METAVERSE

Transitioning (to) Future Cities

Transdisciplinary platforms as instruments to democratise technology for participatory use in building back neglected urban voids of Riga

2032

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THEORETICAL INTRODUCTION

This paper contributes twofold; 1) What we do today as architects and designers will be a small fraction of the building blocks of the entire metaverse one day. However, early adoption can fundamentally shift the trajectory of the AEC industry. 2) Paper explores digital participatory models for inclusive, human-centric and adaptive cities. The focus is on augmented experiences, toolkits, stakeholder governance technologies, and physical implementation.

Keywords:

Neighbourhoods, human experiences, digital playground, public spaces, vacant buildings, Europe, Latvia, economy, ecology regeneration, human-centric streets, Metaverse, virtual and mixed realities, local quality analysis, safe, inclusive cities, placemaking, public life, happy city, hyperintelligence, kit-of-parts, serendipity, super pedestrian, micro-mobility, blockchain, smart contracts, decentralized economy, virtual parallel universe, digital instruments, hybrid reality, 3D experiences, NFT, public education, surveillance capitalism, Industry 5.0, urban software

Relevance

The thesis hopes to operate in the junction between the architecture, public spaces, participatory systems, collaboration tools and digital systems. The paper will dive into the unexplored realm of extended realities, digital twins, physical and virtual experiences and the decentralised blockchain ecosystem. The paper will not be sufficient to study these contemporary topics thoroughly. However, it is the first attempt to combine and practically introduce the metaverse to architecture and the physical realm. The metaverse will branch out in many unpredictable directions. However, we can already see that it can solve many global challenges due to its complex and diverse nature. The research falls under SDGs goals 11 and 16. Goal 11 directly impacts the built environment, while 16 overlooks healthy and inclusive societies for the sustainable development of institutions. The research explored can also fall under the New European Bauhaus initiative. The new ambition highlights dealing with complex societal issues in an inclusive and participatory future by leveraging art, technologies and culture[1].

Methodology

Keeping the focus on accuracy and credibility was complex with all the media attention, so the paper was constructed using academic papers as primary sources.
As the topic is shaped as we speak, podcasts and prominent magazines were used as secondary sources to steer the focus.
Thirdly, through the research and design process, virtual reality and augmented reality were used to grasp the potential of technologies used in the AEC industry.

"We tend to overestimate the effect of a technology in the short run and underestimate the effect in the long run." - Roy Amara, Amara Law.

METAVERSE /
TRANSITIONING *(TO)* FUTURE CITIES

Transdisciplinary platforms as instruments to democratise technology for participatory use in building back neglected urban voids of Riga
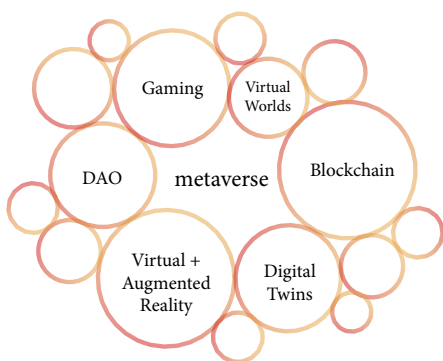
INTRODUCTION

Neal Stephenson has established a strong sci-fi foundation for what today we understand as the Metaverse. In Snow Crash [Fig. 1] in 1992, Stephensons describes the story as told through the eyes of Hiro, the protagonist, who navigates the Streets of a utopian digital universe. In the novel, the Street is imagined as a space where developers can build their own streets that feed off the main artery. Players (avatars) can build their cities, buildings, parks, and even things that do not exist in Reality, such as three-dimensional objects that ignore the universal laws of gravitation (spacetime).

The most significant difference between Stephensons and modern Metaverse is the possibility of a different governance model. Stephensons Metaverse is operated by a centralised-governing body, Global Multimedia Protocol Group (GMPG). Developers, in this instance, software corporations, create pieces of the puzzle - the user interfaces, buy virtual frontage of the Street and obtain zoning permits. The financial resources go back into the GPMG fund to further develop and expand the hardware that keeps the virtual Street alive (Stephensons, 1992, p.26). When the book was written, blockchain was not a term people were familiar with. Hiro collected funds with friends to buy the virtual development licensing, hoping that they would be able to build something on it one day. Hiro was rich in Cyberspace but lived poorly in Reality. This does not reflect the potential of a contemporary metaverse vision. The Snow Crash pictured the real world as a dystopia that we all pulled to the ground and the Metaverse as the utopian escape.

As an alternative, this document is trying to understand how the metaverse systems help improve the physical world and let the two, physical reality and virtual reality, live in synergy. The document focuses on key technologies of the metaverse which enable the virtual universe to exist [Fig. 0].
Nevertheless, firstly, prior to diving into the metaverse, research will look at Riga's social and urban situations to establish a framework and define attention areas, i.e. urban void abundance, NGO activism, and city governance struggles. Secondly, the term metaverse will be summarised and understood via enabling technologies that make the metaverse ecosystem metaverse. Lastly, the paper looks at how some of these enablers, like virtual reality and gaming, are helping spatial designers. To conclude, the document aims to deepen our understanding of the role of blockchain and decentralised autonomous organisations (DAO) in city restructuring through physical applications.

''Digital platforms catalyze community, bringing people together to co-create and fix their city. But what if we had more tools-digital tools to act on the city around us? What if the same mechanisms of smart urban optimization allowed people to take ownership of their city and make improvements that only residents could dream up?'' (Ratti, 2016)

