USER-CENTERED DESIGN IN VIRTUAL WORLD INTERFACES:
A HUMAN FACTORS PERSPECTIVE ON THIRD-PARTY SECOND LIFE VIEWERS

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ABSTRACT

Although research on the social aspects of virtual (or synthetic) worlds abounds, the role of the client-side applications (viewers) used to access these worlds is often overlooked. This thesis examined the interfaces of several popular third-party viewers (TPVs) used by Second Life (SL) residents in an attempt to formulate recommendations for future user-centered viewer design endeavors. The Uses and Gratifications theory was used to identify goal-based user groups in SL. Data collection began with an online survey of 540 frequent SL users; a cluster analysis of the resulting data revealed six distinct groups: socializers, gamers, developers, designers, business communicators, and entrepreneurs. Residents from each identified group were then interviewed to discover the strengths, weaknesses, and relative usability levels of their primary viewers of choice from their group’s perspective. Findings indicated that (a) all groups tended to have similar opinions regarding the strengths and weaknesses of SL viewer UIs, (b) users overwhelmingly preferred viewers based on Linden Lab’s 1.x viewer, (c) most SL viewers tended to have inadequate inventory management tools, (d) the Phoenix viewer was most often cited as having the best content creation tools, and (e) many complaints about the SL user experience related to server-side issues or world design rather than the client application. In conclusion, future research recommendations are discussed.
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Luke Hillman
# Table of Contents

Introduction ..................................................................................................................................... 1  
Literature Review ........................................................................................................................... 3  
  Virtual World Research .................................................................................................................... 3  
  Second Life Research ...................................................................................................................... 4  
Uses and Gratifications ....................................................................................................................... 5  
U&G Relation to User-Centered Design ............................................................................................ 7  
The Synthetic World User Interface ................................................................................................. 9  
Method .......................................................................................................................................... 13  
  Participants ................................................................................................................................ 13  
  Research Design ............................................................................................................................ 14  
  Measures ................................................................................................................................... 15  
  Procedure .................................................................................................................................. 17  
Results ........................................................................................................................................... 20  
  RQ1: Do the actual goal-based groups of SL correspond to the groups assumed by Linden in their profile UI (and if not, what are they)? ................................................................. 20  
  RQ2: What are the strengths and weaknesses of the five most popular Second Life viewers? 21  
    Socializers ............................................................................................................................. 22  
    Gamers .................................................................................................................................. 22  
    Designers............................................................................................................................... 23  
    Developers ............................................................................................................................. 23  
    Business Communicators ...................................................................................................... 24  
    Entrepreneurs ........................................................................................................................ 24  
  RQ3: Are any of the five most popular Second Life viewers particularly suited to use by one or more of the goal-based user groups? ........................................................................ 25  
    Socializers ............................................................................................................................. 25  
    Gamers .................................................................................................................................. 26  
    Designers............................................................................................................................... 27  
    Developers ............................................................................................................................. 27  
    Business Communicators ...................................................................................................... 28  
    Entrepreneurs ........................................................................................................................ 29  
Discussion ..................................................................................................................................... 31  
  Goal-based User Groups of Second Life (Uses and Gratifications) ............................................ 31
Introduction

Second Life (SL), a pioneer of 3D virtual worlds, boasts approximately 700,000 active users and a total virtual land area equaling the physical area of Rhode Island (Ambrose 2010). Its users are mostly concentrated in the United States and Western Europe, though Second Life is available to anyone with unfettered access to the internet. Almost from its beginning in 2003, Second Life has been researched extensively as a communications medium, as an educational tool, and as an online subculture (cf. Bainbridge 2007; Koch 2009; Kirriemuir 2010). Much of the research on SL has tended to classify it as a massively multiplayer online role playing game (MMORPG), though it is not a game in a traditional sense. Because SL is clearly recognized as the leader of interactive virtual worlds by communication and social scientists (cf. Messinger et al., 2009) and has been praised as an ideal virtual space in which to conduct communication and sociological research (Barnett & Coulson 2010), it is important to understand who uses virtual worlds and how.

One potentially large factor in SL interactions is the software client a person uses to connect to the Second Life grid (a persistent instance of a virtual space). This software, known as a viewer (not to be confused with the person doing the viewing – in this thesis, a SL user will be referred to as a “user” or “resident”), mediates all of a user's interactions with and in the synthetic world. From SL's beginning in 2003 and continuing through 2006, residents used a viewer developed exclusively by Linden Lab, the company behind Second Life, to connect to the grid. In January 2007, Linden Lab (known throughout this thesis as “Linden,” “the Lab,” or simply “LL”) released the viewer's code to the open source community under the GNU General Public License citing its wish for SL to be an open and extensible platform (Press Room, 2007). Since that time, the viewer has forked into more than seventeen distinct projects maintained by
independent developers. Linden actively maintains the official Second Life viewer, on which the independent third-party viewers (TPVs) are based.

Dependent on their changes to Linden's original code and user interface, the TPVs each provide their own distinctly different user experience. Some include functionality not originally included in Linden Lab's viewer, while others differ from the original mainly with regard to their UI layout. Naturally, certain viewers have become preferable to certain users. From a human-computer interaction (HCI) perspective, it is essential to understand the factors that cause one viewer to be preferable to certain groups of users over another viewer. Knowing these factors would contribute to a solid understanding of viewer usability and enable more precise user-centered design endeavors. Literature on Second Life in general abounds; however, there is a serious dearth of research relating to TPVs, their user bases, and their usability levels. This thesis attempts to partially bridge this gap by exploring the third-party viewers. Specifically, it attempts to discover whether the goal-based user groups of Second Life require separate software and what functionality and UI elements are seen as most desirable. This information is useful to Linden Lab and TPV developers alike, and can be used to improve users' workflow and overall satisfaction with the viewer.

Blumler and Katz's (1974) Uses and Gratifications theory provides a useful framework for determining goal-based user groups: gratifications sought by various SL users through their usage of specific viewers indicate separate goals they pursue inworld (the term “inworld” is used to differentiate between the physical world and the synthetic world of SL). Usability and user-centered design are used throughout this study as a guiding philosophy to prioritize end users with the hope that Linden Lab and TPV developers will, when appropriate, take the resulting recommendations into account for future iterations of the software. The following literature
review examines (a) virtual world research, (b) Second Life-specific research, (c) recent Uses and Gratifications research on new media, and (d) the intersection between the uses and gratifications theory and user-center design to explore three applied research questions on TPVs.

**Literature Review**

**Virtual World Research**

Schollmeyer (2006) notes that virtual worlds are “serious games,” which many hesitate to identify as such (preferring to refer to them as “simulations”) due to their broad applications to, and implications for, real-world concepts. Schollmeyer in this case is referring to any virtual simulation including technical models on the one hand and issue/scenario-exploration simulations on the other. Gee (2007) examines gaming-specific worlds, eventually concluding that successful video games incorporate several principles relevant to education: distributed/dispersed knowledge, affinity-based learning groups (as opposed to socio-cultural groups), and the notion that a learner is also a teacher and a producer. Questioning whether more mainstream, mass consumer virtual worlds are anything more than a gaming trend, Pinkwart and Olivier (2009) examine their potential uses, concluding that virtual worlds are successful not only in their entertainment endeavors but also in education and business. Thomas and Brown (2009) add that virtual worlds are useful in the sense that they “allow for a new class of affordances to emerge,” allowing users to explore real-world knowledge to new situations virtually and contributing to a general shift in the way problems are presented. That is, virtual worlds are learning environments at their core.

Vastag (2007) argues that even game-based interactive virtual worlds are a boon to sociologists and epidemiologists, who can use them to study specific facets of human behavior such as learning styles, reactions to disasters and outbreaks, and attitudes toward game
challenges. Bainbridge (2007) adds that in addition to socio-behavioral research virtual worlds carry implications for computer science research in human factors. Barnett and Coulson (2009) find that virtual worlds (specifically MMOs) are ideal “virtual laboratories” to explore human behavior due to their overwhelming social components, which they say often overshadow the original game-oriented designs of many MMOs. Because of these social facets of virtual worlds, especially the fact that interaction styles and attitudes from one the physical world seem to carry over to the virtual world (cf. Eastwick & Gardner 2009; Whitty et al. 2011), Castronova (2005) advances the term “synthetic world” as a more accurate descriptor of persistent virtual environments: “they cannot be sealed completely; people are crossing it all the time in both directions, carrying their behavioral assumptions and attitudes with them” (p. 147). One illustration of this is provided by Banakou et al. (2009), who find that elaborate avatars are more successful in social settings in synthetic worlds. See et al. (2009) also find that virtual worlds elicit “natural human behavior” in addition to gamer decision processes, concluding that this should be taken into account when designing new human-computer interfaces.

