CollEagle; AI-enabled Tangible Note-Taking to support Collocated Collaborative Practices

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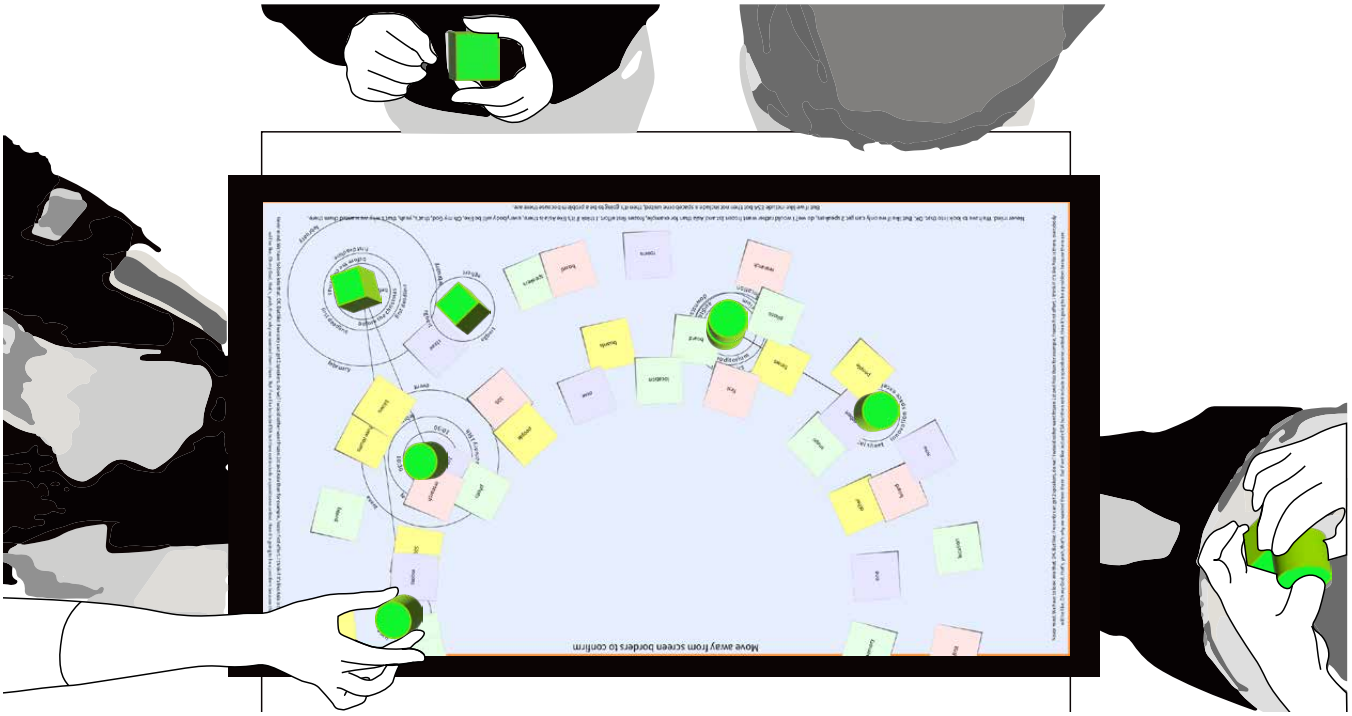

Figure 1: *CollEagle*; an interactive tabletop system that facilitates collaborative note-taking.

ABSTRACT

While AI-enabled technologies are changing the way we work individually, most AI-enabled technologies are not designed to support collocated collaboration. We present *CollEagle*; an interactive interface that facilitates collaborative note-taking. CollEagle enables users to create content and document collaborative processes in a tangible manner. We discuss how it mediates collaboration and describe interactions supported by the system and open challenges for future work.

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CCS CONCEPTS

• **Human-centered computing** → *Collaborative and social computing devices*; Systems and tools for interaction design; **Natural language interfaces**; **Collaborative interaction**; • **Computing methodologies** → **Discourse, dialogue and pragmatics**; Speech recognition.

KEYWORDS

collocated collaboration, tangible interaction

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1 INTRODUCTION

The way people work together is rapidly changing. Collaboration has become a dynamic combination of online, hybrid, and in-person

contexts. While AI-enabled technologies are changing the way we work individually, most AI-enabled technologies are not designed to support collocated collaboration. Despite the increased availability of remote collaboration tools, face-to-face, in-person group communication remains a very effective way to support collaboration.

Natural Language Processing (NLP) – the cornerstone of many AI technologies – provides means to interpret and generate text and spoken language computationally. NLP enables common AI-enabled technologies (e.g., virtual assistants, voice-controlled devices, and generative AI) to analyze prompts and generate appropriate or desired responses, which operate on command before performing an action. It appears this form of interacting with AI is unfit for the complex interactions encompassing collocated collaboration. However, as the entry point to many AI-enabled tools, NLP can be leveraged to integrate AI into human-human collaboration.

In this paper, we demonstrate how NLP can be leveraged to enable tangible human-AI interaction. We present the ongoing work *CollEagle*; an interactive interface that facilitates tangible note-taking. We discuss how it mediates collaboration, and describe interactions supported by the system as well as open challenges for future work.

2 BACKGROUND

Previous works have used NLP to continuously extract content from conversation to produce images that stimulate creativity [4] and to reveal how topics evolve across meetings[1]. While these support collaboration as passive interfaces that enable reflective action, they do not foster the rich interactive context inherent to collocated environments.

Collocated environments enable thought processes to be externalized through the feats of physical space, which mediate behaviors and dialogue, allowing collaborators to reach common ground in ways that remain out of the scope of most digital environments [3].

