Investigating the Concept of Consumers as Producers in Virtual Worlds: Looking through Social, Technical, Economic, and Legal Lenses

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Abstract. Virtual worlds such as World of Warcraft and Second Life enable consumers as producers, that is users can choose to be passive consumers of content, active producers of content, or both. Consumers as producers poses unique challenges and opportunities for both operators and users of virtual worlds. While the degrees of freedom for user-generated content differ depending on the world, instances of consumers as producers can be found in many virtual worlds. In this paper we characterize consumers as producers with the help of four "lenses"—social, technical, economic, and legal—and use the lenses to discuss implications for operators and users. These lenses provide a complementary analysis of consumers as producers from different angels and shows that an understanding of it requires a holistic approach.

Keywords: consumers as producers, prosumer, crowdsourcing, virtual worlds, emergent behavior, architecture.

1 Introduction

Creators of virtual worlds are facing many technical challenges (e.g., scalability, data persistence, consistency, latency, content protection, or security). But besides addressing the underlying technology and infrastructure to operate a virtual world successfully, business, policy, and legal challenges are equally important for success. Examples of important issues that need to be addressed are customer relationship management, Web portals for game-supporting functions (e.g., player matching), revenue models, or terms of service (ToS) agreements. Besides these out-of-world issues, there are also in-world issues to address such as offering a rich and immersive experience that keeps users engaged, game physics, trading mechanisms, and rules of the virtual economy. Within this environment, consumers as producers is another critical aspect that needs to be factored in by operators.

This paper explores the consequences of consumers as producers in the context of virtual worlds. In essence, consumers as producers means that users are part of a virtual environment—including a virtual society and economy—that gives them the freedom to be producers, consumers, or both. In the following, we denote the *concept and phenomenon of consumers as producers* as CasP and use it in the singular. This paper argues that CasP has a significant impact on a virtual world—its society, its economy, its technical infrastructure, and the legal constrains that apply. While CasP adds complexity to a virtual world, it also enriches the world in many (unexpected) dimensions. There are operators of virtual worlds that try to severely limit and constrain the idea of CasP, perhaps because of added complexity, legal repercussions, and emergent behavior that does not allow to predict the world's evolution. Other operators of virtual worlds have embraced CasP, trying to provide an environment that furthers the benefits of both users and operators. Regardless of the operator's approach, the impact of CasP on the virtual world cannot be ignored. This paper characterizes CasP with the help of four lenses (i.e., social, technical, economic, and legal) and then uses the lenses to discuss implications for the operators and users of virtual worlds.

In the following, we restrict our discussion to metaverse-like worlds and massive multiplayer online games (MMOGs). Both have in common that they enable multiple users to interact and collaborate in a persistent computer-generated environment. MMOGs emphasize game characteristics (e.g., leveling, competition, strategy, or winning). In contrast, metaverses have no explicit goal. User-generation of in-world content is much more pronounced in metaverses than MMOGs.

We discuss virtual worlds from the perspective of different stakeholders. These stakeholders are users and operators, but also third parties such as legislation, law enforcement, and policy makers. When speaking of the operator of a virtual world, we mean the entity that offers the service and provides access to the virtual world. The user has access to the virtual world via an account and interacts in the world with his or her avatar.

The rest of the paper is organized as follows. Section 2 introduces the concept of CasP in the context of virtual worlds. Sections 3–6 explore CasP with the social, technical, economic, and legal lenses, respectively. Section 7 discusses overarching issues that affect CasP. Section 8 closes the paper with our conclusions.

2   Consumers as Producers

A central concept that transforms the Internet is CasP [1]. It most visibly drives social network sites like Facebook, YouTube, Flickr, and Twitter [2]. A common characteristic of social network sites is that there is an emerging culture shaped by social interactions of its members in a virtual environment. Members in this culture are not only passive consumers of information, but actively engaged in producing information themselves. Besides the Internet, virtual worlds provide an infrastructure that fosters—or at least enables—CasP. In a report of the Federal Trade Commission on a major hearing in November 2006, CasP was

identified "as one of the most important developments of the past few years, and one which will likely dominate the coming decade" [3].

