Computer-Supported Collaborative Learning: Learning the Work of Play

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ABSTRACT
The similarities among three independent studies, conducted by the authors, of informal learning in human-human-computer interaction (HHCI) in three different contexts are presented: (1) university undergraduates playing multiplayer videogames; (2) adult computer users offering informal help-giving in a variety of workplace scenarios; and (3) elementary school children playing "edutainment games" on a classroom computer during free choice time. These studies have been the basis for a collaboratory founded at the University of Illinois at Urbana-Champaign called Project CSC* -- the "CSC" referring to "computer-supported collaborative" and the asterisk referring to the unix search convention chosen to reflect that instances of learning, play, and work appeared throughout each of our independent research studies.

Keywords
Multidisciplinary Design/Interdisciplinary Design; Computer Supported Cooperative Work (CSCW); Social Computing and Social Navigation; E-Learning and Education; Entertainment; User Studies; User-Centered Design/Human-Centered Design; Video Analysis

PERSONAL INTEREST – HINN
My work in the area of social learning through gaming began during my time at Microsoft Game Studios as a Graduate Usability Intern where I researched and piloted methods for multiplayer usability testing. The most personally intriguing piece of this work involved my observations of the spontaneous, informal learning that took place as the participants were learning how to play the game. Even in games that were designed as strictly competitive two-player games, there was often a shared dialogue between the gamers as they learned the basics of the game and about the game playing skills of each other. I became interested by the lack of attention that groups of collaborative gamers paid to in-game help systems and game manuals and I wondered if identifying the ways that gamers learned from one another, interacted with one another during multiplayer gaming would benefit the design of in-game learning opportunities more in line with how learning and teaching naturally occurred amongst gamers.

RELATED WORK – HINN
When a gamer is learning to play a video game, it is difficult, albeit amusing, to think of this new user attending a formal training course that parallels new users learning productivity applications in the workplace, such as "Introduction to Super Smash Brothers Melee." It is more reasonable to imagine the gamer referring to the manual, in-game help system, or perhaps a third party manual. Or the gamer might refer to game forums on the internet where they can post and read the posts of other gamers about game play "stuck points." But perhaps more commonly, the gamer will refer to friends of theirs for game play advice and/or watch and learn from others vicariously as they play through the game.

With multiplayer games, particularly multiplayer console games where players are located at the same place at the same time, it is common practice that multiple informal teaching and learning moments will occur between the gamers – whether or not the game player realizes that they are actively participating in a learning activity, a term seemingly reserved for the domains of traditional, school-based education and corporate training activities. After returning to the University of Illinois after my internship with Microsoft Game Studios, I began collecting data on social learning as it occurred (or didn't occur) during multiplayer gaming [3].

I recruited twenty-four participants for the study through the educational psychology subject pool of a large Midwestern university. The participants were asked to bring either one or two same-sex friends to the study. The 24 sessions were divided into eight male and eight female dyad sessions and four male and four female triad sessions and in each session participant groups played two different

console games - Tennis 2K2, a sports game, for the Sega Dreamcast and Halo, a "first-person shooter" game, for the Microsoft Xbox. Half of the dyads and all of the triads played both of these games in competitive (e.g., against one another) game play mode and the remaining half of the dyads played both of these games in cooperative (e.g., in order to win the game participants were required to work together) game play mode.

The primary data source was the series of 24 two-hour game play sessions, videotaped using two video cameras - one to capture the on-screen game play and the other to capture the facial expressions and gestures of the participants. The video data were analyzed with regard to the help giving and help seeking activities that occurred during game play. A demographics questionnaire given to the participants at the beginning of their session determined the gaming background of each of the participants and the experience level of each of the groups (i.e., novice/expert, novice/novice, expert/expert) with regard to game genre (i.e., puzzle games, first-person shooter games) and gaming platform (i.e., P.C-based, gaming console-based). The final data source used in the study were the transcripts of post-game play interviews conducted with the participants, focused on following up on help seeking/giving events that occurred during the session. Although other examples of HCI studies in videogame play have appeared in the literature (e.g., [5]; [6]), few have looked at this human-human interaction, this social learning that occurs in the same place and at the same time (e.g., [2]).

APPLIED RESEARCH – HINN, TWIDALE, WANG

While conducting my research on informal learning in collaborative game play activities, I became involved with two other researchers (Michael Twidale and Christine Wang) looking at informal learning that occurred during computer-based school activities [10] and computer-based work activities [9]. As the three of us began to collaborate, we discovered that in all three cases we had issues of learning embedded in other activities. In the case of workplace learning, the main focus of people was to get their work tasks done, but when problems are encountered, people asked colleagues for help and advice. In the case of playing a competitive console game, the main focus was to have an enjoyable time by competing, but if one opponent is far less skilled than the other, the more skilled gamer may need to help the other learn enough skills for both players to be able to have an enjoyable game. In interacting with peers and waiting one's turn to play a game in a classroom, children seem compelled to help each other improve. We termed our collaboration Project CSC* -- the "CSC" referring to "computer-supported collaborative" and the asterisk referring to the unix search convention chosen to reflect our thinking that learning, play, and work appeared throughout each of our independent research studies.

One aspect of the interactions between participants in all three cases was the use of commentaries on the action being undertaken. The nature of the commentaries varied somewhat, but they appear to be an important part of the wider interaction process. For instance, what I found in the console game situation was that time-criticality played an important role, and help could be solicited or offered, accepted or rejected depending on how crucial the game play moment was. Additionally, different kinds of commentary also occurred. Some was more analogous to sports broadcasting – a commentary and analysis for the benefit of a wider (imaginary) audience, although clearly of interest to the participants. Another kind is best described as "trash talking," when players would insult one another and/or their skills at the game. This was often accompanied with a form of help giving, albeit a harsher version. For example, one player might say "what an idiot – haven't you figured out that it's the 'a' button to shoot?"

