CO-Coffee: A Technology Probe Study to Facilitate Coffee Breaks in Open Offices

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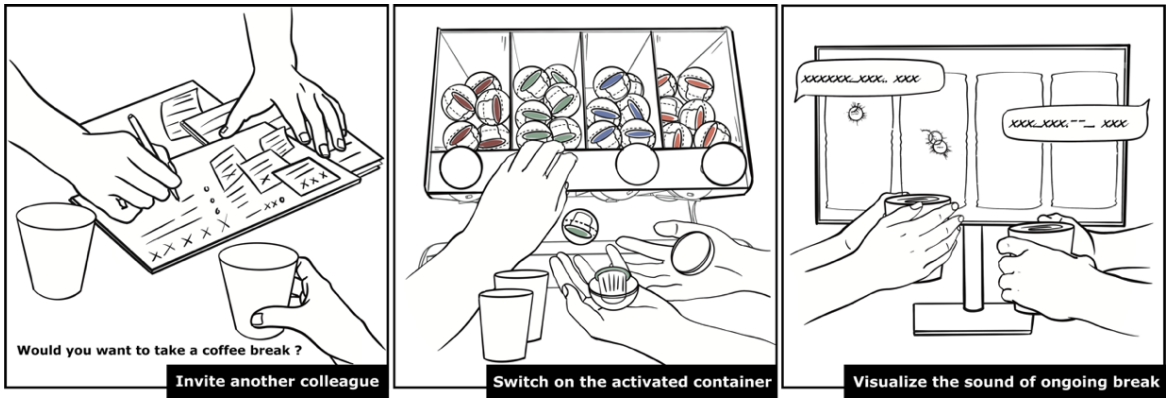

Figure 1: The user experience flow of the CO-Coffee system.

ABSTRACT

Coffee breaks serve as a good opportunity for workers to break up sedentary work and socialize with their colleagues. In this paper, we present a technology probe study using CO-Coffee, a sociotechnical system designed to encourage mutual invitation between coworkers for drinking coffee and visualize the process of each social break in an open office. The one-week probe study was conducted in three workplaces with 28 office workers to gain some qualitative insights into usage patterns and user experiences with CO-Coffee. Our results revealed how this probe facilitated coffee breaks in different working contexts and how participants established rituals around CO-Coffee to engage in break times. We emphasized the importance of positive workplace norms on break-taking behaviors and discussed design implications for reshaping workplace ambiance to encourage active and equal participations in break times.

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CCS CONCEPTS

• **Human-centered computing**; • **Human computer interaction (HCI) ; Empirical studies in HCI**;

KEYWORDS

Office vitality, coffee break, social interactions, technology probe

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1 INTRODUCTION

Nowadays, balancing work and well-being has become increasingly crucial to office contexts. It has been well proven that regular breaks throughout a busy workday can boost employees' intellectual productivity and wellness [12]. Breaks allow workers to recharge and revitalize, mitigating the negative effects caused by a long period of mental-demanding work tasks [18, 26]. Prior Human-Computer Interaction (HCI) studies focused on understanding how and why office workers take breaks [19, 21]. There have also been some data-driven approaches developing predictive models to identify

opportune moments for work breaks (e.g., [11]). Furthermore, ambient displays and digital interventions offer non-intrusive reminders for taking breaks with physical activities due to game challenges [5]. These studies have primarily focused on promoting physical well-being of individual workers, such as postural change to relieve people from prolonged sitting [23].

In contrast, one research strand that has not been adequately explored is the concept of 'social breaks', which involve interactions among coworkers [13]. These social interactions can serve as potent venues for informal knowledge exchange, collaboration, and social bonding, thereby contributing to enhanced productivity and well-being [12, 28]. Existing HCI interventions offer limited insights into how social support can positively influence regular break-taking behaviors [13], despite controlled experiments validating its significance [24]. Therefore, there is a research gap that needs to be addressed in exploring how social dynamics among co-workers could influence their collective break-taking behaviors.

To bridge this gap, we investigated CO-Coffee, a sociotechnical system designed as a set of timeline-related coffee capsule containers in the style of gachapon, a Japanese toy vending machine, with a public display to facilitate social breaks in office settings (Figure 1). Grounded in empirical research, the CO-Coffee system integrated its behavior change mechanisms with coffee breaks, an already established office culture in many workplaces [1]. With CO-Coffee, a social break could primarily be initiated by a mutual invitation between two workers to make coffee for each other using coffee capsule in relevant container according to the timeline of the workday. Afterwards, the process of the social break would be visualized in a real time based on the sound level of the break and kept on the display. Based on CO-Coffee, a one-week technology probe study was conducted in three open office environments to understand how the system prompts social breaks and affects perceptions around break-taking.

