


On Insufficient Documentation of a Virtual World's Economic Development: A Retrospective of Second Life From 2003-2008

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ABSTRACT

Literature on Second Life (SL) was retrieved, reviewed, and aggregated. Although it was found to provide sufficient information about SL's social, technological, business model, and legal issues and although SL received overall dense media coverage, the literature was found to be lacking when it came to a thorough documentation of its economic development in 2003-2008. Using the retrieved literature, the attempt to reconstruct the development of the number of avatars, active users, prices and fees, and monetary development exposes the limits of reconstructing the economic development of a virtual world years after its popularity peak. This article serves as an argument and a reminder for a proper documentation of such developments. Future documentation of virtual worlds in academia should thoroughly track the economic development of next-generation virtual worlds. Otherwise, post-analysis, economic development reconstruction, and trace backs might prove difficult, costly, or infeasible.

KEYWORDS

Business Model, Economic Development Reconstruction, Legal Issue, Linden Lab, Post-Analysis, Reconstructing, Reconstruction, Simulation Technological Issue, SL, Virtual Environment, Virtual World

INTRODUCTION AND MOTIVATION

In order to create and run a successful virtual world, ongoing communication between a company and its customers is necessary to determine whether their ideas about such a world align (Au, 2008, pp. 147-148). Internet communities and social networks are notoriously volatile, and they tend to break up with no warning, triggered by poor policy and service (Au, 2008, p. 165). It is therefore crucial to analyse the developments of past virtual worlds, so that lessons can be drawn from their successes and failures. Such analysis can be conducted using available literature.

This article takes the virtual world *Second Life*, hereinafter abbreviated as SL, and reconstructs its development during its crucial years 2003-2008. For this reconstruction, a literature review was conducted, selecting SL books and articles on a high – if possible, academic – level. The content and data of the retrieved and reviewed SL literature reveal that SL had already started to lose its

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popularity only a few years after its release in 2003. The uncovered reasons are presented hereinafter – they include issues with the content created by its users, but also technical and performance issues, copyright issues, business model issues, and fee- and license-design issues.

However, reconstructing the rise and fall of a virtual world using available literature can teach us more than just the need for benchmarks and regulations, for technological development (e.g., faster servers and better graphics) to enhance user acceptance, and for innovative business models. The content and quality of the retrieved literature reveal existing gaps regarding the proper documentation of a virtual world's *economic* development, i.e., *number of avatars*, *number of active users*, or *monetary income and expenses*. These gaps are critical, since it is only a matter of time before another virtual world emerges, this time embedding itself more successfully into our everyday lives.

Following this discovery, this article warns that although detailed statistics regarding, e.g., *users' monthly spending*, *resident transactions*, *total dollar supply*, *land sales by residents*, and *land for sale* were published on SL's website (Jin & Bolebruch, 2010, p. 4), economic development-related metrics should be collected and documented more thoroughly in books and (academic) articles, so that future researchers can analyse virtual worlds more efficiently.

BACKGROUND: SL'S BUSINESS MODEL IN 2003-2008

This chapter serves as an introduction to SL's business model with a focus on 2003-2008. It includes membership fees, an own virtual currency, the sale of virtual land, and the collection of virtual land use fees. It also includes marketing possibilities.

Registration and Membership Fees in SL

As of November 2020, users can still register for SL at secondlife.com. In addition to a freely selectable username, users also have to enter their email address, date of birth, a password, and a security answer – in case they forget their password. They can then decide whether they would like to purchase a free or premium (paid) account. The free account includes access to SL and the ability to customize the appearance of the avatar. The premium account further includes 512 m² of virtual land which can be decorated and used (Stillich, 2007, p. 122). The membership payment models of July 2017 and November 2020 are listed in Table 1.

The costs for a premium membership depend on the length of the selected billing cycle. As of November 2020, users opting for *annual billing* pay 8.25 USD per month (99 USD billed annually). Choosing *quarterly billing* amounts to 10.99 USD per month (32.97 USD billed quarterly), and *monthly billing* is 11.99 USD. The official site labels *quarterly* as the most popular membership option. In July 2017, membership prices were also noted down by the author. The prices were set at 6 USD per month for the *annual billing*-option (72 USD billed annually), 7.50 USD per month for *quarterly billing* (22.50 USD billed quarterly), and 9.50 USD for *monthly billing* (Second Life, 2020c,m).

Table 1. 2017 and 2020 SL membership payment models

Second Life premium membership fees (in USD)				
Payment model	July 2017		November 2020	
	per month	sum billed annually/quarterly/monthly	per month	sum billed annually/quarterly/monthly
Annual	6	72	8.25	99
Quarterly	7.50	22.50	10.99	32.97
Monthly	9.50	9.50	11.99	11.99

After selecting the free or premium account variant, the user is forwarded to the download and installation window. They receive a URL link via email which must be accessed within 24 hours to verify the email address. When registering for the first time, the user must agree to the terms of service and data protection provisions. In general, the installation languages include German, English, Danish, Spanish, French, Italian, Polish, Brazilian Portuguese, Turkish, Russian, Mandarin, and Japanese.