**Second Life Research**

Malaby (2005) provides a definitive overview of Linden Lab and Second Life. While his main focus is on macro-level issues related to developing and building the virtual world (and the company), he notes several times that even Linden Lab was surprised at the culture developing around and inside Second Life and the uses people found for it. Until recently, Linden considered itself solely the provider of server space and a developer of content creation tools. Goals and motives of non-academic SL users are still little understood since the vast majority of research on it seems to be specifically education-related; furthermore, SL usage has been inconsistent since it first went online. Ambrose (2010), speaking on behalf of Linden, still
considers SL to be in the “early adopter” stage of development despite it having begun in 2003. Reports of the size of the SL user base conflict with each other. Nino (2010) reports that since the debut of the latest version of Linden’s viewer (2.0 codebase), the SL population has been in decline, while Woods (2011), speaking on behalf of Linden, denies that the population has seen a significant change since the previous year. The population and popularity of Second Life depend largely on what needs and goals its users are able to satisfy through inworld activities (Wagner, 2008).

Since SL lacks a game-like structure, inworld activities require discovery by users. This exploration itself can be a sort of amusement, but is alienating to many new and old users of SL (Krangel, 2008). Even though Second Life is the “apparent leader of today’s self-determined virtual worlds” (Messinger et al., 2009), Harris et al. (2009) interestingly discovered that as social networks in SL continue to broaden over time, exploration of the world, as well as inworld communication (i.e., chat) decreases. This appears to extend game observations made by Kirman and Lawson (2009), who found that social networks in gaming communities rely on a dedicated group of “hardcore” players. It was further found by Kirriemuir (2010) that research into the user groups of Second Life was difficult because people who found it too technical or otherwise difficult simply “gave up,” and do not respond to surveys.

**Uses and Gratifications**

The U&G approach originally articulated in Blumer and Katz’s *The Uses of Mass Communications* (1974), and on which much research has been conducted over the past half century, asks what people do with media, not what media do to people. Rosengren (1974) explains that basic needs of individuals interact with other factors in their social environment to produce perceived problems and solutions. In other words, people have motives for using the
media they use and seek to satisfy certain goals through their use of this media. The U&G perspective differs from the traditional effects approach which examines communication from the perspective of the communicator: U&G focuses primarily on the motives (Windahl 1981).

The U&G approach itself relies heavily on self-reporting (i.e., directly soliciting responses from subjects as to their motivations for using a particular type of media), which has drawn criticism in the past (Katz, 1987). U&G theory does not attempt to explain the origins of the goals that spur people to use one medium over another; rather it looks at media as a tool for users with existing motives. Particularly, U&G assumes that individuals have more influence and agency over their own actions and those close to them than does mass media.

U&G was originally applied to mass communication tools such as radio and television, but more recent advances in technology have demassified media (Williams et al., 1988). New media (i.e., the internet and related technologies) have changed the way people are exposed to media (Finn, 1997) and strengthened the U&G approach by giving individual users the ability to choose from an extremely large array of more individualized (as opposed to mass) media (Chamberlain, 1994). Users now take on a much more active role in choosing which media to use, whereas before modern advances choices were limited and often forced the user into a more passive role. Active use of media increases the user's level of involvement (and sometimes investment) in the medium, which Galloway and Meek (1981) point out affects a user's motivation together with how well the user perceives that a particular type of media satisfies a given need.

U&G has been successfully used in recent research on (a) the web (Ko, Cho, & Roberts, 2005; LaRose & Eastin, 2004; LaRose, Mastro, & Eastin, 2001), (b) blogging (Chung & Kim, 2008; Hollenbaugh, 2010; Kaye, 2005), (c) online games (Wu, Wang, & Tsai, 2010), and (d)
social-networking sites such as Twitter (Chen, 2011), Facebook (Bumgarner, 2007), and MySpace (Raacke & Bonds-Raacke, 2008).

Of particular importance to this study is the finding by Ha and James (1998) that the new connectedness of telecommunications systems fulfills informational needs for task- and goal-oriented users, and their further finding that expressive (rather than investigative) users were assisted by the information-gathering capabilities of interactive media in locating others with similar interests. By discovering the goals and related informational needs of SL users, we can begin to formulate research questions about the usefulness of certain TPVs.

**U&G Relation to User-Centered Design**

User-centered design (UCD) requires a knowledge of which user groups and goals exist. The Uses and Gratifications theory provides a conceptual framework for discovering these goals. The gratifications people seek naturally vary from person to person and community to community; gratifications sought through the use of computer games and synthetic worlds are largely unexplored (Boyle & Connolly 2008). However, several studies (mostly since then) have investigated uses and gratifications of video game and synthetic world users in attempts to discover goals and motivations of user groups. These studies have utilized a variety of methods to collect user data, the most frequent methods have been web questionnaires and interviews (cf. Fang et al., 2009).

Study results have varied. Guadagno et al. (2011) found that goals such as shopping, building, owning property, and avatar appearance customization followed real-world gender stereotypes (i.e., with men being more concerned with achievement and women tending to shop and socialize more frequently). This study consisted of a survey of 352 respondents recruited through a listserv of educators in SL. These results seem to be somewhat in opposition to Jansz
and Martens' (2005) study, which found the majority of male gamers surveyed were motivated more by social contact than by competition. Social contact is a running theme in much virtual world research: Shelton (2010) found that Second Life users sought identity, sociality, and achievement; Williams, Yee, and Caplan (2008) similarly found achievement, sociability, and immersion to be motivators of video game users. Their study also debunks many common stereotypes of gamers with regard to age and gender makeup. Zhou et al. (2010) found more motivations of social virtual world users that they grouped into three categories: utilitarian (e.g., shopping and learning), hedonic (e.g., excitement and escapism), and social (e.g., talking).

While highly salient, socialization is not the only gratification frequently sought through the use of synthetic worlds. Though not itself a study of user-generated content (UGC) in synthetic worlds, Shao's (2009) U&G investigation into producers of UGC found that people seek means of mood management through their interaction with the content as well as their interaction with other users in virtual communities centered on UGC. This is relevant to Second Life since the entire world is composed of various forms of user-generated content. Malaby (2005) noted the importance of content creation tools in Second Life, pointing out that the original tools provided by Linden Lab were seen (by Linden) as all users needed to create content inworld (p. 101). Przybylski et al. (2010) found that video game users seek to fulfill basic needs for competence, autonomy, and relatedness, leaving out socialization. Tseng (2011) found that online gamers (which in this case assumes game-oriented synthetic worlds) are primarily motivated by needs for exploration and aggression.

Klimmt et al. (2009) found that users of video games seek a shift in self-perception through “adoption of valued properties of the game character,” implying that avatar customization is an important factor leading to this eventual gratification. As the representative
inworld presence of their users, avatars themselves are treated with care. Users sometimes identify with their avatars to a point where they cannot cope psychologically with seeing avatars taking part in socially taboo activities (Whitty et al., 2011), which suggests that avatar control is a goal to which viewer designers should give highest priority.

**The Synthetic World User Interface**

The importance of the viewer in synthetic world computer-mediated communication (CMC) has been recognized. Sutcliffe and Kaur (2000) address the viewer issue by providing a walkthrough method for evaluating UIs used in inworld interactions; Linden Lab's own usability research team uses a similar walkthrough-based method (Ben Glenn, personal communication, February 28, 2011). However, nearly all other research into Second Life and other synthetic worlds has focused on the design of the world itself rather than the viewer(s) people use to access it. For example, Sidhu and Bowman (1997) explore usability assessment of “collaborative environments” (virtual reality) delivered over the internet. This is problematic because of the entirely user-generated nature of SL; regions may be different but the user experience (UX) related to the viewer is much more universal.

Bartle (2003) focuses mainly on the design of virtual worlds themselves, but makes two important observations on how the viewer affects interaction: (a) that its primary purpose is to translate the world communicated by the server “into a form the player can comprehend” (p. 62) and (b) communication with the server inevitably involves lag due to the load placed on it, and the client can deal with it in various ways (p. 63). Lag being a usability issue (too much resulting in the world becoming incomprehensible to the user, or causing the user to make errors), it is important to consider when designing the interface; in general, good user interface design requires minimizing user errors (Shneiderman, 2009).
Another difficult aspect of synthetic world HCI is knowing where the viewer ends and the world begins. It has been noted by Koch (2009) that the interface does not stop at motion controls, menus, and other UI features but also extends to and includes a user’s avatar (normally thought of as being controlled by the UI rather than being an actual part of it). This is an interesting problem because avatars themselves serve as social devices as well as functional ones. Schultze's (2010) review explores the phenomenon of the avatar and its effect on embodiment and presence in synthetic worlds. Ducheneaut et al. (2009) examined avatar creation tools in three synthetic worlds (Maplestory, World of Warcraft, and Second Life) to determine their ease of use. Finally, the fact cannot be ignored that the synthetic world itself and objects in it are relied on by viewer software to communicate information about the world back to the user. While virtual object parameters often suffice, inadequacies in (or lack of) object metadata becomes especially troublesome in text-based viewers such as might be used by the visually impaired (Folmer et al., 2009).

