Understanding Virtual Worlds: An Infrastructural Perspective

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Abstract

As many organizations – including Delft University of Technology - started using *Second Life* in 2006 and 2007, they faced a problem of inactualization. This problem entails an inability to attain a virtual world application as usage is lower than conceptualized upfront. By taking an infrastructural perspective on virtual worlds in general, this paper explains the root of the inactualization problem. Specifically focusing on investment, value, critical mass and accessibility, we shed light on a current deadlock of innovation in virtual world applications, thereby offering insights for how to overcome it.

Introduction

In 2006 and 2007, the virtual world known as *Second Life* saw a significant influx of users, regularly coming close to 1 million new user registrations each month between December 2006 and October 2007 (Linden Lab, 2008). Developed by Linden Lab, this virtual world offers a three-dimensional, audiovisual, and persistent space, in which multiple users are able to interact with each other and the environment around them (Bartle, 2004: 475). As media attention grew, various organizations like IBM, Sun Microsystems, NASA and Philips were triggered to start experimenting with *Second Life*. Delft University of Technology also experimented in *Second Life* (Harteveld, Warmelink, Fumarola & Mayer, 2008). As with every new technology, these organizations first had to understand the underlying technology, how to use the interface and its building tools, to be able to get insight into the possibilities that virtual worlds such as *Second Life* offer. This understanding can be gained by simply trying to use the technology.

Next, the question arises what exactly to do with it. Organizations envision a diversity of conceptual ideas as for example virtual lectures, services, and collaborative design as one small-scale survey of Dutch businesses revealed (De Nood & Attema, 2007). However, they face the problem of translating these ideas to the virtual world's functionalities. Consequently, once the island or construction is finished, the number of visitors can be disappointing or it might hardly be used at all as a five-month long weekly census of various organization's islands in *Second Life* revealed in 2007 (Tateru Nino, 2007). Thus, a virtual world application as foreseen may not be attained. We call this a problem of *inactualization*.

This inability to realize a successful implementation in a virtual world as foreseen could be caused by the newness of this medium. *Second Life* and other popular virtual worlds could be witnessing the beginning of large-scale virtual world usage by organizations and people in general. The organizations, mentioned earlier, can be seen as early adopters of this new technology. As such, they share the vision, that virtual worlds have a future. This future consists of an intensive use of virtual worlds as a communication and knowledge sharing platform (Smart, Cascio & Paffendorf, 2007; Sun Services, 2008). Similarly, as time passes, organizations will gain experience in virtual worlds, providing a basis for more successful implementations. Although these are sound arguments, we think the problem of inactualization runs deeper. This paper elaborates on the deeper causes of the problem of inactualization.

For the analysis of this problem, we take an *infrastructural* perspective, as is explained in the next Section. Subsequently, the third Section discusses the relevant characteristics of infrastructures. These characteristics are used to describe the underlying problem of inactualization of virtual worlds, which can be found in the fourth section.

Virtual Worlds as Infrastructures

There have been many attempts to explain what virtual worlds are. Most of these analyses had a mono-disciplinary approach, offering for example an economical (Castronova, 2005) or judicial perspective (Balkin & Noveck, 2006). Although these mono-disciplinary ways of researching virtual worlds may provide useful insights, they may also provide a somewhat incomplete picture as these worlds are reduced to the perspective of a single discipline. By taking an integrated and holistic approach these limitations can be overcome to explain the inactualization problem.

A possible integrated and holistic approach, and the one we have adopted in this paper, is to make an analogy with infrastructures. We call this way of looking the *infrastructural perspective*. There are two reasons why we think an infrastructural perspective could support the understanding of virtual worlds and inactualization in particular. In the first place, infrastructures consist of many interdependent systems, such as a technical, managerial, and legal system. This makes it difficult to study infrastructures mono-disciplinarily. For that reason a number of integrated and holistic approaches have been developed that could be useful to apply to the study of virtual worlds as well (Hansen, Magee, de Neufville, Robins, & Roos, 2006).