SL's Own Virtual Currency: The Linden Dollar

Besides SL's membership fee, SL also has its own virtual currency. Every user, no matter if private person or company, is permitted to earn money in SL by means of its own in-world currency, the *Linden dollar*, abbreviated as SLL, L\$, or LD (Martin, 2008, p. 4; Second Life, 2020g). The following were found to be the main characteristics of the L\$:

- **Means to access:** The L\$ serves as a means to access certain offered content, content created by other users, applications, and services in SL (Second Life, 2020g).
- **Value fluctuation:** The L\$ rises and falls with the market for virtual goods (Walsh, as cited in Martin, 2008, p. 4).
- **USD-exchange rate:** The exchange rate of the L\$ fluctuates against the USD (Jin & Bolebruck, 2010, p. 4).
- **Restricted acquisition:** Linden Lab restricts various economic activities in SL, including the acquisition of L\$, in order to minimize the risk of fraud (Second Life, 2020l).
- **Convert back on third-party exchanges only:** The L\$ serves as a virtual token within SL and – once exchanged – cannot be converted back to real-world monetary value at Linden Lab itself. It can, however, be traded with or transferred to other users in SL (Second Life, 2020f,g). It can also be purchased and converted back to real-world monetary value using some external exchanges, and it can be exchanged with currencies other than the USD (Martin, 2008, p. 4).

Virtual Land and Land Use Fees

The first day after SL's commercial launch in July 2003, there were only a few hundred avatars. Although SL had merely a few thousand users from its beta phase coming over, it received a disproportionately large amount of attention. At that time, once the monthly membership fee was paid, the user was given a certain amount of virtual land, of objects (which the user could create within their homes), and of Linden dollars each week. As soon as that certain number of objects was exceeded, Linden dollars were automatically deducted from the user's account. Thus, Linden Lab had set up a *tax* on excessive building, primarily to keep the server utilization low. However, a world where strict boundaries constrained creativity departed from Linden Lab's vision of a place for free imagination. Increasing criticism prompted Linden Lab to discontinue such a tax in autumn 2003, and to change its revenue model. Linden Lab shifted its focus to selling virtual land and charging use fees for virtual land maintenance (Au, 2008, pp. 145-155).

Virtual Land

Virtual land is the graphic representation of three-dimensional space in the virtual world (Second Life, 2020h). A *region* in SL is a virtual area of 256 m by 265 m, i.e., a total of 65,536 m². An *island* in SL is a region separate from all other regions. It can consist of multiple regions, but it cannot be smaller than a single region and thus 65,536 m² (Rymaszewski et al., 2007, p. 38, 148; Tapley, 2007; Second Life, 2020e).

Linden Lab kept adding new land in direct proportion to the growing number of registered accounts (Au, 2008, p. 144). On June 20th, 2013, the total land mass in SL was 700 square miles, which translates to 1,812,992 km² (Linden Lab, 2020b), but that number has shrunk since then. On August 6th, 2017, there were 82,669 regions with a total of 1,544 km² of virtual space, out of which

473 km² belonged to Linden Lab. The remaining 1,071 km² was private property owned by residents. As of November 16th, 2020, there are 91,120 regions with a total of 1,658 km², out of which 558 km² are Linden-owned, and 1100 km² are privately owned (Second Life, 2020a).

Buying Virtual Land in SL

When a user purchases virtual land in SL, Linden Lab grants them a limited license, the *Virtual Land License*, which enables access to and usage of this virtual property. The owner of such a license can set up their own rules according to which other residents are granted access to their virtual property. A user can only build a building on the property that belongs to them (Second Life, 2020f,h,m).

As of November 2020, Linden Lab charges only EU citizens a VAT when purchasing land (Second Life, 2020e,m). At the end of 2008, residents owned a total of 1,760,000 km² of virtual land in SL. Virtual land could be purchased directly from Linden Lab or from another SL resident (Rufer-Bach, 2009, p. 7). With a premium membership, the member received 512 m² of available land – 512 m² being the smallest possible chunk of property in SL. If the member wanted to possess more than 512 m² land, they could acquire licenses directly from Linden Lab, but also from private sellers or from virtual real estate companies – however, again only with a premium membership (Nusch, 2007, p. 76; Stillich, 2007, p. 122; Tapley, 2007).

Paying for Virtual Land Use in SL

Linden Lab charges all users a fee for owning land, the so-called *property tax* or *land use fee* (Nusch, 2007, p. 215) which is billed monthly. As soon as a user owned more than 512 m² of land, they had to pay land use fee to Linden Lab in addition to their premium membership fee (Rymaszewski et al., 2007, p. 37; Second Life, 2020m; Stillich, 2007, p. 122). As of December 2020, users with a premium membership are granted 1,024 m² before land use fees are charged. While the prices for purchasing virtual land are based on demand and fluctuate with the development of the market, land use fees are fixed (Second Life, 2020d,m). Those fees are based on the maximum land size owned within the billing period. For example, a real estate agent owns 512 m² or less at the beginning and the end of the billing period. At one point within that period, however, they own 10,000 m² but resell or give most of it away before the end of the billing period. Nevertheless, they are still charged the land tariff for 10,000 m² for the billing period – in this case 75 USD (Rymaszewski et al., 2007, p. 37; Second Life, 2020d,m).