The purpose of user-centered design is to build software specifically for certain tasks, which ultimately yields a more well-thought-out and comprehensive interface. Luostarinen et al. (2010) cite basing UI design “on the technical properties of a device” as causing needless complication in user interfaces. Krug's (2005) first law of usability is “don't make me think” (p. 11); he finds that “thinking” about an interface interrupts a user's workflow and leads to frustration. Flow (psychological immersion) is an especially important concept for Faiola and Smyslova (2009), who find that flow in Second Life is correlated with telepresence, which allows users to “lose their sense of time and connection with their present reality.” User-centered design prioritizes flow in order to make the interface all but invisible to the user, who should, according to this philosophy, only notice the content they are accessing.
Based on user groups and goals identified in previous studies, a variety of measures have been taken to improve the user experience (UX) of synthetic world interfaces. To satisfy the goal of self-expression, UIs have added support for user-controlled gestures, i.e., avatar body language (cf. Greenhalgh et al., 1997), while others have attempted to automate body language based on what is being said in text chat (Neviarouskaya & Prendinger, 2009) or even to create totally event-driven avatars (Dohi & Ishizuka, 2009). To assist users in their pursuit of exploration, sound (specifically music) has been employed to strengthen user memories of certain inworld regions and improve navigation (Ardito et al., 2007). Mahmud et al. (2010) suggest that integrating virtual worlds with other technologies (most importantly web and hypertext) would improve the user experience by making inworld information more accessible from outside; Linden Lab has lately experimented with web technology in the form of web-based personal profiles for its users. Linden's personal profile interface, specifically the section that posits the existence of specific inworld goals, served as a guide to formulating the research questions that guided this study.

**Research Questions**

Second Life is in the relatively unique position among virtual worlds of having nearly 50% of its users regularly log in from a third-party software client (Quirk, 2011). This is in part due to Linden Lab open sourcing its viewer in 2007; since then, several independently-developed viewers have steadily gained popularity. The goal of this study was to determine whether the goal-based user groups of Second Life are adequately served by Linden Lab’s viewer (version 2.6 at the time of this writing), or if perhaps these third-party viewers are filling requirements overlooked by the original Linden viewer. Until recently, Linden Lab had included a section in SL residents’ personal profiles entitled “I’m here to…” which provided a list of possible goals of
SL users and asked residents to check the boxes beside goals relevant to them. The choices were: build, explore, meet, be hired, group, buy, sell, hire. Users were also given the opportunity to select several skills from a list directly underneath this section, namely: textures, architecture, modeling, event planning, scripting, custom characters. This section is still visible in many current versions of third-party viewers, and goals listed in this section were used as a starting point for the first research question. Accordingly, the following three research questions guided this research:

RQ1: Do the actual goal-based user groups of Second Life correspond to the groups assumed by Linden Lab in their profile UI – and if not, what are the goal-based user groups of Second Life?

RQ2: What are the strengths and weaknesses of the current most popular Second Life viewers?

RQ3: Are any of the five most popular Second Life viewers particularly suited to use by one or more of the goal-based user groups?
Method

Data collection took place in two phases over approximately 45 days. The first phase was a web survey distributed through multiple channels; the second took the form of ten individual, inworld structured interviews in which participants expanded on their survey responses, clarified any particular pain points, and offered suggestions for improvement of their primary browser’s user interface.

Participants

The main criteria for participant selection in the web survey phase of the study were twofold: (a) a minimum age of 18 and (b) some amount of prior experience using Second Life. Because this was an anonymous web survey, no other qualifications were necessary or feasible. After completion of the survey, participants in this phase were separated into six groups roughly corresponding to their primary inworld goals as determined by the survey. Twenty-four people (four from each of the six identified user groups) were contacted for an interview. A total of eight people (at least one per group) participated in the structured interview phase. Criteria for participant selection in this second phase included the age and experience restriction from the survey phase – the eight participants in the structured interview phase had also participated in the web survey. For the interviews, preference was given to verbose participants (that is, participants with the longest open-ended responses) in order to gather as much data as possible. I further attempted to recruit participants who used a variety of SL viewers.

Of 540 survey respondents, 52.59% reported their gender as male and 42.26% reported female. 85% of respondents reported their ethnicity as “White.” Since the survey allowed respondents to check an “other” box and write in their own response, those reporting
“Caucasian” were recoded as “White.” Responses denoting nationality (“Irish” and “Australian” being the most popular) were left unchanged. 2.22% of respondents reported “Asian,” and 1.67% reported “Black.” Other ethnicities and combinations thereof were indicated by less than 1% of respondents.

The most frequent avatar type of any group was human; however, individual groups varied on the second most popular avatar type. Nearly all respondents reported spending more than eight hours per week in SL. The most frequently-occurring Myers-Briggs personality type for the entire dataset was INTJ, followed by INTP. There was some variation in individual type preferences across groups. Finally, the Phoenix viewer was by far the most popular, with Imprudence always coming in second place. Tertiary TPV preferences differed across groups and are discussed below. Note that the “Architect” and “Explorer” categories from the survey were selected by large numbers of respondents who otherwise primarily identified as a member of one of the other groups; therefore, these categories were integrated into other groups but did not merit their own.

**Research Design**

This study employed a dual-method design with a web survey and several structured interviews. The web survey was designed specifically to provide a partial answer to RQ1 (whether the goal-based user groups of SL conform to the Linden-defined groups in the profile interface, noting any differences) and to explore the possibility that members of goal-based SL user groups naturally gravitate toward viewers seen as more conducive to achieving their goals. Most of the questions explored various possible goals of SL users; some questions directly asked participants to comment on their goals and experiences inworld. The question most directly relevant to RQ1 grouped the Linden-specified categories and goals into seven categories (with
the added category “griefer/troll”) and asked respondents to select any categories applicable to themselves.

Individual structured interviews were designed to answer RQ2 (strengths and weaknesses of various SL viewers) and to collect further data to explore RQ3 (the possibility that goal-based user groups in SL require separate software). Though the exact interview prompts varied across user groups (and individual users), the protocol asked specific questions about the preferences of the participant's user group and any interesting facets of their viewer's user interface that they liked or found frustrating. An attempt was made to deduce the participants' experience and comfort levels with the default Linden Lab viewer (either 1.x or 2.x). Participants were asked to relate their experience with the various viewers they had used and to speculate on whether or not specific viewers are better suited to specific tasks in SL. Questions about participants' primary goals were included to verify that the categories discovered through survey response analysis were accurately applied.

Measures

The web survey phase of this study gathered both quantitative and qualitative data and measured 14 distinct variables: SL consumerism, creativity, gaming experience, investment in SL, leadership, playfulness, SL business savvy, SL communication style, SL cultural awareness, sociality, technological savvy, tenacity, vanity, and viewer comfort level. In addition to these variables, a simple measure was taken of respondents' MBTI type preferences (i.e., extraversion/introversion, intuition/sensing, feeling/thinking, perceiving/judging). Simple in this case is defined as one question per possible preference; the point of this was to get a rough estimate of MBTI type frequencies across goal-based user groups.
Questions of the web survey took the form of multiple choice questions (e.g., “what is your primary method of communication in SL?”) and seven-point Likert scale rankings (e.g., “how important is it that you are able to shop for clothes in SL?”). Some questions offered the participants an opportunity to comment on their answer choice or ranking; completely open-ended questions were used sparingly. It is important to note that the survey questions asked about both a participant’s real life characteristics and Second Life characteristics; for example, a person may be more extroverted in SL and more introverted in real life. In some cases, real life characteristics may affect a user’s goals in SL. Appendix A contains the complete list of questions used in this survey.

Individual structured interviews measured participants' level of comfort using various aspects of their chosen SL viewer. Since participants were recruited as representatives of particular goal-based groups, the questions asked varied. Participants who were identified as being in SL primarily to socialize were asked questions relating to their social goals; participants identified as coming to SL primarily to practice scripting and programming were given more user-appropriate questions dealing with the programming tools available in their viewer. Participants were also prompted to clarify and elaborate on their open-ended survey responses. Measures were level of familiarity with their viewer of choice, subjective satisfaction with that viewer compared to Linden Lab's viewer, and the number of viewer-specific features relevant to their inworld goals they mentioned during the interview. For text-based interviews, logs were saved. The investigator kept detailed notes on interviews conducted via inworld voice chat. Appendix B contains a sample interview script.
Procedure

Recruitment for the web survey initially took place in Second Life and on internet forums. Using the “world map” functionality of the SL viewer and a Second Life account registered specifically for the purpose of conducting this study, I located densely-populated areas of SL, teleported in, and talked to the avatars I found at those locations about the survey. First-person experience with Second Life provided some knowledge of web sites typically frequented by other SL users (most notably, the main community forums on secondlife.com and sluniverse.com). I advertised the survey on these sites as an academic study testing user interfaces of various SL viewers in order to discover goal-based user groups. These advertisements contained a brief summary of study objectives and a link to the survey. In addition to inworld word-of-mouth recruitment and web forums, I was assisted by several prolific Second Life bloggers in spreading the word. After their postings, the survey URL was shared by interested individuals on Twitter, Reddit, and other social networking sites. The first page of the survey was an informed consent document advising participants of the requirements for participation and their rights as participants. Participants were advised that by completing the survey they indicated their consent to participate. They were further advised that this study was being conducted on a non-existent budget; no compensation of any kind was offered for any phase of the study. The survey itself was comprised of approximately 40 questions and typically took 20-30 minutes to complete. At the end of the survey, participants were given the opportunity to leave contact information in the form of an email address if they were interested in being considered for further phases of the study. Email addresses were stored in a separate encrypted file to better preserve anonymity of respondents. Once the survey was closed, the
responses were used to formulate goal-based user profiles. At the conclusion of analysis, six distinct user groups were evident, described in the next chapter.