CasP is in stark contrast to the established model of mass media, which is based on the notion of relatively few but large, commercial producers who sell content to a mass audience. In this model, content is offered for consumption but there is no incentive for the producer to encourage or allow the consumers to create derivative works (i.e., remixing). Since content is created and distributed by a few, production and distribution is relatively centralized and easily controlled [4]. In contrast, CasP is highly decentralized and uncontrolled, and embedded in the Internet's borderless communication infrastructure. The concept of CasP is addressed in different ways by different researchers using different nomenclature. Kazman and Chen use the term crowdsourcing [5], Pearce talks about emergent authorship [4], Reuveni says users are conducers [6], Toffler coined the term prosumer (i.e., a contraction of producer–consumer) [7], etc. In the following discussion we will stick to CasP.

The following sections survey the concept of CasP and explore it with four distinct lenses: technical, social, economic, and legal. We argue that each of these perspectives severely impacts virtual worlds—more precisely, the stakeholders of virtual words. In the following discussion we mostly focus on virtual worlds and two major stakeholders, users and operators.

3   Social and Cultural Lens

The social and cultural lens focuses on virtual worlds as persistent social spaces. They enable personal communication and interactions among participants via avatars. Besides operating on a personal level and supporting social relations and networks, a virtual world constitutes a society with its own culture(s).[1] Consequently, virtual worlds can be studied and looked at from the perspective of ethnography.

Pearce has done this with a group of players of Uru, a MMOG based on Myst [8]. In Uru, a player belongs to a certain *hood* (similar to a guild), which has a player as mayor. The founding of a hood can be seen as the beginning of a society. This is apparent from the mayor of one hood who after more and more players joined her hood "realised [she] would have to become organized and set some ground rules" [8, p. 89]. Uru's culture is defined by the (emergent) story of the game, artifacts within the game (e.g., each hood has a central fountain where avatars can gather), special language, and common characteristics of the players (e.g., they "tended to value intelligence and problem solving" [8, p. 81]). After Uru was shut down, players of the hood decided to migrate their society and its culture to other virtual worlds—most ended up settling in There.com but also in Second Life. This meant that central pieces of

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[1] For this discussion, we define culture as a set of shared attitudes, believes, values, customs, behaviors, and artifacts that characterizes a group of people. A society is a social infrastructure inhabited by people that exhibits patterns of relationships between people that share a distinctive culture.

the Uru culture were re-created in There.com and Second Life (e.g., a community center with a central fountain and Uru-style architectural elements). Uru's lead artist became one of the top developers of There.com and Uru's members founded the University of There. As a result, Uru's players "made major contributions to the There.com community, and eventually became fully integrated, while still maintaining their group identity" [8, p. 107]. However, in the beginning Uru members had to keep up with incidents of griefing by established users.

The user's avatar represents an individual within the virtual world's society. Users typically have the option to determine the looks of an avatar and to continuously change it. This is a rudimentary example of the concept of CasP. Uru is an example of a virtual world that offers basic customization by selection from a limited number of options to determine hair styles, facial features, clothing items, etc. Uru has no class system and avatar choices do not influence skills. Hence, the user creates the avatar solely based on the desired looks. Interestingly, Pearce has found that the evolution of an avatar is not only the result of the user's individual desire, but instead that the formation of avatar identity "evolved out of an emergent process of social feedback" [8, p. 69].

When Uru's players looked for a suitable new world, one important goal was to replicate avatars as faithfully as possible. Furthermore, expressiveness of avatar animation was seen as important. In contrast to Uru, There.com and Second Life enable more advanced avatar design. This made it possible to create Uru-style clothing. Another example is the Relto in Uru, which is an avatar's home base in the form of a small adobe cottage. In Uru, the user cannot design the Relto, but in There.com and Second Life users created their own interpretations of the original Relto. Ondrejka observes that users of virtual worlds have the tendency to specialize [9, p. 92]. Some users act as project leaders, while other specialize in aspects of artifact construction (e.g., textures or scripting). As a result, if the virtual world allows it, such as in Second Life, larger-scale construction is often an in-world social activity involving intense collaboration [8, p. 155ff].

