Scarcity in the Metaverse: Space, Location and the Attention Economy

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Summary

Critics argue that virtual land lacks inherent value as it is not truly scarce. In this paper we propose a conceptual framework that distinguishes between space and location and may serve as an explanation why people still pay significant price premiums for certain virtual land parcels. While space is indeed plentiful, location possesses distinct attributes that can serve as a valuable asset within the attention economy of the metaverse. We introduce several terms, including «static and dynamic links», or «address sets», and provide managers with the necessary tools to evaluate whether their application can benefit from acquiring virtual land.

Keywords: attention economy, blockchain, metaverse, network effects, virtual land.

"Why on Earth would land be scarce in the metaverse?" This question has been raised by various people and was used as the title of a popular CoinDesk article by the columnist David Z. Morris. The article summarizes widespread concerns regarding the metaverse's fundamental scarcity properties.¹ Similarly, the well-known investor Mark Cuban even called buying land in the metaverse "the dumbest" idea ever because there are "unlimited volumes that you can create."² Many critics argue that the value of virtual real estate is dubious at best, as it lacks true scarcity. But what exactly are they referring to, with the word "scarcity" and why are people still willing to pay a high premium for certain locations in virtual worlds?³

Welcome to the Metaverse

Virtual worlds attract hundreds of millions of active users worldwide, primarily through online multiplayer video games,⁴ where users can make new connections and embark on adventures with their (real-life) friends. These virtual worlds mirror the physical one in terms of the users' desire for reputation and popularity, often expressed through the purchase of virtual apparel or "skins" for their online characters. Many brands have already seized these opportunities, with athletes, music artists and movie franchises selling skins for the players' characters on popular video games such as Fortnite.⁵ Other virtual worlds allow for more flexible marketing efforts by enabling businesses to create, deploy and sell their content without having to negotiate and rely on video game developers and publishers. Toyota,⁶ American Apparel⁷ or Tommy Hilfiger,⁸ among others, have already explored this option.

For a first-time visitor, the metaverse may feel like a vivid, immersive adventure. Users can personalize their avatars with a wide range of options for body type, hair, skin tone, facial features, and clothing. Once inside the virtual world, they encounter a diverse mix of avatars, some resembling their own and others sporting unique features like branded clothing or celebrity likenesses. Users can interact with each other through text or audio chat, but also through emotes like dance moves or waving. The virtual world itself is expansive, with towering buildings, billboards, and plenty of hidden surprises waiting to be discovered. For instance, users may stumble upon a promotional poster for a live concert currently taking place, and interact with the poster to be teleported directly into a crowd of avatars dancing to their favorite tunes.

While it may seem peculiar to enjoy a concert in this way, the feeling of presence and belonging that virtual reality offers can be more immersive than just watching a livestream at home. As users continue to explore the concert venue, they may come across virtual stores where they can purchase (or in some cases claim for free) branded apparel for their avatar. Though it may seem odd to spend real money on virtual items, users can justify their digital merchandise purchases as a means of supporting their favorite artists, or as a status symbol to show off that they went to a specific event. Exploring more of the virtual world, users may even find businesses with direct links to traditional online stores which give them the option to purchase real, physical goods. Both ⁹ and Samsung¹⁰ have already explored these options.

A Short Definition

There are many definitions and descriptions of the metaverse. Most of them name four recurring key characteristics: user immersion, user-generated digital personas, transferable and unique assets, as well as online collaboration.¹¹ In other words, the metaverse consists of immersive virtual spaces where users control a virtual representation of themselves (a so-called avatar), to have social and economic interactions with other people¹² and the virtual environment. Based on these four key characteristics, many existing projects could be described as a metaverse, including most online multiplayer video games or early virtual worlds like "Second Life".

