THE EXTENDED WORKSPACE

A DIVE INTO THE FUTURE OF COLLABORATION
IN A CONNECTED AND TECHNOLOGY DRIVEN WORLD

ROBERTO TRIVELLI

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"I am thinking about the amazing breakthroughts that has been made possible by developments in communications. [...] These things will make possible a world in which we can be in instant contact wherever we may be. Where we can contact our friends anywhere on earth, even if we don't know their actual physical location. It will be possible in that age, possibly 50 years from now, for a man to conduct his business from Tahiti or Bali just as well as he could from London. [...] Men will no longer commute, they will communicate, they won't have to travel for business anymore, only travel for pleasure."

– Arthur C. Clarke, BBC Horizon (1964)

SUMMARY

ABSTRACT

As we move away from the rigid enclosed grid systems of the past, we are transitioning into a new era of the workplace, one that considers all of the lessons learned from the pandemic and incorporates all of the benefits of the home office. Working from home has proven to be successful but lacks many of the benefits from real human interactions. In the last couple of years, various companies started to invest heavily into new methods of remote collaboration via innovative technology and thus, oversaw the emergence of new patterns of human interaction within the digital space. Some examples of these “technological bridges” are apps such as Zoom and Microsoft Teams, which actively helped us stay connected and productive through difficult times. Moreover, as our work environment and means of communication become increasingly digitized, the infrastructure that makes it possible (the internet) is attaining a new dimension. As physical space starts to overlap with its virtual counterpart, its conception, design, and execution become of architectural interest. This study explores the future ramifications of emerging technologies on our workplaces by investigating the current “status quo” and analyzing the social, phenomenological, and spatial implications of these new concepts within the modern workplace. This study aims to provide a thorough overview of the current state of collaboration, discuss its issues, and finally, speculate on the potential technological solutions yet to come.

HISTORY

In the early 20th century, most offices emanated the feeling of being designed in a style reminiscent of an industrial factory floor. The ratio of machine-to-worker that could be found in mass production was apparent in the emerging desk-to-employee-centered layouts. Following the principles of industrial Taylorism, managers sought maximum productivity rather than company-wide interaction and collaboration. Characterized by a rigid enclosed grid system, the early open floor plan was made up of rows upon rows of desks encircled by window-side closed offices reserved for managerial “overlords” hell-bent on meticulous supervision.

However, the widespread adoption of the open-floor plan did not come from a need for Corpo-compartmentalization but rather as an accommodation for a then-revolutionary piece of analog technology: the manual typewriter. Initially targeted towards the female workforce of secretaries and note keepers, this time-saving device soon transformed into the staple of efficient correspondence and quickly made its way onto the office desk of the modern employee.

Soon after, as if by a corporate saving grace, a new office layout emerged during the 1960s: the Burolandschaft. Originating from the minds of German architects, this layout aimed to counter Taylorism by seeking to increase collaboration

and office interactions. This new human-centered approach deviated significantly from the typical grid system, as it allowed clusters of teams to group together and interact with each other in a far more natural way, thus doing away with previously hierarchical floor designs.

Drawing inspiration from the Burolandschaft, The Action Office emerged in the mid-1960s, with easy-to-set-up module units designed to minimize distractions, maximize productivity, and provide much-needed variation to the everyday work setting. Defined by Individual workstations, partitioned desks now covered a majority of the floor plan which (ironically enough) leads to decreased visibility and genuine interactions around the office. All the while, the search for maximum productivity gave birth to the cubicle, which went on to transform the office from a crowded landscape to that of closed-off individual spaces.

As the 1970s came around, computer-driven technologies became the focal point of workplace design. Even more so in the 80's as the introduction of the fax machine, the high-speed laser printer, and floppy disk computers peaked and as the personal computer (much like the typewriter) found its way onto virtually every desk.

As communication devices continued to develop, the workforce became more and more mobile.