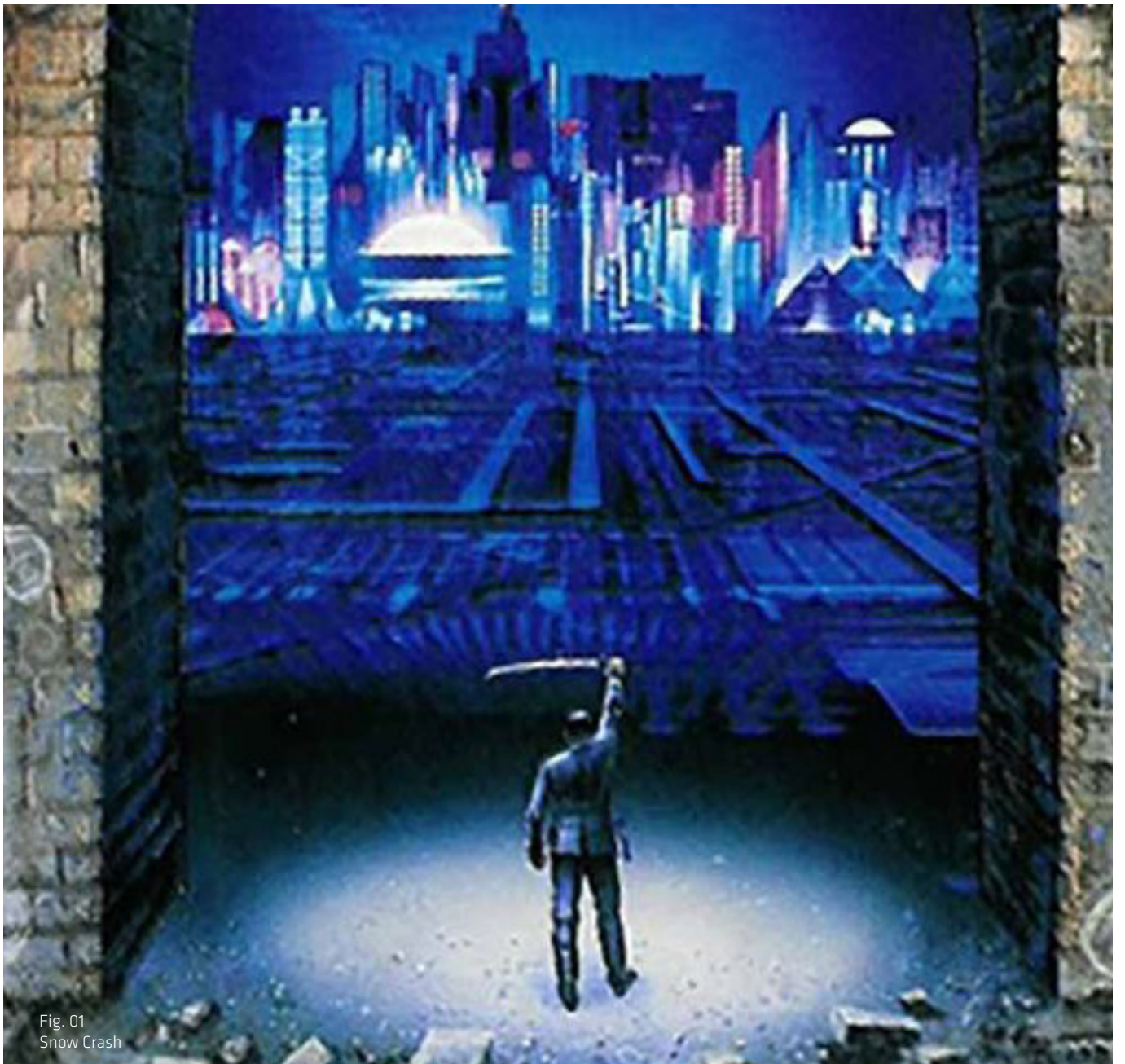**Fig. 0**
Metaverse overall focus areas highlighted within this research paper.

Fig. 3
Neglected govermental building with minor exterior damage.

Fig. 3
Temporary building intervention as part of NGO initative in Riga.

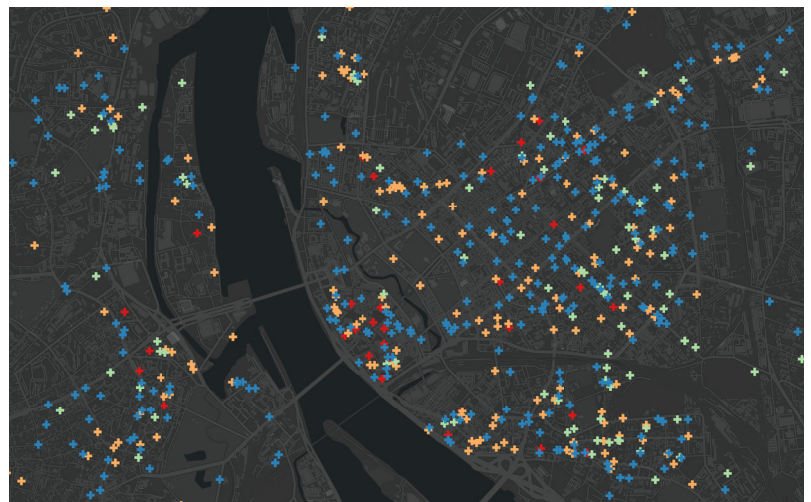**Chapter 01 | 1.1 Riga; Diaspora, Urban Voids and**

Three significant events can be linked to population change in Latvian history; the Independence reclamation in 1991, joining the EU in 2004, and the global financial crisis in 2008[2]. All three events have made life in Latvia difficult, with minimal to no economic opportunities (Williams, 2021).

The most vital economic contributors, the working population (15-35), continue to migrate to other countries worldwide, especially the UK (prior to Brexit), Germany and Norway[3]. Diaspora has had an enormous impact on the local economy and its ability to thrive. The urban fabric of Riga almost symbolises the hardship, as nearly every fifth building and plot in the capital is a neglected urban pocket. On this research day, there were close to 2000 urban voids recorded in Riga [Fig. 2]. Some voids have been empty for decades, while a minimal number face demolition as they have become too unsafe. Out of 1792 voids, 28 were considered for demolition or renovation, while most of these spaces are in good condition for use [Fig. 3]. In the Sustainable Development Strategy of Riga until 2030 (Riga 2030)[4] two key priorities can be highlighted; (1) city revitalisation and (2) engaging governance. @ Revitalisation of property in Riga is a strategy to bring vacant private properties to life for socially meaningful use as a tactic to improve the city's image positively. @ While at the same time, politicians say the buildings are not fit for housing due to their typology, paralysing the overall progress.
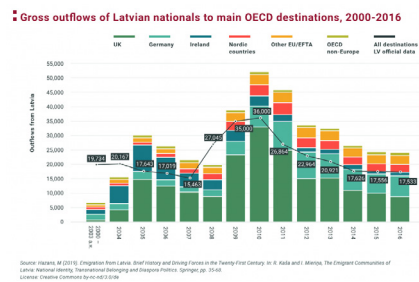
01 | 1.2 Civilian Activism

Public oriented governance is the second pillar of Riga 2030, focusing on creating new effective models of corporations with various groups of interest. Faster information collection and dissemination on activities that reflect the current needs of society with the promotion of vacant property use. Utilise vacant space within neighbourhoods with limited open spaces to generate neighbourhood centres and foster the creation of public activities and startups through temporary use. REFILL city partners (NGOs) say their goal is to go beyond temporary use, but this goal can be challenging with all parties and legal structures (Refill, 2018, p. 7). NGO intervention can be defined as activism and bottom-up initiation. A Non-profit organisation, Free Riga has become the primary mediator between the property owners and space searchers. They facilitate collaboration by connecting artists to vacant spaces. Free Riga, alongside other European NGOs, highlights five challenges with short term tactical urbanism (Refill, 2018, p. 7-9). Latvians are not alone in the urban void conversation; it is a European issue with almost 11 million plots and buildings empty across Europe[5]. Many NGOs are

2

Latvian Statistical Database. https://data.stat.
gov.lv/pxweb/en/OSP_PUB/START__POP__IR__
IRS/IRS010/table/tableViewLayout1/
Accessed: 15.12.2021

3

Latvian diaspora by destination countries. https://
www.bpb.de/themen/migration-integration/
laenderprofile/english-version-country-profiles/
northerneurope/308824/latvia-immigration-emi-
gration-diaspora/

