Using Theatre Tech to Address Attention Issues in Blended Environments for Collaboration

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Abstract
Blended environments filled with information-rich displays can push the cognitive load limits of collaborators. Each display vies for attention, making it difficult to focus on a common objective or activity. In this position paper we demonstrate how lessons from the performing arts can be applied to help focus attention in blended display environments. Through the exploration of theatrical practices (such as lighting, position, sound, stage design, misdirection, and surprise) we begin to understand the attention issues in blended environments for collaboration.

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theatre; performance art; blended environments; attention

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H.5.3. Group and Organization Interfaces: Computer Supported Cooperative Work.

General Terms
Human Factors

Introduction

Live performances in western theatre date back to early festivals honouring the Greek god Dionysus in 384BCE. With audiences ranging from a few hundred to thousands of people, attention has been a key aspect of theatre. In their craft, actors and directors are astutely aware of and carefully manipulate their audience's focus of attention. Yet, connected computers in a blended environment are quite oblivious to their impact on human attention. We are still seeking to understand the defining characteristics of a blended environment. We start here with a rough conception of blended environments as ones which aim to support users in their activities through ubiquitously embedded technology that lets users' actions and interactions span digital and physical contexts and consequences without users needing to be cognizant of the distinction. We think that how users experience blended environments might be analogous to how an audience flitters between fantasy and reality in engrossing theatrical performances. Thus, our objective is to learn from the performance arts and apply their techniques to interaction design in blended technology environments.

Lighting and Position

Visual attention can be directed through lighting. Brightly lit spots attract attention while dimmer areas are ignored. Spotlights help converge attention on a single person or object. However, since most display technology emits light, the display itself demands attention even when no relevant content is present. Blended environments could benefit from coordinated control of the lighting of the room as well as the light emitted by each display. Designers can ensure that only a single display is brightly lit if a single point of attention is needed.

Figure 1. Using Colour to Direct Attention

On stage, the position where an actor will stand is marked on the floor with an X, especially during rehearsals. In addition to lighting, the very position a person stands serves as a very meaningful attention cue. For example, a narrator stands off to the side, facing the audience obliquely when not part of the scene, but then moves to center stage and turns to face the audience when directly addressing them.

Lighting can also be used to increase dramatic tension, e.g., strobe lighting or flashing red lights signal panic and prepare the audience for a stressful event in the plot. Similarly, teachers of young children occasionally flip the lights of their classroom to transition students from their current activity to a new one.

Sound

Of course, performers - actors, vocalists, musicians, etc., - must be heard by the audience and so microphones and public address (PA) systems for sound reinforcement are routinely used the performing arts. These systems may also have an important role in blended environments: for example, they have been shown to improve attention and retention by students in early childhood classrooms [1]. The improved learning and literacy outcomes co-present with sound amplification have been attributed to overcoming difficulties with noise, distance, and reverberation as described by Heeney [2].

Mixing of sound from multiple sources is important. In musical productions, the lead vocal will be mixed at a volume often double that of the support vocals so as to

draw attention to the lead singer. Blended environments are often unaware of their own apparent loudness relative to that of their users. As a result, spurious notification sounds get amplified to a point that they interrupt the flow of group activities. For this reason, we believe blended environments may benefit from awareness of the ambient and conversational sound levels.

Stage Design

Stage and set design is often geared to enabling rapid transitions. Entire scenes can be wheeled in and locked down quickly using stage wagons (wooden platforms on casters with brakes to hold them in place). Blended environments provide the possibility of very dynamic and interactive backgrounds as illustrated by Jones et al [3].

In the late 1800s circus managers introduced the three-ring circus to allow more people to see exotic animals, sideshow oddities, and performances of strength and agility. This increased their profits but also introduced a scale problem. More elephants were needed to occupy three-rings and more clowns were needed to entertain crowds. Furthermore, the larger number of simultaneous performances made it more difficult for audiences to fully appreciate the performance itself. Popular modern circuses such as *Cirque du Soleil* have revisited smaller stages with state of the art lighting and PA systems.

Multiple scenes can be hidden behind curtains so that attention is directed to the current scene. Blended environments can help focus attention by dimming or covering displays that are not currently the focus of attention.

The Third Teacher [4] suggests that a wall used for teaching be a deeper or brighter shade than the side walls so as to attract attention to the front of the classroom. By applying this technique to our blended environment (Figure 1) we have seen the gaze of visitors towards the accent walls at the front of the room.

Misdirection and Surprise

Sleight of hand and misdirection are commonly used tools to generate surprise in magic performances. The sudden appearance of an assistant through a trap door can generate increased tension or stress among audiences. Authors, playwrights and screenwriters routinely use the element of surprise to make important parts of their stories more memorable. Psychological studies into the effects of stress on memory have shown differences in subjects' ability to remember details from before and after the stressful event [5].

This fact may prove useful in blended environments for learning as well as collaboration. But, blended environments must find ways to manage the spurious dialogs and notifications that popup from time to time and cause confusion and anxiety for users in ways that do not advance the flow of collaboration.

Conclusion

We have merely scratched the surface of the theatrical practices that could be relevant to a blended environment for collaboration. While lighting, position, sound, stage design, misdirection and surprise are all ways the environment can focus users attention on a common locus, we recognize that collaboration in the wild undulates between periods of group and solo work,

that is, converging and diverging foci. How will blended environments for collaboration enable users to seamlessly transition between the rich external world provided by the environment and the often richer internal world accessible inside users' own minds? We hope that this work inspires blended environment researchers to explore the impact of theatrical performance on attention.

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