1. An Office Pool in the 50s (Left)
© UNDERWOOD & UNDERWOOD/ CORBIS, https://www.wsj.com/articles/SB10001424052748704476104575439723695579664, Accessed on 12.01.2022,

2. Burolandschraft, OSRAM offices in Munich (Below)
https://www.bbc.com/news/magazine-21878739,
Accessed on 12.01.2022

3. Action Office System,
Jack Kelley & Robert Probst,
Herman Miller, 1968
https://k2space.co.uk/knowledge/history-of-office-design/
Accessed on 12.01.2022,

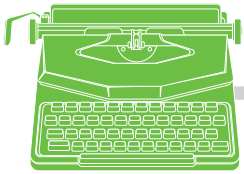
Working was no longer tied to the personal desk as wireless devices injected movement and flexibility into everyday work-life, releasing workers from the entrapment of the cubicle. Moreover, as staff began to work outside the office, companies started to pay more attention to employee morale and, by association, their well-being.

Thus, the office landscape became more eclectic, and work was no longer restricted to a specific location, and the open floor plan made its triumphant return.

4. Cubicle Farm
© Office Space (1999)
Directed by Mike Judge

5. Google's Office in Zürich
© Google
https://medium.com/fwrd/google-offices-are-so-cool-86f7c9852723, Accessed on 12.01.2022

6. WeWork's Co-working Space In China
© Jonathan Leijonhufvud
https://www.dezeen.com/2017/02/09/co-working-office-wework-whimsical-china-flagship-former-opium-factory-interior/#, Accessed on 12.01.2022

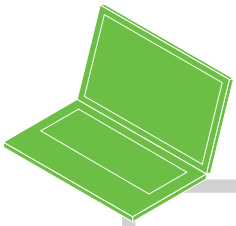


Manual Typewriter

50s

Big Printers

60s



Laptops

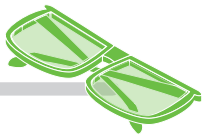
2010's

Smart Phones

2000s

Mainstream VR Headsets

2020s

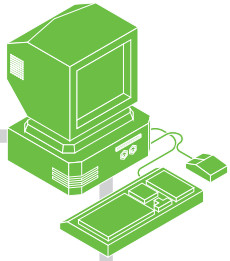


XR Glasses

~2024

Fax Machines

80s



Large Computers

80s

Smaller Personal Printers

90s

Mobile Phones

90s

INTRODUCTION

The world has been through a lot in recent years. Major events have displayed concerns in many fields forcing us to adapt the way we work and communicate with each other.

Health concerns due to the Covid-19 pandemic have triggered global restrictions and travel bans, significantly reducing social interactions and, in some places, to a complete halt for months, increasing mental health concerns and making companies change their work habits.

This year has also highlighted many existing inequalities prompting new measures to tackle them. Racial and social justice movements have persuaded companies and organizations to reduce discrimination and become more inclusive. These inequalities are not exclusive to the physical workplace, with many of them having progressed to the home office as well[1]. Environmental disasters have started becoming more recurrent, sparking increasing unrest and activism across the globe. Countries, institutions, and organizations will have to lean towards more sustainable solutions for growth.

While these events have further physically distanced us from one another, they have reminded us of the importance of human connection and a sustainable and equitable future. Innovative companies have helped us stay connected

[1] Steelcase, *The Hidden Bias of Working From Home*
https://www.steelcase.com/research/articles/topics/work-better/hidden-bias-working-home/
Accessed on 2.11.2021

through these difficult times. As our communication devices evolve, our world is becoming increasingly interconnected, the built environments more digitalized, and our experience increasingly virtual. One thing is clear, if we want to move forward, we can no longer travel halfway across the world as often as we do to conduct our work. Remote work dramatically reduces carbon emissions, but even though it has proven successful, it currently lacks many of the benefits of a physical connection. Emerging technologies might offer a more sustainable and fair solution, but what would it take to make them work?