In the billing period of, e.g., May 2007 (2007 being a peak year for SL), nearly 90,000 residents were paying land use fees (Au, 2008, p. 252). In May 2006, US-American business magazine *BusinessWeek* reported on the first person to become a millionaire thanks to SL and the virtual property trade. Besides buying land and building themed areas, this user achieved such a feat by providing alternate payment plans for SL users in the EU, and by providing multilingual staff workers who were available at EU hours when the Linden Lab staff in California was not available. By the end of 2006, this user had gathered more than 1 million USD in virtual land. Following this coverage were many new registrations to SL (Stillich, 2007, p. 121; Au, 2008, p. 182).

SL's Marketing Possibilities in 2003-2008

SL offered possibilities for businesses and self-employed to place ads for their products, to directly appear in SL, and to find new ways to provide value to customers (Wandt, 2007, p. 196; Park et al., 2008, p. 2). Most companies decided to build and develop on separate, private islands, so that they were able to completely control the user brand experience in SL. Since they had no influence on neighbouring properties and on their offers or appearances on the mainland, they might have not been able to avoid unpleasant, obscene, or unsightly content. Islands could only be reached via teleport, thus marketers had to find strategies so that residents visited their islands voluntarily and stayed long enough for a meaningful brand immersion. An advantage of marketing in SL was that

the three-dimensionality-characteristic provided a brand experience which was more extended and more vivid than advertising in the two-dimensional internet (Au, 2008, pp. 200-204; Park et al., 2008; Rufer-Bach, 2009, p. 7).

In-Game Advertising and Behavioural Targeting

Large corporations participated in SL because they wanted to reach residents in a world that was detached from the problems of the real world. The users of virtual worlds chose to engage with SL in their free time. They were young, keen to consume, and interested in new things. They were, however, no longer powerless customers, but influential *prosumers* – a serious mixture of producer and consumer – who needed to be targeted and marketed to differently. Users in SL regarded a certain type of advertising as conducive to their gaming experience. Real brands represented in SL increased the degree of realism and the recognition effect. Such placement of advertising in virtual worlds based on reality is referred to as *in-game advertising* (Stillich, 2007, p. 128). The addressing of a user via advertising messages based on their current or predicted future behaviour is called *behavioural targeting*. It means that they only receive ads on billboards based on their actions in SL (Stillich, 2007, pp. 137-138).

Content Created by Businesses

Compared to the two-dimensional internet which limited the richness of conducting business activities (e.g., looking at pages of product descriptions), in a three-dimensional virtual world like SL, users (i.e., customers) could participate in the design and customization of products. They could also converse in-game with avatars of business representatives via text or audio conversation (Park et al., 2008, p. 2). For businesses and self-employed, SL's most reliable long-term value proposition was real-time content creation. Since this took place in a virtual environment, customers could, e.g., take part in presentations via their avatars, and suggest changes and additions that could then be executed immediately (Au, 2008, p. 205). Businesses participated in SL because, e.g., their customers could check out their virtual products, and customize and order items. Customers could also ask questions about products or services directly to customer services (Park et al., 2008, p. 2). Also, at the so-called *Crown Plaza*, e.g., companies could book a virtual conference room in which it was possible to project applications such as audio and video recordings as well as PowerPoint presentations onto virtual walls. This facilitated the communication between participants, and it supported visualization. By eliminating the mandatory physical attendance, participants' travel expenses could also be reduced. Virtual events in SL could also support training and education. In addition, exercises which involved a high level of risk, such as the *Idaho Bioterrorism and Preparedness Program*, could be performed virtually without endangering participants (Greenfield, 2008, p. 39).

Content Created for Teenagers

Besides the main SL platform, a virtual world targeting users at age 13-17, called *Teen Second Life* (Teen SL), was introduced in 2005 (Grover, 2008, p. 28; Rymaszewski, 2007, p. 331; Eck, 2011, p. 137; Trueman & Alderman, 2016, p. 168). School libraries were involved in the development and application of Teen SL, which existed separately from SL. In 2011, however, Linden Lab shut down Teen SL, which prompted many K-12 libraries to leave SL and search for new child-friendly virtual environments. Linden Lab also discontinued its offered non-profit and educational discount which offered a halving of sim maintenance costs. This resulted in further educational institutions and non-profit organizations leaving SL. In 2014, there was a reintroduction of the discount for non-profits and educational virtual property owners. By 2016, however, interest of libraries in SL was mainly gone (Boellstorff, p. 2008, p. 164; Trueman & Alderman, 2016, p. 168; Dass & Dabbagh, 2016, p. 263). As of November 2020, there is still no age checking when registering for SL. Further criticism and issues regarding SL are disclosed in the following chapter.