Our work makes the following contributions. Firstly, we introduce the CO-Coffee system, presenting an exploratory study of augmenting existing coffee breaks through HCI technologies by integrating invitation-based mechanism, real-time visualizations, and playful interactions. Secondly, our qualitatively results report its benefits in integrating regular breaks into different contexts effectively, and enhancing the experience users engage in collective breaks and activities in shared workplaces. Thirdly, our study provides insights into the potential of mutual invitation mechanism for supporting regular breaks and highlights its scalability to different contexts for increasing workplace connectedness and collective health behaviors. Finally, our research reveals how the meaningful rituals around coffee making and sharing contribute to a relaxing and creative break hub for improved office vitality.

2 CO-COFFEE SYSTEM

2.1 Design Considerations with Research Questions

Primarily, giving employees breaks at the same time has been proven to be a useful in developing cohesive relationships [28]. Therefore, we propose the concept of one-to-one invitation-based coffee to synchronize coffee breaks. Secondly, we propose to capture and visualize the social activities during breaks in a just-in-time and always-accessible way. This builds on prior research showing how real-time visual support system can influence communication in formal settings [14]. Thirdly, to motivate users to pay more attention to the system, we propose to stimulate the sense of playfulness, which was effective in encouraging collaborative relationships and promoting organizational creativity [17]. We propose to use timeline-related system in the style of gachapon, a Japanese capsule toy vending machine known for its interesting and random interactivity. The system would provide different flavors of coffee at various intervals within the day.

2.2 Design and implementation of CO-Coffee

In this section, we first introduce the user experience flow of the CO-Coffee system. Then we detail the design and implementation of the interactive containers and visualization.

CO-Coffee system features four containers designed in the style of gachapon and includes an always-on shared screen located behind the containers. As shown in Figure 2, during specified time intervals, users can invite another colleague to CO-Coffee, obtain coffee beans from the container activated in this interval and make coffee. As users engage in breaks, the system can capture and translate their sounds into visual representations, and display them on the shared screen behind, which is always on for office workers.

Gachapon containers. Referencing Figure 3, we divide the workday into 4 equal intervals, beginning with 9:00 AM to 11:00 AM, and followed by three periods of the same length. We make an oral agreement with users in advance that they are required to invite other colleagues and each container can be activated during its corresponding time slot. The design intentionally omits mechanical and electronic restrictions to preserve flexibility and spontaneity in user interactions and enable unexpected behaviors. The container is modeled after "gachapon" capsule-toy vending machines, each holding 25 plastic balls containing either 25g of coffee beans or a coffee capsule suitable for one person. For implementation, we employed Rhino for detailed design, focusing on the shape and interlocking mechanisms. Then we used laser cutting to fabricate the required wooden and acrylic boards. Finally, we assembled all the components and filled each container 25 coffee balls.

Real-time visualization. The shared screen is segmented into 4 columns, mirroring the four intervals mentioned above. During coffee breaks, user input their unique 'code names' into the system. The identifies then appear in the corresponding column. Accompanying each name, a dynamic, ring-shaped pattern emerges, showcasing the ongoing duration and volume of the break in real-time. As depicted in Fig.3, the ring's angle and radius visually represent the volume and duration, respectively. We used Processing to develop the interactive sound visualization. This software captures sound via an external microphone, measuring amplitude at ten readings per second, producing a float value between 0 and 1. This value dictates the ring's radius. For visual clarity, the system is connected to a 24-inch screen.

3 METHODS

We used CO-Coffee as a technology probe [10] and deployed it in three workplaces for 5days. The goal of the study is to know about (i) people's break-taking behaviors and social dynamics in

