Connecting Play: Understanding Multimodal Participation in Virtual Worlds

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ABSTRACT
In this paper we propose a multimodal approach to log file data analysis to develop a better understanding of player participation and practices in virtual worlds. To deal with the massive amounts of data collected via log files researchers traditionally have employed quantitative reduction techniques for revealing trends and patterns. We contend that certain qualitative analysis techniques can reveal particular play practices across online and offline spaces and aspects of individual players' participation invisible through other methods. We present examples from our research in the tween virtual world Whyville.net that illustrate the uses of these new techniques. In the discussion we address the benefits and limitations of our approach.

Categories and Subject Descriptors
H.5.3 Group and Organization Interfaces

General Terms
Measurement, Design, Human Factors

Keywords
Virtual worlds, log file analyses, case studies, connected learning

1. INTRODUCTION
Virtual worlds, like other settings, prove to be complex environments, perhaps even more so because they are designed not only by the companies that host them but also by the players who contribute content to them. Researchers who study players and practices have faced two challenges given the particular nature of virtual worlds: capturing player participation across multiple spaces within these virtual worlds and capturing player participation between online and offline interactions. These challenges make clear that player engagement within virtual worlds is not confined to the screen alone but needs to be understood within the context of a larger play culture. A common problem for researchers has been tracking and making sense of players' navigation and interactions across the hundreds of public and private places that constitute virtual worlds. This is not simply an issue in online environments. Previous sociological traditions had teams of researchers follow a child through different settings throughout the course of a day (see [1]) or conduct extensive ethnographies in virtual worlds [2, 26]. Access to server level data where tracking data captures time stamps of locations and chat interactions can alleviate some of the labor of following people across spaces but is often not available to researchers because companies consider these data to be of a proprietary nature.

A second, equally important challenge concerns the distinction that has been drawn between online and offline interactions. Researchers have begun to argue that the boundaries between play in the virtual and the real are not as distinct as some have made them out to be, and both need to be considered as integrated aspects of play in virtual communities [5, 16, 17, 23]. Experiences in cyberspace have become a part of the everyday activities and meaning-making of many players [22]. Indeed, thinking of either physical/offline/real or digital/online/virtual as self-contained denies their flexibility and the ways that people negotiate performance, meaning, and embodiment within them: "Only when we really acknowledge these spaces as legitimate and powerful sites of production, and acknowledge the diverse agents involved in their creation, can we begin to address the challenges facing them progressively" [26].

In this paper, we address these challenges by illustrating different approaches to analyzing log file data both quantitatively and qualitatively. First, we chose a traditional approach aggregating the log file data across activities and players. We then present a case study of a tween player called Zoe/bluwave that we built by sampling her log file records and supplementing this data with what we know about her from observations and post-study interviews. Following one person provided us with an in-depth view of how she became a player in Whyville and revealed some unexpected facets and disparities of her time on Whyville not captured otherwise. Finally, we chose a secret gaming practice, called teleporting, and examined how it was learned not just within the virtual world but also across the club and other settings. Collectively, the multimodal approach to data collection and analyses allowed us to understand better how players came to participate and perform in the virtual world.

2. BACKGROUND
Different methodologies and data sources have been used to address these challenges ranging from in-depth observations and interviews to collection of log files and large-scale surveys, alongside participation in virtual and local spaces by the researchers themselves. Some researchers have begun to acknowledge that the dividing lines between the quantitative and qualitative methodologies create a false dichotomy because each

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perspective contributes to our understanding of what, when, and why players engage in these worlds (see [27]). Furthermore, the complexity of virtual worlds indicates that not any one data source alone but the triangulation of many may do better justice in understanding player practices, purposes, and psychology (e.g., [3]). Yet we still find that particular data sources such as log files are associated with quantitative analysis for generalization purposes. For instance, Williams, Yee, and Caplan [28] suggested using log file analyses for identifying general patterns across players while using interviews for more individualized assessments. While such approaches promote data integration and triangulation, they also limit our possibilities in harnessing new ways to meet the challenges of researching virtual worlds.

We decided to approach the log file data with two different perspectives: in one, the *person* perspective, we wanted to build case studies of players thus recreating their participation over time, while in the other, the *practice* perspective, we wanted to develop an account of how a particular gaming practice was adopted over time. In both cases we used log file data to capture the "who, when, how and where" but supplemented this with information available from field notes, video records, and interviews. Making sense of log files qualitatively, especially longitudinally following one person or one practice over several months, is challenging and unusual and represents one of the contributions of this paper. Some researchers have used logfiles selectively over a short period of time, for instance two girls over a few days [4] or a small group during a few class periods [6]. Others have done extensive quantitative analysis of log files (e.g., [28]) or analyses of social networks [7] or combined multiple data sources [8]. Perhaps the most common *qualitative* use of log files is to collect and analyze chat [24] but collection of chat has generally been limited to whatever place the researcher virtually inhabits at a given time.

