Mixed Reality Games

Abstract
Collaborative technologies increasingly permeate our everyday lives. Mixed reality games use these technologies to entertain, motivate, educate, and inspire. We understand mixed reality games as goal-directed, structured play experiences that are not fully contained by virtual or physical worlds. They transform existing technologies, relationships, and places into a platform for gameplay. While the design of mixed reality games and interactive entertainments have received increasing attention across multiple disciplines, a focus on the collaborative potential of mixed reality formats, such as augmented and alternate reality games, has been lacking. We believe the CSCW community can play an essential and unique role in examining and designing the next generation of mixed reality games and technologies that support them. To this end, we seek to bring together researchers, designers, and players to advance an integrated mixed reality games’ research canon and outline key opportunities and challenges for future research and development.

Keywords
Games, mixed reality, augmented reality, alternate reality, social games, gamification, CSCW

ACM Classification Keywords
H.5.m [Information Interfaces and Presentation (e.g., HCI)]: Miscellaneous; K.8.0 [Personal
General Terms
Design; Theory.

Introduction
During the past decade, we have seen an explosion of interest in technology-mediated games that build on everyday experiences. Collaborative mixed reality games manifest in multiple forms, with game-world interfaces that can be placed along a continuum from “augmented reality” to “real environment” [8]. Though definitions of these emerging game genres are yet to be formalized, we view mixed reality games as goal-directed, structured play experiences that are not fully contained by virtual or physical worlds. They transform existing technologies, relationships, and places into a platform for gameplay. Because they play with the boundaries of more traditional game spaces, they hold unique potential to extend or blend game mechanics into our everyday experiences [4,9].

Examine mixed reality games as a group allows us to better understand the game mechanics, technologies, and social engagement strategies that work well across the mixed reality game genres. Game mechanics are the underlying rule-based systems of games that define patterns of player behavior, for example, when a player makes a goal-oriented choice and the game provides a meaningful outcome [10]. How do core game mechanics like capturing territory, collecting, or even talking [9] change in mixed reality contexts? Likewise, how can existing relationships be leveraged to attract new players and support new types of gameplay? What new CSCW tools are needed to support mixed reality games and how can existing systems incorporate game elements? This workshop will address such questions and explore how these game mechanics, technologies, and social engagement strategies can be blended to produce novel game experiences.

Erring on the side of inclusiveness, we outline a few of the major game genres that fall within the mixed reality game umbrella in Table 1, while recognizing that new genres in this space are rapidly emerging. These genres of mixed-reality games are often pervasive games, or experiences integrated with everyday routines and social networks. Alongside the rising trend of "gamification," or the application of game mechanics to tasks not traditionally associated with structured play, these games incorporate play that extends over time and space.

One popular example of gamification is the growth of context-aware apps, such as foursquare, that use social, location-based services. These services award users with points and badges as they annotate and share their whereabouts, effectively playing through their day-to-day interactions. Similar location-based, “real-world” games include iSpy and Parallel Kingdom. In all cases, these mixed-reality games offer a playful lens for viewing experiences, relationships or ideas grounded in the context of real spaces—they cross the boundaries between the real and virtual.

Alternate reality games (ARGs) blur the lines between fiction and reality, inviting players to collaboratively weave a coherent storyline from narrative bits distributed across a variety of existing media, such as telephones and email, as well as physical artifacts and specialized software [5,7]. Notable ARGs include the
award-winning *Evoke*, whose goal is to inspire and educate a global community of social entrepreneurs, and *The Lost Experience*, designed as part of a marketing campaign by the writers and producers of the popular television series, *Lost*.

Social network games as diverse as *Farmville* and *America 2049* build on players’ existing relationships, enabling cooperation and competition through these now-pervasive components of players’ online lives.

Table 1: Primary genres of mixed reality games and their defining characteristics