The second reason is that virtual worlds are or have the potential to become a next generation infrastructure. One characteristic of an infrastructure is that it provides services for social activities (National Resource Council, 1995). Users of virtual worlds look for entertainment or use this place to meet other users and socialize. More active users might develop their own buildings and businesses and actually start a virtual life. Another characteristic is that they support economic activities. Since virtual worlds, like *Second Life,* also have an internal economy, virtual worlds have an economic value as well. Many organizations noticed this and started experimenting with using virtual worlds, for example to create brand awareness (Siklos, 2006). We observed organizations searching for possibilities to use virtual worlds to offer services, for example by creating virtual products, to test prototypes of new products or for

collaborative product design. Thus, virtual worlds are used as a network for these activities and can subsequently be considered as infrastructures.

However, the analogy of virtual worlds as infrastructures does not totally fit. According to different descriptions of infrastructures, infrastructures are essential for economic and social life (Hirschman, 1958; National Resource Council, 1995). Virtual worlds are not essential for economic and social life, at least at this moment. On the other hand, many believe that virtual worlds will become more important in the future (Smart, Cascio & Paffendorf, 2007; Hendaoui, Limayem & Thompson, 2008). Similar to the growth of other infrastructures, like mobile telephony or e-mail, it starts with a couple of people using it, before it becomes an essential part of our lives.

The Infrastructural Perspective

To explain the problems related to realizing a successful implementation in a virtual world, we have opted for four relevant characteristics that could possibly determine, or at least elaborate, the successfulness of an infrastructural project when it is at the beginning of its trajectory (Noam, 1992; Shapiro & Varian, 1999). The infrastructural perspective could encompass more, but for the explanation of inactualization this focus is sufficient. The opted characteristics are investment, value, critical mass, and accessibility.

Investment

Infrastructures are known to have long life times and high investment costs. These costs are difficult to split, because only the system as a whole can provide a service. For example, a railway infrastructure without stations is not functional. The same holds for virtual worlds. Building in *Second Life* has relatively high investment costs as, after purchasing virtual property called “islands”, desired functions have to be available before the island can become useful to the public. Although it is technically possible to open an empty island, users are not likely to visit an island without any clear incentives.

Value

Due to high investments economies of scale and scope are of importance to infrastructures. Economies of scale relate to the additional costs of an extra user, which in general decrease with the number of users, while economies of scope relate to the production costs, which in general become lower with joint than with separate costs (Png, 1998). These economies are of importance to infrastructures as the high investments have to be earned back, and without these characteristics this would be hard to achieve. However, in infrastructures, this Return-On-Investment (ROI) is generally difficult to define, partly due to the economies of scale and scope. For example, while in a railway infrastructure the revenues can be calculated relatively easily through the purchased tickets, the income or value of the freedom of movement of people cannot be objectively defined. Similarly, the value of an organization’s virtual world application - which could have economies of scale and scope as well - is difficult to define, because revenues of brand awareness, lower traveling costs for meetings or lower testing costs are only indirectly measurable.

Critical mass

The value of an infrastructure increases with the number of users. A well-known example is the telephone network. With an increasing number of telephone users, the number of possible calls increases, thus increasing the value of having a telephone. If a minimum number of users has been reached for an infrastructure to operate successfully (without subsidy), it is said to have reached a critical mass (Noam, 1992). This characteristic is of importance to virtual worlds as well. Socializing and co-design is only possible (and worthwhile) when there are enough users.

Accessibility

As infrastructures are critical for the functioning of society, they should be non-exclusive (Png, 1998). In other words, everyone should be able to make use of it. However, the possibility does not mean people actually make use of it. The amount of switching costs, the costs to change from one infrastructure to another, plays a role within such a transition process. For virtual worlds this accessibility is also an issue. For potential users virtual worlds need to be worth switching to.

The inactualization problem

With the characteristics of the previous Section in mind we are able to explain the inactualization problem. First of all, virtual worlds are characterized by their emptiness. Actual usage is scarce and also difficult to maintain. Some places are relatively crowded, like popular entertainment areas, but most areas have the appearance of a deserted ghost town. Hence, it seems that virtual worlds have a lack of critical mass. When there is hardly any activity, the added value of being involved in a virtual community becomes low.