Recruitment for the structured interview phase began at the conclusion of survey data analysis. The possibility of participation in this phase had been alluded to in the initial web survey advertisements, and a full forty percent of survey respondents expressed interest. Of these, three from each of the defined user groups were contacted for interviews based on the length of their answers to the open-ended survey questions. Of those contacted, at least one from each group responded. Interviews took place virtually on the Second Life grid. Upon meeting with the investigator at a time and grid location of their choosing, participants were given the informed consent document in notecard form (the ideal means of transferring large amounts of text inworld) and asked to read over it and respond that they understood and agreed to be interviewed. Special care was taken during the interviews to reassure participants that the study was about the software, not SL residents. The interview script varied slightly from participant to participant as it depended largely on which group they fell into and the content of their survey response. In general, they were asked to elaborate on their open-ended comments, especially any aspect of their primary viewer's user interface they identified as painful to use; i.e., items they ranked more important and less easy. For example, if someone ranked “inventory management” 1 in importance and 3 in ease of use on a seven-point Likert scale where 1 was very important/very easy and 7 was not at all important/very difficult, that was treated as a pain point because the importance value was less than the ease of use value (even though, objectively, 3 is still on the easy side of the scale). Participants were also asked questions about their identified user group's general preferences and goals, successes and difficulties experienced while using SL, and their thoughts on specific improvements to the interface. Of additional interest was their
experience with the latest Linden Lab viewer (2.6 at the time of this writing). When a participant brought up a particularly interesting point, the researcher attempted to prompt the participant for an elaboration. Interviews lasted approximately sixty minutes.
Results

The data was collected through two methods, an online survey and in-depth interviews. The web survey served both as a means of data collection and as the sole method of recruitment for individual interviews. The findings of both phases of the study yielded results both anticipated and unexpected. Due to the popularity of the web survey on various social networking sites, the response of users far surpassed my expectations in terms of number of participants (n =540). All survey respondents self-identified as at least one of the categories mentioned in the previous section, though many participants indicated multiple categories and in turn, not all the categories were mutually exclusive (one person per category).

RQ1: Do the actual goal-based groups of SL correspond to the groups assumed by Linden in their profile UI (and if not, what are they)?

My analyses began with an examination of goal-based user groups. First, I explored how well participants’ self-selected goals were aligned with the Linden Lab categories. Initial goal selection was based on responses to the question, “which of the following categories best describes you in SL?” This question allowed respondents to select up to one or multiple categories: Business user, Designer, Architect, Programmer, Socializer, Role Player, Explorer, and Griefer/Troll. These eight categories (excepting Griefer/Troll, which was added as an amusement for the respondents and which was not frequently selected) were based on the Linden-defined goals.

In an attempt to discover how closely users fit Linden’s segmentation categories (e.g., are people who consider themselves “business users” likely to select only that category, or secondary categories as well?), I explored the pattern of frequency counts and combinations (pairs, triads, quartets) of user goals (Table 1). Next, I conducted the TwoStep cluster analysis in SPSS, which
is suited to the use of categorical data. Similarity between clusters was determined using the log-likelihood distance method. The determination of the optimal number of clusters was performed automatically using the Bayesian information criterion. To generate the clusters, we used the eight dichotomized user goals (yes/no response). The cluster analysis produced six distinct goal-based groups that differed slightly from the Linden Lab eight groups: (a) Socializers, (b) Gamers, (c) Designers, (d) Developers, (e) Business Communicators, and (f) Entrepreneurs. These groups have been named so as to take into account any overlap between the original categories. The explorer category was discarded; equal numbers of participants across all groups selected these categories. Business Users were divided into two distinct groups (communicators and entrepreneurs) based on the type of usage they specified. The divide loosely correlated with the selection of the architect category: participants who selected business user and architect together formed the new Entrepreneur group; those who did not select the architect category were found to be using SL mainly for telecommunications purposes.

RQ2: What are the strengths and weaknesses of the five most popular Second Life viewers?

Each group had distinct complaints about their viewers' user interfaces. This is perhaps one of the most relevant aspects of the web survey to this study because it lends direct insight into which modules of the UI could be improved for which groups. It also provides an overview of the weaknesses of popular third-party viewers. Further, it served to guide much of the next phase of the study (structured interviews). The relevant section of the survey asked users how easy it was for them to accomplish certain tasks using their primary viewer, and followed up with how important they considered each task. These questions took the form of seven-point Likert scale rankings. Any task with a lower ease value than its importance value was treated as
a pain point. Frequencies of pain points across user groups determined group pain points. The following are detailed descriptions of each group as determined by the web survey results.

Socializers

Socializers are respondents who selected up to three categories: socializer, explorer, and griefer/troll. Most of these respondents selected only the socializer category; however, a large minority selected both the socializer and explorer categories. Only nine survey respondents total selected the griefer/troll category. Respondents who had selected other categories are not included in this group. The socializer group included 99 of the 540 respondents. Socializers were nearly equal in their (real life) gender makeup: 50.51% reported male, 47.47% reported female, with the remaining 2.02% declining to respond. The most frequently-occurring non-human avatar form in the socializer group was anthropomorphic animal (furry). 95.96% of socializers responded that they shop for things in SL. After Phoenix and Imprudence, the most popular viewer of the socializer group is Kirstens. In terms of personality type, socializers are more likely than any other group to be extraverts – a full 25% reported being more extraverted than introverted. Additionally, socializers are as likely to have a J preference (33.33%) than a P preference (33.33%); the remaining third of socializers fell exactly between J and P. UI pain points identified among the socializers were voice chat, inventory management, search, building, and contact list management.

Gamers

Gamers are respondents who selected up to five categories: designer, architect, role player, explorer, and griefer/troll, with role player being an absolute requirement. Gamers additionally responded that they were also involved in other virtual worlds and games outside of SL (e.g., World of Warcraft, Avination). Respondents who selected socializer and business user
are not included in this group. The gamer group included 16 of the total respondents. Of these, eight reported their gender as male, seven reported female, and one declined to respond. The most frequently-occurring non-human avatar form in the gamer group was “fantasy animal” (e.g., dragon, unicorn). 93.75% of gamers reported shopping in SL (only one respondent reported not shopping). After Phoenix and Imprudence, the most popular TPVs are Kirstens and Restrained Love. The most frequent inferred personality type among gamers was INTP. The groups UI pain points mostly dealt with movement (walking, flying, teleporting) and communication (specifically text chat). Most gamers also ranked “playing in general” one of the most difficult tasks to accomplish.

Designers

Designers are respondents who selected up to four categories: designer, architect, explorer, and griefer/troll, with designer being an absolute requirement. Respondents who selected business user, role player, socializer, or programmer are not included in this group. Of the 23 respondents in the designer group, there was a slight female bias: 13 reported female, 8 reported male, and one declined to respond. The most frequently-occurring non-human avatar in this group was “other life form.” 100% of designers reported shopping in SL, and a majority (58%) report selling virtual items. After Phoenix and Imprudence, the most popular TPVs were Kirstens and Firestorm. Designers' UI pain points were inventory management, flying, and playing in general.

Developers

Developers are respondents who selected “programmer” and up to three other categories: architect, explorer, and griefer/troll. Respondents who selected socializer, designer, role player, and business user are not included in this group. Developers accounted for 12 of the 540 survey
responses, and among them there was a clear male bias: seven reported male, three reported female, one reported transgendered, and one declined to respond. The most popular non-human avatar form among developers was robot. Ten of the twelve developers (76.92%) reported shopping in SL. The most frequent inferred personality type among developers was INTJ. The developer group was unique in that one third reported spending less than eight hours per week in SL. Their most frequent UI pain points were search (specifically for locations and groups), inventory management, and playing in general.

**Business Communicators**

Business communicators account for part of the survey's original “business user” category. Therefore these are respondents who selected that category and up to three others: programmer, socializer, and explorer. Of the 28 business communicators, 20 reported their gender as female, while only 8 reported male. 100% of business communicators report using human avatars. Similarly, 100% reported shopping in SL. As with most other groups, the most frequently-occurring inferred personality type among business communicators was INTJ. Business communicators prefer the Ascent viewer after Phoenix and Imprudence. This group's UI pain points centered on navigation and communication: they searching for places, teleportation, inventory management, and navigation in general were the most frequently identified complaints.

**Entrepreneurs**

Entrepreneurs account for the other half of what the survey originally called “business user.” These are respondents who selected the business user category AND the architect category AND the designer category. This group did not include role players or people involved in any other virtual worlds or games, but did include several people who had selected the
programmer category. This group accounted for 27 of the total survey respondents, and it was relatively balanced in terms of gender (13 male, 14 female). The most frequently-occurring non-human avatar in this group was “furry,” and 92.59% reported regularly shopping in SL. Nearly all entrepreneurs spend more than eight hours per week in SL. The dominant personality type among them is INTJ. Popular third-party viewers were Kirstens and Firestorm. UI pain points among entrepreneurs are search, inventory management, buying $L (Linden Dollars), and building/creating in general.