4

Sustainable Development Strategy of Riga until
2030
https://www.rdpad.lv/wp-content/up-
loads/2014/11/ENG_STRATEGIJA.pdf

5

Vacant Central Europe: Mapping and recycling
empty urban properties.
https://issuu.com/kekfoundation/docs/vacant_
central_europe

6

Refill Temporary Use Initiatives across EU.
https://issuu.com/refillthecity/docs/refill_mag-
azine_6

Fig. 2
Urban Void Map of Riga. https://grausti.riga.lv/objekti/

Internet
// Today //
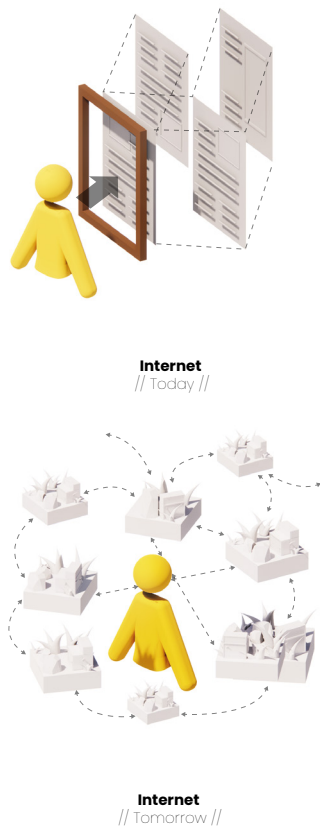
Internet
// Tomorrow //

Fig. 4
Metaverse (MV) can be seen as a speculative term to describe the next generation of the internet. From 2-dimensional web-base d browser interaction with the virtual world, MV promises to be an immersive 3-dimensional internet experience.

7
Lex Fridman Podcast with Mark Zuckerberg
https://lexfridman.com/mark-zuckerberg/

8
Guide to build a metaverse space.
https://docs.mona.gallery/get-started

exploiting temporary interventions as tools for rejuvenation[6]. Tactical urbanism engages locals, is solution-driven, usually low-cost, and is initiated by civil servants and artists who act as neighbourhood leaders who are space searchers themselves. Locations like Riga do not have time to spend 5+ years on one void at a time. In locations like this, multiple parties need to be triggered simultaneously. Politically, it can be challenging as officials change every few years; they can be barely trusted even when they are around. High profile initiatives will need an open governance system.

01 | 1.3 Digitalisation as 3rd Party

An example can be seen in Amersfoort, The Netherlands. Most of the empty spaces in Amersfoort are privately owned. Local initiatives and businesses had a hard time finding each other. Amersfoort has engaged the networking organisation Matchpoint to create a platform for the two parties to find one another. Matchpoint has set up a website and builds a solid database of empty spaces and space searchers. Matchpoint organises events in a speed dating manner between city authorities and bottom-up initiatives searching for vacant spaces (Refill, 2018, p. 28). Matchpoint acts as a governance body and new model of administration and collaboration, proving effective in patching the urban scars. In Riga, innovative systems will be needed to tackle the vast issue of urban voids, political corruption and stakeholder disbalance.

In the next chapter, the paper will explore how the Metaverse can be seen as a new form of urban governance and spatial design methodology.

Chapter 02 | 2.1 What is The Metaverse?

Metaverse will change everything known today, from how we work and play to how we communicate, earn and learn. (Rosenberg, 2021) Metaverse [MV] is an evolving concept, enriching and shaping itself as Facebook's rebranding generated more attention to Meta in October 2021. Currently, we see metaverse worlds, metaverse fashion. However, we might need to reframe this as the metaverse is not an object but rather a state, an ecosystem where things happen and are connected. (Zuckerberg, 2022, on Lex Fridman Podcast)[7].

On a fundamental level, the metaverse provides three-dimensional, immersive experiences based on virtual and augmented reality technology **[Fig. 4]**. It appears to be a total fictional 3D space in media, but Braud, Lee and Zhou (2021) believe MV creates mirrored images based on the real world, like Digital Twin technology. On top of that, MV blends the economic, social, and identity systems, allowing each user to produce content and edit the world, be it Virtual or Physical (Ning et al., 2021; Braud, Lee, Zhou, 2021). Metaverse is gaining popularity due to its possibility to create direct monetary value for its creators through blockchain-powered technology, like NFTs, smart contracts, and consensus algorithms. Power over one's information can be defined as a 'mutation' of our present-day systems that can emerge from all parties' active participation. The future where we all have a chance to benefit from the inherent value of our daily activities is possible and maybe even more desirable (Ratti, 2016).

02 | 2.2 Metaverse Key Players

Creating a 'metaverse' world is a simple process[8]; however digital worlds, at least today, suffer from information silos, experiencing limited connectivity with one another and the physical world. As connectivity and hardware improve, independent 3d environments will connect to the overall metaverse landscape (Braud, Lee, Zhou, 2021).
 In the metaverse, avatars are closely involved in 3D object creation, which exists purely in the digital realm. Tech companies create virtual frameworks (plots)

9
https://docs.decentraland.org/development-guide/SDK-101/

10
https://docs.mona.gallery/create-your-space

11
https://developer.oculus.com/blog/meta-avatars-sdk-now-available/

12
https://lightship.dev/products/ardk/

13
Metaverse that uses real robots as avatars.
https://screenrant.com/hyundai-robot-metaverse-project/

and software development toolkits (SDK) to attract creators to their ecosystem. User-generated content (UGC) approach is evident among leading metaverse platforms, e.g. Decentraland SDK[9], Mona.Gallery SDK[10], Meta SDK[11], Lightship ARDK[12]. Although purely focused on the virtual gaming or entertainment sector, with software updates and plugins, digital can be linked to a physical counterpart, IoT or a robot[13]. 'Smart' virtual worlds infused with local building regulations, culture, economy and social norms can facilitate and support dual content creation. (Braud, Lee, Zhou, 2021) Virtual worlds can be open (Decentraland), private (mona.gallery), or exclusively open by invitation (privately developed or owned multiverses). However, the metaverse will become exciting when the individuals abroad (online) will feel physically present.

To shift our understanding of the metaverse as a place, we need to look at what enables the interconnected metaverse as a state.