7. Amazon workers protest against their employer
© Valerie Macon/AFP via Getty Images, https://www.gettyimages.ch/detail/nachrichtenfoto/workers-protest-against-the-failure-from-their-nachrichtenfoto/1211479568, Accessed on 12.01.2022

8. Capitol Hill
© Kevin Wolf/Associated Press
https://www.nytimes.com/2019/09/20/climate/global-climate-strike.html, Accessed on 12.01.2022

9. Disinfection at the Wuhan Tianhe International Airport
© Getty Images
https://www.gettyimages.ie/detail/news-photo/firefighters-disinfect-the-wuhan-tianhe-international-news-photo/1216629031, Accessed on 12.01.2022

TODAY'S WORKPLACE

All of a sudden, millions of families around the world have found themselves restricted to their own homes, forcing people to work and live in the same location.

Most households were not equipped for remote work, and it was then no surprise that most people wanted to return to the office. In the U.S., it has been reported that only 12% of workers wanted to work full time during that period[2]. The task was challenging for many, sometimes having to perform with ongoing distractions from family members, making it harder to maintain a work-life balance. People performed differently depending on their geographical locations, workstyle, caregiving responsibilities, and many other factors.

Companies started adopting work-from-home policies, and as they did, many inequalities from these new work environments surfaced. Those who were less equipped at home suffered increased stress levels, leading to less engagement and decreased productivity[3]. On the other hand, higher-earning employees more often than not had a better set-up at home. So the privileges and inequalities that were found at the physical office were translated in the remote one. Nevertheless, besides a better home office configuration, our most significant need was real in-person interactions. Despite spending many hours discussing digitally, virtual meetings currently

[2] Gensler, *Back to the Office* U.S. Work From Home Survey 2020, Gensler Research Institute https://www.gensler.com/https://www.gensler.com/gri/us-workplace-summer-survey-2021 Accessed on 2.11.2021

[3] Steelcase, *The Hidden Bias of Working From Home*

cannot replicate the same level of connection as face-to-face meetings. The lack of social connections was the top reason employees wanted to return to the office during the crisis[4], and collaboration was its primary purpose[5]. Offices are social environments where we have been accustomed to building camaraderie, discussing with clients, and accessing resources, to name just a few.

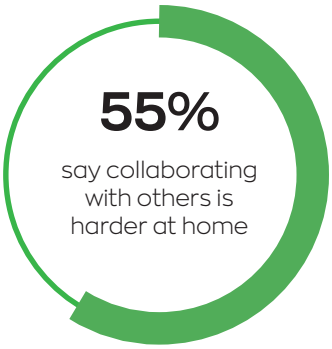
[4] Gensler, *Back to the Office*

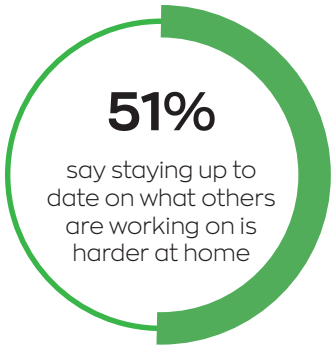
[5] Gensler, *Young Workers Value the Office Differently* U.S. Workplace Survey Summer 2021, Gensler Research Institute https://www.gensler.com/https://www.gensler.com/gri/us-workplace-summer-survey-2021 Accessed on 2.11.2021

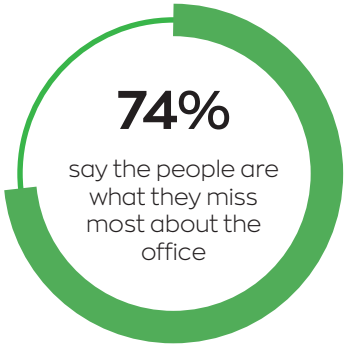
"It's a real shame, 'cause studies have shown that more information gets passed through water-cooler gossip than memos. Which puts me at a disadvantage, because I bring my own water to work."