Depending on the particular platform, a wide range of devices, such as computers, gaming consoles, mobile devices, or Virtual Reality (VR) headsets, can be used to

immerse oneself in these virtual spaces. Augmented Reality (AR) – a visualization technology to enhance the physical world with virtual elements¹³ – is sometimes also included in this list. While AR is a fascinating technology which can enhance the physical world with virtual objects, it is strictly speaking not a visualization tool for the metaverse. The confusion stems from the fact that "metaverse" is often used as a catch-all phrase for anything AR- or VR-related. User immersion certainly is a key characteristic of the metaverse and an important factor for its future success, but it is not the only one. The creation and ownership of virtual spaces is a crucial factor as well because it drives economic activity and business development in the virtual world. Virtual spaces create opportunities for businesses and entrepreneurs to develop new applications, but they may also serve as a new sales channel¹⁴ for already existing products.

Despite many efforts to create an overarching "open" metaverse,¹⁵ the metaverse today mainly consists of siloed platforms. Users must create separate accounts and avatars for every platform and cannot move from one virtual world to another. Interoperability in the metaverse, or the ability to move avatars and assets between different virtual spaces, is desirable and there are many initiatives in this direction. However, current implementations of metaverse platforms are quite restrictive, and each platform is primarily concerned with their own interests and interoperability between their own spaces only. An open standards-based metaverse would not only allow for interoperability, but also offer an expansive network of content locations that could be extended by anyone, similar to the World Wide Web.¹⁶

To fully leverage the potential of the metaverse, managers must understand the scarcity properties of virtual real estate and determine which business applications warrant investment in this seemingly non-scarce asset. The crucial point is that space and location in an open metaverse are separable, and thus, their scarcity properties must be assessed independently.

Space

Talented developers can create a variety of virtual scenes, such as art galleries, conference centers, meeting rooms, retail stores, games, or other customer engagement spaces by combining virtual objects and programmable logic. Similar to the content of websites, these scenes must be hosted somewhere. A scene could be running locally on your own computer or on a hosting service. The key question is, how it can be made accessible to the intended audience, whether it be friends, employees, potential customers, or business partners.

Proprietary metaverse platforms offer standardized content sharing similar to social media platforms like Facebook or Twitter. On these platforms, anyone can create an account and share content with others, but they are constrained by the platform's rules. The scarcity of virtual space is dictated by the operator, who can decide on the quantity and dimensions of spaces per user or per community, and offer different plans based on their users' needs. The operator essentially is a monopolist who can unilaterally adjust the supply of land in order to maximize their own profits. This raises various governance

questions that far exceed the topic of scarcity,¹⁷ and businesses should be concerned if they trust the centralized operator to always act in their best interest.

A metaverse based on open standards provides businesses with the freedom to choose where their content is hosted, whether it is on their own local server or with any hosting provider of their choice, similar to the World Wide Web. It also enables businesses to have greater control and customization over their scenes. Unlike space in a proprietary metaverse, the supply of space in an open metaverse cannot be limited because anyone can create and host new scenes in various sizes. Therefore, virtual space in an open metaverse is abundant.

Location

Virtual spaces offer numerous applications. However, to unlock the potential of these applications, the target audience must be aware of their existence and be able to find them. Otherwise, the scene may not get any attention. To make virtual scenes accessible, they require an identifier, or an address, that points to the server, on which the content is hosted. This address can take many forms, similar to domain names on the World Wide Web or handles on social media platforms like Twitter. Essentially, it is an abstraction of the IP address, that allows people to find and retrieve the content more easily.

The difference to traditional domain name systems is that locations in virtual worlds are part of a quasi-geographic context. Think of an address set that divides a large virtual land mass into a grid of individual parcels, each with their distinct location. Similar to an interaction in a web browser, users can travel to these locations by entering the corresponding address in their client. However, adjacent parcels are connected to each other through quasi-geographic, static links, which allows users to transition seamlessly to neighboring parcels and naturally explore the address set by walking around. Depending on the particular virtual world, this happens seamlessly (e.g., Decentraland¹⁸), similar to the physical world, or via pre-arranged portals between neighboring parcels (e.g., The Sandbox¹⁹). In any case, locations within the same address set can benefit from a significant network effect.

In addition to the quasi-geographic connections, landowners can make use of dynamic links. A dynamic link can be thought of as a portal, that proposes avatars to travel to a different location within the same address set, or potentially to a completely different virtual world that adheres to the same standards. This is similar to hyperlinks on the World Wide Web, where anyone can create a direct link from their website to another, and produces a complex, non-linear network of interconnected scenes. The metaverse, therefore, combines features of the physical world through static links with features of the World Wide Web, in the form of dynamic links.