In the case of workplace learning, this commentary could be a help giver telling the user what to do by giving a demonstration [1]. The demonstrations observed usually involved a sequence of actions performed and described interspersed with higher level commentaries such as particular values to use that had been found useful for the work being done, and reasons why these operations and values were used for this kind of work in this work group. For example, an explanation of how to attach a document to an email also covered the choice of which mailing lists to send it to, how to find details of these lists on the intranet, and the important distinctions of who was on which lists that would help in deciding which lists to select, bearing in mind subtleties of work relations and office politics.

In the school situation, two children playing would discuss the game while other children would watch and offer suggestions, or offer to help or to show the pair how to solve a particular challenge in the game. These additional participants had usually either just been playing, or were on the waiting list to take a turn later during the session. The main differences from the workplace commentaries were that as the game was being played in real time, there were occasions when advice was time-critical, leading to shouts of advice to avoid a problem or seize an opportunity. Sometimes children could not seem to resist helping or offering advice, either through a burning desire to help, to show off their knowledge, or to see greater progress in the unfolding game and the group achievement of a final high score. Thus some of the help offered was unwanted, and distracting, and even ignored or rejected by the intended recipients

Many of the activities observed were different kinds of scaffolding (e.g., [7]; [8]) that support the learning objective. Social scaffolding includes splitting up a task to make it easier to perform. For example, one child might focus on the keyboard options for periodic special cases while

another concentrates on the mouse to operate more general movement. Running commentaries can act as external memory, making the learner aware of issues that they need to act upon soon, and the consequences and meaning of the actions just taken. A partner may act as an emergency override, doing very little most of the time but ready to intervene if the user is about to do something dangerous, undesirable or difficult to recover from. The presence of such a social safety net can encourage more adventurous exploration than when investigating on one's own where the consequences of explorations must be recovered from also on one's own.

In the case of workplace help, the running commentaries create a structure for the learner to make sense of the actions being done. Rather than being an arbitrary sequence of semi-magic steps, the explanations give the steps meaning and help in chunking them together into groups that help structure the activity. For example, help in how to create a web page may involve use of more than one application, and needs to cover issues of making sense of testing local copies of the HTML, and then testing the web page after it has been uploaded to the server. Otherwise the learner may become confused by very similar looking actions that have completely different meaning depending on where they are done in the larger action sequence.

In the case of game-playing, one can consider a design technique called "rubberbanding" where, in a single player game, AI computer opponents might be "forced back" by the program if it's too far ahead of the human player, as if being snapped back by a rubberband. In the case of a multiplayer game, an example of social versus programmed scaffolding would be where a more expert player might pause for a minute in a race to allow their competitor(s) to come closer to them to make the game at hand more challenging.

In all three contexts, we found that learning is interleaved with other activity, either work or play. If the studies are representative of widespread computer use, as we believe to be the case, then this carries significant design implications both for built-in support for learning (such as help systems and tutorials) as well as for wider learning infrastructures of manuals, training etc. The interleaving of the pairs (work & learning and play & learning) has led us to wonder about three-way interleaving. Do games have a component of work in them? Does the playing of games have implications for work? Does workplace learning have a playful component in it, or if not, should it? The last question does seem particularly surprising. Learning a feature in MS Word does not appear to be as much fun as figuring out how to get to Championship Level in Tennis 2K2. However, the informal help-giving interactions that we saw in work settings often had some aspects of playfulness about them. Sometimes it was a break from routine work, or a chance to interact with a colleague as a change from solitary work. Sometimes social interactions (greeting people as they arrived or passed by) turned into a request for help. Nardi notes that even mundane work related applications such as spreadsheets led to the emergence of local developers who chose to spend more time 'tinkering' (a term implying playfulness); learning about the technology and interacting with programmers [4].

BIOGRAPHY STATEMENTS

1. D. Michelle Hinn (Workshop Participant) is a Doctoral Candidate in the Department of Educational Psychology at the University of Illinois, Urbana-Champaign where she has been a National Science Foundation Fellow. She has worked at Microsoft Game Studios as a Graduate Usability Intern and is an active member of the International Game Developers Association's Game Accessibility Committee. Additionally, she has worked for Computer Sciences Corporation, the National Center for Supercomputing Applications (NCSA), and the University of Nevada at Reno. Hinn is the co-editor of the 2001 book "Visions of Quality: How Evaluators Define, Understand, and Represent Program Quality" (published by Elsevier Science) and is on the editorial board of the Computers in Entertainment Magazine, a publication of the Association for Computing Machinery. She has also authored several award-winning papers on the topic of universal accessibility from organizations such as the American Evaluators Association and the International Visual Literacy Association.
2. Michael B. Twidale is an Associate Professor in the Graduate School of Library and Information Science at the University of Illinois at Urbana-Champaign. His most recent research has been focused on the informal workplace learning of computer applications (Over The Shoulder Learning) and the development of functionalities and interfaces to support the process. Twidale is on sabbatical at Waikato University, New Zealand until August 2004.
3. X. Christine Wang is Assistant Professor of Early Childhood Education at the State University of New York at Buffalo. She obtained her Ph.D. from the University of Illinois at Urbana-Champaign in 2003. Her research focuses on children's collaboration in technology-rich environments, technology in teacher's education, and digital divide issues. Wang has published articles and book chapters in these areas. In addition, she is actively involved in the Technology and Young Children Interest Forum affiliated with the National Association of Education of Young Children (NAEYC).

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