One particular issue we faced was the overwhelming amount of data and detail collected in field notes, survey answers, and log files of 681 consenting participants aged 10-13 years over 6 months in the virtual world of Whyville. In particular, the log files recorded every word of chat typed in Whyville as well as click-level data, i.e., records of every click that were stamped with time, location, and where applicable, chat text, over a six-month time period. Though this might suggest comprehensive coverage of tweens' participation, initial analyses of chat counts, location visits, or other trends (see [14]) left us wishing for a better understanding of how players manage to navigate these virtual worlds and learn about different norms and practices from others. This was particularly important since we researched a tween virtual world and thus our own adult play experiences were most likely not comparable in many aspects.

With only a few exceptions, previous studies of online and offline gaming have focused on older teenagers or adults, in general, the intended audiences of the most popular massively multiplayer online games and the general populace of cybercafés. To date, children and tweens' increasing activity in popular virtual worlds such as Club Penguin, Neopets, Habbo Hotel, Webkinz, and Whyville has largely been ignored [15]. Before we delve into the different examples of using log file data to understand multimodal participation in virtual worlds, we will provide some background on Whyville.net, the virtual world we studied, and on the design of our data collection.

3. VIRTUAL WORLD

Whyville.net is a massive, free virtual world (in 2005, at the time of our study, it had over 1.2 million registered players; now in 2012, it has over 5.6 millions registered players) that encourages youth ages 8-16 (with an average of 12.3 years) to play casual science games in order to earn a virtual salary (in "clams"), which they can then spend on buying and designing parts for their avatars (virtual characters), projectiles to throw at other players, and other goods such as cars and plots of land. The general consensus among Whyvillians (the citizens of Whyville.net) is that earning a good salary and thus procuring a large number of clams to spend on face parts or other goods is essential for fully participating in Whyville [21]. Looks also demonstrate a player's tenure on Whyville and relative experience level; new players have fewer clams, and their looks generally show this because cheaper face parts are perceived as less attractive [20].

When Whyvillians enter the site, they immediately arrive at the Welcome Page with links to events for the week, *The Whyville Times* newspaper articles, survival tips, and FAQs. Upon arrival, users can also check their personal email, status on their Whyville salary, and their latest bank statement. From the Welcome Page Whyvillians may head straight to the Sunroof, Pool Party, and other locales to chat with friends and other users on topics related to school, friendships, and appearance. They may also engage in a number of other community-related activities. Whyville has an active community life that elects its own mayor, organizes annual virtual proms, and posts many public petitions that campaign to include or change features of Whyville. Places such as the Trading Post allow Whyvillians to exchange goods.

4. DATA COLLECTION

We collected data across three different spaces. The first space was the online community of Whyville where we tracked 681 consenting participants. We recorded every time each player went to a different place in Whyville–in other words every time the screen changed–with a marking of the virtual location and time stamp as well as everything each child typed in public chat or private whisper (private chat from one individual to another in the same virtual location/screen). In addition, we set up an after-school club where 21 tweens (9-12 years old) came to play on Whyville for an hour most days after school. While the club began as a quiet place, it quickly became loud and lively as participants learned about the site and began to shout advice to each other, arrange virtual parties, chat, throw digital projectiles at one another, and critique each other's avatars [10,17]. Most of the tweens were new to Whyville, so learning to participate in the site was a common (if tacit) goal. Club members eagerly displayed their knowledge of the site by offering advice and answering questions, such as how to create a good look or throw a projectile. The third space where students played on Whyville included the two sixth grade classes at the school. In this classroom setting, students' activities on Whyville were structured primarily to facilitate their learning about the root and spread of infectious diseases [19].

We collected several kinds of data during the study. For all 681 participants, we collected log file data. For the 88 children who were members of the club and/or the classes alone, log files included over 950,000 lines. In addition, ethnographic field notes were recorded daily to capture the overall activity of the club. Two video cameras focused on small groups of youth clustered at tables with two to three computers over the nine weeks in which

the club took place during the winter of 2005. Club participants were interviewed individually at the end of the club.