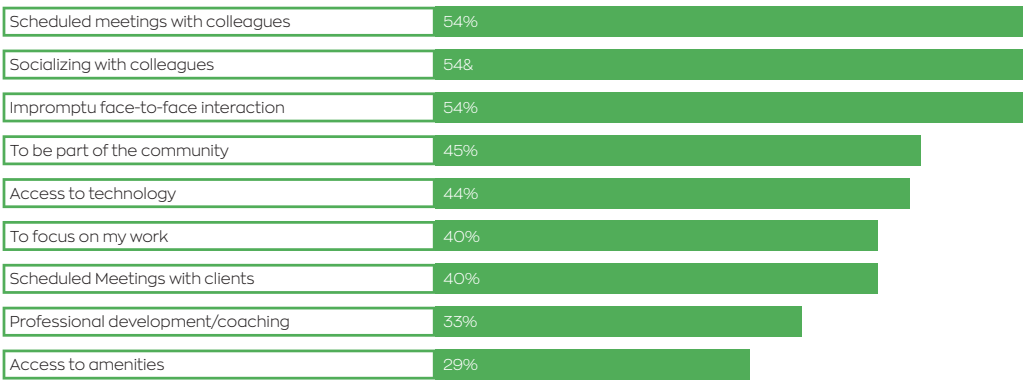
– Dwight K. Schrute, *The Alliance (EP4-S1), The Office* 2005

10. Water-cooler gossip
© The Office
Directed by Greg Daniels









11-12. The top reason employees want to come to the office: the people, Gensler.

Furthermore, these workplace interactions have been the main driver for creativity and innovation. Having everyone work by themselves makes it hard to seek new opportunities. Daily tasks rely on a wide range of activities that need their own environment, and the house just cannot support all of that. People need to control their work environment and socialize more than anything. 72% of global leaders plan a mix of remote and virtual work strategies[6], with many companies even planning to increase their real estate footprint to allow more space for collaboration and to ideate[7]. However, imagining that employees will come back to the workplace mainly for collaboration is far from the truth. We plan our days differently, very often scheduling private moments too, and collaboration is not only about group work; it also requires a bit of isolated work too.

[6] J. Keane, T. Heiser, *4 Strategies for Building a Hybrid Workplace that works*, Harvard Business Review, 2021 https://hbr.org/2021/07/4-strategies-for-building-a-hybrid-workplace-that-works Accessed on 4.11.2021

[7] Gensler, *Top Performers Prefer the Workplace*, U.S. Work From Home Survey Summer 2021, Gensler Research Institute https://www.gensler.com/gri/us-workplace-summer-survey-2021 Accessed on 2.11.2021

ATTENTION & PRIVACY

Performing focused work has never been as hard as it has been before. We are always connected and reachable nowadays, losing a sense of our own privacy and having a hard time dealing with distractions. Neuroscience research has aided in defining spaces for our different types of attention. Allowing us to manage our distractions and move to different locations depending on our tasks. The Sohlberg and Mateer model[8] is of particular interest, defining attention types depending on our

[8] M. Sohlberg and C. Mateer, *Effectiveness of an attention-training program*, 1986 https://www.tandfonline.com/doi/abs/10.1080/01688638708405352 Accessed on 21.12.2021

ability to attend to or change focus from one to several stimuli. Arousal, focused, sustained, selective, alternating, and divided attention as defined by them. Some assignments need intense focus when others can be done while discussing and catching up with colleagues, and finally, some tasks require group work. Not all work is equal, and not everybody works the same way. Allowing people to control their distractions and privacy ultimately improves performance and wellbeing, which is why offices that cater to these differences are very effective.

As companies are emerging from the crisis and employees are returning to the offices, new workplace strategies are taking place, ones that have to consider the changing needs and demands of our time and the learned lessons from the pandemic.