The case of Uru illustrates well that a virtual society enables CasP at several levels. This is most obvious in the users' creation of avatars, clothing, Relto and other (cultural) virtual artifacts. Not so obvious is that production happens via exploration of the virtual world and via interaction with avatars and objects within the world. Pearce argues that the role of the operator of a virtual world is to create "context" rather than content [4]. This is perhaps most apparent in virtual worlds like There.com and Second Life that provide context in the form of "world rules" (e.g., the physics of virtual objects), but leave it to the users to populate the content and to explore, interact, and utilize the rules and architecture of the world. Ondrejka argues that operators should leverage the "desire of people in general to express themselves through creation and customization. . . . People want to be perceived as creative by customizing their surroundings. People want to have their moments on the stage. In many cases, it seems that users are just waiting for access to the right tools" [9]. This holds for both in-world and out-of-world content.

4   Technical Lens

The technical lens emphasizes challenges to meet the functional and non-functional requirements of virtual worlds. CasP has a negative impact on some of these requirements in the sense that it increases the technical difficulties to satisfy them. Furthermore, the design, implementation, and maintenance of a virtual world requires different approaches compared to the traditional approach of engineering software systems [10]. Software development for crowdsourced systems that enable CasP is characterized by a *bifurcated architecture* (consisting of a relatively stable kernel and a not-so stable periphery), and needs to accommodate "perpetual beta" and "always on" [5].

Humphreys points out that in computer games "players have developed new objects to be imported into the game, new 'skins' that make characters or objects in the game look different, new AI (artificial intelligence) characters to play against inside a game, and even new games using game engines from existing games" [11]. To allow CasP on a larger scale, a technical infrastructure needs to be in place that supports the effective creation of content by users.² The Sims was perhaps the first mass-market game that released tools to users so that they could easily create content (in this case, domestic goods such as furniture). As a result, 80–90% of the content has been created by players [9] [11]. Machinima is an example of out-of-world content produced by users, which leverages the game engine itself, supporting tools (e.g., level editor), and possibly game-related content such as backgrounds and characters. Machinima is typically sanctioned or even encouraged by the game operator. Second Life supports content generation with in-world tools and scripting capabilities with the Linden Script Language (SLS). SLS is an event-driven language that can be used to control behavior of objects and avatars. Building of new objects is done with *atomistic construction* (i.e., building of larger and more complex creations out of basic building blocks) [9]. In Second Life, the basic elements—called *prims* as in primitives—are geometric shapes such as box, tube, sphere, or torus.

The functional requirements for a virtual world primarily address the features of the world. For example, an important decision—that greatly affects the design—is whether the world uses bitmap or vector graphics. Another important requirement is the viewpoint and representation of geometric data in 2D, 2 1/2 D, or 3 D. Other functional requirements address the in-world experience such as whether objects are solid or not (implemented with collision detection) and whether objects adhere to physical laws or not (implemented with the physics engine). Non-functional requirements of virtual worlds address quality attributes such as availability, scalability, persistence, and privacy [12]. That these requirements are difficult to meet is illustrated by recurring server outages, scripting vulnerabilities, inconsistencies, duping, and content loss in popular virtual worlds

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² If the operator does not provide an infrastructure for users, they will work around this limitation as best as they can. This is illustrated by mods (e.g., Counter-Strike, based on Half-Life) [11], and elaborate strategies to decorate homes in Ultima Online (e.g., building a piano out of items such as cloth, desk, and chessboard) [9].

[13] [14]. To scale virtual worlds to larger user bases and many in-world objects, techniques such as shards (e.g., World of Warcraft) and tiling (e.g., Second Life) are used.

Functional and non-functional requirements determine the extent to which the concept of CasP is possible. A fixed synthetic world offers no or little opportunities for user-generated content. In contrast, a co-constructed word that is based on vector graphics and scriptable behavior such as Second Life gives users the freedom to create content in the form of virtual objects, textures/skins, and sophisticated object behavior.

CasP directly impacts scalability. While fixed synthetic worlds can handle several thousands of users per server, Second Life can accommodate only about 40 users per server [12]. For fixed synthetic worlds most game content (i.e., object geometries, textures, animation attributes, collision parameters, and placement in the world [14]) can be pre-installed on the client; in co-created worlds most content data needs to be downloaded from the server to the client, significantly increasing the network load. As a result, co-created worlds typically exhibit less detailed graphics and smaller view peripheries. Comparing World of Warcraft and Second Life, Symborski found that Second Life required more than 20 times the bandwidth load [14]. Even though data can be cached, since the content is dynamic—users can continually create and modify objects—it needs to be checked for staleness and accordingly updated. This problem is further exacerbated by the fact that "in practice, user-created objects are massively clustered together," which can lead to incomplete rendering and inconsistencies in the world, causing strange avatar-world interactions [14] [15].