5. CONNECTING PLAYERS ACROSS ACTIVITIES

The most common approach to analyzing massive log files is to aggregate the data of players across activities and understand the overall difference in players' participation in Whyville. In a first step, we took every click players made and every word of chat they typed and performed a few different analyses to unpack what they did (for more detail on this statistical approach, see [14]). We divided all of the activities in Whyville into 13 categories and used these to look for similarities and differences in players' activities (see Table 1).

Table 1. Frequency of player participation in Whyville activities by gender

	Overall		Girls (N = 462)		Boys (N = 219)		
Categories	Mean	SD	Mean	SD	Mean	SD	t-test
chat	6209.85	11822.87	6670.59	11993.56	6913.64	12679.61	-0.48
face	3714.41	5359.62	4074.40	4798.74	3851.47	6638.31	0.42
ymail	3159.89	4502.16	3581.21	4875.54	2958.65	3757.85	1.49
social	1609.06	2332.00	1702.85	2246.88	1796.82	2625.32	-0.79
misc	679.53	2344.28	718.67	2515.26	763.40	2283.26	-0.18
economic	670.25	991.49	649.63	815.30	877.11	1327.27	-3.15**
whisper	574.65	1277.84	597.89	1170.97	693.56	1600.27	-0.73
game	548.06	649.32	518.47	561.66	728.25	777.62	3.45***
bbs	373.98	1733.01	460.87	2044.27	298.73	1162.17	1.04
info_com	370.75	857.97	400.35	869.22	400.45	933.73	0.11
multigam	182.41	621.77	136.13	391.84	318.69	976.98	-3.55***
house	155.01	256.98	155.09	221.82	187.11	326.99	-1.3
whypox	38.02	37.92	36.68	28.66	47.21	50.80	-2.89**

Note: **p<.01, ***p<.001. Results were based on independent sample t-tests and were replicated using negative binomial regression.

We first looked for differences in gender and found there were very few significant differences between girls' and boys' participation on Whyville; both girls and boys played the same activities with roughly the same frequency. Both boys and girls spent the same amount of time customizing their avatars through shopping, dressing, and trading face parts – in fact, on average all Whyvillians spent nearly 1/3 of their clicks on their avatars' appearance [8]! Only in a few minor activities did relatively small differences reveal themselves. On average, boys tended to play more multiplayer games or do economic things (e.g., looking at their bank accounts) more often, but these differences were still quite slim.

Next, we conducted cluster analyses to see if there were any players who had similar patterns of activity. We found the only major difference involved frequency of activity – about 7% of Whyvillians we studied were the most heavily involved on Whyville. We call this tier of players "Core." A much larger set of players (34%) fill the second tier, what we call the "Semi-Core" players. Finally, most players on Whyville form the third and largest tier, what we call the "Peripheral" players because they played less frequently than the other tiers of players. Figure 1 shows a breakdown of the activities of each player tier and the relative frequency of engagement in 13 different types of activities.

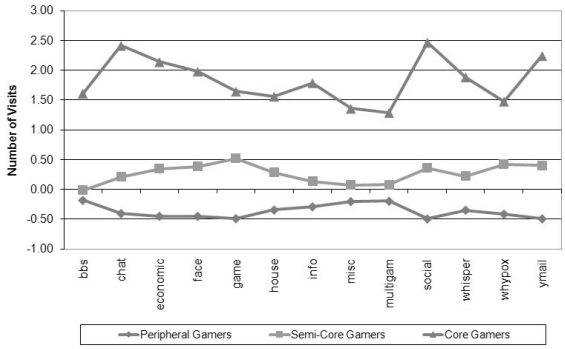

Figure 1. Player profiles by type of activity

The "Core" players spent by far the most time on Whyville, and perhaps not surprisingly this group spent much more time socializing, chatting, ymailing, and customizing avatars than any other group. "Semi-Core" players took part in far fewer activities than the Core tier, but they also engaged in more economic activities like salary-raising games ("game") and checking bank statements ("economic") as well as going to more social spots ("social") and ymailing ("ymail") than the "Peripheral" players. Across our 681 participants in the larger study, representative of the population of Whyville as a whole, Zoe/bluwave was in the top group of players, the group that participated most regularly and intensely on the site. Her case study is presented next.

6. CONNECTING A PLAYER ACROSS ACTIVITES

We choose one female club member, Zoe (bluwave), an African-American girl who was a sixth grader (12 years old) at the time of the study. In the club she was one of the first members to learn inside gaming practices on Whyville such as teleporting and throwing projectiles [9, 10], and she often taught others how to do things on Whyville, such as trading face parts. In fact, what she said that she most liked about Whyville in an interview three months into her life on the site was the social opportunity to hang out with friends and the financial side of life: "almost like a real everyday life, because you get a salary... and you can raise it by playing games or selling parts." Zoe/bluwave was not only one of the quicker learners of the club, she was also one of the core 7% of participants on Whyville.