13. Open or Closed?
© Madmen, created by Matthew Weiner

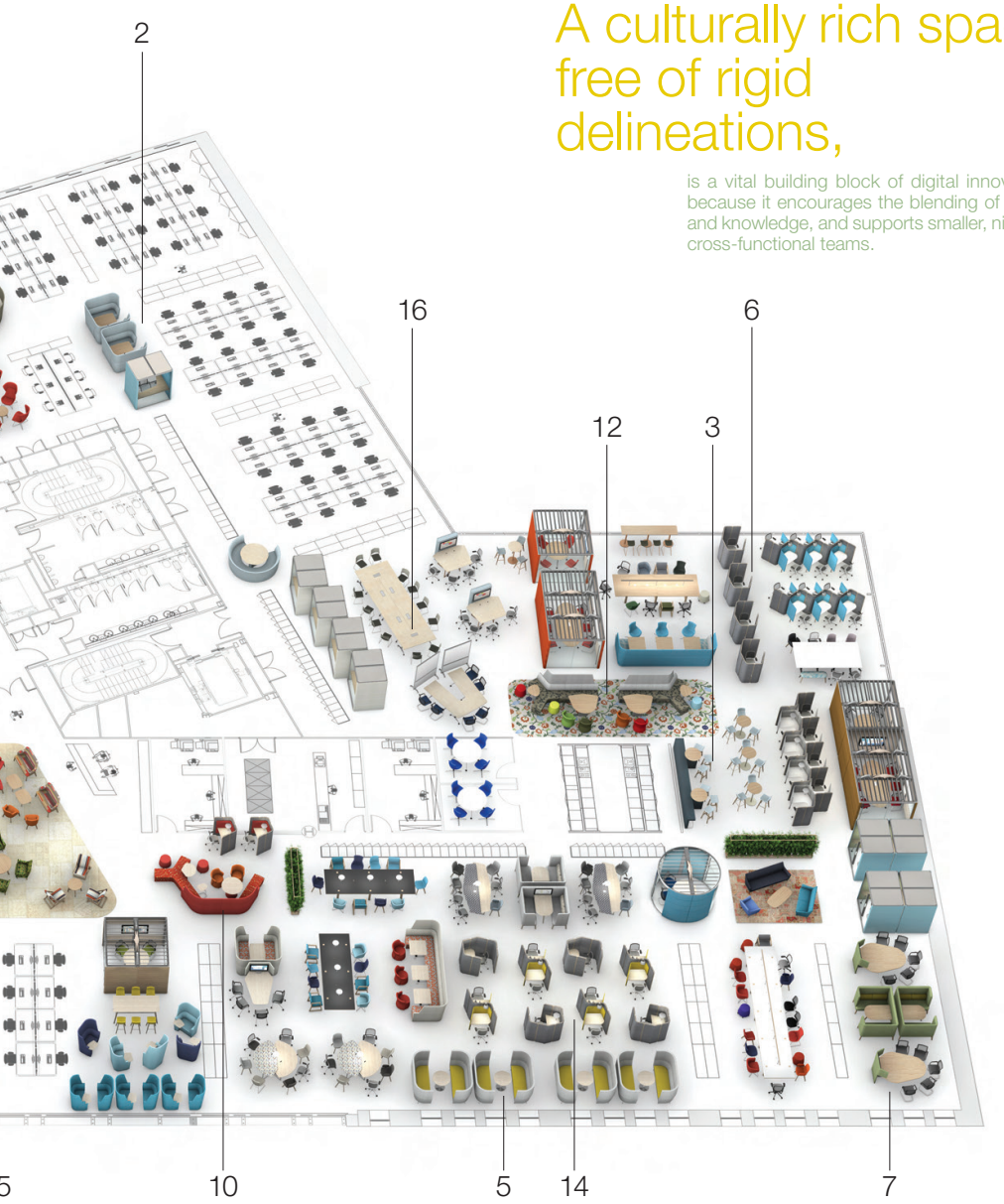
1 Acoustic Pods
2 Booths & Banquettes
3 Café
4 Café-Height Working
5 Enclosed Meeting
6 Enclosed Personal Work
7 Media Tables
8 Meeting Tables
9 Open Bench Working
10 Open Collaboration
11 Open Team Working
12 Project Space
13 Quick Catch-Up
14 Quiet Concentration
15 Relaxed Lounge
16 Study & Learn
17 Active Task Seating