Another challenge of CasP is that content generated by the user is not optimized for the technical infrastructure of the virtual world because users have neither the information nor the expertise to do so. In fixed synthetic worlds content can be tested and optimized by the operator so that it "looks good and is rendered at interactive rates" [12].

5   Economic and Business Lens

The economic lens looks at virtual worlds as a form of (many-to-many) e-commerce and explores issues such as value generation via production of information goods. Another economic aspect is the business model of the virtual world. MMOGs often used to have a subscription-based business model that requires users to pay a monthly fee. This approach is attractive for the operator because it mitigates uncertainty with a more predictable revenue stream. Nowadays, operators increasingly offer free play coupled with item sales. Leveraging CasP requires the operator to come up with new or enhanced business models that are different from established ones, which typically place the consumer as a passive recipient of goods or services at the end of the value chain. For example, Kazman and Chen argue that crowdsourced system need to embrace service-orientation, which requires "a shift on the part of businesses, to see consumers . . . as co-creators of value" [5]. This requires a shift "from thinking about value

as something produced and sold to thinking about value as something co-created with the customer."

Swire emphasizes the economic aspect of CasP when observing that "users can produce high-quality information goods from home, and sell through the global distribution system of the Internet" [16]. There are many examples of such information goods ranging from open source software to multi-media in blogs and social network sites. For virtual worlds, users can create or add value to virtual assets and sell or trade them either through in-world channels (*in-context economy*) or out-of-world via eBay (*out-of-context economy*) [17]. In MMOGs, users can deal with virtual assets (e.g., weapons) or level-up their avatar and then sell it. The latter is an example of the transfer of in-world content via real-world money. From an economic perspective, it is a rational choice for time-constrained users to advance their characters through real-world money rather than time-consuming leveling.

Commerce is significantly enhanced if the virtual world has an economic model involving virtual money and users that can own virtual property [18] [19]. Virtual money (e.g., Second Life's Linden Dollars or Entropia Universe's PED) is real in the sense that they can be exchanged for real money and vice-versa. With a virtual economy in place users can derive revenue through business activities. In Second Life, a user has claimed to have earned $1 million USD with virtual estate dealings. If the virtual economy is paired with user-generated content such as in Second Life, commerce is enriched further. To give a few examples, in Second Life users can create virtual clothing, jewelery, tattoos, and hair styles for avatars and offer them for sale in virtual shops. The same holds for furniture, vehicles, and buildings. This form of virtual economy works because just as in real life users are willing to indulge in shopping and consumerism. As in real life, users are willing to pay for virtual objects that they want but do not have the expertise, time, or interest to produce themselves. Lehdonvirta has identified a number of drivers that make users purchase virtual items: functional attributes (e.g., performance), hedonistic attributes (e.g., customizability), and social attributes (e.g., branding) [20].

Operators can define the rules of the virtual economy to ensure that they make (virtual) money from it. For example, Second Life did tax users for the virtual objects that they created. The rationale for this was that objects in the virtual world take real-world resources to process, store, and transmit. However, this scheme resulted in very high taxes that effectively prevented users from creating on a large scale (e.g., experiences such as gardens) [21]. User frustration over these economic constraints (culminating in a "tax revolt") prompted Second Life to change these rules. Under the new scheme, the amount of owned land effectively limits the content that can be created (in terms of the number of prims). Second Life auctions off virtual land for virtual money. The value of virtual land is determined by virtual world architecture. Before Second Life abandoned telehubs, proximity to a telehub increased the price of land because the expectation was that they would become commercial centers populated with many avatars. A virtual economy that gives users the opportunity to make real

money has another consequence: "users would want to own their creations" [9]. This issue is discussed in the next lens under virtual property.

6   Legal and Policy Lens

This lens explores virtual worlds from a legal and regulatory perspective. Considerations are, for instance, applying existing law to virtual worlds, development of legal theories in response to virtual worlds, and possibly dedicated laws to regulate virtual worlds.