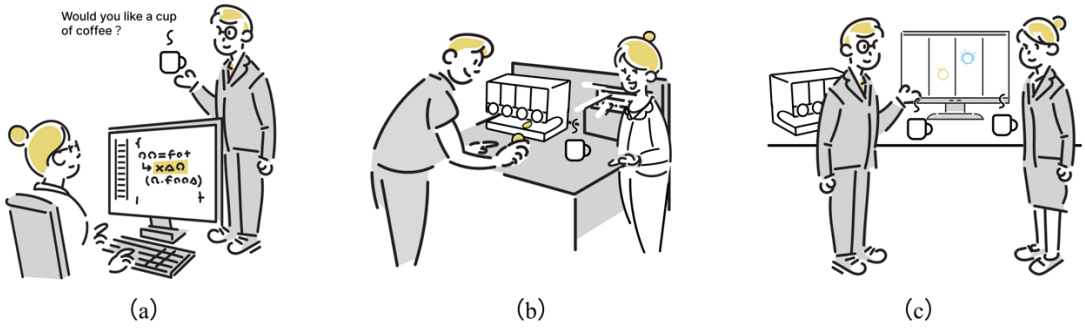


Figure 2: User scenarios: (a) one user invite another colleague; (b) users switch on the activated container to get coffee balls; (c) the system visualizes the sound data of the ongoing coffee break.

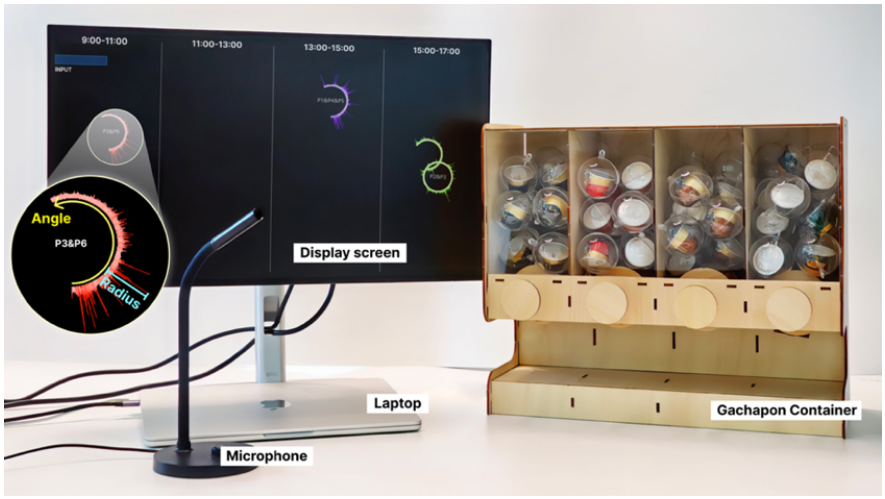


Figure 3: The CO-Coffee system

real contexts, (ii) how CO-Coffee fosters people's positive attitudes towards socially active breaks, and (iii) their practical needs and desires.

3.1 Experimental site and participants

Prior study have highlighted the influence of spatial layout [29], job categories [25] and interpersonal relations [3] on the employees' behaviors and office culture. Hence, we chose three workplaces for their differences in these above aspects.

Group A. The first experimental site was a university laboratory with 9 participants (8 females, 1 male, age: M=22.89 , SD=1.45), all from design disciplines. They were relatively new to the late-established lab. The workplace was a large-scale and open-plan office, including formal workspaces and rest areas. A coffee corner with an espresso machine was situated near the entrance. The CO-Coffee system was installed here and stocked with coffee beans.

Group B. In Field Study 2, we recruited a community of eight knowledge workers, who were co-located in a shared university workplace. All participants (5 females, 3 males, age: M=22.57, SD=1.64) were students in creative disciplines. The community is longer established, so all participants were familiar with each other. Their workplace was relatively small-scale. There was a coffee machine in the corner of the room, but due to overcrowding, we placed the CO-Coffee system in an idle workstation and filled it with coffee pods.

Group C. The third site was a mechanical engineering company based on college-enterprise cooperation with 11 participants (2 females, 9 males, age: M=27.82, SD=9.41). Three of them were senior workers, while eight were students. All participants worked in a large-scale workplace without a separate rest area. There was no coffee machine in the workplace, but participants usually had the habit of drinking coffee. We placed the CO-Coffee system in an idle workstation, filled it with coffee pods, and provided a capsule coffee machine.