Our log files, identified with usernames, contain every click and word of chat and whisper of the 681 participating individuals in our larger study. We isolated Zoe's/bluwave's log files and by going click by click through the data, we first created minute-by-minute summaries of her Whyville activities and then condensed these into short daily narratives that noted patterns and innovations in participation. Each line of her log files contained her username (bluwave), a time stamp (year-month-day-hour-minute-second), her location in Whyville, and if applicable, chat or whisper text. In all there were over 54,000 lines of text in bluwave's log files. To create the minute-by-minute summaries, we sampled the days she was on Whyville, selecting the first

seven days and then alternating every five or six days to ensure breadth of days of the week in our sample. In all we analyzed 35 days during her first two months on Whyville from January to June 2005. In the final interpretation of Zoe's activities, we also took into account video, field notes, and interview data from the club (for more detail, see [12]).

Early on bluwave took up what is probably a very familiar pattern of Whyville participation: logging on to Whyville, checking ymail messages (Whyville's e-mail system), checking her bank statement, adjusting her look (using a feature called "Pick Your Nose"), and then alternating between socializing and earning clams, perhaps with a shopping break at Akbar's Face Mall (where you can use clams to buy face parts for your avatar). Earning clams is accomplished by playing science games, trading face parts (for a profit), or designing and selling face parts – the latter of which is more difficult than meets the eye and is usually only taken up after several weeks of participation [20]. Bluwave gradually built up her salary by finishing several levels of science games, going through periods of heavier and lighter play of these games – she played salary-raising games more regularly during weeks 1-3 and 6-8, with a dip in participation during weeks 4-5. In creating her avatar, she began with donated parts from Grandma's – Whyville's charity – supplemented with parts from trading at the Trading Post or shopping at Akbar's Face Mall. After her first two weeks, she completely left off going to Grandma's and relied solely on shopping and trading. This in itself was a move toward higher competence in Whyville – what might be considered an important move toward a socially acceptable look since parts from Grandma's are generally held in ill-esteem by other Whyville players (*ibid).*

While this summary describes time spent on Whyville that is fairly typical of other Whyville players, there were a few aspects that were not captured in our field notes or video records from the club. Only through digging through the log files were we able to identify the scope of bluwave's search for racial representation (wanting to be African-American on Whyville), her period of heavy flirting, and a short time of scamming others in the Trading Post (for more detail on these activities, see [12]). Here we will focus on one of the places where bluwave spent extensive amounts of time in Whyville – the Trading Post. In the after school club, Zoe was one of the first members to teach others how to trade on Whyville, and she often solicited others to go to the Trading Post and trade with her. In her final interview, she said that one of her favorite parts about Whyville was trading as it related to the financial exploration she enjoyed. But how did she figure out how to trade well and what did her time at the Trading Post consist of?

Bluwave first went to the Trading Post on her second day in Whyville. In total during her first seven days, bluwave spent over 20 hours on Whyville and 38% of those (or almost 8 hours) were at the Trading Post, where she quickly learned to trade parts. There was a significant learning curve as within that first week she dramatically changed the way she negotiated trades. At first she spoke in long phrases such as "does anyone want a head?" or "okay, ill trade the pokadot hair pin for the clams." But by the end of her first week she had adapted to a shortened, more precise language that fit her trading interests. Consider the differences between the two different trading exchanges on Day 3 and Day 6 in Table 2. These two trade negotiations are indicative of bluwave's trading conversations in the first three days and in the last two days of her first week. In contrast to the early part of her first week, by Day 6 she started with a shorter invitation to trade, having put up a barrette for trade (probably the same polka dot hair pin discussed on Day 3 as it is a common newbie part): "u lik." She had a sales pitch, "a barrette for your hair." Instead of saying that she wanted clams, something she had realized was more versatile than face parts, she simply listed a price ("25??") and followed quickly with a markdown, "how about 20." She also used shortened spellings and language more commonly used in Whyville, "u" for you, "lik" for like, "Kk" for okay.