<table>
<thead>
<tr>
<th>Game Genres</th>
<th>Examples (Platforms)</th>
<th>Description</th>
<th>Collaborative Elements</th>
<th>Real-world Elements</th>
<th>Technology-mediated Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Context-Aware</td>
<td>- Biblion (iPad)</td>
<td>Leverages sensor data as a game input, causing location, time, etc. to be components of game play.</td>
<td>Automates some elements of mixed reality game play, so that they do not have to be input explicitly by players, recognizing, for example, the co-locatedness of players.</td>
<td>- Uses location-based data to personalize knowledge and learning experience</td>
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<td></td>
<td>- iSpy (iOS devices, Facebook)</td>
<td></td>
<td></td>
<td>- Offers opportunities for playful learning in context, in collaboration with physical environment</td>
<td>Senors translate reality to be “machine-understandable”.</td>
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<td></td>
<td>- <em>Evoke</em></td>
<td>Narrative that must be constructed by players from diverse media elements.</td>
<td>Multiple players combine gathered information to form a coherent story. Peer-rated performance and feedback.</td>
<td>- Expands upon or rethinks the form of existing physical institutions and knowledge structures</td>
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<tr>
<td></td>
<td>- <em>I Love Bees</em></td>
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<td></td>
<td>Players required to collaborate with each other, typically via social media, to solve game challenges</td>
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<td></td>
<td>- <em>The Lost Experience</em></td>
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<tr>
<td>Alternate Reality</td>
<td>- <em>Evoke</em></td>
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<td></td>
<td>- <em>I Love Bees</em></td>
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<td>- <em>The Lost Experience</em></td>
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<tr>
<td>Social Network</td>
<td>- <em>DropIn</em> (LinkedIn)</td>
<td>Builds on players’ networks of friends and acquaintances.</td>
<td>Game mechanics invoke existing social ties between players for collaborative accomplishments</td>
<td>Players’ social network of friends, family, co-workers</td>
<td>- Rely on social networking sites like Facebook to share invitations &amp; game status notifications</td>
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<td></td>
<td>- <em>Oregon Trail</em> (Facebook)</td>
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<td></td>
<td>- <em>Spent</em> (Facebook)</td>
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<td>Augmented Reality</td>
<td>- <em>Magic: Eye of Judgment</em> (PS3)</td>
<td>Information is overlaid on some depiction of reality.</td>
<td>Can incorporate shared experiences of the layered virtual world; opportunities for exchange of resources</td>
<td>Use of game as lens for viewing reality: integrates either action or image within physical space with virtual play</td>
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<td></td>
<td>- <em>Face Raiders</em> (Nintendo 3DS)</td>
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<td></td>
<td>Sensors translate reality to be “machine-understandable” and augment perception of reality with virtual elements</td>
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<td></td>
<td>- <em>Parallel Kingdom</em> (iPhone)</td>
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Augmented reality involves overlaying digital imagery on the real world and requires sensors (such as cameras, accelerometers, gyroscopes, and location-sensing) and either a see-through display or a digital camera feed [8]. The feasibility of augmented reality games is now clear, with both desktop (Eye of Judgment) and mobile examples (Nintendo’s 3DS, Parrot.AR). Despite their differences, each of these games incorporate elements of the “real world,” overlaid with reality-enhancing, interactive technologies such as location sensors, camera capture, and social media.

This workshop aims to bring together CSCW researchers, game designers, and players to develop a preliminary, mixed reality games’ research canon and agenda. Although workshops in past conferences have addressed specific aspects of game design and play [2][3][6], none have focused on the unique properties of mixed reality games and the social technologies that support them. This workshop will help assure that there is healthy cross-fertilization of ideas from the different mixed reality game stakeholders and that the CSCW community plays an important role in this emerging phenomenon that relies so heavily on collaborative systems.

**Themes**

Workshop themes include, but are not limited to:

- Design Patterns (or Meta-Game) discussions for mixed reality games
- Collaborative tools and technologies used in game-design
- Game mechanics and tools that support collaborative work/play
- Empirical studies of games that require player collaboration, multi-player task management, shared storytelling
- Mobile and augmented reality technologies that support context-aware games
- Opportunities and challenges that arise from bringing mixed reality games into everyday life
- Application areas for mixed reality games with a social, scientific, or educational purpose
- Research methods for studying collaborative elements of mixed reality games
- Mixed reality games as a testbed for novel collaborative tools
- Group performance assessment measures in mixed reality games

**Workshop Goals**

The proposed workshop goals are to:

- Characterize the relationship between technology-mediated collaboration and mixed reality games in order to improve the design and products of each.
- Establish a boundary-spanning community [12] of CSCW researchers and game designers that facilitates future collaboration on mixed reality games. Promote small-group formation for proposal writing, data sharing, and co-authoring.
- Develop a preliminary mixed reality games research canon with a focus on collaborative, cooperative, and/or social components of game design/play.
Craft a research agenda for future projects, funding, and publications. Identify major research questions, known gaps in the literature, low-hanging fruit, and large-impact possibilities.

Workshop Activities
This is a one-day workshop. Activities will consist of blitz presentations, followed by group discussions and activities. A social post-workshop Research in Play session will follow in the evening.

The workshop will begin with introductions to the topic by the conference organizers. Next, each participant will give a blitz presentation similar to the CHI “madness” presentation session. Each participant will also bring a visualization, audio element, or physical artifact that represents the core concept from their presentation. These items will be displayed as a group for the duration of the workshop. At the conclusion of the presentations, all participants will engage in group discussion and activity that will help capture common and emergent themes.