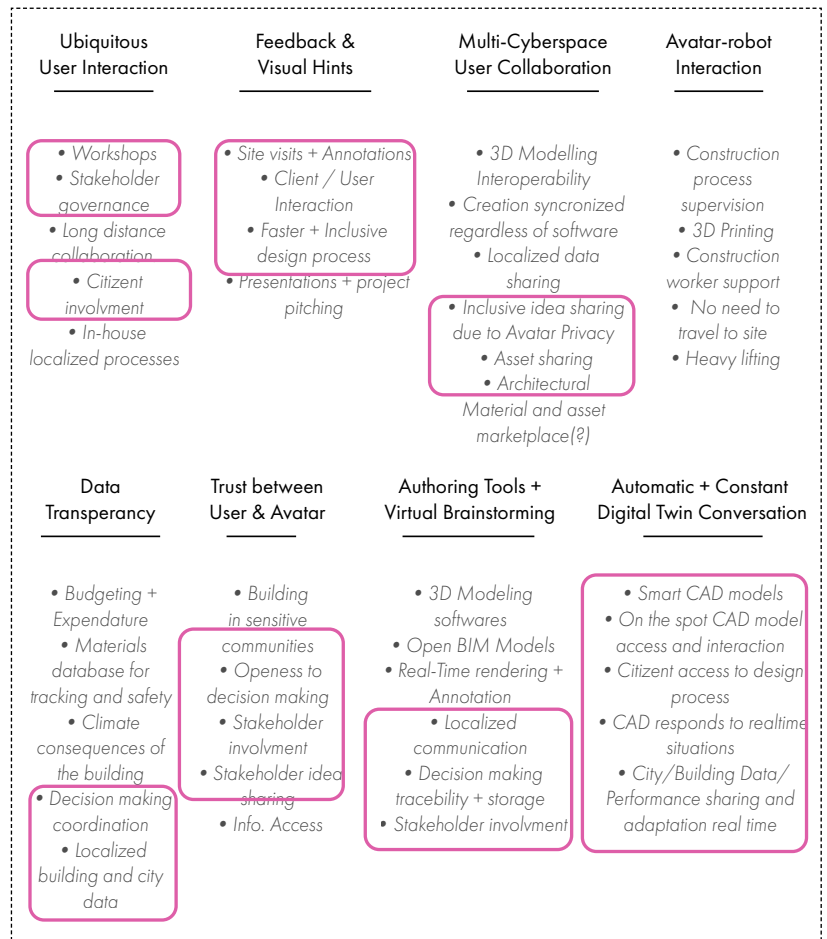## 02 | 2.3 Metaverse Enabling Technologies

The metaverse industry's fourteen focus areas [Fig. 5] fall under two key aspects, ecosystem and technology. The key technologies enable the Digital Big Bang, which feeds and supports the ecosystem (Braud, Lee, Zhou, 2021).

Enablers in architecture can be enhanced versions of our day to day tools and design processes. Digital Twins (DT) technologies are the most prominent elements. Architects replicate physical worlds into 3D models to interact and adapt to their desired outcome. Digital Twins are smart models infused with the city and building data to allow a more thoughtful data-driven decision making. Data digitally maps the real world, such as people's movements, vehicles, objects, climate and spaces. Trained BIM/DT professionals can add, interact and manipulate such complex models. However, these models will become more accessible
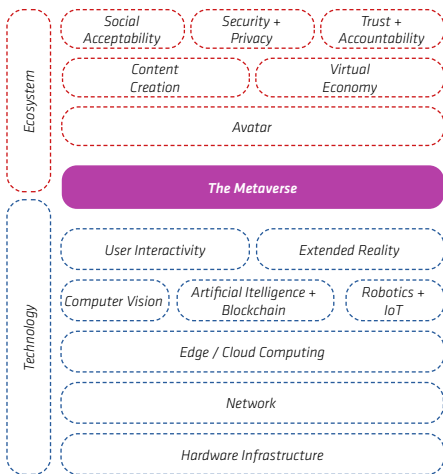
Fig. 5
Metaverse industry fourteen focus areas fall under two key aspects, **ecosystem and technology**. The key technologies enable the Digital Big Bang, which in return feeds and supports the ecosystem. Source: Braud, Lee, Zhou, 2021

Fig. 6
Each enabler has an underlying use case that will feed into and drive the development of the metaverse. Circled one can be directly linked to architecture.

Ubiquitous User Interaction	Feedback & Visual Hints	Multi-Cyberspace User Collaboration	Avatar-robot Interaction
• Workshops • Stakeholder governance • Long distance collaboration • Citizen involvment • In-house localized processes	• Site visits + Annotations • Client / User Interaction • Faster + Inclusive design process • Presentations + project pitching	• 3D Modelling Interoperability • Creation syncronized regardless of software • Localized data sharing • Inclusive idea sharing due to Avatar Privacy • Asset sharing • Architectural Material and asset marketplace(?)	• Construction process supervision • 3D Printing • Construction worker support • No need to travel to site • Heavy lifting

| Data Transperancy	Trust between User & Avatar	Authoring Tools + Virtual Brainstorming	Automatic + Constant Digital Twin Conversation
• Budgeting + Expendature • Materials database for tracking and safety • Climate consequences of the building • Decision making coordination • Localized building and city data	• Building in sensitive communities • Openess to decision making • Stakeholder involvment • Stakeholder idea sharing • Info. Access	• 3D Modeling softwares • Open BIM Models • Real-Time rendering + Annotation • Localized communication • Decision making tracebility + storage • Stakeholder involvment	• Smart CAD models • On the spot CAD model access and interaction • Citizent access to design process • CAD responds to realtime situations • City/Building Data/Performance sharing and adaptation real time

[Fig. 6]   Highlights show potential points of interest for Riga Dashboard.

with metaverse development due to blockchain, edge and cloud computing, and code-less content creation applications, as discussed earlier.

To summarise metaverse architectural trends, we can look at the existing 'built' forms:

- No real life rules or restrictions such as gravity, structural stability, climatic issues, or physical laws will be at play in the metaverse.

- No distinct design process, web3 designers are focusing to create immersive experiences and to exhibit digital art, nfts and social events.

- No distance rules but still some metaverses have prime locations based on zoning.
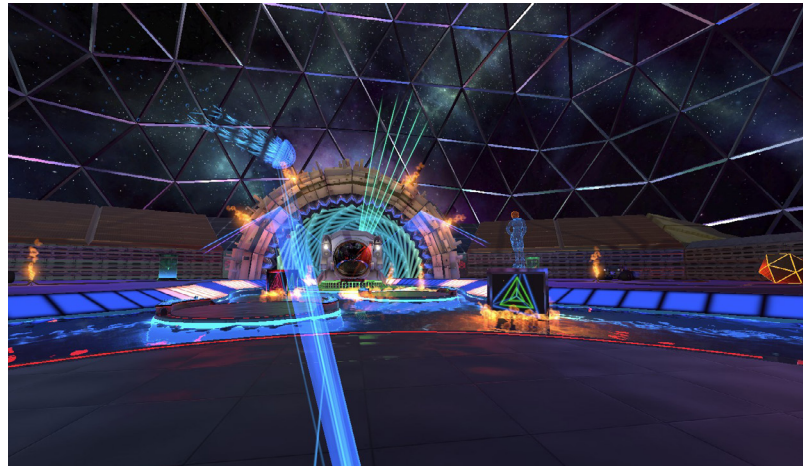
Current metaverse architects follow a 3-step recipie to build for the metaverse.