Table 2: Bluwave's Changed Discourse of Trading

Day 3	Day 6
you have anything else?	u lik
let me see!!	a barrette for your hair
some clams	HI!
okay, ill trade the pokadot	25??
hair pin for the clams	Kk
ill trade the clamz for the hair	how about 20
do you hav any oter hair?	
let me see!	
yes..the first one looks cool!!!!	
wanta trade	

The change in discourse shown in Table 2 demonstrates part of bluwave's new ability to negotiate trades. She also changed her pattern of participating at the Trading Post from having longer conversations with Whyvillians in a given room in the Post to cycling from room to room saying, "u lik?" or "got any clamz?" and quickly moving on to another room if she did not like the answers. This probably made better use of her time, allowing her to see more people in a shorter amount of time and quickly gather whether others had clams or if they were interested in anything she had. The log files were essential for observing this kind of shift in discourse because these kind of changes were not captured in video records or field notes.

On February 21, six weeks into her life in Whyville, bluwave began using the Trading Post in a new way – to scam or fraud other Whyvillians out of their clams. It began when she herself was scammed. In the main lobby of the Trading Post, where Whyvillians mill around trying to identify people to trade with before moving on to a specific Trade Room, some Whyvillians broadly solicited people who wanted their "clams doubled." Bluwave expressed interest in this and followed them to the designated Trade Room (#48), but on finding out the details, she initially expressed skepticism (see the conversation quoted below). After pressing with questions, "r u a scammer?? TELL THE TRUTH," she agreed to their methods, which consisted of one person (bluwave, the victim) putting all her clams up in a one-sided trade while the others put nothing up for trade. After the other party left their seat (giving the illusion of the trade ending and pretending there was a fake software glitch), bluwave was told to press "agree" to complete the trade, thus giving all of her money to the scammers. Bluwave's side of the conversation appears below:

2:53 p.m.	Trade Room 48
	O SRRY
2:54 p.m.	i don't beleive u!!!!
	WAIT
	r u just gonnin on his side>>>>>
2:55 p.m.	fine
	r u a scammer?? TELL THE TRUTH
2:56 p.m.	fine ill do it

get back in the chair ill do it
soo what am i supposed 2 do?

After following the instructions, bluwave checked her bank statement and realized that all of her money was gone. Then she went immediately back to the Trading Post where she begged time and again for people to donate 5 clams to her (the amount charged for each trade) – she was so bereft that she could not even trade face parts! She actually found the culprits who tricked her, confronted them with their actions, and briefly followed them to their Trade Room to try to stop the next victim from falling prey to their scam. Shortly after this she gave up on trying to disrupt their scam and after finally succeeding in getting someone to give her 5 clams unconditionally, she began to try the same scam on others.

Over the next two weeks, bluwave consistently tried to get unsuspecting Whyvillians to fall for the "clam doubling" scam as it is known among the Whyville designers. This involved going to densely populated areas on Whyville like the Beach and the Trading Post Lobby and asking people "do u want ur clamz doubled?" If someone expressed interest, she directed them to a specific trading room and told them, "put up all of ur clamz plz," then instructed them, "ok when i get out of the chair press the agree." From a chat frequency count, we know that she used the word "doubled" over 200 times, demonstrating persistency in her scamming activity, though it did not continue past two weeks. In a single day (February 25), she actually recruited for her scam 30 times in 90 minutes and got six people to go to a trading room. We know that she completed her scam at least once and probably enough times to keep her continuing at it for a time. Below is the account of when she successfully completed her scam:

11:44am	The Moon
	do u want ur clamz doubled?
11:45am	rm 49 at the trading post kk
	Foyer, TradeRoom 49
	...
	put up ur clamz plz
11:48am	ok when i get out of the chair press agree
	the typ all clear?
11:49am	leave
	Index, tradeResult, oneMail, delete, records, userDetails
11:50am	records, userDetails, index 2x, bankStatement

In this conversation, bluwave began by recruiting a victim for her scam on the Moon with her typical solicitation, "do u want ur clamz doubled?" When the person responded positively, bluwave directed the person to Trade Room 49, then went there herself. A couple minutes later the person arrived and bluwave directed the Whyvillian to put all of his/her clams up for trade "put up ur clamz plz" then said to press "agree" when she left her chair. Bluwave then left her chair ("leave") and immediately went to check the result of the trade ("tradeResult"), checked her ymail and looked at someone's profile on City Records (perhaps her victim's?), then checked her bank statement. Because there was a trade result, we know the trade went through. That bluwave checked her bank statement afterward is another confirmation that she successfully obtained the Whyvillian's clams. She continued for a few more days and then all scamming stopped.