Almost all legal issues that exist in real life are potentially applicable to virtual worlds [22]. The key question is how to map virtual incidents to applicable law: killing a human is not the same as killing an avatar, so the latter is not being considered murder (even though there may be other repercussion of such an act depending on the virtual world). If the virtual world allows (real-time) user interactions (e.g., avatar movements in 3D or voice chat) there is increasing possibility of harassment, assault, and libel that resemble real-world scenarios. If the virtual world has an economic model involving virtual money and users that can own virtual property there is the problem of taxation, fraud and money laundering [23] [18] [19].

When users create content, this content may be illegal or inappropriate (e.g., offensive) [24]. In terms of illegal content, intellectual property (IP) is the most critical issue from the perspective of CasP. Generally, content accessible in virtual worlds may infringe on (out-of-world) copyrights and trademarks [25]. Operators have to provide an infrastructure where infringements can be reported and affected content can be taken down. Violation of IP rights can have serious consequences for the operators. The MMOG City of Heroes was sued by Marvel because it allegedly enabled copyright and trademark infringement by its users [25]. Dougherty and Lastowka say that a lesson for operators may be that "to avoid litigation, [they] should err on the side of caution when deciding whether to empower participants with tools for creative expression" [25].

If users create content in a virtual world, either the operator or the user may own the copyright. Game operators often claim copyright of users' in-world creations or allow user-created content only for noncommercial use (e.g., EA's The Sims) [11]. Auran's Trainz is a rare example of a game that allows users to own and commercialize their content [11]. Similarly, Second Life allows users to retain their IP rights (or license them under Creative Commons). When users retain IP of their creations, certain challenges have to be faced when these creations become part of the virtual world. For instance, if a user sells one of her virtual creations, certain rights attached to it may have to be transferred or licensed to the new owner; and if users retain the copyright of their avatars, what about screenshots with a commercial interest that are depicting them? Bartle believes that "IP laws are currently a pitfall for VW developers because they are inadequately stated" [26]. For CasP this legal uncertainty "may already be deemed chilling of creativity" [27].

Another critical issue that interacts with IP is virtual property: do virtual items constitute property and, if so, who owns that property? These questions are

as yet unresolved.[3] Lastowka and Hunter have argued convincingly from the legal perspective that virtual items could be treated like real property [18]. Bartle has raised concerns about the impact of virtual property from the perspective of the game developers [17]. A key legal consideration is that virtual property resembles real property in its rivalrousness, persistence, and interconnectivity [23]. More precisely, virtual property has these attributes if the virtual world's architecture chooses to do so, but this is typically indeed the case. Not surprising, there are court cases that have treated virtual property as real property. Operators have argued that since they own the IP of a virtual item, they should be the ones to control it (e.g., forbidding users to sell these item). On the other hand, IP law already recognizes the distinction between the copy of an item (e.g., a book) and the copyright on that item (e.g., the copyright in the book)—and this distinction directly translates to virtual items [23, p. 1632]

Besides the laws that directly regulate virtual worlds, there is also the contract between the world's operator and the users of that world in the form of ToS and end-user license agreement (EULA). Operators typically try to keep control over the virtual world to the extent that supports their business model. For example, World of Warcraft's ToS claims ownership of player accounts and since users have to agree to "no ownership rights in account" the gateway to their virtual assets can be rendered inaccessible "for any reason or for no reason." On the other hand, operators may allow certain forms of user-generated content and make that explicit in their contracts. World of Warcraft allows users to create machinima under certain conditions (e.g., non-commercial and "T" rated). Contracts between the operator and users come with legal uncertainty. An unbalanced policy that is not freely bargained and that puts users at a clear disadvantage increases the operator's risk that courts will find *unconscionable* conduct—and as a result may refuse to (partially) enforce the contract [28].

Consumer protection law is another area that impacts virtual worlds [16]. Under certain conditions CasP may have to comply with consumer protection laws. This has an impact, for instance, on advertising. Conversely, under certain conditions users may be treated as consumers under the law and may claim consumer-style protections. For example, Bartle points out that if an operator is selling virtual items and these items are treated as virtual property then users "can expect the same kind of security that they get under regular consumer protection laws" [26].