SL'S ISSUES IN 2003-2008

This chapter covers SL's emerging issues and criticism from media, corporations, and new customers which ultimately resulted in its decrease in application. It further covers some current terms and regulations from Linden Lab's official websites as of November 2020.

Issues With Content in SL

In late 2006 through 2007, after the initial euphoria, SL was sharply criticized for its questionable content linked to sexual violence, paedophilia, gambling, and other illegal activities (Au, 2008, p. 90). In 2007, further negative news reports appeared – covering besides paedophilia and violence the inadequate protection of minors, infiltrated terrorists, theft, and plagiarism of virtual objects in SL (Eck, 2011, pp. 133-137; Au, 2008, p. 281; Boellstorff, p. 2008, p. 164). In response, on May 31st, 2007, Linden Lab prohibited the depiction and execution of sexual acts with child avatars, of rape, and of other forms of extreme violence within SL (MacCallum-Stewart, 2007, p. 204). Until then, Linden staff had suggested that such actions were permitted in SL as long as they took place entirely in private (Au, 2008, p. 275). In July 2007, gambling for L\$ was also banned in SL (Au, 2008, p. 274). To counter further moral criticism, SL's user agreements include as of August 8th, 2017 restrictions on viewing content that is not intended for minors. Furthermore, no user was allowed to act as a virtual bank, or use robots or other automated means to increase traffic to any virtual land in SL (Second Life, 2020i).

Rejection of Real-World Products

The 3-D internet offered novel opportunities for businesses to gather revenue streams, and to increase productivity and brand opportunity (Greenfield, 2008, p. 37). In SL, the first commercial locations opened in mid-2006, but most of them were a failure (Au, 2008, p. 213). Between 2006-2007, companies in SL attracted only few visitors, because residents preferred locations and virtual items natively created in SL, as well as in SL established residents as creators and sellers (Au, 2008, p. 168). Companies, however, had their focus mostly on replicating real-world places and objects (Rufer-Bach, 2009, p. 210). Compared to the fantastic creations of the SL community, products of real-world companies looked monotonous, banal, and unimaginative. In mid-2007, less than 5% of virtual landowners – which make up Linden Lab's primary revenue stream – were businesses. In 2008, company locations in SL were mostly empty, unless there were special events. Instead, most users gathered in the big cities and urban areas, also known as *sandboxes*, where they did not need their own land to be able to build (Au, 2008, pp. 73-74, 198-202).

Niche User Base

In 2004, SL users were mainly tech- or video game-savvy and early adopters. This began to change in mid-2005 when real-world companies and the mainstream media developed an interest in SL. Many of the technically skilled entrepreneurs in SL were fashion designers, tech-savvy people, programmers, and architects who could not find work in the *real* world during the recession (Au, 2008, p. 158, 172).

When SL stopped growing in 2006-2007, Linden Lab's CEO Rosedale recognized the similarities of the remaining residents based on user analyses: A lot of available time that could be invested in SL. SL had become a retreat for dropouts and escapists, just like it used to be throughout 2004 before its hype. Escapists in particular because of SL's focus on real estate ownership, self-employed commercial activity, and the experience economy. This could be interpreted as an idealized version of the United States and a return to the capitalist optimism of the American dream – a retreat reaction triggered by geopolitical conflict dominating real-world headlines at that time (Bruns, 2008, p. 303; Manthorpe, 2016; Greenfield, 2008, p. 43; Au, 2008, p. 158).

Technological Issues in SL

For less motivated users with limited free time, SL was hard, confusing and alienating, not only but also due to its controls. According to Rosedale, it took users 40-50 hours to become familiar with SL's commands via mouse and keyboard (Manthorpe, 2016). Besides the complicated controls, some of the criticism was directed at SL's unstable client, its graphics, connection-related delays, and user interface (Eck, 2011, pp. 133-137). The interface and controls were notoriously user-unfriendly even in the first few years after SL's release. As a result, many newcomers left SL even before completing the tutorial (Au, 2008, p. 166; Boellstorff, p. 2008, p. 126; Eck, 2011, p. 134).

Additional hurdles were the download of the software, the set-up on the user's PC, and the system requirements, for SL could not be started on the move via smartphones or tablets. It was also more cumbersome than the typical business application (Greenfield, 2008, pp. 42-43).

Furthermore, the frequently occurring delays between an action and the corresponding response had to be eliminated. These delays were caused by SL's centralized system architecture. Having such an architecture meant that an action did not immediately receive a reaction. This was an issue for a virtual world, since users were used to immediate reactions from the real world. Having such an architecture also meant that even though SL had 5 million registered users in March 2007, only around 40,000 users (i.e., less than 1%) were able to use the system at the same time. Furthermore, only 40 avatars could be in one place at any time, thus only 40 avatars could be accommodated in one room at an event. In order for events in SL to be accepted by users and companies, the possibility to accommodate more avatars was crucial (Manthorpe, 2016; Barucca et al., 2007, p. 140).

