CSCW: Colocated-asynchronous applications

CPSC 554m
Kalan MacRow

INTRODUCTION

Computer Supported Cooperative Work (CSCW) has produced a wide variety of systems and applications, each of which is broadly categorized as *remote-synchronous, remote-asynchronous, colocated-synchronous*, or *colocated-asynchronous* (CA) by the CSCW Matrix [A1]. This report is concerned primarily with the latter, but acknowledges that considerable overlap exists between it and other categories, in particular with *colocated-synchronous*.

CA applications support continuous, colocated collaborative tasks that do not necessarily proceed in a serial fashion. For example, maintaining awareness of co-workers' activity, creative brainstorming sessions, and location-aware meeting facilitation are all opportunities for CA applications and technology.

Among the CSCW categories, CA is perhaps the broadest and most difficult to characterize precisely due to the diversity of what can be called an asynchronous task. In section 1 we identify three distinct types of CA applications. In sections 2 – 4 we discuss each type in more detail, section 5 provides thoughts on future work and 6 concludes.

1. Application categories

It is useful to classify CA applications and technologies into one of three subcategories: *perhipheral displays, shared displays,* and *context-aware* applications. As is the case with the higher-level CSCW application categories, there is some overlap between these; a location-aware application might use a shared display as a rallying point, or post updates to a peripheral display notification system, for instance.

Peripheral display systems are generally intended to be passive sources of information concerning collaborators' activity, presence or contributions. They occupy dedicated secondary displays, such as with *The Notification Collage* [1], or implement various strategies (translucent windows, non-modal popovers, taskbar icons, etc.) to share the workspace with primary applications.

Shared display systems range from large public displays with a gradient of interaction options to smaller shared surfaces and devices supporting more intimate and or mobile collaboration. Shared displays face a unique set of usability, social and privacy challenges.

Finally, context-aware applications, and in particular location-aware applications, are able to support collocated collaboration by exploiting high resolution asynchronous updates about users' working context, such as their precise indoor location or recent activities (e.g. modifications to a particular document).

Each type of CA application faces a specific set of challenges stemming from the devices they are deployed on, the environments they are deployed into, and the expectations of the people who will utilize them.

2. Peripheral displays

Peripheral displays are perhaps the most familiar type of CA application. In modern work environments where multiple desktop displays are commonplace, we are used to placing email, social networking web sites, IM clients, and other non-critical, albeit useful, sources of information in our periphery on a secondary display.

Exemplary early work in this space includes *Tickertape* [3] and *CollageMachine* [2], both of which provided the inspiration for Greenberg and Rounding's much more sophisticated *Notification Collage* [1] published in 2001. *Tickertape* is one of the earliest (1998) presence notification systems, and took the form of a single line of scrolling text, not unlike its namesake: the traditional stock ticker. Predating the rise of dual display workstations, *Tickertape* shared the primary workspace with more critical applications and as such sought to minimize its footprint. The *Notification Collage* would take a more 21st century approach in single-display mode: a unobtrusive translucent window.

Andruid Kerne's *CollageMachine* provided the artistic inspiration for the *collage* layout of the *Notification Collage*. A considerably less practical tool, *CollageMachine's* strength was its acuity as a visualization [A2] of diverse web media and content. Peripheral display applications generally serve as notification systems from which collaboration can be initiated. Providing mechanisms to help avoid distraction, manage screen real estate, and prevent breaches of privacy are primary design considerations for these applications.

3. Shared displays

Shared displays are a very diverse category of systems and applications ranging from shared tablets and tabletop surfaces to wall-mounted public and semi-public displays. Unlike peripheral displays, shared display systems require increased attention to usability to facilitate casual use without prior instruction. Social factors concerning users' apprehension to perform work (or other tasks) in view of their peers for fear of embarrassment, or violation of cultural norms, must also be considered. Privacy issues remain present as well.

Daniel Vogel and Ravin Balakrishnan's work on *Interactive Public Ambient Displays* (2004) [4] is one of the most thorough system implementations in this area. Their work develops and implements a set of design principles for building applications with the unique variety of interaction scenarios possible on large public displays. They support single and multi-user interaction with a single display over a range of implicit-public interaction to explicit-personal interaction. Explicit consideration[A3] of the transitions between the these types of interaction, and the relevant design decisions, is particularly novel.