3.2 Procedure and Data Collection

Initially, we gave a brief explanation of CO-Coffee and confirmed participants' schedules to maximize their full-time presence. During the study, a researcher was available on-site to address technical issues promptly and to observe. Serving as a technology probe,

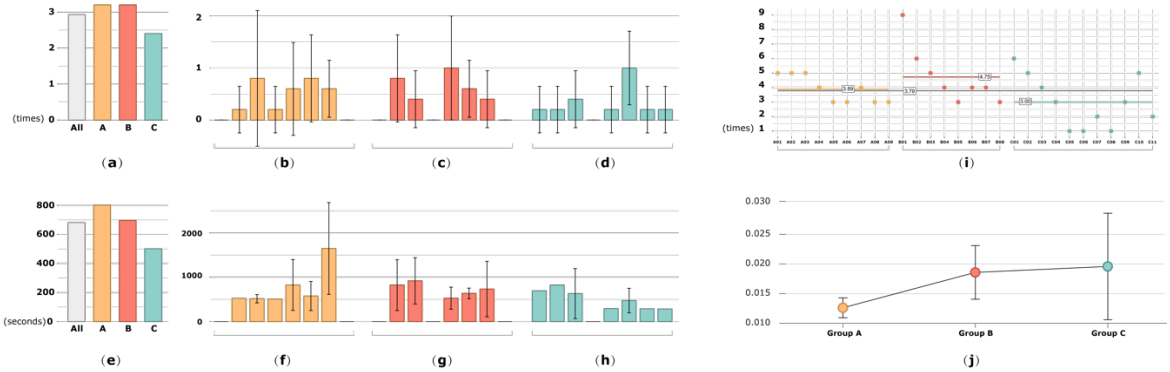


Figure 4: (a) average daily frequency; average hourly frequency in (b) Group A, (c) Group B, and (d) Group C; (e) average duration of coffee breaks; average hourly duration in (f) Group A, (g) Group B, and (h) Group C; (i) participants' engagement; (j) average sound levels.

CO-Coffee system could gather data such as participants, start time, end time, etc., and export them to CSV files. Participants were also provided with diaries and stickers to record their nuanced thoughts and encouraged to photograph meaningful moments. We advocated for the flexibility of CO-Coffee system and encouraged participants to reinterpret it and use it in creative way. After 5-day experience, a semi-structured interview was conducted. We asked semi-structured questions about the perceived effects of CO-Coffee, specific social activities around CO-Coffee, their interpretation of the usage patterns and overall experiences. All the interviews were audio-recorded with participants' permission.

3.3 Data analysis

We analyzed the data collected by CO-Coffee system quantitatively to present the overall picture of usage patterns in three workplaces. In terms of qualitative analysis, the audio-recorded interviews were transcribed and analyzed using inductive thematic coding [4]. One author finished the first round of open coding. Two authors then discussed and clustered the labeled statements, which could be categorized under two main themes: the positive influence of CO-Coffee, and the challenges and opportunities.

4 RESULTS

4.1 Quantitative findings

In this section, we present the quantitative findings from probe-recorded data, including the frequency and duration of coffee breaks, participants' engagement, and average sound level.

On average, participants took 2.93 coffee breaks per day. Specifically, Groups A and B averaged 3.2 breaks daily, while Group C had 2.4. An hourly breakdown (Figure 4 (b-d)) shows Group A's peak times at 11:00-12:00 and 14:00-15:00 (average 0.8 breaks, SD=1.3 and 0.84 respectively), Group B at 10:00-11:00 (average 0.8 breaks, SD=0.84), and Group C at 14:00-15:00 (average 1 break, SD=0.71).

The average duration of breaks was 11 minutes 21 seconds across groups, with Group A averaging 13 minutes 21 seconds, Group B 11 minutes 36 seconds, and Group C 8 minutes 21 seconds. Longest average durations were observed in Group A between 15:00-16:00 (27 minutes 29 seconds), in Group B between 11:00-12:00 (15 minutes 19 seconds), and in Group C between 10:00-11:00 (13 minutes 41 seconds) (Figure 4 (e-h)).

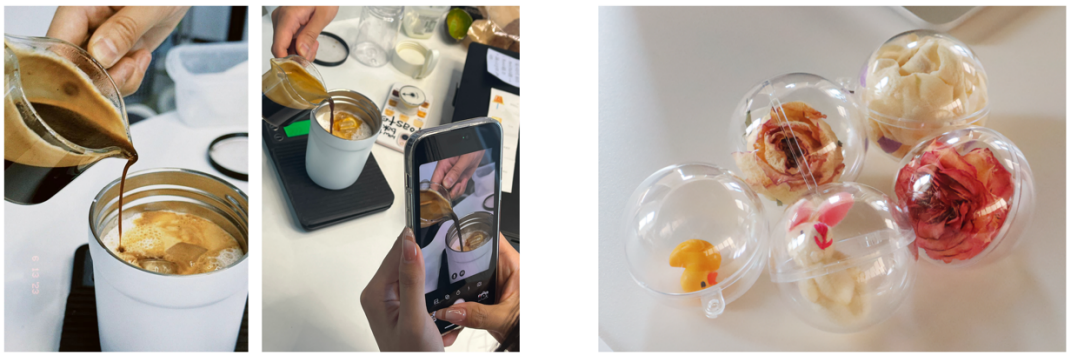
Individual participation over five days averaged 3.89 times for Group A, 4.75 times for Group B, and 3 times for Group C (Figure 4 (i)). Regarding sound levels, Group C recorded the highest average, followed by Group B, with Group A being the quietest (Figure 4 (j)).