The afternoon will consist of small-group discussions devoted to each of the identified themes. These discussions will follow a “World Café” format [1], in which groups will cycle through discussions on each theme in a timed round-robin format. During the final round of discussions, participants will be invited to focus and elaborate on the theme in which they are most interested. At the end of the round-robin discussions, group leaders and/or workshop organizers will present the results to all participants.

After the formal workshop has concluded, an evening social event will enable the CSCW community to experience games directly. The Research in Play session will allow participants to demo their own games, share favorites, and socialize in a fun atmosphere. The organizers will provide board games, in addition to research demos. This event will be open to all CSCW attendees.

Call for Participation
To ensure we meet our workshop’s goals of establishing an interdisciplinary community, we will invite participants from a variety of backgrounds, including game designers and players (e.g., International Game Developers Association (IGDA), Digital Games Research Association (DiGRA), Alternate Reality Games Network (ARGNet), Games-for-Change (G4C), Games+Learning+Society (GLS), Gameful) and game researchers focused on technology-mediated games and platforms (CSCW, CHI, DiGRA, IFIP Entertainment Computing, IEEE Pervasive Computing, IEEE PSM SIG, ACM Ubiquitous Computing, CSCL).

Social Media Strategy
We plan to create videos of all the presentations, which will be made available on a website after the event. The workshop will have its own Twitter hashtag to support back-channel discussion and engagement with a wider community, and we will create a Facebook page for it to keep interested participants informed. Images and/or videos of all summary materials will be preserved and shared with all participants and interested individuals on the Facebook page. We intend to use these spaces as seeds for a community of mixed reality researchers that will extend beyond the CSCW workshop participants.
Acknowledgements
Elements of the research outlined in this call for participation was funded in part by the National Science Foundation (NSF IIS-0952567, IIS-0943184).

Organizing Committee
Elizabeth Bonsignore is a PhD candidate in the iSchool at the University of Maryland. Her research interests include the design and use of collaborative sense-making technologies that support lifelong learning, whether in formal education or informal contexts (museum, library, home). Specific work includes analysis of mobile storytelling application design and use; online communities for educators and children; and the design of Alternate Reality Games as platforms for learning and collaborative-tool evaluation. These efforts include close collaboration with Kidsteam, a participatory design research team at the Human-Computer Interaction Lab.

Derek L. Hansen is an Assistant Professor at the University of Maryland’s iSchool, Director of the Center for the Advanced Study of Communities and information, and member of the Human-Computer Interaction Lab. His research focuses on technology-mediated social participation, online communities, social network analysis, and increasingly games for change. He is currently working on two NSF grants focused on the workshop topic: one examines alternate reality games in the service of education and design, the other studies location and online games that encourage citizen scientists to capture and analyze data on biological species.

Zachary O. Toups is Research Engineer directing the new Emergency Operations Human Interfaces Lab with Texas Engineering Extension Service Disaster Preparedness and Response. His research interests include the use of game mechanics to engage players in human-human interaction and interfaces to information technology in coordinating real-life disaster response. His dissertation and ongoing research pioneers zero-fidelity simulations that capture human- and information-centric aspects of practice. Ongoing work develops game designs for educating emergency responders, including mixed reality outdoor play. His focus has been on teaching team coordination by creating game environments in which players cooperate and communicate under stress, based on observations of work practice.

Lennart E. Nacke is an Assistant Professor of Game Development and Entrepreneurship in the Faculty of Business and IT at UOIT in Canada. His research focuses on the creation and analysis of digital gaming environments and mechanics. In the past years, he has organized and chaired several workshops on research topics such as applying game design principles to system development (i.e., gamification), affective computing and psychophysiological evaluation, game metrics and biometrics, physiological computing, game usability and user experience at venues such as CHI, DiGRA, FDG, Future Play, and GDC Canada.

Anastasia Salter is an Assistant Professor at the University of Baltimore in the Information Arts and Technologies department. Her primary research is on digital narratives with a continuing focus on virtual worlds, gender and cyberspace, games as literature, educational games and fan production. She holds a Doctorate in Communications Design from the University of Baltimore, where her dissertation
examined the Adventure Game Studio platform as a source of fan creativity and personal storytelling through gaming. She is also currently completing her MFA thesis in Children's Literature at Hollins University.

Wayne G. Lutters is an Associate Professor of Information Systems in the College of Engineering and Information Technology at the University of Maryland, Baltimore County (UMBC). His research interests are at the nexus of CSCW, social media, and knowledge management. He specializes in field studies of IT-mediated work, from a socio-technical perspective, to better inform the design and evaluation of collaborative systems. His lab is currently examining processes of virtual organizing in ARGs, MMORPGs, and a host of more traditional work environments.

References