The somewhat earlier *Dynamo* system (2003) [5] is representative of the communal surface class of shared display CA applications. Designed to reduce the overhead and complexity of sharing digital assets during meetings in public places, *Dynamo* builds on the ideas underpinning electronic whiteboards, situated displays, and other single display groupware. Huang and Mynatt's 2003 work[6] looked at the role of "semi-public" displays for closely collaborating colocated groups; in some ways a compromise between the large public display and the smaller shared surface.

4. Context-aware systems

The final class of CA applications we will consider are context-aware, and specifically location-aware, applications. Much of the research in this area comes from the ubiquitous computing community and focuses primarily on the technical and engineering challenges around indoor location sensing. That said, most of the work is motivated by the types of CA applications that could be built on high resolution 3D location sensing technology. Coupling precise location information with knowledge of other work activities can yield opportunities for application-supported facilitation of collaboration in a busy office complex or campus.

A notable research program in this area is the PARCTAB (1993) [9] [A4] mobile computing system. The PARCTAB system was born at Xerox's Palo Alto Research Center and consisted of an indoor Infrared network of PDA devices, complete with location tracking and a suite of CSCW applications. Due the Global Positioning System's (GPS) reliance on satellites, it is unsuitable for indoor applications. As such, several more recent projects such as LANDMARC[8] and SpotON[7] have laboured (quite successfully) to improve the precision of indoor location sensing with RFID and Wifi signal strength based methods.

The issue of high resolution indoor location sensing would appear to be solved. However, the cost of hardware, privacy concerns, and lack of a killer "context-aware" app have lead to stagnation.

5. Future work

CA applications face a number of challenges in the years ahead. Many of them are technical: the tactile features of large surfaces and touch displays likely have a long way to go, and the rise of the "retina" display has only just begun. Indoor location sensing technology is not yet commodity hardware, nor is the computer vision required by systems like [4]. Unfortunately many of the challenges around privacy, cultural norms (e.g. taking credit for work done in front of peers), and potential for embarrassment are social, and have markedly less clear solutions. Finally, there are existential problems that warrant further study. For example, it is not clear that the pain many of the these systems aim to relieve is real, and that we are not simply building tech for its own sake.

CONCLUSION

Unfortunately, with the research output in this area tapering off since 2004, it would appear that the popularity of CA applications is lessening. Despite a substantial body of early promising work and reasonably clear next steps for a variety of technologies, interest in recent years has waned. Perhaps a lack of adoption and various barriers to commercialization (cost, complexity, stability) are responsible. Perhaps these applications are too far ahead of their time. In the worst case, they are solving problems that simply do not, and will not, exist. However, with digital collaboration on the rise, personal privacy on the decline, and an ever increasing preference for asynchronous processes and means of communication, there is likely hope yet for colocated-asynchronous applications.