**RQ3: Are any of the five most popular Second Life viewers particularly suited to use by one or more of the goal-based user groups?**

After defining the six goal-based user groups above, four respondents from each group were contacted based chiefly on the length of their open-ended survey responses (preference was given to the most verbose responses). These respondents were invited to participate in structured interviews inworld to elaborate on their own responses and clarify their group's preferences. Of those contacted 8 participated (two developers, two entrepreneurs, one gamer, one socializer, one business communicator, and one designer) in an interview. Highlights from the interviews for each group is given below. While participants in this phase have been assigned random pseudonyms to preserve anonymity, an attempt has been made to capture the essence of their SL names.

**Socializers**

The socializer interviewed, “Debbie Lang,” primarily used Imprudence viewer due to her distrust of Phoenix (Phoenix having been developed by the same team who made the Emerald viewer, which was banned by Linden following privacy violations). In the past, she had considered Emerald the best of the third-party viewers. When asked what specific features she
missed most from Emerald, she replied: “The skins and the area search feature. I've gotten to using that function, and I first used it in Emerald.” Debbie preferred text chat to voice chat, like most of her fellow socializers: “I didn't like a lot of the changes [Linden Lab] made to the chat and communicate boxes when voice was integrated.” Also like many socializers, Debbie had trouble managing her inventory. She had over 44,000 items in her inventory when we spoke, and mentioned that the Imprudence inventory interface was still not as good as it should be (though she was clear to voice her preference for it over Linden's 2.x viewer series).

Gamers

One gamer was interviewed. “Fiona Starfield,” who primarily used the Phoenix viewer, also frequently used Restrained Love. Restrained Love (or RLV) is a viewer with built-in support for certain elements of role play not available by default in other viewers – for example, sharing control of an avatar with another user (often used in sexual contexts). Fiona had numerous reasons for using the Phoenix viewer: she had, like many, been reliant on Emerald before its end; she was uncomfortable with the Linden 2.x series; furthermore, she appreciated that Phoenix had built-in RLV script support (meaning that it has much of the same functionality of the Restrained Love viewer). When asked to elaborate on her indication that “playing in general” was a difficult task, Fiona stated that RLV scripts were essential to certain forms of play in SL and that she was disappointed that it took third-party tools to accomplish this. As a member of the gamer group, Fiona was also involved in other games and virtual worlds outside of Second Life. When asked why movement and text chat in SL were particularly burdensome, she mentioned that the Second Life interface did not follow some of the conventions established by these other games (at the time of interview, she was most active in World of Warcraft). She
found that the chat interface often interfered with the motion controls: she often found herself moving in unintended directions while attempting to chat.

Designers

As a designer, “Gregor Grigorovic” has an objectively large inventory. Designers are the main creative group defined by this study; as such, working with multiple objects and textures (image files which can be applied to inworld objects to make them seem more realistic) was a large part of Gregor's inworld experience. His inventory was accordingly much larger than that of an average SL user (over 100,000 items). At the time of his interview, Gregor primarily used Kirstens viewer, which uses Linden’s 2.x viewer codebase. He noted that the UI “seemed cleaner” than Linden’s 2.x viewer, but still suffered from certain of its drawbacks, among them poor inventory management. He added that he had been more comfortable with Linden’s 1.x series inventory manager, and that the new sidebar on the 2.x-based viewers was confusing to use and required too many clicks to navigate. He appreciated that Kirstens included a “separate inventory floater” button, which opened an inventory window separate from the sidebar. When asked why he used Kirstens viewer, he replied that it “gave the most attention to [graphical] detail,” and that the image quality was more realistic, even seeming to be photographic in some cases. He further clarified that he felt more accomplished when viewing his creations through the Kirstens viewer than other viewers.

Developers

Two developers responded to the interview invitation. The first, “Harold Finch,” was an IT specialist in real life and a robotic spider in Second Life. Harold primarily used the Imprudence viewer and clarified that this choice was due to Imprudence being “as close as possible to the original SL 1.x viewer.” He said that he had had experience with the new Linden
viewer, and did not have problems with it, but preferred the old layout because it was what he was used to. Harold's main issues with SL were unrelated to the viewer, he said, and mainly had to do with latency (what many SL users would refer to as “lag”). He said that he had an “extremely fast” internet connection, but still occasionally had problems with objects not loading quickly and with instant messages not being sent immediately. Consequently, most of his coding was done offline on his local machine, then uploaded to SL for testing and debugging. He appreciated the syntax highlighting in Imprudence (which is standard across SL viewers) because he was not aware of any offline text editors that properly dealt with LSL (Linden Scripting Language, the proprietary scripting language used in SL, which is similar to JavaScript).

The second developer interviewed was “Betty Goldfinger,” who worked for a landscaping business in Second Life. Her programming and scripting mainly revolved around getting aspects of virtual land to act realistically (waterfalls were her specialty). She used Phoenix because she considered its inventory system the least painful to navigate – “you'd think that [Linden Lab] would come up with a system where I could access more than one folder at once,” she said of Linden Lab's 2.x viewer. “Often when you start on a new branch of the inventory you don't know how you're gonna be using those items – like when I started sculpting, I sent it all to textures. So, you need to be able to reorganize, and then [multiple] windows helps.” When asked about her feelings on the search feature, she clarified that while it was not particularly difficult to use, it took too long to load and returned poor results.

**Business Communicators**

“Kaylee Heimlich” was one of two participants in the interview portion of the study who preferred voice chat to text chat. Kaylee had originally come to SL while looking for a game for her teenaged son. After trying there.com and TSL (Teen Second Life, which she described as
“truly a Lord of the Flies experience”) she settled on SL as the best choice for a teen needing a social and creative outlet. After introducing her son to SL, she began using it herself to conduct teleconferences and other business meetings for her real-life business. Her primary viewer was Phoenix, which she used because of the “excellent building tools,” specifically the options to copy an object’s size, shape, and position attributes to a new object (though she does not consider herself primarily a designer). Kaylee’s chief complaint about the Phoenix UI (which extended to the other viewers she had experienced) was the inventory window, which she said sometimes failed to fully load and was difficult to keep organized. Furthermore, she found the location search tool inadequate because search results were not updated frequently enough (more a general SL problem than a viewer-specific issue), and she often found herself teleporting into simulations that no longer existed.

**Entrepreneurs**

“Slink Rosenbaum,” an entrepreneur in her late forties, also preferred voice chat due to chronic pain in her wrists (she also found time spent in SL to be an effective distraction from the pain). At the time of her interview, she ran a own business from her own island in Second Life, the initial cost of which she had quit smoking in order to afford. She began making money in SL in her free time as a pole dancer shortly after being introduced to it by her sister, who had met her husband in SL. After six months, Slink had become the manager of the club where she worked, and said that it was at this point that she “realized the potential of this place.” Following the death of her daughter, she opened a full-time graphics business in SL. She had very few complaints about the Firestorm viewer interface. “For the most part, I have everything I need, but sometimes building with Firestorm is frustrating and I switch back to Phoenix.” She also mentioned that it is sometimes difficult for people outside the United States (such as herself) to
purchase items in a timely fashion due to problems with the credit card networks. More than once during the interview, Slink expressed trepidation “about where [Linden Lab] is taking SL,” referring to the changes introduced with the 2.x viewer series.

The final interview was with an entrepreneur, “Tina Sheffield,” who was a full-time college professor in real life and a fashion designer in Second Life. Like Slink, Tina owned an island, the cost of which was offset by her business. Tina used the Imprudence viewer at the time of her interview, and expressed extreme distaste for the Phoenix viewer due to its connection to the defunct Emerald viewer. “I used and supported Emerald until last April, then I spent a month alone researching the back-story on Emerald when I found out that [a close friend's name] was logged in this password-revealing database. The risk [of using Phoenix] is too high for me; I deal in real dollars to pay for this sim.” Tina considered herself a power user of the Imprudence viewer, but like many designers found the inventory management system inadequate. There were features from the Emerald viewer (which have been integrated into Phoenix) that she missed, including “God-like land management,” which was a quick access menu to tools for freezing or ejecting problem users (i.e., griefers) from a simulation. Tina feels most comfortable with Imprudence because of its developers' accessibility.

The Discussion section takes into account both survey responses and insights gained from interviews and provides answers to RQ2 and RQ3.
Discussion

Three research questions were posed in order to gain insights into the usability of third-party Second Life viewers. With an eye toward goal-centered design, the first step in my method was to identify distinct goal-based segments of the SL population (RQ1). The resulting user groups were similar to the groups assumed by Linden Lab in its profile interface, but provided additional granularity in some cases (discussed below). After groups had been defined using web survey responses, survey data and structured interviews were used to explore the strengths and weaknesses of popular SL viewers (RQ2) and determine whether certain viewers were more suited to use by certain groups (RQ3). When considering the results of both the survey and the interview phases of this study, two new important questions are raised: first, given the gratifications SL users seek through their use of third-party viewers, is it possible or desirable to design a viewer that satisfies all or most of their requirements? Second, will users be satisfied with a Linden-produced viewer that fulfills their interface expectations?

Implications of these questions are discussed in this section, followed by limitations of this study and recommendations for future research. The research questions are addressed directly in my final conclusion.