Barucca et al. (2007) even regarded the technical challenges which SL faced as its biggest determinant for long-term success or failure, i.e., whether it would grow to a mass communication and transaction platform (p. 140). In 2006 and 2007, some well-known residents left SL in protest. They disclosed Linden Labs' inability to house and control large numbers of residents as their reason for departure. These technical problems were noticeable due to regular server failures and downtimes on the grid, lags, and loss of inventory and monetary resources. Linden Lab was also criticized for its lack of liability for user-created value within SL (MacCallum-Stewart, 2007, p. 203; Barucca et al., 2007, pp. 139-140).

In 2008, despite all efforts, improved scalability, performance, usability, and security were not enough to make virtual worlds more attractive for companies. Companies which were dominant in nascent markets, such as SL in the virtual world market, rarely saw advantages in interoperability. Interoperability between the real and virtual world, however, was crucial for a 3-D world to make sense for real-world businesses. Even if a seller in SL wanted to interoperate, the technological issues were significant. Avatar configuration and security credentials needed to transition among worlds. Cross-platform communication, the transferability of objects, and virtual currency exchange had to be guaranteed (Greenfield, 2008, p. 43). Furthermore, the anonymity of user avatars impeded the realization of projects from the real-world business sphere within SL. The identification of a user was crucial to establish a virtual business with real-world products and services (Barucca et al., 2007, p. 140).

In economic terms, most companies' expectations from SL were not met, so they eventually left it (Eck, 2011, p. 17). As of November 2020, the small selection of installation languages can restrict the range of companies active in SL on a geographical or linguistic level. Furthermore, even if the user sets the language to, e.g., German, some steps in the registration process (e.g., the agreement to the terms of service and data protection provisions, or the selection of a free or premium account) are still displayed in English. Also, official auctions related to the purchase of land are listed in English, even when setting the site to, e.g., German. Such a bias towards the English language can limit the number and variety of businesses settling within SL (Second Life, 2020b).

Legal Issues in SL

Apart from technical aspects, another reason for several well-known residents leaving SL in 2006 and 2007 was because of Linden Lab's inconsistent policies towards freedom of action within SL. It was a consumer versus service provider conflict (MacCallum-Stewart, 2007, p. 203), and some legal aspects had to be solved in order for SL to become attractive for users and businesses (Barucca et al., 2007, p. 139).

Besides allowing the purchase and sale of Linden dollars on the free market using real-world USD, Linden Lab additionally allowed its residents to retain the intellectual property rights of designs and representations of three-dimensional objects and scripts they created in SL. This was introduced to live up to the *your world, your imagination*-slogan, and to encourage creativity (Au, 2008, pp. 145-155). From 2003 to 2006, there was an economic boom in SL mainly due to this transfer of intellectual property rights to the residents, who as a result created a virtual market for their creations. Also, the virtual land and tradable Linden dollar attracted additional companies and entrepreneurs to SL (Au, 2008, p. 157).

At the end of 2006, however, conflicts developed between owners of intellectual creations and their consumers. Usage rights for own creations within SL were unclear, and imitations of creations were not sanctioned by Linden Lab. Hackers were able to duplicate, e.g., entire avatars including clothes, thus simplifying the theft and unauthorized distribution of intellectual property. Linden Lab did not take immediate countermeasures. It instead issued a statement which said that copying does not always mean theft. It told content creators to forward their complaints to a court, which led to many land and shop owners closing their shops in protest. Eventually, Linden Lab apologized and banned all copy software in SL (Au, 2008, pp. 158-161; Barucca et al., 2007, pp. 139-140).

In addition, the taxation of virtual revenue and profits needed to be solved. Users also demanded to have a say when it came to fundamental decisions, since they participated in building SL (Barucca et al., 2007, p. 140). In 2012, Linden Lab was accused of focusing more on the development of other software than on SL, which was at that time allegedly already used mainly for financial exploitation (Hax, 2015, pp. 45-46).

Linden Lab employees further had access to chat histories (Rufer-Bach, 2009, p. 54). Businesses situated in SL are still heavily dependent on Linden Lab. As of November 2020, the Linden dollar is subject to the rule of Linden Lab. Linden Lab has the right to revoke, regulate, control, change, and delete the granted license rights at any time as it sees appropriate without prior notice. It can also change the value and functionality of the licenses at any time, as well as make them more or less common. The number of Linden dollars that can be purchased in one transaction as well as the amount of money that can be aggregated on the user's account can be restricted by Linden Lab (Second Life, 2020f,h),

It should also be noted that although the Virtual Land License is transferable to other users, it does not grant ownership of a piece of land, but only the right to access and use that piece of land. Linden Lab charges fees for the right to acquire, transfer, and access virtual properties, and just like the Linden dollar, it may revoke licenses at any time without prior notice (Second Life, 2020f,h,m).