REFERENCES

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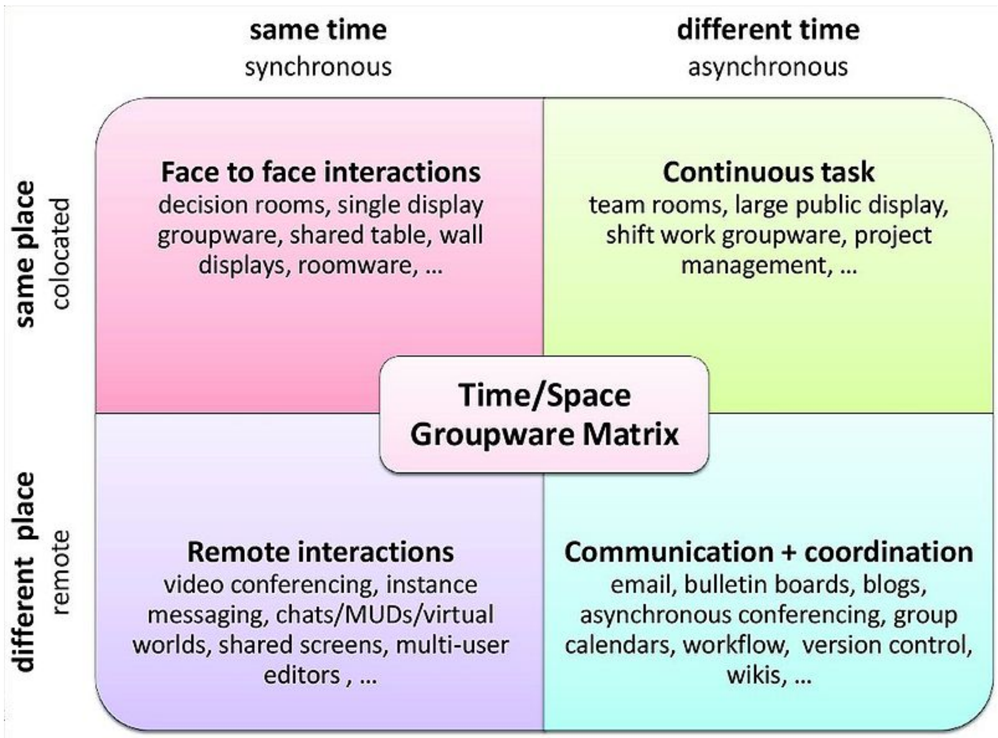
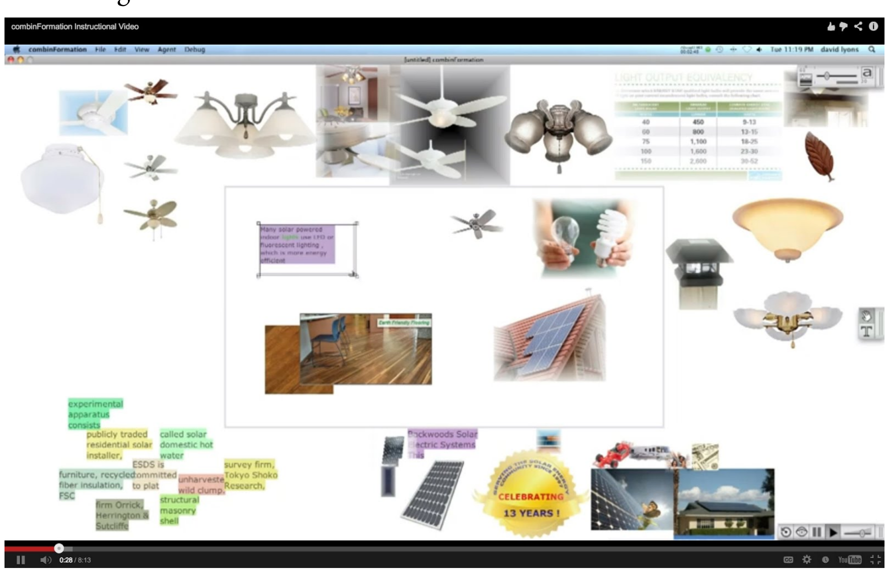
APPENDIX

A1. The CSCW Matrix (http://upload.wikimedia.org/wikipedia/commons/thumb/2/28/Cscwmatrix.jpg/800px-Cscwmatrix.jpg)



A2. Andruid Kerne's CollageMachine



A3. Vogel and Balakrishan's *Interactive Public Ambient Displays* Interaction Diagram. (http://www.nonsequitoria.com/v.php?s=research&f=interactive_public_ambient_displays)

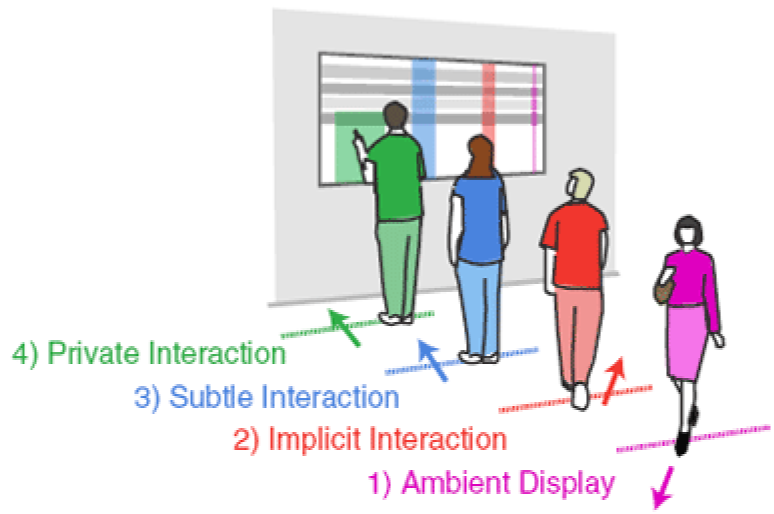


Figure 2. Four interaction phases, facilitating transitions from implicit to explicit, public to private, interaction

A4. PARCTAB (http://www.computerworld.com/common/images/site/features/2010/09/parc_parctab_338.jpg)