7   Discussion

Table 1 exposes the tradeoffs (i.e., opportunities and risks) of CasP for both users and operators. For the social lens, CasP enables users to shape their own culture

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[3] When we speak of property, we do not necessarily apply it strictly in a legal sense (as the notion of property depends on the legal system and its philosophical underpinnings), but rather use it to refer to a legal position that, inter alia, grants its holder an exclusive position vis-à-vis third parties, including the right to use, to transfer, and to commercially exploit the "property."

(e.g., via creating artifacts or in-world games), which increases the user's sense of belonging to the virtual world and helps the operator to retain customers. On the downside, user-generated content can prompt griefing or other forms of harassment since users expose their culture and values via their creations. As a result, operators may find themselves in a mediating position between different user groups (even though presumably they do not want to be involved) [8, p. 102].

For the technical lens, since user-generated content requires skills such as scripting and graphics design, users can distinguish themselves through their technical and artistic expertise. Operators can establish technological leadership via the supporting infrastructure that is required for user-generated content. On the other hand, this technical infrastructure is more complex and based on novel technology, increasing the risk of security vulnerabilities. Also, this infrastructure requires more computing resources on both the client and server side (cf. Section 4).

For the economic lens, the user has the incentive of making money from the virtual world, but this also comes with the risk of losing money by circumstances that are beyond the user's control (e.g., because of changes made by the operator to the virtual economy). The operator can participate in the virtual economy (e.g., via "taxation") and can derive revenue from it (cf. Section 6). However, there is the risk that the virtual economy collapses and with it the operator. Since users are creating most of the content, operators have to spend less resources on content creation themselves.

For the legal lens, treating virtual items as real property strengthens the position of a user against other users (e.g., in the case of theft) or the operator (e.g., in the case of content loss). Operators can also try to claim ownership of virtual items created by users (based on the ToS). Acknowledging virtual property reinforces the legality of practices such as gold farming and third-party trading platforms. Thus, virtual property does not necessarily align with the interests of users and operators. Generally, the current situation is characterized by great legal uncertainty, posing a risk for both user and operator (even though both parties appear to be relatively unconcerned about this).

We believe that the identified lenses are a useful vehicle to understand and analyze the concept of CasP and its implications better. While scholars have

Table 1. Opportunities and risks of CasP for users and operators

Lens	opportunities/benefits		risks/drawbacks	
	user	operator	user	operator
social	co-creator of emerging culture	better user loyalty/retention	griefing	dealing with offending content
technical	technical/artistic expertise	technological leadership	complexity and vulnerability of technical infrastructure	
economic	financial gain (e.g., asset sales)	taxation, less in-house content	devaluation of assets	economic instability or collapse
legal	claim to ownership and IP rights of virtual assets		legal uncertainty (e.g., virtual property, consumer protection, IP)	

already analyzed CasP from individual lenses, they have not addressed CasP holistically. In our discussion we have focused on each lens individually in order to sharpen the discussion. However, it should be clear that there are interactions among the lenses. A good example to illustrate this is virtual world architecture, which is explained in the next section.

7.1   Virtual World Architecture

Lessig has introduced *architecture* into the discussion of cyberlaw [29].[4] The architecture of the real world is the "physical world as we find it." The architecture's constraints regulate behavior in the world (e.g., you cannot communicate through a brick wall). In a virtual world, the architecture of the world can be defined arbitrarily via its "code" (i.e., its implementation in software). For example, the architecture of a virtual world could mimic the constraints of a real-world brick wall, or not. A virtual world could define that avatars can communicate and walk through brick walls, or not. There are many architectural choices that the designers of virtual worlds can make: avatar constraints, cause-and-effect behavior, interaction and communication mechanisms, economic structure, and so on.