SL'S ECONOMIC DEVELOPMENT IN 2003-2008

This article so far shows that the retrieved SL literature covers SL's social and technological developments and issues in a satisfactory manner, so that they can be thoroughly reconstructed with rather low effort and resource utilization. However, data regarding the economic-related development was found to be fragmentary. Thus, a uniform presentation of figures such as *number of avatars*, *number of active users*, or *monetary income and expenses* in SL proves to be challenging. But instead of entirely discarding this aspect, Table 2 shows which source types were used to retrieve data from and to reconstruct SL's economic development.

Table 2. Source types used for reconstruction of SL's economic development

Source types used for reconstruction of SL's economic development	
Source type	Number
Books or chapters in an edited book	11
Articles from academic journals	3
Websites	1
Blog posts or online-only news sites	3

Considering the given circumstances, the following depiction of the economic development should not be understood as a complete picture. Special emphasis is put on SL's increase in popularity in 2006-2008, as well as on the number of avatars, number of active users, and volume of monetary transactions over time. Regarding the latter two points, this article reveals the difficulties of reconstructing such developments years after a virtual world has lost its popularity and wide application.

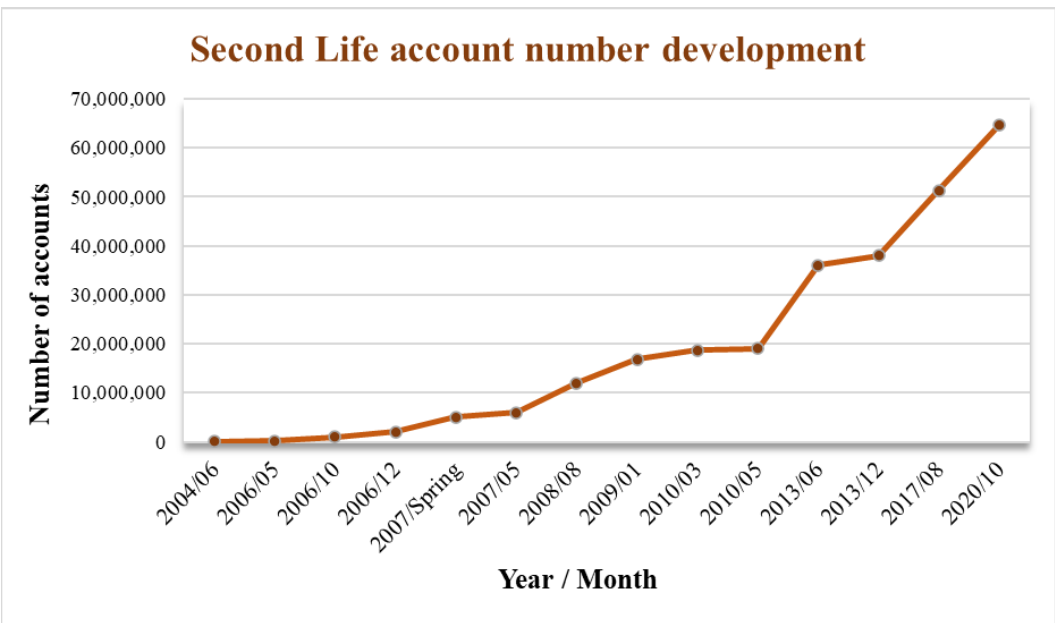
Number of Avatars in SL

This section covers the *number of avatars* and the *number of active users* in 2003-2020 in SL. Various sources use terms such as *number of residents* or *number of accounts*, which are treated as equivalent to *number of avatars* in this article. It should be noted that SL had many *account corpses*, i.e., avatars of users who left SL (Eck, 2011, pp. 114).

Figure 1 was created using data found in the retrieved literature. It shows the development of the *number of avatars* in SL in 2004-2020.

In July 2004, one year after its release, SL had around 10,000 registered accounts (Stillich, 2007, p. 75). This number rose exponentially due to positive as well as negative media coverage which took place between 2006 and 2008 (Eck, 2011, p. 17). In May 2006, there were 227,056 accounts. This

Figure 1. Reconstruction of number of avatars in Second Life in 2004-2020



number rose to more than one million in October 2006, and to two million eight weeks later. The spring of 2007 saw over 5 million accounts (Nusch, 2007, p. 25; Stillich, 2007, p. 121; Eck, 2011, p. 114; Chávez-Aguayo, 2017). Linden Lab reported the number of registered accounts on May 2nd, 2007 at six million (Nusch, 2007, p. 25; Stillich, 2007, p. 121; Eck, 2011, p. 114; Stöcker, 2007, p. 11).

Finding coherent numbers and sources often proved challenging. For example, depending on the used source, SL is reported to having had over twelve million registered avatars in August 2008 (Peters, 2008, p. 3), or almost 15 million (Martin, 2008, p. 2). For the shown graph, the pessimistic approach and thus the source with 12 million accounts was chosen. There were 16,785,531 accounts as of January 27th, 2009 (Rufer-Bach, 2009, p. 7). On March 21st, 2010, that figure was at 18,657,959 accounts (Eck, 2011, p. 114). May 2010 had more than 19 million registered users (Chávez-Aguayo, 2017).