Goal-based User Groups of Second Life (Uses and Gratifications)

RQ1 asked which goal-based user groups existed among the SL user base. The six goal-based user groups discovered by the web survey results are an indicator of the gratifications SL residents seek through the use of their viewers: socializers seek socialization, gamers seek entertainment, designers seek fulfillment of creative endeavors (similar to developers). Entrepreneurs and business communicators both see SL as a tool in some way, either to maximize productivity or profit (or both). Entrepreneurs tend to view SL as a new place in
which to conduct business and reach new target populations, and business communicators using SL seek new, media-rich modes of telecommunication for their existing real-world businesses. There exists a great deal of overlap between these groups and the Linden-assumed categories, but there are notable differences: the Linden categories seem to assume that “business users” – that is, users who indicate their desire to sell, hire, or be hired – fit squarely into what this study calls the “entrepreneur” category. In fact, both types of business user are likely to attempt to make money in Second Life, but in reality these two types of business users (communicators and entrepreneurs) are separate and distinct. In the SL profile interface, users are given the option of indicating which of several skills they possess; all of these skills are ways in which people attempt to make money in SL (designing textures, buildings, and avatars; programming object behaviors; planning social events). Some skills are more particular to certain categories than others (for example, “custom characters” and “modeling” are designer skills and “event planning” is a socializer skill). There is, however, no skill option to indicate proficiency in business communication or less profitable activities such as “exploring” – which brings up another important difference: the Linden-assumed user categories include “explorer,” but this in itself is not a distinct category according to survey results.

In fact, over 57% of all survey respondents considered themselves “explorers” (in addition to other categories in most cases), a fact which does not take into account the types of exploring SL users might seek to accomplish. For this reason, explorer category was eliminated and integrated with others. The most frequently-occurring combination of categories selected by users including “explorer” was “socializer, role player, explorer,” seeming to suggest that in addition to exploring social venues and UGC in Second Life, many users are also interested in some form of role play. A large portion of SL role players are included in the gamer category,
which was not one of the original classifications posited by Linden. This can perhaps be attributed to public relations: SL is not a game in the traditional sense of achieving goals and earning rewards, and it is not marketed as such. When asked by people unfamiliar with Second Life if it is a game, many experienced SL users are vehemently insistent that it is not. Interestingly, however, a small but distinct group of survey respondents use SL primarily for gaming (role players are included in this category, along with people who play structured games in SL). Though SL in its entirety is not a game, the 3D and interactive nature of it certainly does not prevent interested users from playing games within it. The users who fall into the gamer category are also involved in other gaming activities outside Second Life, e.g., World of Warcraft, and undoubtedly bring goals and expectations from those environments. The interview with gamer Fiona Starfield indicated that she sought to do things in SL that the structure in World of Warcraft would not allow (i.e., RLV-related activities), but found “playing in general” to be a difficult task; therefore, her pursuit of entertainment as a gratification is not fully successful.

**Strengths and Weaknesses of Popular TPVs**

RQ2 attempted to discover the strengths and weaknesses of the most popular third-party SL viewers. Throughout the web survey and structured interview phases, it became clear that only two viewers stood out as being particularly popular – Phoenix and Imprudence. Kirstens viewer, while not overwhelmingly chosen by participants, occasionally merited mention by participants with extensive experience with multiple TPVs. The main weakness discovered across all viewers was inventory management. This is for multiple reasons: first, the inventory interface is not well-organized or user-appropriate. It seems to be geared mainly toward people who need organization imposed upon them from an external source, meaning that implementing
one's own organizational scheme is difficult. Objects sometimes categorize themselves into arbitrary directories upon first appearing in one's inventory rather than prompting the user to make choices about where to put them. Furthermore, an inventory window is, by default, singular. This causes difficulty when moving items between directories. Finally, the fastest way to locate an item in one's inventory is currently to search for it. Depending on the viewer's cached inventory index, this could take longer than necessary; in some cases, an item simply will not show up. There is some question whether or not these issues are entirely attributable to the client software; latency especially is often caused by server-side issues. Regardless, some effort should be made by all viewers to alleviate the inventory issue to the highest possible degree. The following are viewer-specific strengths and weaknesses.

**Phoenix**

Phoenix enjoys the highest level of popularity among third-party viewers because it is the direct successor of Emerald, which was the most widely-used TPV before it was disallowed by Linden Lab one year ago. Features frequently cited by interview participants as being particularly desirable in this viewer were (in order of frequency) familiar 1.x look and feel, advanced building tools, radar, avatar physics, and RLV script support. “Advanced building tools” refers to the ability to copy an object's attributes (i.e., size, shape, degree of rotation, and location) to a new object, as opposed to filling in the new object's values by hand one at a time. This is a simple UI implementation that is not in any way server-dependent; therefore it is notable that Phoenix is one of the only TPVs to include such a feature. The radar feature (predictably) allows a user to examine her avatar's immediate vicinity and locate other users on the sim and her avatar's proximity to them. This is especially useful for socialization. Avatar physics, also known as “breast physics” because the first implementations of it focused on avatar
breasts, cause elements an avatar (such as breasts) to behave more realistically – i.e., jiggle. This is a client-side rendering feature. RLV script support, named after the viewer that first pioneered it (Restrained Love Viewer), was frequently cited as a particular strength of Phoenix. This is an interesting case of a feature from a less-popular viewer being absorbed by a more popular one; the end user benefits by having access to all of Phoenix's other strengths plus RLV's in a single piece of software.

The main weakness of the Phoenix UI (besides inventory management, which has already been discussed as a drawback of all viewers encountered by this study) is the occasional latency experienced by its users – what many SL residents would refer to as “lag.” Though this is arguably an issue with the SL protocol itself, not to mention individual connection speeds, some users report having “less lag” on other viewers. This issue, however, does not specifically affect one user group more than any other.

Imprudence

Imprudence, the second most popular third-party viewer, gained a devoted following immediately after Emerald's dissolution and before the first version of Phoenix was released. Many of its users have stuck with it because of trust issues with the Phoenix development team, fearing that there may still be malicious code leftover from Emerald. Like Phoenix, Imprudence was often cited by its users as being more usable due to its interface's similarity to Linden 1.x. This was its most talked-about feature, followed by its speed and stability: Imprudence users frequently mentioned that it was the fastest-loading viewer they had used, referring to both its startup time and the loading (rezzing) time for the avatar's surrounding environment (though users still had complaints about general speed issues of Second Life). Finally, users appreciated
the accessibility of the Imprudence support team; several remarked that they had gotten prompt assistance when they had asked for it.

Frequently-cited drawbacks of the Imprudence viewer seem to be informed by what other viewers (specifically Phoenix) have incorporated into their feature sets. The lack of a radar or similar feature was particularly lamented, and seems to be a feature that many ex-Emerald users had become accustomed to having before their switch to Imprudence. Some who had had experience with Phoenix similarly regretted Imprudence's lack of RLV script support. Building tools were not often mentioned by Imprudence users as a particular drawback or feature.

**Kirstens**

Kirstens was the third most popular TPV, but was only rarely mentioned by users who did not consider themselves “viewer connoisseurs.” Its current build uses the Linden 2.x codebase, which means that it suffers from many of the same shortcomings attributed to the current Linden viewer. Of these, the sidebar was most frequently cited as a nuisance, but several participants mentioned that the Kirstens sidebar had been tweaked slightly from the Linden version such that it was not *quite* as painful. In fact, Kirstens was cited several times by several participants as being the most tolerable of the 2.x-based viewers. Care has been taken to eliminate some of the clutter inherent in a 2.x-based viewer by default. Its strengths are primarily graphical: Kirstens attempts explicitly to be a tool for machinimists. It includes a film and photography menu which is useful for people who produce artwork in SL, and it devotes much of its allocated memory to graphical rendering, with the end result of making the 3D environment seem more realistic. This is at the expense of one's graphics card, as one participant remarked; a computer running the Kirstens viewer is likely to overheat unless it possesses top-of-the-line hardware. Kirstens includes customizable avatar physics.
Suitability of Software for Specific User Groups

RQ3 asked if certain viewers were particularly suited to use by one or more of the goal-based user groups. As mentioned above, the most popular viewers – Phoenix and Imprudence – received roughly the same percentage of use across all six user groups. Other viewers received varying support across groups, but were so eclipsed by the first two as to be insignificant. Certain viewers have doubtlessly been created to fulfill the requirements of certain niche groups – the Dolphin viewer (one of the viewers mentioned on the survey) was created to provide advanced functionality for sailors in Second Life; the Kirstens viewer web site mentions that it includes specific features for machinimists; Restrained Love was clearly intended for two-person role play – but these groups were not among those identified through this study. Phoenix and Imprudence, then, find themselves in the position of enjoying almost exclusive support from the community of TPV users. Phoenix has clearly shown itself to possess more novelty features (building tools, game-like radar, RLV scripting, and developer-specific tools), while Imprudence seems to be a strong basic viewer offering speed and stability. Both viewers are based on Linden's 1.x viewer code (though both projects are currently developing 2.x-based versions, “Firestorm” and “Kokua”) and both seem to be responsive to requests for specific functionality from the community. Phoenix in particular showed impressive initiative by integrating RLV scripting into its current release. Assuming that this trend will continue, my conclusion with regard to RQ3 is that Phoenix and Imprudence both are suitable for all defined goal-based groups. Put more explicitly, these groups do not require separate software.

