Crowd-powered Creativity Support Systems

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ABSTRACT

Crowdsourcing has great potential in supporting humans to be more creative. This doctoral dissertation explores *crowd-powered creativity support systems* and covers a research arc from the fundamental prerequisites of leveraging crowds for creativity support to an accompanying set of case studies to clarify how complex creative work can be supported in practice.

CCS CONCEPTS

• **Human-centered computing** → *Interactive systems and tools*; • **Information systems** → *Crowdsourcing*.

KEYWORDS

creativity support systems, crowdsourcing, creativity

1 INTRODUCTION

Crowdsourcing has been applied in a great number of applications, from finding cures for lower back pain [7] to supporting weight loss [8]. Since humans excel in divergent thinking, recombination, analogical transfer, and other fundamental characteristics needed for creativity, crowdsourcing has great potential in supporting creativity [10]. Supporting human creativity has been considered as one of the grand challenges of human-computer interaction [26].

And indeed, many studies and experiments in academia and industry routinely tap into the creative ability of the crowd, either for creativity-directed research or for simply eliciting ideas and creative artifacts from a large group of people [6]. However, the ability and willingness of the crowd to participate in creative work and creative experiments is largely unquestioned by the academic community. Insights into the crowd workers' perspectives are rare, but important, as they may inform the design of studies with higher validity. It is imperative to develop an understanding of what crowd workers, as one of the primary stakeholder groups of crowdsourcing platforms, think about creative work. Such insights may inform the design of online systems and tools that rely on *crowd-powered creativity* [22, 24]. Much is to be learned about how the crowd perceives creative tasks and experiments, and what could be done to optimize such studies.

The research is motivated by the growing trend towards automation and a concern about the effect of artificial intelligence (AI) on the future work force. Creativity is what makes us human, and machines fail to epitomize creativity. Machines can interact with us in human-like ways, but they cannot tell whether a photograph is aesthetically pleasing, whether a painting will elicit feelings, or whether there is a deeper meaning behind a creative artifact. Creativity is thus one of the key skills that will secure human's place in future value chains. Research on human-centered AI [27], interactive machine learning [5] with a "human in the loop", human-machine-interaction [14], and hybrid AI [2] highlights the need of involvement of humans in future work flows, as a source of sentient human control in AI systems.

This research project explores the design space of *crowd-powered creativity support systems* [22] in two separate parts (see Figure 1). The first part (papers I–IV) investigates the crowd worker's perspective of creative work on crowdsourcing platforms. The findings from this part affect the requester's pre-ideation activities of outsourcing creative work (i.e., planning a crowdsourcing campaign, selecting the right crowdsourcing platform, and designing the task). The second part (papers V–VII) explores crowd-powered creativity support systems in three case studies.

2 RELATED WORK

Creativity. In this work, creativity is viewed as a domain-general concept. We follow the sociocultural view of creativity [1]. From this perspective, an idea or an artifact is considered creative if it is *novel* (or synonyms thereof, such as unique, original) and *appropriate* (or useful, effective) for a given domain, as judged by the domain's gatekeepers (the "field").
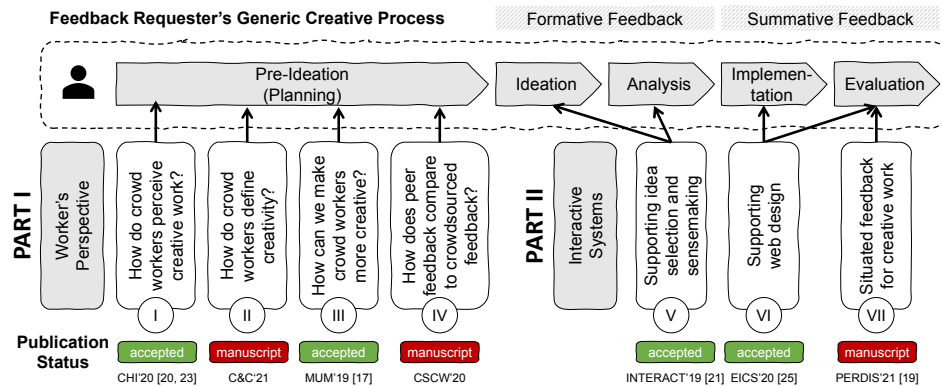
Figure 1: Structural overview of the research project.

Crowdsourcing. Crowdsourcing has become part of the toolkit of many researchers as a means for cost-effectively recruiting study participants and conducting experiments online. Our work focuses on investigating creativity on *general-purpose crowdsourcing platforms.* On these platforms, requesters publish tasks for an anonymous crowd to complete in exchange for a small monetary reward [9]. Other crowdsourcing platforms created for the specific purpose of eliciting creative works and ideas, such as Teefury, 99Designs, and many others, are out of scope of this work.

Crowd Feedback for Creative Work. Crowd feedback systems are computer-mediated systems that enable creative individuals to collect feedback and critique from a large number of people online [12, 15, 18, 30]. The present research project investigates the application of crowd feedback systems for supporting the creative process of the feedback requester. To this end, we adapt a generic model of the requester's creative process [31]: ideation (i.e., idea generation), analysis (e.g., idea selection and making sense of alternatives), implementation, and evaluation. In addition, we place emphasis on the early stages of the creative process, and extend the creative process model with pre-ideation activities, as found in the process typology in [6]. We acknowledge that this creative process is often iterative in practice and may evolve over time [3]. In this work, the generic process model serves as an overall framework along which we observe and investigate the crowd worker's perspectives in several creative activities.