Scams are not infrequent on Whyville, though they are strongly discouraged and warned against by both the designers and local citizens. Along the range of cheating practices in Whyville, from making guides for science games to identity theft (stealing people's passwords and accounts), scams are on the unethical and fraudulent side and certainly not publicly condoned (Fields & Kafai, 2010b). There are regular ymail warnings against giving out one's password and newspaper articles alerting citizens to the latest clever innovations in scamming. In some ways, Zoe's scamming could be seen as part of her efforts to be an insider on Whyville and in one sense it demonstrates her growing expertise in Whyville. She was a victim and then became a perpetrator; she imitated the practices of others in an effort to become rich (a common value in Whyville). It is also one other way that her Whyville life was tied to her frequenting of the Trading Post and her interests in the financial opportunities in Whyville.

Not surprisingly, it is not something she discussed in her interview at the end of the after-school club. She did acknowledge in the interview that she had a few other Whyville accounts – a common way to earn more clams on Whyville (the second author even did this to earn enough for her first Whyville car), though she did not describe the way that she persistently begged people to give her accounts that already had high salaries – an activity she carried out about the same time that she began scamming people. Both of these activities – seeking multiple Whyville accounts and scamming others – are indications of bluwave's move toward being a Whyville insider, building up experiences with practices that were common on the site, including scamming. But her adoption of the questionable practice of scamming was also temporary, lasting only two weeks within our six-months time period of observation. With help of the log files we were able to capture these hidden aspects of her online participation.

7. CONNECTING ACTIVITIES ACROSS SPACES

There are two reasons why we chose to study the teleporting practice. First, it was a secret, insider practice important to socializing on Whyville that could only be learned from another player. This meant that we could study the spread of teleporting as a form of socially shared knowledge, as a way to observe kids helping other kids learn to be a part of Whyville. At the time of our study, most places in Whyville were easy to access by means of the "Destination Menu" which citizens pull down, scroll through, then click on a specific location (such as the Beach). However, some of the more popular places in which to socialize were not visible to players in the menus available on the site: Earth, Moon, Mars, Jupiter, and Saturn. Because these sites were not listed in any written records on Whyville, the only way to discover them was from other people. The only exception to this can be found on some cheat sites where instructions on teleporting are included on "tips" for newbies [9]. Therefore, these teleporting destinations came to represent insider status and many players prized them as social hangouts because they were not overcrowded or overpopulated by "newbies," or players new to Whyville. Second, because teleporting is accomplished by typing a specific command, "teleport moon" (or "teleport [place]"), each teleport action is visible in the chat records that are part of the log files we collected. We can easily search for the occasions when the word "teleport" was typed and find each time a participant teleported.

Once we identified teleporting as a practice to study (a process that involved significant immersion in the data), we conducted different kinds of analyses. After an initial coding of the field notes and logging of the video data, we combed both types of data

for any mention of teleporting or the places to which one can teleport. Whenever teleporting was mentioned in either source it was highlighted and/or transcribed. Similarly, the online tracking data was searched for the first time players teleported, and the first time they teleported to Saturn, since that place was not commonly known early in the club. This was done by selecting out club members' chat data from the larger database and searching for those times they typed "teleport" in their chat. This data allowed us to identify the first time each player teleported, even if they were logged on to Whyville from home, and whether they sought any online help. After these incidents of teleporting were identified from all of the data, we organized them into a timeline to coordinate when and how players learned to teleport. We then further analyzed both the online log files and the video data to flesh out the context(s) in which players discovered that teleporting existed and was an option for them. Through this process we were able to compile a more complete picture of how and where club members learned to teleport than if we had not had access to these multiple data sources.

Teleporting may be the least obvious insider knowledge since one cannot observe it in others' chat (the typed command "teleport moon" is not visible to others) unless people are publicly discussing the command option during a social gathering. Out of 39,673 lines of chat data from club members, 2372 (5.98%) were instances when the word "teleport" was used. By searching through this online chat data, we were able to determine when each club member first teleported (see Table 3). This formed the basis of further investigations into from whom, how, and where participants learned to teleport.