Especially collaborative ideation is generally supported by physically situated materials (e.g., whiteboards and post-its), but these form an intermediate step to documentation [2]. Particularly documenting, curating, and collating outcomes often become a significant overhead. It plays a critical role in collecting evidence and communicating knowledge; however, this process is usually carried out post-collaboration by a single person. While NLP might be used to transcribe collaborative endeavors, it remains too inaccurate to deal with the messiness of collaborative conversation.

3 COLLEAGLE: AI-ENABLED SYSTEM

CollEagle is an interactive interface that leverages NLP to facilitate tangible note-taking. It enables users to interact with real-time conversational data and create an overview of their discussion by transcribing ongoing dialogue and pushing key phrases onto the display as digital 'post-it notes'. (see Fig 1.)

3.1 Interacting with conversational content

Users can place any opaque item on top of extracted content to attach it to the post-it, after which its content rotates around the item to be viewed from all angles. Items can be reused to collect additional speech segments and enhance their meaning. Lines are drawn between segments represented by objects if their content has been extracted within the same utterance. Placing another item on top removes this link, and adding a third item reveals the phrase from which the content surrounding an object had been extracted.

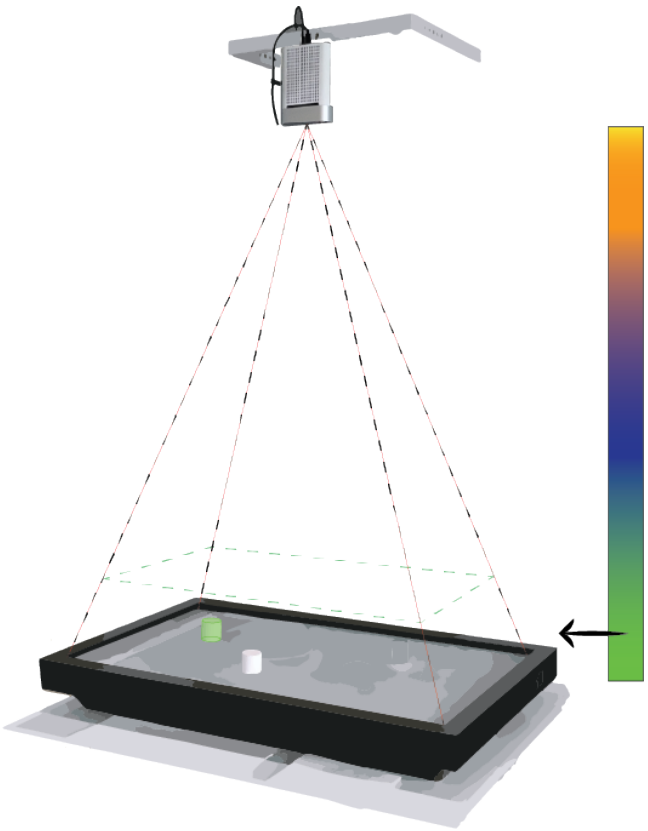

Figure 2: The depth-map interface actuated by Azure Kinect sensor and display boundaries

4 IMPLICATIONS

The presented version limits itself to tangible annotation using uniform items (i.e., cubes and cylinders) and a blank background to demonstrate the core principles of tangible note-taking. Various items (e.g., 3D printed, braille, speaker boxes) may be deployed in tangible note-taking, supported by various background images on which conversational content is displayed. We see opportunities for integrating AI into these backgrounds. For example, the content of post-its that are linked to an item might be used as prompts for generative models to provide visual stimuli onto the interface that augments its meaning.

5 FUTURE WORK

Preliminary tests indicate tangible annotation practices emerging through CollEagle are suitable for various use cases. Upcoming work includes an observational study to examine collaboration

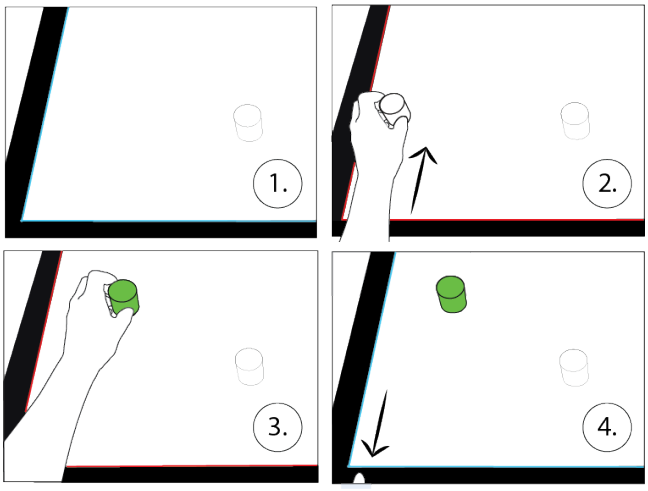

Figure 3: Interaction sequence; (1) initial depth state, (2) border is crossed - interaction in motion, (3) item (4) borders uncrossed - interaction completed

styles emerging from the system and a detailed overview of data collected through collaboration.

6 CHALLENGES

- **Scalability:** How might multiple systems work together to support remote collaboration? What role can AI play in facilitating mass collaboration? What data collected through the system in one session could best support the other?
- **Manual input:** What forms of user input alongside conversational content can best support collaboration? How could AI play a role in this? How could users make content appear that is not verbally expressed?
- **Privacy:** How do we ensure the privacy of users? How to ensure users have ownership over content generated through and collected by the system?

7 POSITION STATEMENT FOR WORKSHOP

We would argue the integration of AI agents into human-human collaboration is inherently counterproductive. Considering agents become actors, it likely results in a scenario where humans collaborate with an agent instead of one another; it implies a framing that forms a barrier to the creative integration of AI into human-human collaborative practices. When AI is expected to perform and behave like humans, it often results in disappointing user experiences.

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