Figure 1 visualizes three distinct address sets and their respective static links. In addition, the figure also shows examples of user-generated dynamic links. Note that dynamic links may be internal (same address set) or external (different address set). By default, they are one-way only, similar to hyperlinks on the World Wide Web.

Depending on the application, the scene's location may be of great importance or completely irrelevant. Take, for instance, an online meeting that takes place in the metaverse. Clearly, there is no need for this room to be discoverable by the general public. Similarly, transportation costs are negligible in the metaverse. As such, location will not be important for that particular application. Anyone who is invited to the meeting, will simply get a link that allows them to access the scene's content server.

A different example, for which location is crucial, is a virtual retail store. Profit is likely a function of the expected traffic, which can be directly influenced by the location choice. Spillover effects from the quasi-geographic, static links have the potential to significantly increase the visitor count, if the address set in general, and the adjacent parcels in particular, create high traffic.

In a truly open metaverse, location and space are completely separable. A content provider may buy a location that allows them to link a scene that can be hosted on any server. However, there may be limitations for locations within a given address set, that will require the landowner to host the content with the provider of the address set. Once again, it may be helpful to look at the analogy of URLs and domain names. If you sign up to a proprietary social media platform, you get a username within the context of the existing site, but you will not be able to link this name to content that is hosted on a different server. Instead, you are constrained by the content sharing options of said platform.

FIGURE I: Static and Dynamic Links in the Metaverse



Attention Economy

The use of virtual land differs significantly from that of physical land. As avatars do not require housing or food, there is barely any demand for residential, agricultural or industrial land in the metaverse. Artificial restrictions, such as the need for an avatar to consume food, are sometimes introduced in gaming experiences that strive to achieve a sense of realism, but other types of spaces will usually refrain from implementing such restrictions and focus on creating a seamless user experience. Thus, apart from these gaming experiences that are subject to their own rules, land use in the metaverse will be driven by commercial activities.

Examples of commercial land use in the metaverse include Samsung's virtual showroom for promoting their products and services,^{ix} the Australian Open's creation of a festivallike experience for international fans during the COVID-19 pandemic,²⁰ "Metaverse Fashion Week" where brands from all around the world previewed their new clothing lines and offered both virtual and physical apparel,²¹ and the "Metaverse Music Festival" featuring performances by popular artists like "deadmau5."²²

Virtual worlds can be described as so-called "attention economies" where businesses compete for the attention of users in an information-rich environment.²³ For business applications that rely on high traffic, discoverability and random encounters are key drivers of marketability and revenue. Content that creates more traffic can advertise products more effectively, and in return has a higher commercial potential to sell goods and services more easily. The network of quasi-geographic connections, or static links, facilitates the free flow of users between adjacent scenes and can create spillover effects. Thus, land parcels in close proximity to high-traffic areas are more valuable to commercially driven businesses.²⁴

Intuitively, one may suspect that dynamic links devalue virtual real estate because, in contrast to the physical world, users can travel quasi-instantaneously to any location within the metaverse, and transportation costs are independent of traveling distances. However, this argument disregards the attention economy principle and the strong network effects that arise from static links. If users know what content they want to consume and where they can find it, they will directly move to the respective scene, but

there may be cases where users curiously explore a specific district, or address set, similar to shopping streets and malls in the physical world. Figure 2 visualizes these spillover effects. Note that spillover effects that originate from static links are inherent to the location, whereas spillover effects based on dynamic links are not necessarily permanent and can be modified similarly to hyperlinks in the World Wide Web.





To better understand the value of virtual real estate, consider the example of land in Downtown Manhattan. With limited supply and high demand, space in Manhattan is very valuable. In a commercial setting, businesses would have a strong incentive to establish a presence in this area due to its high number of visitors and potential spillovers from neighboring businesses. Since premium locations in close proximity to high-traffic areas have a greater potential for spillovers compared to other areas, there will be significant differences in land prices within Manhattan.