Table 3: First Teleports

Username	Name	Date	Time	Whyville	Physical
fairi60	Kaitlyn	Jan 3	1:41:32 p.m.	Nutrition Counter	Home
whskr29	Briana	Jan 7	1:29:37 p.m.	Whyville Square	Class
WOW4	Gabe	Jan 10	8:20:11 a.m.	Leila Patio	Class
bluwave	Zoe	Jan 13	3:25:41 p.m.	Sector Y	Club
sharky404	Kyle	Jan 14	10:44:30 a.m.	Beach	Class
masher47	Aidan	Jan 19	11:56:52 a.m.	Warp Tarmac	Class
raybeams	Blake	Jan 24	7:20:28 p.m.	Bazaar	Home
stngray09	Trevor	Jan 24	3:57:33 p.m.	Beach	Club
zink	Bryce	Jan 25	4:08:34 p.m.	Taxi	Club
leo95	Cole	Jan 28	3:45:44 p.m.	Courtyard	Home
ivy06	Isabel	Jan 31	4:01:32 p.m.	Beach	Club
betelguice	Paolo	Feb 1	3:43:18 p.m.	Spin Geek	Club
vulcan61	Brad	Feb 2	9:24:44 p.m.	Beach	Home
sirius	Scott	Feb 2	3:38:06 p.m.	LeilaPatio	Club
amarylys	Jill	Feb 3	3:30:12 p.m.	Mall Fountain	Club
Peachy5	Leslie	Feb 3	4:54:22 p.m.	Beach	Home
funster	Paul	Feb 8	3:58:41 p.m.	Checkers	Club
Lucky7	Marissa	Feb 16	3:59:54 p.m.	Main Page	Club
violet5	Ulani	Feb 16	4:08:03 p.m.	Main Page	Club
BluSwirls 93	Molly	Mar 3	3:50:35 p.m.	Beach	Club
bloofer	Paige		*never teleported*		

The broad trends of teleporting activity reported in Table 3 reveal two interesting things. First, Table 3 maps out the most basic order in which club members first teleported – and that all but one of the club members (named "bloofers") did learn to teleport, a finding that should not be dismissed. Second, it begins to take into account the multiple spaces that tweens occupied in the club and Whyville. We can already see from this table that learning to teleport took place in a range of locations and differed between the club members. Indeed, the table points to the need to expand beyond the club and Whyville to take into account both the sixth-grade classes where some club members played on Whyville and implied home space.

However, when we refocus our research lens to look at individual trajectories of learning to teleport, we will see that this table is vastly oversimplified. Learning to teleport did not take place at a single second in time, though it may have been recorded that way in chat data. Further, the word-search capability of tracking data does not even begin to make use of the potential of information embedded in those logs. This identification of time points of first teleports for the club members was an essential beginning step in tracing individual trajectories of learning this insider practice (for more detail see [9]). As a case in point, Isabel, a fourth-grade club participant (9 years old) provides yet another initial context for the start of a trajectory to learning the insider practice of teleporting, this time in the after-school club. From Table 1, we can see that Isabel first teleported on Monday, January 31, while in the club. Or did she? When we took into account the combined field notes, video, and logfiles surrounding the time of her teleporting, we came to a different conclusion.

On Jan. 31, the video data show that Blake yelled across the room to Cole, telling him to meet him at the Moon. While it is apparent from the field notes that Cole was in the room with Isabel and logged on to her computer not long after Blake's call, the online tracking data show that Isabel (ivy06) teleported to the moon directly after Blake called to Cole, then gossiped to someone on Whyville that Cole (leo95) was "hot." The table below is a shortened version of the event that shows what we were able to glean about the incident from the three primary types of data (see Table 4).

Table 4: Connecting Data Sources for January 31

FIELD NOTES	VIDEO DATA	ONLINE CHAT RECORDS	ANNOTATION
~3:45pm Cole visits with Isabel, telling her about a girl who sent him a ymail. He types the girl's username on Isabel's computer so she knows what the girl looks like. ~4:00pm Cole asks Isabel to log off so he can use the computer	Blake: Cole! Meet me at the Moon!" Cole: Hang on! *((far away))*:	4:01:32pm ivy06 teleport moon 4:02:38pm ivy06 leo95 says that u are hott	*Cole is at Isabel's computer showing her a girl he had flirted with.* *Blake urgently tells Cole to go to the Moon,* *Cole types in "teleport moon" on Isabel's computer.* *Isabel sees the girl Cole pointed out earlier and whispers to her.* *Isabel logs off and Cole logs on to her computer*

This incident explains Isabel's effort to learn how to teleport on the following day. It seems apparent that Cole either gave her direct instructions or typed "teleport moon" on her computer while she was logged on because the next day during club she tried to teleport but did it incorrectly a number of times and asked Whyvillians several times how to get to the Moon:

3:13 p.m.	ivy06	Beach	go to moon
	ivy06	Beach	do u now how to go to the moon?
3:14 p.m.	ivy06	Beach	how?
	ivy06	Beach	teleport mars
3:15 p.m.	ivy06	Mars	teleoport moon
3:16 p.m.	ivy06	Mars	teleoport moon
...			
3:17 p.m.	ivy06	Beach	no how to go to moon?
3:24 p.m.	ivy06	Beach	how do u go to the moon?