1. Parcel Scouting:
First, you buy virtual land on the metaverse worlds, Decentraland, Sandbox etc. This is the biggest challenge when working with brands, as everyone wants to get the best location for a reasonable price. Voxel Architects have connections to acquire land. The land is sold as NFTs. Unique pieces of tokens. You can buy or rent parcels.
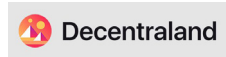
2. Architecture + Design:
Architecture in the metaverse has endless possibilities. It ignores the physics of the natural world, where imagination is the only limit and parcel size. Each building has a unique style, depending on the metaverse platform itself. Crypto Voxel and Sandbox work with blocks. Minecraft inspires them. Decentraland is a metaverse that relies on heavier 3d software, like blender, Maya etc. Somnium Spaces is more similar to SimCity; re probably the most realistic in appearance to real-world.
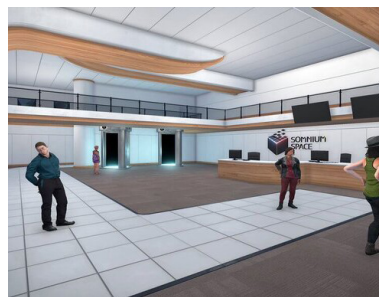
3. In-Game Coding:
Metaverse is shifting towards becoming, or already is, an e-commerce space, and in-game shopping is becoming standard. Like opening doors or pop-up artwork, interactive features require additional in-game coding. Potentially this is where the digital twin information is integrated. How much scripting is needed? How heavy are the models? Can they be live synced?

SOMNIUM SPACE

Decentraland

CRYPTOVOXELS

THE SANDBOX
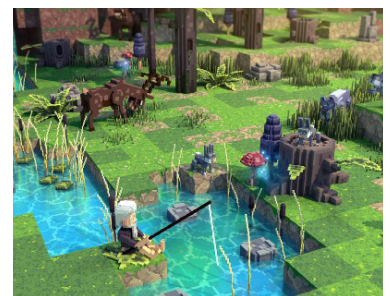
02 | 2.4 Metaverse Architects (-ure). [Visual Chapter]

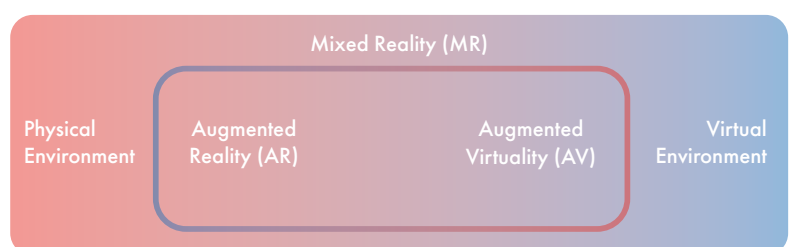**Chapter 03 | 3.1 Virtual, Augmented and Mixed Reality**

Today's metaverse experiences represent a small subset of the larger Metaverse spectrum. Currently, Metaverse is viewed as a cartoonish fictional world that facilitates socialising and utilises cryptography to lay the foundation of an open creator economy with new ownership models. These creations are digital files, from simple photos (jpg) to 3d worlds and gifs/video assets (digital art, fashion pieces)[14]. The metaverse, however, in combination with virtual reality (VR), augmented reality (AR) and mixed reality, can be also seen as media technology whose core idea is to present content engagingly and as realistically as possible (Rosenberg, 2021). Moreover, the chapter looks at early mixed-reality adapters in the architecture field.

The metaverse will be possible to access not only through browsers (i.e. Chrome, Mozilla) or VR but rather with AR headsets with overlays, hand-held devices with touch screens, projectors, touchscreen tabletops and even wearable projections (Braud, Lee, Zhou, 2021) such as Google's Glass launched in 2013. In 1965, Ivan Sutherland, in an essay, coined 'The Ultimate Display' as a head-mounted three-dimensional display that was built for training purposes for NASA Ames Research Centre. This can be viewed as the first iteration of VR goggles, and since then, aerospace has utilised VR and AR as tools to reduce costs and failures prior to departure. Such intervention has only yet to be fully adopted for architectural projects in architecture but to help spatial designers communicate, engage, and design.

With cheaper hardware and powerful software VR and AR, technologies have the potential to immerse design teams and clients, manage expectations and reduce time on the design process, especially if the target audience is not trained architects. In the context of the metaverse, virtual environments accompanied by headsets and online browsers will further allow Multiple User Collaboration (real-time interaction) on an unprecedented scale.

The most significant difference between MR and AR is that MR technologies are embedded with the knowledge of the physical reality, while AR systems overlay graphics onto our physical world (Skarbez et al., 2021). When looking at the Reality-Virtuality Continuum by Milgrim and Kishino **[Fig. 7]**, VR is on the complete opposite spectrum to physical reality. Currently, the metaverse is on this spectrum, Virtual Environments. John Hanke (2021) called the current metaverse direction a walled garden. Also, the rising fear of isolation caused by VR can be sensed among different generations.

Metaverse has a danger of pulling us away from our information bubbles (targeted ads) to our custom realities, further separating us from others, even when we are standing face-to-face in a public space. VR is a powerful tool to enhance our social interactions and even permit new social interactions. (Alvarez and Duarte, 2020)

14
Digital world marketplace.
https://opensea.io/collection/virtual-worlds

15
Second Life creator metaverse advice.
https://techcrunch.com/2022/01/13/
second-life-philip-rosedale-returns-linden-lab-high-fidelity/

16
Pokemon Go creators metaverse advice.
https://nianticlabs.com/blog/real-world-metaverse/

Fig. 7
Milgram and Kishino's (1994) Reality–Virtuality (RV) Continuum.

17
VR Usage in Architecture.
https://www.cgarchitect.com/features/arti-
cles/919b2174-survey-results-vr-usage-in-arch-viz

18
Gensler VR lead project.
https://www.archpaper.com/2017/04/gen-
sler-nvidia-new-headquarters/

19
SHOP Architects use AR on-site.
https://unity.com/case-study/shop-architects

20
BIG / UNStudio Virtual Reality Startup
https://www.dezeen.com/2019/06/21/hyper-
form-squint-opera-big-unstudio-virtual-reali-
ty-design/

21
BIG designs for Metaverse
https://www.dezeen.com/2022/03/02/big-vice-
verse-metaverse-virtual-office-vice-media/

Second Life creator Philip Rosedale emphasised that even with all the software and hardware available, most people; "do not want to be a cartoon avatar while wearing a VR headset"[15]. Creators of PokemonGo shares a similar opinion; ''The [virtual] Metaverse is a Dystopian Nightmare. Let's Build a Better Reality.''(Hanke, 2021)[16]. Neal Stephenson, in 1992, with Snow Crash, imagined the metaverse as a utopian place where we went to escape the dystopian reality we have created. Niantic uses such an argument to remind us that the virtual reality world is not to look forward to but rather let us build an augmented reality that fosters interaction with the natural world and real people.

