.

1) *Studying computer-supported collaborative creativity*. Studying computer-supported collaborative creativity entails *methodological challenges*. Which study approaches are apt for capturing and analysing collaborative creativity? How can we identify the particular role that a digital system or tool plays in the process? How can we study creative processes of different time spans, e.g. a single ideation event vs an entire creative project? How do we examine the use and impact of tools in collaborative and distributed processes, as opposed to an individual's use of a tool? Which questions do we ask when studying such tools,

Participants and selection criteria

Maximum number of participants: 25. Participants will be selected on the basis of the position papers (2- 4 pages) described in the *How to Participate* section.

Duration: 1 full day.

Announcement and recruitment: The workshop will be announced on a dedicated website providing a more thorough description potential tools for documenting design processes, and on mailing lists (CHI Announcements, PhD Design List, etc.). Furthermore, the organisers will actively recruit participants through their networks in the HCI community.

Required facilities: The workshop requires no special facilities beyond a standard room for joint work, and adjacent facilities for break-out groups.

and how do we pose them? How do we study the potential effects of a novel system at a prototype level, as opposed to studying existing systems that are well incorporated into use situations? How can we productively combine methods to study collaborative creativity in controlled settings (in vitro) and in real-life situations (in vivo) [26]?

2) *Understanding the role and nature of digital tools in collaborative creativity*. Understanding the role and nature of digital tools in collaborative creativity entails *theoretical challenges*. Which theories can we build on when we seek to understand such tools? To which extent can we lean on existing frameworks in HCI - many of which are arguably oriented towards functional aspects [22] and may have little to say about creative processes - and to which extent is there a need to import or develop novel perspectives? Are there well-developed strands of theory outside of the normal scope of HCI research that are particularly apt for these purposes?

3) *Transitions and dynamics between individual and collaborative work*.

Co-located collaboration in creative industries is often mixed-focus collaboration [25] and transition between phases of tightly coupled collaboration between team members and loosely coupled parallel work during which individuals pursue own approaches or prepare their personal contributions to the joint effort [16]. This entails a number of use-oriented challenges when it comes to the transitions and dynamics between individual and collaborative work. How can we support the interplay between these different modes of activity, and how can we help creatives transition between them? In many real-world practices, creative collaboration is a distributed, concurrent, and sometimes seemingly chaotic activity that eludes predefined sequences or rigid application structures. Is it possible to accomodate messy and unpredictable processes, and how? What is the role of spatial cognition and physical movement in space for individual and collaborative interaction? Also, which novel modes of collaboration do digital tools enable, e.g. crowd-sourcing, and how can we (re)design creative processes to accomodate them?

4) *Mimicking existing tools and approaches and/or developing novel ones*.

Creative work is often built around well-established processes and routines, and novel tools and approaches must build on a thorough understanding of how and why existing processes and structures work, and how they are embedded into the spatial and social structures of the studio. This presents us with a series of *design challenges*. When and how is it feasible and desirable to replace existing tools with novel digital ones, and when is it preferable to provide novel tools as supplements to existing practices? How can we - and when should we - create hybrids of existing and new tools? How do we involve creative professionals and domain experts in the design of new systems? Many existing collaborative creative work practices to a large extent relies on analogue tools, such as pen, paper, sticky notes, and whiteboards. What makes these tools so well suited for these processes, and what are the good strategies for finding the proper mix of analogue and digital tools?

Organizers


Peter Dalsgaard


Nanna Inie


Nicilai Brodersen Hansen

How to participate

The workshop requires participants to commit to capturing and documenting one or more cases in which digital tools have been employed to support collaborative creativity. This documentation forms the basis for the presentations during the workshop and grounds the subsequent discussions. In order to participate, interested parties must therefore do the following:

1) Submit a proposal (2-4 pages SIGCHI Extended Abstracts Format) describing the case to be documented, the project or institutional/organizational frame (e.g. at which institution or company is it carried out and what partners are involved), the focus of the case (for instance, how a novel multi-surface tool can support collaborative ideation; how skilled practitioners have adapted a tool to fit specific needs in a work practice; how an online system has opened up new opportunities for crowd-sourced concept development, etc.), and the method and strategy for documenting the project.

2) Participants must then document the case as outlined in their proposals. This work forms the empirical data for the workshop.

Organizers

Peter Dalsgaard is an Associate Professor at Aarhus University. His work combines practice-based experimental interaction design projects and theoretical developments aimed at understanding and developing digitally enhanced tools and spaces that help people create and innovate. He is the PI and director of three major research projects that explore the role of digital tools in creative processes: *CoCreate, Creative Tools,* and *PLACED*. He has published a series of conference and journal articles on creativity and design, and has extensive experience in organising research workshops, and has been the organiser of workshops at e.g. *Creativity and Cognition*, *CHI*, and DIS.

Nanna Inie is a PhD student on the project *Creativity in Blended Interaction Spaces*. Her work focuses on understanding the emergence and transformation of design ideas. This includes studies and surveys of real-life creative work practices as well as controlled studies of particular forms of ideation and concept development techniques.