Isabel eventually learned how to teleport consistently to Mars and the Moon, because on the following dates her tracking data show a typical club member pattern of teleporting from one location to the next in rapid succession (teleport Mars, teleport Moon, teleport Earth) while on Whyville. Interestingly, while Isabel saw the Moon and chatted with someone there on Jan. 31, in her interview she said that she learned how to teleport from people at Whyville. Other members of the club received mixed instruction on teleporting from youth physically present in the club and from club members virtually present on Whyville.

8. Discussion

The purpose of our paper was to illustrate additional approaches to analyzing log file data beyond the traditional quantitative summaries of pages viewed or sites visited and to go beyond traditional ethnographic observation. We did some of the traditional data aggregations too in order to illustrate how these additional analyses can provide new insights into player participation. Most commercial games or virtual worlds do not lend themselves to large log file or chat data gathering by independent researchers, and the companies who develop them regard any large database of virtual activities as proprietary information, making such data difficult to access. Our study is an exception to this rule, as the creators of the virtual world of our study, Whyville.net, allowed us access to the entire body of log file data for participating tweens who gave signed permission.

Arguably, our analyses of a practice and a person were conducted through both direct and indirect means. Strategic choices allowed us to leverage the record-keeping facility of log files to focus our multimodal analysis on particular time points. This analytic technique responded to growing concerns to understand participants' learning across multiple spaces and practices. The analyses clearly demonstrated that a focus solely on the after-school club space and on any one data source would have limited our understanding of when and how players came to learn about teleporting or how Zoe/bluwave engaged in very different trading/scamming practices in the Trading Post. One contribution provided by our study is to showcase how the integration or connection of multiple data sources in our analysis allowed for a "thicker description", to use Geertz's term [13], of how young players learned a particular practice and ways of being in a virtual world.

While documenting and analyzing club members' learning of teleporting and Zoe/bluwave's trading practices in this way illuminated many aspects of players' participation in ways that were hidden to us before, our approach to the qualitative analyses of log file data is far from omniscient. First, reading the logs was often like listening to a one-sided telephone conversation because only consenting players' log files and chat were recorded and available for our analysis. We are left to guess at what others were saying, and when they switched from talking from one person to another. Occasionally if we thought they were with someone else participating in the study from school, we would look at that specific moment in time and sort by usernames from school participants, isolating the people in the same virtual room with them and documenting a fuller conversation. However this was rare.

Second, we do not have all of the club members' online data. For instance we do not have screenshots or spatial records of their movements within particular spaces on Whyville. As one might imagine, avatars move around in Whyville, and much can be signified by relative proximity. Many people move next to each other when whispering on Whyville, embodying the closeness of a private conversation. We also did not collect ymails (the email in Whyville) because these were deemed to be more personal than live chat. This means that we cannot document who they might have ymailed, how often they ymailed specific individuals, or the content of ymails. While we know how much time they spent ymailing and can often guess who they ymailed based on the order of activities (talking to someone, saying they would ymail him/her, and going immediately to ymail), we have very limited knowledge of this practice that leant itself to more enduring relationships (ymail is generally used to keep in touch with already established friends – it does not depend on finding someone live on Whyville).

Finally, these were analyses of one particular practice and one particular girl player in a particular virtual world for a limited amount of time (six months) at a certain period of time in the development of that virtual world. We chose two different perspectives, practice and person, in our analyses of logfiles for an additional view on their developments. In future steps, we're planning to examine other practices and more cases to validate this qualitative approach to logfile analysis. We have already taken first steps into this direction by choosing a more complex practice such as projectile throwing [10] for analysis. Projectile throwing is also traceable in chat but is more complex because it involves multiple actions such as purchasing and selecting projectiles and different ways and contexts of using them. We also created five other case studies to get a better sense of individuals' different trajectories in virtual worlds [25]. In addition, we have analyzed the log files to capture social practices such as flirting and dating that are not tied to particular commands (as teleporting and projectile throwing are) but to a different discourse in chat and whisper [14]. These further applications will provide us with a better understanding of how fruitful this type of log file analysis can be. In the end, we understand that even adding more data sources will not solve a fundamental conundrum of all research – to account as fully as possible about events, activities, and players in communities. But we advocate considering multiple data sources and even considering different ways of how to analyze them. As we demonstrated in this paper, there is more than one way to look at log files.

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