The mere existence of vast land masses elsewhere, for example in Nebraska, has no significant impact on Manhattan's commercial value, even in the absence of transportation costs, and the hypothetical possibility to instantaneously travel from New York to Nebraska. As long as Manhattan generates a substantially higher visitor count, the commercial value of land will be much higher than in Nebraska. In fact, even the creation of more land around Manhattan does not necessarily diminish the value of already existing land, and can potentially create even stronger network effects.²⁵ Certainly, managers would need to weigh the difference in cost and see if a premium location is indeed a good choice, but the attention economy principle demonstrates that – under these circumstances – it can be reasonable to buy virtual real estate, or in other words, a location in an area with a high visitor density.

However, a very interesting application is the combination of land parcels in popular virtual worlds and dynamic links to other virtual spaces which use the same open standards. This enables businesses to get quite literally "the best of both worlds", benefiting from the popularity and network effects in one world, while having a larger space due to the second virtual world's nearly unlimited space. In our example of Manhattan and Nebraska, businesses could buy (or rent) land parcels in Manhattan to take advantage of the area's high visitor density. On these parcels, they create portals to Nebraska where they host a large metaverse experience with barely any space

restrictions. Rather than buying (or renting) multiple adjacent land parcels in Manhattan where premium locations are expensive, the business outsources its content to another space. They make use of the separation of space and location, leveraging Manhattan's network as a means of promotion and Nebraska's nearly unlimited space for their content. This is very similar to how social media platforms are used in the World Wide Web. For example, businesses and content creators use character-limited Tweets which link to articles that are hosted on external websites. As a result, popular virtual worlds may become hubs in a network of interconnected scenes.

The dominance of these hubs is not necessarily permanent, and the flow of user traffic can shift between them based on various factors. In our example, if a significant number of content creators decide to establish a presence in Nebraska, if content in Nebraska is more enticing, or if Nebraska provides a better user experience, people may begin to spend more time there. As a result, the network effects in Nebraska may strengthen, and it may become the dominant hub in the metaverse. A historical example of such a shift can be seen in the rise of Facebook and the fall of MySpace.

Provable Scarcity of Digital Locations

Now that we understand how certain business applications may generate incentives to choose locations within high-traffic virtual worlds, it is worth taking a closer look at the locations' scarcity properties.

Virtual land parcels are entries in a database. Similar to a land registry, the database stores the parcels' attributes and keeps track of their current owners. This leads to two questions: First, are landowners facing the risk of someone modifying the existing address set? Any kind of manipulation on the existing database could change the properties of their land parcel and undermine its scarcity. Second, are landowners facing the risk of some third party creating a competing address set and thereby expanding the supply of new locations?

The two questions may seem very similar but refer to distinct risks and must be explored separately. Question 1 refers to a situation in which someone can perform arbitrary changes to an existing address set. Question 2 refers to a situation, in which someone can create an entirely new address set, and potentially compete with the existing one. While this does not directly affect the attributes of the existing locations, it may still undermine their value and scarcity.

Let us start by exploring question 1. If the ledger is controlled by a central operator who could unilaterally modify the database, add new parcels, rearrange the neighborhood by manipulating static links, or even choose to shut down the entire database, the land parcels' uniqueness and scarcity are clearly at risk. Managers who consider buying land parcels in a centralized virtual world, should always perform due diligence on the virtual world's tech stack and governance structure. This is quite similar to the physical world, where political stability and a set of reliable rules will arguably play an important role in a firm's locational decision-making process. Managers must be careful when buying virtual

land in a proprietary virtual world, and be aware of the hold-up,²⁶ their limited bargaining power and the operator's rent extraction opportunity.

This risk can be mitigated with a truly open metaverse. The database would no longer be controlled by a single entity, but rather be based on a distributed ledger — or blockchain.^{27,28} Depending on the blockchain's architecture, it may serve as an independent and immutable foundation for so-called non-fungible tokens (or NFTs) that can represent individual land parcels and capture their unique properties. Note that NFTs are effectively sub-databases on the blockchain, keeping track of the attributes and owners of each non-fungible asset. If the NFT contract is statically deployed, the rules and characteristics of individual tokens cannot be changed, and the existing address set is immutable.²⁹

Now let us turn to question 2 and explore if landowners can be diluted by the creation of additional address sets. This question is more complex than the first one.