4.2 Qualitative findings

Mutual invitation could facilitate the insertion of social breaks in different workflow. Specifically, due to a sedentary workstyle, participants in Group A commonly used CO-Coffee to alleviate tiredness after prolonged work. For example, *"When someone felt tired, she would send out invitations."* (A01) In Group B, coffee breaks became a socializing and networking tool. Due to their varied arrival time and closer friendship, participants used CO-Coffee for reunion where they could update each other on personal matters and working issues. In Group C, due to the intense pace and serious atmosphere, participants used CO-Coffee after lunch break for transitioning into work tasks and avoid disrupting intense work periods later.

Moreover, our studies revealed how workplace layout influenced CO-Coffee usage. In Group A and C, invitations for coffee breaks were typically one-to-one, with individuals approaching colleagues at their workstations. In contrast, in Group B, due to the small scale of workplace, when someone wanted to take coffee breaks, he or she usually asked out aloud *"Who wants to drink coffee? "* This led to random, larger groupings.

Synchronized break facilitated a detachment from work in terms of perceived atmosphere, thus creating a relaxing and creative break hub. CO-Coffee area became hubs for informal interactions where participants frequently interrupted and joined ongoing social breaks. The shift from individual to group breaks was seen as positive and socially endorsed. For example, *"Solitary breaks felt like shirking responsibility, group breaks harmonized with the workplace ethos."* (A07) The social break atmosphere also fostered creativity. As shown in Figure 5 (a), study 1 saw spontaneous photography



(a) (b)

Figure 5: (a) photography activities; (b) redesign of CO-Coffee.

activities related to coffee. In Study 2, participants repurposed the plastic shells as shown in Figure 5 (b), inserting flowers and ornaments, and exchanged with others. They even broke the rules to drink coffee which was stored in the fourth container in the third interval.

CO-Coffee also contributed to team building. The process of interacting with CO-Coffee involved many hands-on and cooperative activities. For example, *"We could grind coffee beans and get milk for each other and share our preferred blend of coffee."* (A06) Interestingly, it happened that the device broken in Study 3. Participants enthusiastically collaborated on repairing and described this as a simple yet engaging team-building exercise (C09). In this case, it happens to be around coffee. But they were sure when they work together on non-work goals, they can strengthen their working relationships for more critical work goals.

Lastly, we observed self-defined values of neutral visualization based on the intersection between CO-Coffee and workplace norms. Although we did not embed any explicit value indicators, participants could associate the patterns with specified meanings and have relatively consistent interpretation of CO-Coffee's visualizations. For example, a complete circle was seen as a cue to return to work. The radius, changing with talking volume, also held significance: a large radius led to quieter conversations to avoid disturbance (A07), while a smaller radius encouraged louder speech for a more distinctive ring, symbolizing a lively social interaction (C01). Participants also derived insights from the overall pattern of rings, with similar distributions suggesting shared work rhythms and an unspoken agreement (B08).

4.3 Challenge and opportunities

Simple system interactions might reduce motivation for long-term use. While CO-Coffee stimulated playfulness, participants noted its limitations due to simplistic interactions. Consequently, many suggested enhancing the system with gamification elements, such as time-limiting tasks, materials collection (A03). Additionally, they proposed more intricate cooperative actions, e.g., whole-body interactions. One participant shared, *"Users need to lead coffee balls through the maze using their motion together."* (A09)

Invitation might create extra social pressures for workers. Participants indicated social pressures caused by this invitation-based mechanics, e.g., *"Sometimes I was too embarrassed to refuse other colleagues' invitation. "* (A02) Notably, some introverted participants indicated that they felt more comfortable in larger group settings, e.g., *"While more than two people were present, I wouldn't need to keep talking and thinking."* (A06) Some participants suggested encouraging more extroverted colleagues to send out invitations. As one of the participants stated, *"It was challenging for me to invite others. But I looked forward to joining them."* (A08)