03 | 3.2 MR Early Adaptors

Despite the criticism, in 2016 CGArchitects surveyed around 400 architectural professionals, asking if they use VR/AR/MR in their practice. 69% replied they are using, but only 22% were architecture firms themselves[17]. Surely, this number has increased, especially among large design firms like Gensler [18], SHOP Architects[19] and BIG / UNStudio[20]. Gaming and VR will be a key player in driving the development of metaverse platforms, but only a tiny part of it.

Chapter 04 | 4.1 User Generated Content Platforms

What makes metaverse so exciting is pushing towards making all of these interoperable towards user-generated environments. The previous chapter highlighted vital concepts as to why and how accessible digital twins will be part of the Metaverse; this chapter will focus on how architects use gaming and virtual environments to shape ideas and engage citizens.
Blockchain and metaverse have created a new category of software applications (apps + dAapps) built for the Web3 wave. Decentraland is the closest we have to metaverse state, as it is the first iteration of the user-generated, managed, and ecosystem accessible through VR or Web2 browsers. Architects are slowly transitioning towards the Decentraland metaverse to exhibit and create a multi-platform (physical + virtual) presence for other companies[21]. First iteration of the metaverse world will be built on other platforms, but spatial designers will utilise gaming engines to create new architecture in the long run.

04 | 4.2 Gaming in Architecture

The current market focuses on game-ish virtual spaces because video games test technologies and cultural and social features of contemporary society. Video games and Metaverse will transform spatial design, placemaking methodology, and city governance. Gaming in architecture is used as a robust design tool, offering alternate perspectives to designers. (Alvarez and Duarte, 2021, p. 192) As argued by Malgorzata Hanzl (2007), Role-Player (video) Games (PRG) can be a valuable tool in consensus building programs. (Alvarez and Duarte, 2021)

Architects have a lot to learn from video games, as video games are creating serendipitous and non-linear storytelling to shape environments. Most city-like video games mimic the real world to capitalise on our mental associations. (Alvarez and Duarte, 2021, p. 187) The most common engagement happens from a third-person perspective, as almost a drone or a bird hovering above one's head. A similar manner is used by urban planners, where cities and neigh-

bourhoods are designed from a top-down plan view for a three-dimensional city. This way, the planner or player operates as a strategist afar, disconnected from the life and activities of a vibrant city. Daniel Golding (2003) advocates for a first-person perspective which acts as a tactician; ''individuals encounter the city not as a concept, but rather as an immediate experience''. (Alvarez and Duarte, 2020; Golding, 2003) Employing a first-person approach to physical reality and city-type games can force us to consider the spatial characteristics, ludic moments and narratives as part of the design process. These elements facilitate a more immersive sense of place, curated by the players and designers. Metaverse infrastructure is not ready for digital twins as its hosting massively multiplayer-online (MMOG) experience with custom toolkits is challenging.

04 | 4.3 Block by Block (BbB)

Block by Block (BbB) is an initiative launched in 2012 to integrate the computer game Minecraft into public space planning with local community participation. Minecraft is their primary methodology to engage people from all backgrounds and age groups because of its simple interface, easy to learn and ability to visualise ideas three-dimensionally. BbB operates as a platform and mediator for governments and public space advocates to open up the city to all. BbB has completed 135 public space interventions using Minecraft, which community leaders phrase to be cost-effective and engaging[22].

In 2015, UN-Habitat selected Pristina, Kosovo, to test the BbB methodology in rejuvenating neglected urban spaces. More than 70 individuals participated in the workshop to redesign an abundant marketplace. Facebook pages were used to inform and mobilise locals. Based on the initial brainstormed ideas, the participants co-created the final design on a multiplayer Minecraft server. The final proposal included inclusive public spaces, a palace for resting, Kosovo's first skatepark, and a playground. The project transforms an urban void into an attractive and multifunctional public space in one of Europe's poorest countries.

After the project, the Mayor of Pristina noted; '' "We live in a municipality, in a community. We should establish a mindset that we should jointly make decisions about how a certain part of the neighbourhood we live should look". Game developers of Minecraft (Lydia Winters from Mojang) have praised BbB for using their game in a manner that was not intended to shape our physical world; "Block by Block democratised the development process and gave people ownership over the space. There are a lot of new residents in the area, and Block by Block gave them a path to come together positively." Block by Block, and the institutional initiative[24] proves that inclusive and open design processes can be a success, especially in politically tricky areas.
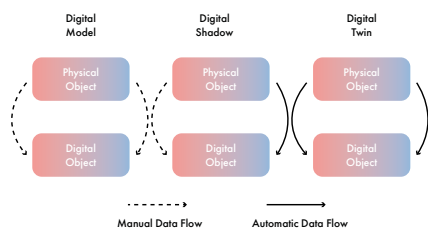
The initiative came from the UN, a powerful entity that supervised and managed the whole process. So the question is, can we use DAO and Metaverse worlds as mediators and tools of governance in areas where *live players*[23] like powerful governments are not present?

Chapter 05 | 5.1 Digital Twins

Future metaverses will be high integrity and conscious models which will be able to execute tasks on their own. In architecture, building information models (BIM) are becoming more accurate thanks to IoT sensors which can be implemented across cities in a size of a fiat coin. Metaverse can help make Digital twins more accessible and open to everyday humans. With 3D models living on cloud and edge servers, virtual models can become 'breathing' walkthrough environments with existing and proposed architecture and urban planning futures. Digital simulations facilitate transparency and more straightforward dissemination

22
Block by Block / Minecraft used for regeneration in Kosovo.
https://www.blockbyblock.org/projects/kosovo

23
Meaning of Live Players.
https://medium.com/@samo.burja/live-versus-dead-players-2b24f6e9eae2

24 - Similar Projects

Block'hood
https://www.plethora-project.com/blockhood

Public Play Space
https://www.publicplayspace.eu/

SpaceForm
https://www.spaceform.io/

Programmable City
http://progcity.maynoothuniversity.ie/about

Dublin Dashboard
https://dashboards.maynoothuniversity.ie/exhibition/

Fellenopoly
https://urbansync.nl/2018/12/12/urban-sync-in-de-krant/

Riga Minecraft
https://urbcultural.eu/news/gamification/minecraft-as-a-tool-to-think-out-of-the-box/

SuperBarrio
http://superbarrio.iaac.net/

24
Riga in Minecraft.
https://geoboxers.s3-eu-west-1.amazonaws.com/riga_ov/index.html#Riga/0/7/597/-1744/64

Fig. 8
Digital Twin Continuum.
https://ieeexplore.ieee.org/
ielx7/6287639/8948470/9103025/graphical_ab-
stract/access-gagraphic-2998358.jpg

of private sector and government decisions to the public prior to physical imple-mentation (and negative consequences). (White et al., 2021). Many semantic 3D models available today are a top-down view of the city focusing on smart city tech development and general 'progress', ignoring the social concerns. (Cureton and Dunn, 2021, p. 267/8)

DTs are created to fundamentally understand and explore the relation-ship between a place through digital technologies. Several governments around the globe are exploring DT in city governance; Virtual Singapore[25] and Welling-ton Digital Twin[26] (Cureton and Dunn, 2021). Investing in Smart city policies can be linked to a robust economic growth (Caragliu and Del Bo, 2019)

Smart City replicas benefit us by monitoring and predicting wider sys-tems-of-systems (SoS) actions. Metaverse cities can create living testbeds for future cities, test proposed scenarios, and allow digital twins to learn from the environmental data, city data, and resident inputs. (Fuller et al., 2020). Deep Learning-enhanced digital twins analyse and synchronise metaverse and physical systems to predict and improve physical reality. If the changes are proposed to meet the scripted requirements, changes will be deployed, peer-reviewed, or autonomously. DTs are sensing systems accessed via a centralised control room, or more recently, through our mobile devices and open-data cloud platforms, accompanied by virtual models. (Cureton and Dunn, 2021). With semi-auton-omous and autonomous organisations, Metaverse can make digital twins more accessible.