In the case of a proprietary virtual world, the emergence of new address sets is possible but unlikely. For third parties, this would be hard to achieve, as the integration would require the endorsement and support of the virtual world's operator. The operator itself usually has little incentive to create an alternative address set, as they are in full control of the existing one. However, there can still be certain circumstances under which it can make sense for a centralized operator to create a new address set, and they certainly have the power to do so. An open metaverse, on the other hand, will likely have multiple competing address sets. Recall that there are no restrictions. Anyone may deploy a new NFT contract and thereby create a new set of addresses. At first glance, it may seem that this unlimited supply of locations would completely undermine any kind of scarcity. However, locations are nonfungible, and their unique properties are derived from the address set (or collection) they belong to, as well as their own properties within that set. A good location, within a popular address set, will most likely be unaffected by the creation of a new address set. This is in fact similar to top level domains, where a popular ".com" domain will not be affected by the fact that there is a corresponding ".gw" domain.

In the context of metaverse addresses, this network effect may be amplified by the presence of static links within a given address set. For domains, there are no static links. Consequently, the owner of a .com domain does not directly benefit from the fact that other .com domains have a high visitor count. For parcels in a popular metaverse address set, however, there will be spillover effects, further increasing the address set premium. In conjunction with the fact that address sets can be limited in size, the presence of static links may be even more important.

Managerial Implications

Let us revisit the opening statement and explore if the critics are right, or if virtual land can indeed be considered "scarce". Table 1 summarizes the scarcity properties of virtual land. In what follows, we present five actionable recommendations for managers.

	Space (Hosting)	Location (Address)
Proprietary	 The virtual scenes are hosted by a centralized operator. The host cannot be chosen, and self-hosting is not an option. If the operator decides to shut down its services, the virtual world will be gone. Supply of space is at the discretion of the operator. 	 The address set is under the control of the operator. It can be unilaterally modified and extended. Rules can be changed, and there is a risk of rent extraction. There is no provable scarcity and the parcel's properties, such as static links, can be changed.
Open Metaverse	 The virtual scene can be hosted on any computer. This includes services by any hosting provider and self-hosting. The metaverse essentially is defined as a protocol with a set of open standards. Space is abundant. 	 Locations are represented by NFTs. Provable scarcity can be achieved within a given address set. The openness allows for multiple address sets to emerge and compete with one another.

Be Careful When Buying Land in Proprietary Virtual Worlds

For proprietary virtual worlds, the verdict is clear. Buying land in a virtual world that is under the exclusive control of a centralized operator is risky. Any properties of the land parcels, that could be considered unique or scarce, can be modified and new virtual land can be created at any time. Most importantly, the operator could no longer be willing or able to maintain the server infrastructure and shut down the entire virtual world. Since proprietary virtual worlds are based on closed source software clients and do not allow for external hosting, landowners would likely face a total loss of investment.

Unfortunately, the use of a public blockchain to tokenize land parcels, cannot mitigate the centralization risks posed by a proprietary virtual world. The operator could simply deploy a new NFT contract and declare that the old NFTs will no longer be considered. Any risks stemming from the fact that the operator is the sole hosting provider, are also not treated by the use of blockchain.

We therefore recommend managers to be very careful when engaging with proprietary virtual worlds. They must be aware of these dependencies, analyze the virtual world's tech stack and plan accordingly. Doing business in proprietary virtual worlds is quite similar to building stores and engaging with customers on social media platforms, with the additional complexity that most of the proprietary virtual worlds have no proven track record and limited funding.

Try to Understand the Difference Between Space and Location

Most of the existing virtual worlds either rely completely on a centralized operator, or have severe dependencies and limited interoperability. Yet, a significant number of these proprietary worlds present themselves as decentralized, open and interoperable projects. Managers should be very careful and understand that proprietary virtual worlds are comparable to closed social media platforms. An open metaverse, on the other hand, is quite similar to the World Wide Web. It is a set of loose standards, and its openness allows for the separation of "space" and "location."