Linden Lab announced in late 2011 that it would no longer publish its quarterly statistics. From this announcement, critics interpreted that Linden Lab wanted to conceal visible indicators of a decline in the use of SL, for this would have only accelerated the withdrawal of the remaining active residents from the platform (Hax, 2015, pp. 45-46; Chávez-Aguayo, 2017). On June 20th, 2013, Linden Lab disclosed that the number of registered avatars had increased to 36 million, and new registrations averaged to 400,000 per month (Linden Lab, 2020b). The number of registered avatars rose to over 38 million in December 2013 (Chávez-Aguayo, 2017), to 51,358,982 on August 17th, 2017, and to 64,687,961 on October 21st, 2020 (Second Life, 2020a).

Number of Active Users in SL

The *number of avatars* does not equal the *number of active users*, since users can have several avatars in SL (Eck, 2011, pp. 115). *Active users* (or *active residents*) are those residents who are still online at least once a week three months after registering their account (Au, 2008, p. 253).

In 2006, there were 200,000 active users per week, six months later it was 500,000 (Stöcker, 2007, p. 11; Au, 2008, p. 253). Despite over 5 million registered accounts in spring 2007 (Nusch, 2007, p. 25; Stillich, 2007, p. 121; Eck, 2011, p. 114), approximately only 1.3 million people ran the official software and logged in to SL in March 2007. Compared to January 2007, however, this was still a plus of 46% in the number of active users (thus January 2007 had 890,400 active users). During March 2007, SL was further visited by 3.6 million *visitors* worldwide, which was a plus of 17% and 46% compared to February and January 2007, respectively (James, 2007).

On May 17th, 2007, out of the six million registered avatars at the time, 33,350 were online that day, and 1.7 million were active within the last 60 days (MacCallum-Stewart, 2007, p. 198). There were 560,000 active residents per week in July 2007, and 600,000 in August 2007 (Au, 2008, pp. 279-281). In 2009, up to 85,000 avatars populated SL simultaneously – about twice as many as a year earlier (Vieweg, 2009, p. 100). 82,653 accounts were logged in on January 25th, 2009 (Rufer-Bach, 2009, p. 7). In general, since 2009, the number of daily users logged in at the same time started to decrease. May 2009 saw 62,000 average concurrent users, while in May 2010, that number decreased to 54,000 (Chávez-Aguayo, 2017). On January 27th, 2009, 522,526 accounts were active within the last 7 days, and 1,444,530 within the last 60 days (Rufer-Bach, 2009, p. 7). On June 20th, 2013, SL's 10th anniversary, the monthly user number was over a million (Linden Lab, 2020b). In 2016, almost 900,000 users logged in each month (Manthorpe, 2016). 35,357 avatars were online on August 17th, 2017, and 46,335 avatars were online on October 21st, 2020 (Second Life, 2020a).

This chapter shows that the data from the retrieved literature is fragmented in a sense that although, e.g., the numbers of active users *per day*, *per week*, *per month*, and *within the last 60 days* were frequently found, the corresponding dates usually did not have all four metrics covered. Therefore, reconstructing these data via graphs was omitted, for different metrics cover different combinations of dates. The same issue applies to SL's monetary development in the following chapter.

Monetary Development in SL

As of November 2020, buying L\$ is charged with 1.49 USD per transaction, and selling L\$ is charged with 3.5% (Second Life, 2020m). Table 3 lists selling rates of L\$ to € in 2010, 2017, and 2020. It should be noted that checking the current market rate of L\$ via the official SL website requires a login (Second Life, 2020j,k).

The selling rate of L\$ to € was around 373 to one on March 28th, 2010 (Eck, 2011, p. 124.), and around 305 to one on August 7th, 2017 (The Virtual World Exchange, 2017). On November 16th, 2020, the selling rate of L\$ to USD was 250 to one (Second Life, 2020k), which in L\$ to € is 211 to one (TransferWise, 2020). Overall, Table 3 shows a clear decline in the selling rate of L\$ to € within the last ten years.

In 2006, SL's gross domestic income was 64 million USD (Wandt, 2007, p. 196). In early 2007, each resident spent on average 50-60 USD a week in SL (Au, 2008, p. 197). As an example, on March 17th, 2007, transactions worth over one million USD took place within 24 hours (MacCallum-Stewart, 2007, p. 198). In spring 2007, the equivalent of around 1.5 million USD was spent in SL within one day. At the time, nearly 900 residents had made more than 1,000 USD in SL (Stöcker, 2007, pp. 11-12). In May 2007, almost 300,000 residents were using Linden dollars (Au, 2008, p. 252). However, most users did not become rich. By 2007, only 1,600 residents were making more than 200 USD, and only 400 residents were making more than 2,000 USD per month (Stillich, 2007, p. 121). According to Linden Lab's economic statistics, 304,499 of the 600,000 active residents spent some Linden dollars during August 2007 (Au, 2008, p. 279). Of those residents who bought Linden products and services, 131,000 spent 500 L\$ or less – which was around 2 USD at the time. Around 60,000 residents (10% of the active population) spent more than 10,000 L\$ a month, the equivalent of around 40 USD (Au, 2008, pp. 279-280). August 2007 also had around 42,000 residents seeing positive cash flow from their activities in SL. They made more Linden dollars doing business than they were paying Linden Lab for their virtual land and other services (Au, 2008, p. 179). SL had a GDP of 500-600 million USD as of early 2007 (Bruns, 2008, p. 300). In 2009, the converted monthly turnover in SL was around 35 million USD (Vieweg, 2009, p. 100). On June 20th, 2013, the number of transactions of virtual goods per day amounted to 1.2 million pieces. The number of transactions carried out up to that day was worth 3.2 billion USD in total (Linden Lab, 2020b). SL's GDP was half a billion USD in 2014 (Manthorpe, 2016).