   While the designers of the virtual world have in principle unlimited choices how to define the architecture, in practice these choices are constrained by the four lenses. For example, the social lens argues for an architecture where users feel at home and encourages them to engage in an emergent society. Ondrejka says that "Second Life chose to mirror the real world in many important aspects in order to provide a place that felt familiar and comfortable, while granting freedoms not possible in the real world" [30]. The architecture of a virtual world has a significant impact on CasP. Thus, the operator can define the architecture in such a way that it meets the desired characteristics. For example, Second Life places little restrictions on the kinds of objects that can be constructed because the basic building blocks are prims. Thus, users can create all kinds of buildings. If the basic building blocks were not prims but pieces of buildings that could only be combined according to certain rules then the virtual world would impose some form of "building codes" (e.g., Ultima Online). Analogously, the looks of an avatar can be more open (e.g., Second Life) or more restrictive (e.g., City of Heroes) [24]. Putting restrictions on user-generated content may be needed to provide a consistent (user) experience or to limit legal liabilities.

7.2   Emergent Behavior

While the operator can control the architecture, emergent behavior is outside of the operator's control. Ondrejka defines emergent behavior as follows:

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[4] Besides architecture, Lessig also introduces law, social norms, and markets as regulators (or modalities) of behavior in cyberspace. Thus, Lessig's regulators can be seen as lenses to explore regulation in cyberspace, while this paper introduces lenses to explore CasP in virtual worlds. While Lessig's regulators are similar to our lenses, they are not identical.

"Emergent behavior occurs when a set of rules interact in interesting and un-expected ways to allow experimenters and innovators to create truly new creations" [9]. These "new creations" are typically not forseen by the operators of the virtual world. While the operators define the architecture, the creations that emerge from the rules and constraints of the architecture are not foreseeable. Besides in-world emergent behavior there can be also an out-of-world emergent economy. Emergent behavior can range from dropped items as decoration for a wedding ceremony (Lineage) and the exploitation of a collision-detection bug for hide-and-seek (Uru), to Buggy Polo (There.com) and D'ni Olympics (Uru) [8] [31].

7.3   Operators as Gods

The fact that operators have total control over the in-world architecture means that they can be seen as "gods" of the virtual world. The risks that users of virtual worlds are facing have the following analogy: "In the real world, those who make investments in a country expose themselves to uniquely 'sovereign' risks because of the danger that the government might alter the laws under which they claim to hold assets" [32].

The more users have invested in virtual assets and have come to depend on certain architectural features, the more likely that they will sue if they believe that a change in behavior constitutes a misconduct on the side of the operator. In this respect, operators are constrained by considerations of keeping users happy and of legal implications. As a consequence, for the operator evolution of the world becomes much more difficult. The basic problem is that any change—no matter how insignificant it may appear—can have an unexpected impact on the virtual world [17]. As a result, the value of a virtual item may decline or a virtual weapon may be less effective.

7.4   Factors Impacting Consumers as Producers

To analyze further the concept of CasP, we are presenting the key issues discussed so far and their interdependencies with the help of a sign-graph diagram as shown in Figure 1. The diagram identifies the key variables or concepts of the system under discussion and likely effects of changes (i.e., making interventions to the system). The arrows between the variables are labeled with a plus or minus sign, indication whether a change in the variable at the tail strengthens or dampens the variable at the arrowhead.

The concept for CasP is given at the top of Figure 1. The extent to which a certain virtual world enables CasP depends on many variables, but whether they have a negative or positive impact on CasP is not readily apparent. For example, are the kinds of users that the world attracts more likely to generate content than others and under which conditions? Would a different set of prims in Second Life change the amount of content produced and what gets produced? Has Second Life's policy of "patent peace" in its ToS an impact on content
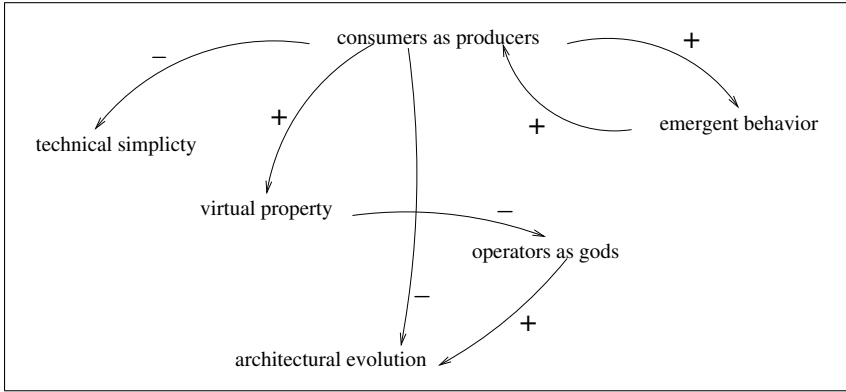
Fig. 1. Interdependencies of CasP in virtual worlds

production?[5] While there are many such variables that cannot be taken into account, there are several key concepts that expose important dependencies. These are discussed in the following:

CasP $\xrightarrow{-}$ **technical simplicity:** CasP increases technical complexity and costs because of issues such as scalability (cf. Section 4). Furthermore, the operator has to invest in a technical infrastructure (e.g., tools) that encourages user-generated content.