Space refers to the server infrastructure where the content or scenes are hosted. It is generic and does not have any unique properties. Taking the server's uptime for granted, hosting can even be described as a commodity. It has no effect on the virtual land parcel's discoverability, and its visitors will not observe any differences based on the owner's server choice. Consequently, space in an open metaverse is just as abundant as space on the internet. If the hardware is available and hosting providers can scale in line with demand, there will always be space — and putting quality differences in the services aside, there is no reason to pay a premium.

However, paying for virtual land parcels must not be confused with paying for hosting plans. Investors pay a premium for location, hoping that the address and its static links will increase the discoverability of their business and generate more traffic. Similarly to domain names, the address (location) can be linked to the content (space). As such, the open metaverse is more flexible and companies can be in control of their address and content. They have the option to choose their hosting provider, including their own local server. So, if a hosting provider is unreliable, too expensive or if they close their services, businesses can link their address (location) to a different content server.

Only Pay for Location if it Matters for Your Application

Whether virtual locations in an open metaverse are considered scarce, is a question of perspective. The total number of virtual locations in an open metaverse is not limited. Anyone can create an interoperable world with its own address set, as long as it is in line with the open standards of the metaverse. But this is also true for domains. Anyone could create a new address set by selling subdomains, propose new top-level domains, or create an entirely new lookup system that maps names to IP addresses. Yet, people pay significant premiums for high profile domains in the most popular top level domain sets.

Splitting the term virtual land in "space" and "location" makes a lot of sense and will contribute towards a better understanding where the scarcity is coming from. The big difference between space and location, is that space is fungible, whereas locations are unique – or non-fungible. Each address has its distinct properties and can potentially generate a premium on the open market.

Whether a company should acquire an expensive location depends on the application. For storefronts or advertisements, where discoverability and the generation of a constant visitor influx are important, the purchase of a favorable location at the main plaza of a popular world can be reasonable. In fact, it is similar to buying advertising space on a popular website or Times Square.

Conversely, companies should refrain from buying expensive locations, if discoverability is not important or even detrimental to the application. An internal meeting room, for example, must not be prominently featured on a popular location, for the same reasons why no one would buy a popular .com domain for an internal conference call. Offices, employee training simulations or even personal spaces are other examples that are frequently mentioned in the context of the metaverse and clearly are location independent. The corresponding address can simply be shared with all invited participants, and in contrast to the physical world, transportation costs are negligible.

We recommend managers to carefully assess, if their application requires discoverability, and employ a decision-making process that is similar to the thought process when buying an expensive domain name. In many cases, they will reach the conclusion that there is no need for the application to be linked in a popular address set.

Static Links Create New Opportunities and Challenges

Besides the potential for innovative visualization techniques and advanced user immersion, the biggest novelty of the metaverse, when compared to the World Wide Web, arguably is the presence of static links. Static links are the source of the quasi-geographic relationship between parcels and the resulting locational effects. From the users' perspective, static links can emulate the feeling of walking through a shopping district. They allow them to naturally explore and seamlessly jump from one scene to another. For businesses, static links allow for interesting strategic decisions.

However, there is also a dark side to the very nature of static links. Similar to the physical world, your customers will be able to see and explore the content on neighboring parcels. If this content is offensive, it may have adverse effects on the popularity of your location.

Even worse, it could damage your brand name and force you to move the business to a different area or potentially even a new address set.

This issue, once again, highlights the need for good governance. Static links add complexity and will raise many legal questions. As a result, we expect that address sets will have their own content moderation rules.

The Scarce Resource is User Attention

To sum up, the metaverse offers interesting new opportunities and many companies are already experimenting with this new world. It is best described as an additional channel that allows businesses to create immersive experiences and find novel ways to interact with their target audience. However, there are various risks and misconceptions. Most "metaverse" implementations today must be considered proprietary virtual worlds that lack openness and interoperability. To come back to the opening statements: scarcity is a result of the attention economy. The quasi-geographic network with its static links between land parcels can create a market for more desirable locations. Ultimately, the scarce resource is user attention, and location may be a way for businesses to get it.

Notes

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