The lack of critical mass can be subscribed to a number of aspects. For users, the switching costs to start using virtual worlds are high. Learning curves for entering virtual worlds are steep and the learned knowledge and skills are to a limited extent exchangeable between virtual worlds as each one of them has their own particular implementation. In other words, the accessibility is cumbersome. This makes the required investments high, while the expected utility of this investment is low. The current users are in fact early adopters who bear the high investments and low accessibility out of curiosity and high expectations for the future.

Actual and large-scale development requires even more investments. It is easy to build simple models, but to build sophisticated models good skills are needed. Compared to for example building and editing websites, development in virtual worlds is much more difficult. In addition, for large-scale development users cannot even start without owning virtual property. For instance, in *Second Life* this property must be rented. This means users will receive a constant flow of maintenance costs. Again, this lowers the accessibility of using virtual worlds.

While it takes a high investment to start off and a constant amount of money has to be paid, the marginal costs of an extra user are almost non-existent. As long as the technical capacity and the functionality of the design allow it, any extra user does not

generate extra costs, unless users have to receive in-world services from avatars. Nonetheless, this economy of scale advantage does not pay off, because there is no critical mass. And if there was, it would be difficult to calculate the ROI as it is difficult to measure the incomes. Due to this, it is hard to see whether the investment effort was worth it.

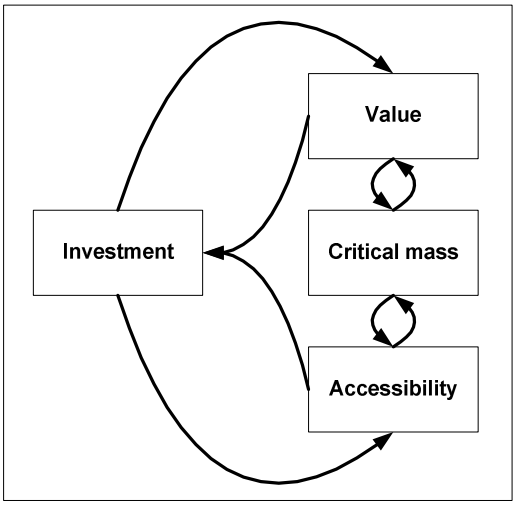

Figure 1: Deadlock of innovation in virtual worlds. Each arrow represents how an influence of one element affects the other.

All of these problems, i.e. high investment, low accessibility, a lack of critical mass, and low value, are related to each other in such a way that a deadlock of innovation occurs (see Figure 1). To get any value, investments need to be made, but with no critical mass and a low accessibility, the decision to do so becomes unlikely for many organizations. This deadlock explains why only a few (innovative, mostly research oriented) organizations have attempted something (without realizing their objectives) and why so little organizations have followed them after their implementations.

Conclusion

Virtual worlds have sparked interest and discussion, but the outcomes in terms of usage and effects are currently disappointing. Many organizations have stepped into virtual worlds with high expectations and these were not fulfilled. This problem of inactualization - not being able to realize a successful implementation in a virtual world as foreseen - could be caused by the newness of this medium. It could be that only early adopters make use of it and as time progresses virtual worlds may become more widely used.

However, we argue that the problem of inactualization runs deeper. It has ontological roots, as our analysis reveals that virtual worlds share many characteristics of infrastructures. They require large investments in terms of time as well as money, while their ROIs are difficult to observe. On top of this, they require an effort to achieve a critical mass, support economies of scale and scope, and have accessibility issues. This infrastructural perspective enabled us to observe that the problem of inactualization can be attributed to a deadlock of innovation. Investments are needed to improve the value

and the accessibility, but these same investments are only done when there is some value and when organizations are able to use this medium. As such, the infrastructural perspective provides an understanding of the current situation and status of virtual worlds and from where we need to proceed to breach the deadlock and solve the inactualization problem.

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