Land Price and Use Fee Development

Table 4 shows the one-time costs and monthly fees in 2007, in 2017, and the current ones in 2020.

In 2007, an entire region or island with 65,536 m² cost around 1,670 USD (one-time payment). The corresponding monthly land use fee was 295 USD, and the monthly premium membership fee was 9.95 USD. Furthermore, island set-up costs for a one-region island amounted to 1,250 USD (Rymaszewski et al., 2007, pp. 37-38; Stillich, 2007, p. 122). In July 2017, a full region or island with 65,536 m² cost a one-time 600 USD. The monthly land use fee was 295 USD, and a premium membership fee of 9.50 USD was charged when selecting the *monthly billing period*-option. To celebrate SL's 15th anniversary, the maintenance fee for a full region was lowered on July 2nd, 2018 from 295 to 249 USD, and the set-up cost for a full region was lowered from 600 to 349 USD. As of November 2020, a full private region with 65,536 m² costs a one-time 349 USD, with a monthly land

Table 3. Comparison of 2010, 2017, and 2020 selling rates of L\$ to €

Selling rate of L\$ to €			
Date	March 28 th , 2010	August 7 th , 2017	16 th November, 2020
L\$ to €	373: 1	305: 1	211: 1

Table 4. Comparison of 2010, 2017, and 2020 SL prices and fees

Land price and land use fees for full region (65,536 m ²) in USD				
Payment model	Costs & fees	2007	2017	2020
One-time	Land purchase price	1,670	600	349
	Island set-up costs	1,250	n.a.	349
Monthly	Land use fee (maintenance)	295	295	229
	Premium membership fee	9.95	9.50	11.99

maintenance fee of 229 USD and a premium membership fee of 11.99 USD when selecting the *monthly billing period*-option. The set-up fee for a full region is 349 USD (Second Life, 2020c,d,e,m,n,o).

CONCLUSION

By creating a virtual environment for social interactions as well as for producing and consuming, Linden Lab wanted to realize its vision of an immersive internet which unifies all the world's knowledge and perceptions (Au, 2008, p. 22). For visionaries, the two-dimensional internet will be replaced by the three-dimensional internet (Nusch, 2007, p. 13). This means that companies will have to do their research and implement this novel internet to stay competitive. Furthermore, the increasing mobility of users will gradually become crucial for virtual worlds and companies (Greenfield, 2008, pp. 37-38). Experts likewise treat the emergence of an immersive 3-D internet as an inevitable forecast for the future, but according to them, it will not belong to a single company such as Linden Lab (Au, 2008, p. 22).

The first half of this article provides an overview of SL's business model, as well as of the issues and criticism it was confronted with, particularly in regards to its accessibility, its in-game content (e.g., violence, hate speech, and depiction of sexual acts), and its business model. Reconstructing the development of these aspects in 2003-2008 was comparably easy using the retrieved literature.

The goal of this article is to show in its second half – in contrast to its first half – the limits of reconstructing the *economic* development of a virtual world years after its popularity peak. To demonstrate these limits, SL was taken as an example. Available SL literature (if possible, on an academic level) was collected and compiled, and the focus was set on its economic development in 2003-2008. Reconstructing this development some years later, in 2020, is shown to have some limits caused by loopholes in the retrieved literature.

These loopholes can stem from a lack of sufficient data provided by Linden Lab or other official institutions, as well as from a lack of proper documentation. Also, time limitations make manual checks of large quantities of literature infeasible. Accordingly, the compiled content of the retrieved literature provides only an incomplete picture of SL's economic development in 2003-2008. Such an incomplete picture implies that even a virtual world like SL which received dense overall media coverage can still end up having the peak time of its *economic* development (2003-2008) insufficiently documented.

In the near or distant future, it is inevitable that companies and the general population will once again return and commit to a virtual world. Therefore, this article serves as an argument and a reminder for a proper documentation of such developments – otherwise later research and trace backs of the economic development of next-generation virtual worlds might prove difficult, costly, or infeasible.

This critical review of simulation literature suggests for future documentation of virtual worlds in academia to be less one-sided (e.g., avoid a predominant focus on the sole application of such virtual worlds), and that in particular economic metrics should be tracked more thoroughly for the purpose of easier post-analysis and development reconstruction.

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