DTs are a fusion of geospatial information systems (GIS and building information modelling (BIM) (Laat and van Berlo, 2010), but the usefulness of such models depends on how comprehensive (White et al., 2021) and compre-hensible the data is. Digitalisation for cities can be seen in three ways; 1) digital model, 2) digital shadow, and 3) digital twin **[Fig. 8]**. Digital model is a simple 3D model with no interaction from IoT, metaverse or the physical world. CAD environment could be a Sketchup/Rhino/Maya building model, which does not impact the physical world if the change is applied. The digital shadow is the digital representation of the physical entity, which adapts once a change is made in the physical realm. Digital twins are the next iteration of digital shadows. Once the physical changes, digital changes, and if the digital changes, the physical adapts too. The metaverse and the physical world can influence one another. (Fuller et al., 2020)

Besides architecture and planning, DT is entering the mainstream period for application in healthcare, transportation, energy & utility, and electronics & manufacturing[27]. Post pandemic normal is making virtual worlds more desired as the market is expected to grow from USD 3.1bn in 2020 to USD 48.2bn by 2026 at a compound growth rate (CAGR) of 58.0%[28].

With available technology, large scale DTs are questionable in terms of the usefulness and possibility, as an intentional focus of these virtual worlds is required for near-future urban design and placemaking. Metaverse's focus on users, gaming engines and virtual experiences can redefine digital twins. Inter-active game-like digital twins need to be tested; Riga's urban voids can operate as an innocent test-bed of new organisations, digital twins and digital toolkits for participatory placemaking.

Chapter 06 | 6.1 Blockchain

Blockchain refers to a general-purpose technology describing infor-mation exchange and digital asset transactions. A distributed ledger, consensus algorithm, and smart contracts are critical ingredients of the metaverse. It is not the virtual world space alone but the system that enables connectivity to Web3

While blockchain processes and techniques are evolving rapidly, distributed ledgers are built for big data. Cities generate a vast amount of data each day, making centralised cloud servers unable to carry the load due to limited network resources (Braud, Lee, Zhou, 2021; Xu. et al., 2018). Users (or nodes identified in the blockchain) keep a complete list of the data (cryptographic hash) locally and synchronously stored on a specific blockchain. Distributed Ledgers (DLT) is a database that is geographically shared or stored among multiple participants, making each node a legible and responsible source of verification or trustless trust, as, by default, ledgers are immutable unless designed otherwise.

Blockchain and city governance are essential elements when thinking about future cities, as in many cities around the world, especially in Eastern Europe, centralised entities symbolise corruption. Most companies, governments, and banking are examples of a centralised database and single point of distribution, making this the most prone single node of failure when it comes to corruption, privacy breach, and fraudulent activities.

As an example of Riga, new governance models can be seen as digital activism by removing third parties and handing over the power to the citizens. Also, one of the most significant metaverse concerns is the monopolistic platforms that will provide the metaverse infrastructure (Rosenberg, 2021).

06 | 6.2 Decentralised Autonomous Organisation (DAO)

DAO can be seen as a decentralised funding administration, where individuals can determine where all the money gets allocated in a peer-to-peer (P2P) manner. Investors convert fiat currency (USD, EUR, GBP) for a token (cryptocurrency). Decisions are recorded on the blockchain, immutable and executed through smart contracts. The set of rules on which DAO can operate - consensus algorithms are a set of agreed-upon criteria to allow transactions, voting or data sharing to be committed and executed through smart contract codes. Algromitization creates frictionless and more honest bureaucracy/microtransactions, as the operation will become invalid if the agreed criteria are not met. Like traditional job or agreement contracts, smart contracts are rules in a business or government. However, the scripted code and ability to execute an action on themselves create a smart contract that facilitates frictionless peer-to-peer (P2P) operations.

DuPont (2018) compared The DAO to the crowdfunding website Kickstarter[29]. Kickstarter promotes commercial good 'product ideas' or start-ups for which many individuals, the general public, can donate funds through its centralised platform. Typically, backers receive ''rewards'' as a pre-sales mechanism. In DAO, anyone with a refundable token (post gas fees and volatility) is eligible to vote. ''Voting'' for a project is conceptually the same as funding a Kickstarter project, but voting members have significant control over each transaction and project (DuPont, 2018).

Decentraland, run on DAO[30], is the largest metaverse platform claiming to offer the first fully autonomous virtual world - the user community can propose and vote on events, features, land, and NFTs policies. The metaverse governance can be accessed through Decentraland DAO's governance interface, powered by Aragon[31]. Decentraland has created a simple application programming interface (API) dashboard through which all governance can be filtered.

06 | 6.3 DAO as a City

The critical challenge of both blockchains, smart contracts and Cryptourbanomics are that they cannot be sustained and grow as solely bottom-up projects. Moore's law indicates that the rate of change is accelerating exponentially; the public and private sector, governmental bodies and individuals will have to col-

29
Kickstater Homepage
https://www.kickstarter.com/

30
Decentraland ''Decentalised Autonomous Organisation'' DAO
https://dao.decentraland.org/en/

31
Decentraland built DAO by using a third-party company, Aragon. Build your own DAO infrastructure. https://aragon.org/

32
CityCoins
https://docs.citycoins.co/about-citycoins/what-are-citycoins

laborate to forge a new shared understanding of the use and governance of blockchains (Tapscott, 2018, p.392). In this case, both ends (bottom and top) must invest and operate together to mature and solidify Metaverse (Marsal-Lla-cuna. 2021). The CityCoins[32] is a blockchain that enables smart contracts on the Bitcoin network, connecting the bottom (citizens) with the top (governance). The main objective of the CityCoins is to give communities the power to improve their cities while providing rewards to participating individuals and municipalities. Each city can create a coin to raise funds for specific city development. MiamiCoin[33] is one of the first CityCoins to test the use case on an actual location.

Through MiamiCoin, the city and its constituents can shape the sur-roundings with (or without) governmental institution involvement, depending on the scale of the project. The investment is split between 30% going into the cryp-tocurrency wallet of the city, and 70% being returned to holders of MiamiCoin to earn money by participating in the stacks blockchain consensus process (Proof of Transfer or PoX[34]).