Limitations

While this study was successful in soliciting participation from a large number of respondents, it is clear that responses were limited to users who had, objectively, a high level of
experience in SL and a high level of subjective investment in it. More than half (62%) of all respondents had been active in SL for three or more years, and a full 77% spent eight or more hours per week in SL. This can perhaps be attributed to the web survey's popularity on external-to-SL sites and social media applications. Though several participants were recruited through inworld means based on population density of SL regions, the vast majority discovered the survey through alternate channels. Web page statistics (Table 2) which began being recorded midway through the survey, indicate “no referring link” as the most frequent referring page, which is consistent with clicking a URL from inside Second Life – but also with results achieved by following a shortened URL (commonly found on Twitter). The next most frequent referring pages were entries of popular SL-related blogs and forum posts.

Second Life is not primarily a web-based community. Because it is a 3D virtual world which users must download additional software to view, the vast majority of SL interactions happen inworld through use of this software – not web browsers. Users who are involved in “outworld” discussions of SL matters – that is, discussions on “the normal web” – have naturally reached the level of involvement and investment in SL that they care about what happens there even when they are not actively interacting within its 3D environment; it has become a more ubiquitous part of their everyday internet communications. Linden reports that a scant 1% of active SL users also participate in the community forums at secondlife.com, and most of these users have multiple years of experience inworld.

Therefore, this study cannot explain issues specific to new users, which are the target demographic Linden had in mind when designing Viewer 2.0 and its recent successors (R. Woods, personal communication, April 12, 2011).
Finally, though this study was reasonably successful in determining why users choose certain TPVs over others, and was especially successful in determining that many long-time SL users are dissatisfied with Linden's Viewer 2.x series, it does not explain what factors initially inspire users to make the switch from the Linden viewer they initially downloaded upon creating their account to an unknown third-party viewer.

**Future Research**

Linden Lab continues to produce new iterations of its viewer, and has conducted usability testing on it with participants completely new to Second Life. Some of these participants have previously heard of SL and have given it some thought (such as what they would do there and what their inworld goals would be – that is, potential uses of the software) before these tests; others have had no exposure to SL whatsoever. Linden has, in recent iterations of its viewer, made an effort to target the latter group. The Linden 2.x series of viewers is designed to resemble software that a user completely new to virtual worlds would already be familiar with – namely, a web browser. However, there has been some question (R. Woods, personal communication, April 12, 2011) whether or not this is beneficial to the mass adoption of SL: many users do not understand the difference between a web-based virtual world and one accessed through a separate desktop client, and the fact that the new Linden viewers look more and more like web browsers might be confusing to new users. In fact, in one usability test I observed, a new user was confused that he was not “on Second Life” when he visited secondlife.com through his browser. Linden Lab usability engineers are of the opinion that in terms of general usability, the Viewer 2.x design is as good as the original, and that totally new users are likely to be as satisfied with it as new users who started out on the 1.x series were
satisfied with that viewer. The complaints of long-time users who began using SL with Viewer 1 are attributed to the changes in Viewer 2’s interface disrupting their workflow.

Since this issue was more revealed by this study than researched, and the retention of new users is obviously of paramount importance, future research relevant to Linden Lab should be conducted on questions such as (a) the overall satisfaction level of SL users using Viewer 2 and 1.x, (b) the likelihood of switching to a third-party viewer and which ones, (c) the retention rate of users who began using SL with Viewer 2.x vs. The retention rate of users who began with Viewer 1.x and (d) the goals of those who begin with Viewer 2 vs. Viewer 1.

These questions are structured in order to benefit future versions of Linden's own viewer, but for the moment (since approximately half of all SL users log on from third-party viewers) it is still important for third-party developers to conduct their own usability research. TPV developers do not necessarily have the same goals as the Linden developers; after all, nearly all SL users start out on the Linden viewer. It is not the TPV community's job to see that SL retains new users – rather, its goals should center on improving the user experience for those residents who feel they are not adequately served by the Linden viewer but want to remain active in SL. Therefore their own UX research should examine (a) the factors most relevant in choosing TPVs, (b) the appeal of the TPV across the user groups, (c) the functionality of the TPV, (d) the codebase most conductive to the user experience and (e) the most important improvements for the default UI.

The MBTI predictor questions were especially revealing – the ratio of respondents with INT preferences to respondents with other preferences seems to indicate that SL users in general are introverted (more likely to think than talk), intuitive (more comfortable with general theories than with interpreting first-hand sensory data), and thinking (more comfortable making decisions
based on logic than on feelings). While not directly relevant to the research questions posed in this study, MBTI types potentially lend insights to a user's interaction style (e.g., more playful vs. more serious, more talkative vs. more tacit) which can assist in the formulation of more specific user profiles (i.e., hypothetical personas) for use in traditional usability testing. Since only four questions were asked in this section of the survey – one per type preference – a more in-depth personality test could prove valuable.

Another unexpected survey result was the approximately 80% of respondents indicating that they used SL for romantic and/or sexual activity. This bears looking into because of the gradations possible in a positive response to this question (which was a simple yes/no choice; no open-ended comments were solicited). For example, romantic activity holds a number of meanings: residents may use SL for communication with an existing romantic partner, they may use SL as a medium to discover new romantic prospects (as one might use an online dating site), or they may go on virtual dates inworld. “Sexual activity” is similarly vague, and perhaps even more so. In addition to interactive sexual simulations in which one might partake with a partner, there is an element of self-exploration possible in a virtual environment, and of course there are levels of involvement in these scenarios as well. A survey respondent who indicated that they had used SL for sexual activity may not be involved in SL BDSM communities or necessarily have any use for RLV scripting. It is important to know the magnitude and extent to which sexual activity is popular in SL. Depending on its popularity, it may even indicate the presence of an entirely overlooked goal-based user group – potentially, several. If so, it would perhaps be beneficial for Linden Lab or TPV developers to include more functionality useful to this group.
Conclusion

This study began as an attempt to explore which software provides the best functionality and workflow for distinct goal-based Second Life user groups and ended up raising more questions than it answered; answers to the original three research questions (the six group descriptions, reported benefits and drawbacks of certain viewers, and the finding that a single well-designed viewer has the potential to satisfy all groups) provide a suitable launching point for further study by both Linden Lab and independent software developers.

Whether these studies will be undertaken is unclear. Linden Lab has gone through a number of changes in the past year and in the past month both negative and positive. Last June, the Lab cut 30% of its workforce, but followed that with the hiring of a new CEO, Rod Humble, with a reputation for openness and accessibility. As recently as last month, Linden released “basic mode,” a new Second Life UI that attempts to solve many of the problems faced by completely new users with no gaming experience. As mentioned above, however, Linden's viewer targets the new user above all others; if this continues to be the case and they are successful in retaining these new users, the role of third-party viewers can only become more important as these users become more proficient inworld and are classifiable as members of one of the goal-based groups defined here.
Appendix A: SL Viewer Survey

1. Thank you for participating! Remember that your answers will be anonymous (your name will not be identified with your answers). Let's start with some general information about your experience in Second Life. First, how long have you been active in SL?

   o Less than 1 year
   o 1-2 years
   o 2-3 years
   o 3-4 years
   o 5-6 years
   o more than 6 years

2. Do you have friends in SL that you don’t know in real life?

   o Yes
   o No

3. About how many people are on your SL friends list?

   o 0-5
   o 6-10
   o 11-15
   o 16-20
   o 21-30
   o 31-40
   o More than 40

4. Do most of your SL friends know each other?

   o Yes
   o No/don't know/doubt it

5. In general, do you prefer surprises and making things up as you go along, or do you prefer careful planning?

   1  2  3  4  5  6  7
   Surprises  o  o  o  o  o  o  Plans

6. What is your real life gender? Do you shop for things in SL (this could be inworld or on the SL marketplace web site)?

   o Yes
   o No
7. Is your SL avatar USUALLY… Select the best option

- A human
- An anthropomorphic animal (or “furry”)
- A non-anthropomorphic animal (or “feral”)
- A fantasy animal (e.g., unicorn, dragon)
- Some other life form
- A robot
- Some other inanimate object

8. About how much time do you spend in SL?

- Less than two hours per week
- 2-4 hours per week
- 4-6 hours per week
- 6-8 hours per week
- More than 8 hours per week

9. When you are in SL, do you typically stay in or around places with other people?

- Yes, I spend most of my SL time around other people.
- No, I spend most of my SL time alone.