Nicolai Brodersen Hansen is a Postdoc in the project *Creativity in Blended Interaction Spaces*. His research focuses on design materials and their role and nature in design processes, particularly in Participatory Design. His research is published in venues such as DIS, NordiCHI, CoDesign, Communities & Technologies, and the International Journal of Human-Computer Studies.

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References

1. Amabile, T. (1983). *The social psychology of creativity.* New York: Springer-Verlag.
2. Chan, J., Dang, S., & Dow, S. P. (2016). Improving crowd innovation with expert facilitation. In *Proceedings of the 19th ACM Conference on Computer-Supported Cooperative Work & Social Computing* (pp. 1223-1235). ACM.

3. Csikszentmihalyi, M. (1988). Society, culture, and person: A systems view of creativity. In R. J. Sternberg (Ed.), *The nature of creativity* (pp. 325–339). New York: Cambridge University Press.
4. Dalsgaard, P., Halskov, K., & Nielsen, R. (2008). Maps for design reflection. *Artifact*, 2(3-4), 176-189.
5. Dalsgaard, P., & Halskov, K. (2012, June). Reflective design documentation. In *Proceedings of the Designing Interactive Systems Conference* (pp. 428-437). ACM.
6. Edmonds, E.A. and Candy, L. (1996) Computer support for concept engineering design: Enabling interaction with design knowledge. Journal of Systems Engineering and Electronics 7, 2 (1996), 55--71.
7. EY (2014): *Creating growth: Measuring cultural and creative markets in the EU.* Accessed online 2016-10-15 at http://www.creatingeurope.eu/
8. Fischer, G., Giaccardi, E., Eden, H., Sugimoto, M., & Ye, Y. (2005). Beyond binary choices: Integrating individual and social creativity. *International Journal of Human-Computer Studies*, 63(4), 482-512.
9. Gedenryd, H. (1998). *How Designers Work*, Sverige, Lund University Cognitive Studies.
10. Guilford, J. P. (1950). Creativity. *The American Psychologist, 5,* 444–454.
11. Halskov, K., Dalsgaard, P. 2007, "The Emergence of Ideas", CoDesign – International Journal of CoCreation in Design and the Arts, vol. 3 no. 4, pp. 185 – 211.
12. Harrison, S. (Ed.). (2009). *Media space: 20+ years of mediated life*. Springer Science & Business Media.
13. Herrmann, T. (2010). Support of collaborative creativity for Co-located Meetings. In *From CSCW to Web 2.0: European Developments in Collaborative Design* (pp. 65-95). Springer London.
14. Hutchins, E. (1995). *Cognition in the Wild*. MIT Press.
15. Jacucci, G., & Wagner, I. (2007). Performative roles of materiality for collective creativity. In Proceedings of 6th ACM SIGCHI conference on Creativity & cognition, ACM, 73-82.
16. Jetter, H. C., Gerken, J., Zöllner, M., Reiterer, H., & Milic-Frayling, N. (2011, May). Materializing the query with facet-streams: a hybrid surface for collaborative search on tabletops. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 3013-3022). ACM.
17. Jetter, H. C., Reiterer, H., & Geyer, F. (2014). Blended Interaction: understanding natural human–computer interaction in post-WIMP interactive spaces. *Personal and Ubiquitous Computing*, 18(5), 1139-1158.
18. Kim, J., Cheng, J., & Bernstein, M. S. (2014). Ensemble: exploring complementary strengths of leaders and crowds in creative collaboration. In *Proceedings of the 17th ACM conference on Computer supported cooperative work & social computing* (pp. 745-755). ACM.
19. Klokmose, C. N., Eagan, J. R., Baader, S., Mackay, W., and Beaudouin-Lafon, M. (2015). Webstrates: Shareable Dynamic Media. Proceedings of ACM User Interface Software and Technology 2015.
20. Lucero, A., Vaajakallio, K., & Dalsgaard, P. (2012). The dialogue-labs method: process, space and materials as structuring elements to spark dialogue in co-design events. *CoDesign*, *8*(1), 1-23.
21. Luther, K., Tolentino, J. L., Wu, W., Pavel, A., Bailey, B. P., Agrawala, M., & Dow, S. P. (2015). Structuring, aggregating, and evaluating crowdsourced design critique. In *Proceedings of the 18th ACM Conference on Computer Supported*

Cooperative Work & Social Computing (pp. 473-485). ACM.

22. Rogers, Y. (2004). New theoretical approaches for HCI. *Annual review of information science and technology*, *38*(1), 87-143.
23. Sawyer, R. K. (2008). *Group genius*: The creative power of collaboration. Basic Books.
24. Smith, S.M., Linsey, J.S., Kerne, A. (2010). "Using Evolved Analogies to Overcome Creative Design Fixation." Proceedings of Design Creativity 2010, 35-39.
25. Tang, A., Tory, M., Po, B., Neumann, P., & Carpendale, S. (2006, April). Collaborative coupling over tabletop displays. In *Proceedings of the SIGCHI conference on Human Factors in computing systems* (pp. 1181-1190). ACM.
26. Wiltschnig, S., & Onarheim, B. (2010). Insights into insight-How do in-vitro studies of creative insight match the real-world complexity of in-vivo design processes. In *Design Research Society International Conference*.