CasP $\xleftrightarrow{+}$ **emergent behavior:** There are many examples how CasP fosters emergent behavior. Conversely, one can also argue that any form of emergent behavior constitutes an instance of the concept of CasP. Thus, there is a positive feedback loop between both concepts, which is consistent with the observation "that 'emergence happens,' regardless of the world type" [31].

CasP $\xrightarrow{+}$ **virtual property:** Once users are producing content, many of them have the desire to own their creations. This is especially true if content creation happens within a virtual economy. Hence, CasP pushes for virtual property and there are virtual worlds (e.g., Second Life) that are accommodating this demand. However, even if the operator tries to discourage virtual property (which is typically the case in MMOGs), there is a pressure towards it because virtual assets can be converted to real money (cf. Section 6).

CasP $\xrightarrow{-}$ **architectural evolution:** Architectural evolution of virtual worlds is complicated by CasP because any change of the architecture may invalidate or alter the users' content. For example, changing the specification of a prim or removing one in Second Life would have unpredictable effects on the

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[5] Ginsu of Second Life says that "the patent peace provisions of our terms of service are there to protect innovation, not to prevent anyone's profit. We believe that these terms will lead to better content, lower costs for everyone involved, and more innovation and variety and experimentation and economic growth," `https://lists.secondlife.com/pipermail/educators/2006-September/002634.html`.

virtual world. The more user-generated content and the more important that
this content is for the experience of the virtual world, the more constrained
is the operator.

virtual property $\xrightarrow{-}$ **operators as gods:** Bartle argues that a consequence
of virtual property is that users are demanding from operators that their
property retains its value; this in turn "puts severe—perhaps impossible—
constraints on them" and thus diminishes their god-like status [26].

operators as gods $\xrightarrow{+}$ **architectural evolution:** If operators can make de-
cisions without any constraints imposed on them, they can act as gods when
it comes to the evolution of the virtual world. In practice, operators are con-
strained by legal considerations and regard for the user base. An example of
such as constrain is virtual property as discussed above. Note that virtual
property (indirectly) exacerbates the evolution problem because a change in
the architecture will invariably have an impact on the value of virtual as-
sets. Any change in the architecture will predictable make a number of users
unhappy, possibly prompting them to seek compensation via the courts.

The above dependencies can be seen as working hypotheses that need to be
further refined and researched (e.g., based on qualitative or quantitative studies).
Furthermore, additional key concepts could be identified and added to the sign-
graph diagram.

8   Conclusions and Future Work

This paper has addressed the concept of consumers as producers (CasP) with the
help of four lenses. The social lens perceives virtual worlds as a society that has
its cultures; the technical lens addresses how to design, implement and operate
a virtual world; the economic lens approaches virtual worlds as many-to-many
e-commerce that deals with virtual assets; and the legal lens encompasses laws
that potentially affect virtual worlds.

CasP is a potentially disruptive phenomenon that transforms how users and
operators perceive virtual worlds. It can be beneficially leveraged by operators
provided that they have the right strategy and business model. For users, it
can significantly enhance the experience of a virtual world, leading to a vibrant
society with rich emergent behavior. Thus, CasP can be a win-win situation for
both operators and users.

Each lens provides a complementary view of CasP. Operators should take each
lens into account when analyzing the impact of CasP on their virtual world. Op-
erators have to understand that "the more user-created content is not always the
better" [27] because it comes with risks as well as opportunities. For example,
there is significant uncertainty in the legal and economic area—and the interac-
tions between the two. Furthermore, user-generated content can be leveraged for
griefing and harassment. Thus, operators will have to carefully assess the rami-
fications of business models and virtual world architectures that aim to leverage
CasP.

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