To better explain how an individual can become part of a DAO, we can look at MiamiCoin's four-step process:

1) Digital wallet set up - an anonymous crypto wallet through which most block-chain activities are facilitated.
2) Buy City's coin - purchasing crypto does not have to be a significant invest-ment; some blockchains ask for it to verify the credibility of a digital wallet.
3) Visit the cities **DAO Dashboard** with a wallet.
4) Engage, propose, review and vote for projects and proposals. This can in-clude new public space rejuvenation, improvements to local bike lanes or gener-al infrastructure, reporting an accident or proposing an event.

06 | 6.4 DAO as a City by Law

Wyoming becomes the first U.S. state to recognise DAO[35] as a sep-arate entity, which will help lay the foundation for DAO and its members. (Dill, 2021) CityDAO.io is one of the first networks to create decentralised asset own-ership for physical reality, the first land-based in Wyoming, U.S.

CityDAO[36] claims to pursue what Bitcoin and Ethereum have done for the digital ecosystem. They aim to create the same impact for physical locations. The platform is still under development and will be launched in Spring 2022 with actual Wyoming Land as NFTs[37].

Wyoming's DAO Law recognises DAO governance as an LLC Limited Liability Company (LLC), creating legal opportunities for citizens to become in charge of their city. LCCs can own physical land, which creates opportunities for people to decide what the land is used for. With plenty of untouched and future-less physical voids, Riga has an opportunity to become NFTs. Creating a digital urban design toolkit based on successful city interventions can foster creativity and provide a framework for citizens to engage with their city on a granular level.

Miera street in Riga becomes a satellite neighbourhood to test for proof-of-concept of DAO and urban voids as self-contained city regeneration incubators shaped by residents. Besides being a fully bottom-up proposal, plat-formization can enable new and sustainable economic growth while partnering with local communities.

A popular trend is appearing in the cryptocurrency world, where many cities around the globe are planning to launch their coins, e.g. Korean S-Coin[38], + Reno Coin; Reno DAO. Everything digitised will have an opportunity to be con-nected, from digital twins of physical objects and systems, digital identities (par-ticipant avatars) to small and large scale business and city governance (Braud, Lee, Zhou, 2021). There are many opportunities within cities to take advantage of digitalisation. Metaverse or virtual worlds dashboards can operate as an Ap-plication Programming Interface (API) [Fig. 9] for new innovative governance models.

33

MiamiCoin, an app that allows you to propose and fund new projects in Miami.
https://miamivoice.org/

34

Participation on Bitcoin network can be refeered to as Stacking.
https://www.hiro.so/wallet-faq/how-does-stack-ing-work

35

Wyoming Law introduces DAO as a legal entity for the U.S State.
https://finance.yahoo.com/news/daos-tak-ing-over-wyoming-law-194516224.html

36

Guide on how to set up a Crypto Wallet by coin-base.com.
https://www.coinbase.com/learn/tips-and-tutori-als/how-to-set-up-a-crypto-wallet

37

CityDAO for decentralized physical asset owner-ship.
https://www.citydao.io/

Fig. 9
API Operates as a "third person" to communicate with the metaverse and manufacturing robots.

38

South Korea launches S-Coin. Its own cryptocur-rency.
https://www.coindesk.com/mar-kets/2018/04/02/south-koreas-capital-is-plan-ning-to-launch-its-own-cryptocurrency/

39
Reno Coin
https://coinmarketcap.com/currencies/renos/

39
Next Gen EU
https://europa.eu/next-generation-eu/index_
en#ecl-inpage-30

Fig. 10
Using a Virtual Reality headset to experience design options and test how 'real' does the 3D model of the physical site 'feels'. VR creates a sense of presence, but throughout the exploration, research revealed that VR headsets can be less reliable when shared with others. Primarily due to hardware size, cables and network issues (at least at the TU Delft BK faculty). With long preperations VR headsets can drastically influnce how we design and communicate.

Fig. 11
Augmented Reality apps on a mobile device was used to better grasp the concept. A physical model was also used with an AR overlay, but this proved inaccurate due to hardware limitations. With newer devices, overlay design exploration would become dual physical/virtual. AR here funcioned as a new methodology to study and communicate ideas. As more and more individuals own a smart phone, AR can become a fun and fruitful participatory tool.

CONCLUSION

Metaverse summary

Today's Metaverse experiences represent only a tiny subset of the larger Metaverse spectrum; however, it can be studied as a speculative term to describe the next generation of the internet and design medium. Currently, Metaverse is viewed as a cartoonish fictional world that facilitates socialising and utilises cryptography to lay the foundation of an open creator economy with new ownership models. Architects will have to engage with data scientists, geographers, and policymakers to utilise the new medium. For DAOs to become a more transparent and inclusive city governance model, general public involvement will also shape the digital and physical realm. In some way, big-city data is already affecting our cities. However, the metaverse platformatisation has an opportunity to operate as an open-source API for spatial design, placemaking, and system governance. The Metaverse can fundamentally give decision-making power to small artists, upcoming architects and potentially all citizens, giving them rights to their cities.

Riga summary

In locations such as Riga, a multifaceted collaboration between architects, programmers and locals, and institutions can create a fundamental restructuring of the city systems. Riga has less than 30 years to make changes to its economy to become a sustainable city in a nation where the population is in decline, and the number of urban voids is constantly growing. Only a handful of vacant agglomerates have been given a second chance, mainly, if not only, from bottom-up initiatives. Despite NGOs and tactical urbanism thriving on making a change, the process is slow, and the issue is more extensive than those institutions can address. New business and urban design models are needed to design an inclusive and prosperous future city. The conversation on large scale restructuring can begin by further studying the examples of Wyoming, CityCoin and the Dublin Dashboard.

Besides the governance, academics, researchers and professionals can work on other parts of the Metaverse. For example, studying gaming logic, how games create inclusive and serendipitous environments shaped by users, adopt VR/AR into everyday activities and develop social infrastructure toolkits to make architecture and technology age-inclusive.

Conclusions next chapter

This research paper feeds into a design project, where parts of the examples provided above are studied. [Fig. 10,11] Self-organising systems and the creator's economy are significant connectors between the Metaverse and the city of Riga. For the project ahead, research conclusions feed into the broader ambition of the Next Generation EU, which inaugurates the next ten years as the digital decade. With allocated funding, the EU aims to encourage junior and senior citizens to study science and technology in preparation for a green and digital future. At the same time, the same initiative is promoting the creation of more green spaces and making our buildings and public spaces more energy efficient[40]. In these terms, an existing Riga void will operate as a hypothetical case study to catalyse a large scale redevelopment. An equilibrium of digitalisation, learning and co-creation. The Metaverse can act as an anchoring policy instrument for participatory urban void rejuvenation.

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METAVERSE

Transitioning (to) Future Cities

2022