Current system lacks support for icebreaking between strangers. Although CO-Coffee offered playful activities, it wasn't effective enough to encourage social interactions between strangers and reduce awkwardness during breaks. In Study 3, students and employees rarely invited each other to use CO-Coffee. For instance, *"We're just coworkers with little overlap in our personal lives. "*(C05) This led to notable differences in user participation. In Study 3, three employees only used CO-Coffee once over five days, with one stating, *"With most members being students, we tend to stay quiet and stick to our own work areas."* (C08)

Visualizations might troublesome workers' privacy. Participants viewed coffee breaks as informal organizational activities, which ought to be less open to management. That their boss could know about their break-taking behaviors resulted in discomfort. To address privacy issues, one participant proposed presenting the social rings through personal objects, e.g., mug, badge, and coaster. Lastly, abstract visual coding was recommended for less direct feedback. For instance, *"We could use different colors to represent different people and generate colorful and abstract paintings on the ceiling according to people's participation in social breaks."* (B05)

5 DISCUSSION AND CONCLUSION

In this paper, we designed and deployed CO-Coffee system, incorporating invitation-based mechanism and real-time visualization to facilitate socially active breaks among office workers. We conducted probe study in three workplaces and illustrated how CO-Coffee system served as encouragement of heathier workflow and more positive social climate. CO-Coffee allowed us to understand both

universally shared and culturally specific contexts in different workplaces, uncovering spontaneous usage patterns and self-defined interpretation. In what follows, we unfold a few directions that could inform future design.

Associate break-taking behaviors with office culture. Our project provides real-world evidence of the association between organizational culture on break-taking[24]. Users in creative field normally share free atmosphere and could easily integrate refreshments into their workflow. In contrast, Group C users prioritized productivity and rarely took breaks during work. Hence, this is a notable aspect of quantifying workplace culture [9] and providing team-centric solutions [11] to promote active break. Meanwhile, we also see the potential in encouraging collective activities and reshaping the ambiance to support office vitality [7, 8, 22]. Users need to feel that work-break balance could be really accepted as part of office culture.

Enrich peer invitations to enhance workplace dynamics. In this study, we achieve this transformation through an invitation-based mechanism. Future work can consider establishing trigger points for mutual invitations in more health-related initiatives [7]. However, the synchronous and face-to-face invitation also presents challenges. It lacks mechanisms for icebreaking among unfamiliar peers, tends to limit diverse grouping, and results in unequal participation where some people are marginalized. Therefore, it is imperative to explore innovative methods that facilitate more enjoyable and less stressful interactions, like AR.S.Space's use of asynchronous messaging and virtual agents to ease direct interactions [6]. To promote diversity and inclusion, future iterations could integrate recommend systems and provide long-term feedback on interaction patterns, which could serve as a basis for reflection and actionable change [20].

Fit Co-coffee system into different spatial settings. Our findings reveal that the spatial settings could significantly influence how users send out invitations, which corroborates previous findings that architectural elements have a substantial impact on people's behaviors in social contexts [15]. Therefore, future research could extend the application of CO-Coffee to different types of office layouts, e.g., the cell offices. Given the increased needs for informal interactions in remote settings [16], adapting CO-Coffee system with IOT technology to be suitable for distributed workplaces could also be a meaningful avenue for further exploration [27]. Moreover, our study was conducted in workplaces with relatively flat hierarchical structures. Future studies should examine how CO-Coffee performs in organizations with more complex hierarchies. According to previous research, the social dynamics and resultant office culture are heavily influenced by the organizational form [2].

5.1 Limitations and future work

Firstly, most participants in three workplaces were college students and they were relatively young. So now we cannot argue that the impacts of CO-Coffee are generalizable to all audience. Future work can include more office workers from various age groups and diverse socioeconomic groups. Secondly, our study lasted relatively short in three workplaces. Future work can appropriately prolong the experimental duration to validate the effectiveness of CO-Coffee in long-term use. Thirdly, the sound produced by individuals who did not participate in ongoing social activities, the actual distances between participants and microphone could potentially affect the visualizations, thus reducing the accuracy of quantitative analysis. Future research can explore strategies for mitigating the influence of ambient noise generated by non-participating individuals and non-related activities on the visualizations.

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