10. When you are in SL, do you build furniture and/or buildings?

- Yes, often
- No, not usually (or not at all)

11. In SL, do you design clothing, jewelry, or gadgets?

- Yes, often
- No, not usually (or not at all)

12. Have you ever attended a political event in SL?

- Yes
- No

13. Have you ever organized (or helped organize) a political event in SL?

- Yes
- No
14. When you are in SL, do you experiment with scripting or programming?
   o Yes, I script and/or program
   o No, I don't script or program

15. Do you primarily use text or voice chat when communicating in SL?
   o Text chat
   o Voice chat
   o Both
   o Neither

16. Do you primarily use the default SL program (viewer) that you downloaded when you
    signed up for SL, or do you use a third-party viewer (for example, Phoenix or
    Imprudence)?
   o I primarily use the default SL program
   o I primarily use a third-party viewer

17. If you use a third-party viewer, which one(s) do you use (check all that apply)?
   □ Phoenix
   □ Imprudence
   □ Emergence
   □ Kirstens
   □ Ascent
   □ Restrained Love
   □ Dolphin
   □ Libretto
   □ Other(s):

18. Are you more interested in future possibilities or respected traditions?
   o Future possibilities
   o Respected traditions

19. What is your approximate real life age?
   o 18-25
   o 26-35
   o 36-45
   o 46-55
   o 56-65
   o Older than 65
20. Have you ever sold anything in SL?
   - Yes
   - No

21. Have you ever held a business meeting in SL?
   - Yes
   - No

22. Have you ever used SL for fantasy roleplaying?
   - Yes
   - No

23. Have you ever attended any kind of performance in SL?
   - Yes
   - No

24. Have you ever put on a performance in SL?
   - Yes
   - No

25. Have you ever used SL for romantic or sexual activity?
   - Yes
   - No

26. Would you say that you have a leadership role in your Second Life community/communities?
   - Yes
   - No

27. Are you involved in any other virtual world communities or any immersive 3D online games? If so, which ones?
   - No, I’m not involved in any other virtual worlds or games.
   - Yes, I’m involved in the following other virtual worlds and/or games: ____________

28. Are you a member of any groups in SL?
   - Yes
   - No
29. Do you use your real name in SL, or do you prefer to remain anonymous?
   o I often use my real name.
   o I use only my SL name and prefer to remain anonymous inworld.

30. How important to you is your SL avatar’s appearance?
   1 2 3 4 5 6 7
   Very important ○ ○ ○ ○ ○ ○ Not at all important

31. How important is it that you make friends in SL?
   1 2 3 4 5 6 7
   Very important ○ ○ ○ ○ ○ ○ Not at all important

32. How easy is it to accomplish the following tasks on your primary SL viewer?

<table>
<thead>
<tr>
<th>Task</th>
<th>Very easy</th>
<th>Very difficult</th>
</tr>
</thead>
<tbody>
<tr>
<td>Find a friend</td>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Add a friend</td>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Find a place</td>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Teleport to a place</td>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Send an instant message</td>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Set up/use voice chat</td>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Buy an item</td>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Find an inventory item</td>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Walk around your area</td>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Customize your appearance</td>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
<tr>
<td>Find an interesting group</td>
<td>○ ○ ○ ○ ○ ○ ○ ○</td>
<td></td>
</tr>
</tbody>
</table>

47
### 33. How important do you consider the following activities in SL?

<table>
<thead>
<tr>
<th>Activity</th>
<th>Very important</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Very easy</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Purchase SL</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Communicate in general</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Navigate in general</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Shop in general</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Play in general</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Build/create in general</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Finding a friend</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Adding friends</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Finding places</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Teleporting places</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Sending instant messages</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Setting up/using voice chat</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Buying items</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Finding items in your inventory</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Walking around your area</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Customizing your appearance</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Flying around your area</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Finding interesting groups</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Activity</td>
<td>Very important</td>
<td>Not at all important</td>
<td></td>
</tr>
<tr>
<td>--------------------------------</td>
<td>----------------</td>
<td>----------------------</td>
<td></td>
</tr>
<tr>
<td>Purchasing $L</td>
<td>○ ○ ○ ○ ○ ○ ○</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Communicating in general</td>
<td>○ ○ ○ ○ ○ ○ ○</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Navigating in general</td>
<td>○ ○ ○ ○ ○ ○ ○</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Shopping in general</td>
<td>○ ○ ○ ○ ○ ○ ○</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Playing in general</td>
<td>○ ○ ○ ○ ○ ○ ○</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Building/creating in general</td>
<td>○ ○ ○ ○ ○ ○ ○</td>
<td>○</td>
<td></td>
</tr>
</tbody>
</table>

34. Are you ever frustrated by the limitations of the viewer you use?

- Yes
- No

35. Please comment on your answer to the previous question: if you are sometimes frustrated, why? If not, why not?

36. Please briefly summarize why you use the viewer you use.

37. When faced with a decision in real life, are you more likely to be guided by your feelings or your logic?

- I'm more likely to be guided by my feelings.
- I'm more likely to be guided by logic.

38. Which of the following categories best describe you in SL? Select all that apply:

- Business user
- Designer
- Architect
- Programmer
- Socializer
- Role player
- Explorer
- Griefer/Troll
39. In your opinion, how long of a time did it take you to learn how to use your primary viewer?

1 2 3 4 5 6 7
Not long ○ ○ ○ ○ ○ ○ ○ A very long time

40. In real life, would you consider yourself more introverted or more extroverted?

1 2 3 4 5 6 7
Introverted ○ ○ ○ ○ ○ ○ ○ Extroverted

41. When faced with a potentially useful but challenging computer program, are you more likely to try to learn how to use it, or give it up?

1 2 3 4 5 6 7
Learn it ○ ○ ○ ○ ○ ○ ○ Give it up

42. How “tech savvy” would you consider yourself?

1 2 3 4 5 6 7
Very tech savvy ○ ○ ○ ○ ○ ○ ○ Not at all tech savvy

43. What is your SL avatar’s usual gender? What is your real life ethnicity?

□ Asian
□ American Indian / Alaska Native
□ Black
□ Native Hawaiian / Other Pacific Islander
□ White
□ Other:

That’s it! If you would like to be considered for participation in further phases of this study (inworld interviews or focus groups), please leave an email address where you can be reached: (Contact information will be kept strictly confidential and separate from your answers. Your survey responses will remain anonymous.)
Appendix B: Sample Structured Interview Script

1. Do you prefer voice or text chat? We can use either one; just tell me which is easiest for you.

2. I’m sending you an inventory offer with an informed consent script. Please read over it and tell me you understand and that you are over eighteen years old.

3. Tell me which viewer you’re using right now – the default Linden Lab one, or some other viewer?
   a. If using another one, how long have you been using it? What made you switch to this one from the default one? Do you like this one better? Why?

4. Is your current avatar one that you wear regularly? Do you change it often?

5. Tell me how you first got involved in Second Life. What were your motivations?

6. I have a list here of your survey responses. It seems like you had complaints about the inventory management system on your viewer. Would you please elaborate?

7. You also mentioned being disappointed in the building functionality. Tell me more about that.

8. Is there anything about your viewer that you find particularly confusing?

9. Do you think the confusing things would be easier on a different viewer?

10. If you could change something about your viewer, what would it be?

11. Now how about the default Linden Lab viewer – have you used it recently?

12. Do you think it could be improved?
Table 1: Frequencies of Category Combinations

<table>
<thead>
<tr>
<th>No. of Categories Selected</th>
<th>Frequency</th>
<th>Combination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>56</td>
<td>Socializer</td>
</tr>
<tr>
<td>3</td>
<td>49</td>
<td>Socializer, Role Player, Explorer</td>
</tr>
<tr>
<td>2</td>
<td>44</td>
<td>Socializer, Explorer</td>
</tr>
<tr>
<td>1</td>
<td>20</td>
<td>Explorer</td>
</tr>
<tr>
<td>1</td>
<td>14</td>
<td>Role Player</td>
</tr>
<tr>
<td>2</td>
<td>14</td>
<td>Socializer, Role Player</td>
</tr>
<tr>
<td>1</td>
<td>12</td>
<td>Business User</td>
</tr>
<tr>
<td>1</td>
<td>11</td>
<td>Designer</td>
</tr>
<tr>
<td>1</td>
<td>10</td>
<td>Programmer</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
<td>Architect, Socializer, Explorer</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
<td>Designer, Socializer, Explorer</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
<td>Business User, Socializer, Explorer</td>
</tr>
<tr>
<td>5</td>
<td>9</td>
<td>Designer, Programmer, Socializer, Role Player, Explorer</td>
</tr>
<tr>
<td>5</td>
<td>9</td>
<td>Designer, Architect, Socializer, Role Player, Explorer</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>Role Player, Explorer</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>Designer, Socializer, Role Player</td>
</tr>
<tr>
<td>4</td>
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</tr>
<tr>
<td>2</td>
<td>7</td>
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</tr>
<tr>
<td>3</td>
<td>7</td>
<td>Programmer, Socializer, Explorer</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
<td>Designer, Architect, Explorer</td>
</tr>
<tr>
<td>4</td>
<td>7</td>
<td>Designer, Socializer, Role Player, Explorer</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
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</tr>
<tr>
<td>3</td>
<td>6</td>
<td>Programmer, Socializer, Role Player</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td>Business User, Socializer, Role Player, Explorer</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td>Business User, Designer, Architect, Programmer</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>Business User, Architect, Socializer, Explorer</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>Designer, Socializer</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>Designer, Role Player, Explorer</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>Designer, Programmer, Socializer, Explorer</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>Business User, Designer, Socializer, Explorer</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>Architect, Socializer</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>Designer, Explorer</td>
</tr>
<tr>
<td>2</td>
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Table 2: “Originating From” Frequencies of Web Survey Respondents

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Note: Web page statistics began being collected midway through the survey. These figures do not account for all responses. The frequencies above indicate page loads only; a page visitor does not necessarily indicate a survey respondent. This table is provided only as a rough indicator of whence participants originated.
References


