Creativity-Oriented HCI

From Classic Approach to LLMs-based CSTs

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ABSTRACT

Human-Computer Interaction (HCI) has incorporated creativity as a research domain, supported by digital tools, such as Creativity Support Tools (CSTs). However, with the rise of Generative Artificial Intelligence (GenAI), especially Large Language Models (LLMs), the creative process and support tools require reinterpretation. Our work articulates the foundations of CSTs through the creative process assisted by LLMs. The analysis emphasizes the importance of maintaining human agency throughout the process, even when collaborating with the machine.

CCS CONCEPTS

• Human-centered computing → Human computer interaction (HCI) → HCI theory, concepts, and models

KEYWORDS

HCI Research, Creativity, Creative Process, Human-Centered Artificial Intelligence, Large Language Models

1 Introduction

The field of Human-Computer Interaction (HCI) has been evolving, encompassing several directions, such as human environments in intellectual work [1] and various dimensions, including experience, emotion, and, more recently, creativity [2], reflecting the multidisciplinary nature of the HCI community [3]. In this sense, creativity is no longer an exclusive domain of psychology and has become recognized in the HCI field through research that operationalizes creative processes through technology. In the 2000s, Ben Shneiderman [4, 5] investigated technology as a means of supporting creativity, introducing Creativity Support Tools (CST)—systems that enhance both divergent and convergent thinking, promoting the creative process during problem-solving or task-solving [5]. Currently, with the emergence of diverse technological approaches (such as Artificial Intelligence) and their impact on creative work, it is essential to revisit these classic contributions. We reframed creativity-oriented HCI in light of generative technologies, which offer the ability to expand the original CST principles proposed by Ben Shneiderman, including transformative opportunities during the creative process, practical transformation through human-machine collaboration, and new challenges during interaction with the tool and in the design itself.

2 Background

Some visionary thinkers [6, 7, 8, 9] have explored the potential to enhance human creativity over the decades, but in a theoretical way. A significant contribution to this shift was the GENEX framework proposed by Shneiderman [4], which comprises four phases (Collect, Relate, Create, Donate) that foster both personal and collaborative creativity, forming the basis of CSTs [5].

The following design principles guide these technological tools: support exploratory search - encompasses prior knowledge that can be obtained through faceted search (compact visual cues) and dynamic queries (incremental and reversible exploration); enable collaboration - intermediate stage (supporting trust, accurate records, and secure exchanges) and advanced stage (validating results through appropriate testing and disseminating results to preview audiences and media partners); provide rich history-keeping - discovery and innovation processes take many forms, requiring a history of solutions and learning from previous patterns; Design with low thresholds, high ceilings, and wide walls—levels of complexity based on user expertise and the presentation of various functionalities (data entry, analysis and statistics, report generation). However, these principles have limitations. We observe static interfaces, time-consuming data analysis, and a lack of clear, step-by-step guidance, which contribute to lengthy and sometimes incomplete creative processes.

Considering these key designs and observed limitations, it becomes essential to analyze the evolution of CSTs in light of contemporary approaches, the LLM models, and how they redefine and expand CSTs and support the creative process.

3 LLMS and the Evolution of CSTs

Based on technological evolution, a new approach has emerged that integrates contemporary technologies (AI) with HCI, resulting in the synthesis of Human-Centered Artificial Intelligence (HCAI) [10]. This approach emphasizes a symbiotic relationship focused on algorithms that better meet human needs and simplify workflows, aligning with the advancement of HCI

to promote human efficiency and predictability during the creative process.

Within this rapidly evolving paradigm, LLMs have significantly impacted the creative process, demonstrating capabilities ranging from simple text production to code writing, while also being innovative and creative [11, 12]. This autonomy guides and collaborates with human users through the cognitive spaces of the creative process—divergent and convergent thinking [13]—expanding the principles of CSTs by generating diverse alternatives in real-time, transforming collaboration through human–AI co-creation, and enhancing contextual learning capabilities (see Table 1).

CST Principle	Principle Reinterpretation	LLM Application
Support Exploratory Search	Facilitate broad exploration through rapid and diverse generation of ideas and alternatives.	Real-time idea generation and combination support divergent thinking [14].
Enable Collaboration	A creative process driven by collaboration requires trust, records, and secure communication.	Models act as creative partners and human-AI co-creation, contributing to collaborative workflows [15].
Provide Rich History-Keeping	The process is recorded and reused, allowing revisiting previous versions, understanding the evolution of thinking, and supporting the cognitive process.	Implementation of idea tracking, generation of summaries, and contextual history of information generated by models [16].
Designing with Low Threshold, High Ceilings, and Wide Walls	Provide personalization and control, adapting complexity to the user profile and needs.	Applying natural language and contextualized prompts balances complex tasks for experts (high ceiling) and adaptation (personalization) [17].

Table 1: Mapping Shneiderman's CSTs design principles into the LLM context

By mapping design principles to LLMs, we mitigate some historical limitations of CSTs and introduce new challenges. For example, the tool developed in [13] demonstrates precisely this scenario by developing an LLM-based CST (SAIESE) that supports the creative process while solving real-world problems (e.g., sustainability). The tool supports idea generation and its evaluation through contextualized metrics. However, the tool reveals new challenges due to its reliance on model responses, the need for transparency in idea justifications, and the risk of bias in automated evaluation.

These findings reinforce the importance of framing LLMs within HCAI, aligning with the classic guidelines presented in [4, 5]. Reinforce the relevance of creativity-oriented HCI in the application domain and contemporary contexts.

4 Conclusion and Future Directions

This research revisits the fundamentals of creativity-oriented HCI through a reinterpretation of the classic principles of CSTs presented by Ben Shneiderman in light of LLMs. Due to the realignment of these tools, it is necessary to investigate the transparency and explainability of LLM-based CSTs, aligning them with HCI principles and promoting AI literacy for creative professionals.

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