3 CROWDSOURCING CREATIVITY SUPPORT

The remainder of this paper briefly presents completed studies (papers I and III) and systems (papers V and VI), followed by an outlook on future studies (papers II, IV and VII).

How do Crowd Workers perceive Creative Work? (I)

Resentment towards creative work and pre-exposure to common creative tasks could negatively impact the validity of creativity studies and crowd-powered creativity support systems. In this work [20, 23], we explored what crowd workers think about creativity on two general-purpose crowdsourcing platforms: Amazon Mechanical Turk and Prolific. To the best of our knowledge, our work contributed the first worker-centered qualitative study of creative work on general-purpose crowdsourcing platforms.

The Study. We launched a survey task on the two crowdsourcing platforms. A mixed-method analysis of the workers' responses ($N = 215$) allowed us to develop complementary insights into creative work on the two platforms and a sense for different archetypal worker profiles.

Findings. Among other findings, we identified several archetypes of workers with different preferences and motivations for creative work. For instance, we found that professional crowd workers may have a negative attitude towards creative tasks. Different types of workers thus require different strategies for crowdsourcing creative work. Further, we found evidence that the overwhelming majority of workers (90%) in our sample preferred to work alone. Collaborative work flows have been researched in prior literature and some were found to be superior to non-collaborative work. Our finding stresses the need for careful design of the task and experiment, as enforced cooperation may cause issues in crowd-powered creativity support systems. Last, we found that some general-purpose crowdsourcing platforms may be more suitable for creative work than other platforms. The above findings highlight the need for novel mechanisms for recruiting workers interested in creative work.

Augmenting Creativity of Crowd Workers (III)

Microtask crowd work can be monotonous and repetitive and workers may not be "in the mood" for creative work. Prior research found that looking at a problem through the lens of a different person may lead individuals to be more creative [11, 13, 28]. In this work [17], we investigated the use of

roles in stimulating the divergent thinking of individuals in two complementary studies.

The Studies. In the first study, we implemented an online instrument for priming workers with roles and images, and recruited crowd workers ($N = 60$) to complete a divergent thinking task while assuming a role. In the second study, we observed the effect of roles on the ideation process of individuals when they reach an impasse in the flow of ideas.

Findings. In contrast to prior work, our analysis could not confirm computational priming having a significant effect on the outcome of a small batch of creative tasks. Our findings highlight that adopting roles can be an effective tool when creative individuals run out of ideas, but roles are not a silver bullet for improving divergent thinking.

4 CREATIVITY SUPPORT SYSTEMS

This section provides a brief overview of two crowd-powered creativity support systems created in this research project.

CrowdUI: Supporting Web Design (VI)

CrowdUI [25] is a crowd-powered creativity support system that enables the community of a website to visually provide feedback to the designer of the website, using the website itself as a canvas. Website visitors can directly modify (move, delete, resize) the elements of the web page. CrowdUI's multi-step process includes a tutorial to familiarize the user with the tool, as well as a peer review stage in which users rate other users' creations. The system allows designers to inspect the individual modifications of the user interface, and also provides further decision support by visually aggregating user modifications in heatmaps. The system was evaluated in a study with 45 users and 60 web developers with promising results.

GAS: Supporting Search and Exploration (V)

We designed and tested an intervention [21] to support writers in finding and exploring different ideas for a writing piece. The lightweight system draws on a crowdsourced database and supports complex searches for information, that is, searches with at least two criteria, through a faceted filtering interface. Our study compared the system to Google Search and found the system provides its users with support for exploring an information space and selecting ideas.

5 FUTURE WORK

The following three sections describe future work in the context of this research project.

How do crowd workers define creativity? (II)

We will provide an in-depth exploration into how crowd workers on general-purpose crowdsourcing platforms conceptualize creativity. A conceptual gap between how workers conceive creativity and how requesters of creative work (often implicitly) define creativity may potentially impact the validity of creativity studies and creativity support systems. Ideally, this conceptual gap should be minimized.

Crowdsourced Feedback versus the Classroom (IV)

We will investigate the perceived usefulness and fairness of crowdsourced feedback in the context of an undergraduate design course. The study will add to the body of knowledge of applying crowd feedback systems in education [4, 29]. The aim of this study is to contextualize crowdsourced feedback and creativity support within a realistic design context.

SIMPLEX: Situated Feedback on Public Displays (VII)

While the willingness of situated workers to contribute to a task has been investigated (e.g., [16]), the willingness of a situated worker to provide summative feedback for creative artifacts has received little attention. With our third system, we will explore a situated system for supporting creative individuals with crowdsourced feedback for digital artifacts on public displays. The project aims to investigate the interplay and communication between feedback requesters and the situated crowd. In a preliminary needfinding study [19] with two artists and 12 users, we evaluated eight different types of feedback. We found a preference for simple feedback mechanisms on the side of the users, and identified the problem of making sense of many different feedback items as one of the key challenges for the requester of crowdsourced feedback.

6 CONCLUSION

Our work helps researchers and industry professionals who wish to harness the inherent convenience and power of crowdsourcing platforms in creativity-oriented studies and crowd-powered creativity support systems.

This research aims to advance our understanding of how complex and subjective creative work can be supported with a distributed non-expert crowd of anonymous workers. The work contributes towards defining crowd-powered creativity support systems as a research area within Human-Computer Interaction (HCI) and Engineering Interactive Computing Systems (EICS).

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