14.
Orangebox proposes diversified work environments for varying concentration and work-styles.
Smart Working Brochure
© Orangebox 2019
https://orangebox.com/imgup/tools/1559298161Smartworking-Brochure_Solutions-for-Connecting-People.pdf,
Accessed on 12.01.2022

Both designers and organisations are now using furniture layouts and adjacencies to help break down silo mentalities and recalibrate organisational culture.

A culturally rich space, free of rigid delineations,

is a vital building block of digital innovation because it encourages the blending of talent and knowledge, and supports smaller, nimbler cross-functional teams.



THE HYBRID DILEMMA

As we adjust to the cultural shift imposed by the pandemic and get back to working in the office, it will soon become apparent just how accustomed we have become to remote work and virtual meetings.

Digital collaboration tools such as Zoom, Miro, or Google Doc have allowed us to work together despite our distances, and now that our offices are opening back their doors, we have started to conduct our work through a mixed meeting experience of in-person and virtual interactions, constantly learning how to juggle from one to the other. We now work more flexibly and connected than ever, and our environments are evolving along with us.

Many organizations have started repurposing cafeterias into social gathering spaces. Meetings are no longer solely taking place in closed rooms but in open spaces with adjustable boundaries, while individual tasks that require more privacy are starting to take place in separate enclosed spaces more adapted to that kind of work[9]. Some leading companies have also taken additional safety precautions. Nestlé's HQ's in Switzerland imposed an occupancy restriction rate of 40% (in 2021), added a medical center that delivered anti-body tests to employees, and spread out several amenities to decrease potential large gatherings.

[9] J. Keane, T. Heiser, *4 Strategies for Building a Hybrid Workplace that works*

We are seeing major changes in office layouts, innovation is accelerating faster than ever, and our hybrid fate necessitates a more flexible, adaptable plan. It will become necessary to create multi-functional spaces that can adapt to any kind of social work environment as employers are starting to realize that workplaces are mainly environments for collaborating.

EQUITY, ENGAGEMENT, AND EASE

Due to the ability to collaborate and meet virtually, the number of short work-related commutes has reduced, and virtual meetings have increased. Our video-conferencing devices follow us everywhere, so every room we enter has the potential to become a meeting room. Architects now have to start thinking like movie directors, factoring lights, acoustics, content, displays, and cameras into their office designs,[10] Hybrid meetings do come with a set of challenges, however. When collaborating, virtual users are often less committed than those attending remotely, and those physically present often struggle to set up all necessary devices for their meeting. A Steelcase study mentions three critical concepts for better hybrid collaboration: Equity, Engagement, and Ease.[11] Equity between remote and virtual attendants can be improved by using mobile displays by splitting people and content into separate ones, adding better lighting, thus allowing all members to view and hear other

[10] Steelcase, *Collaboration in the Hybrid Workplace,* Steelcase Inc. https://info.steelcase.com/hubfs/Steelcase-Hybrid-Collaboration-Guide.pdf Accessed on 2.11.2021

[11] Ibid.

participants or information freely. Engagement is often lost when virtual attendants are unable to participate in the ongoing tasks; online collaborative tools allow for interactions from all parties. Finally, our connected spaces have to allow for seamless transitions from our digital devices; our spaces and devices should work and pair together. Design can help ease the challenges given by virtual communication, so creating spaces that can reduce the issues is imperative.

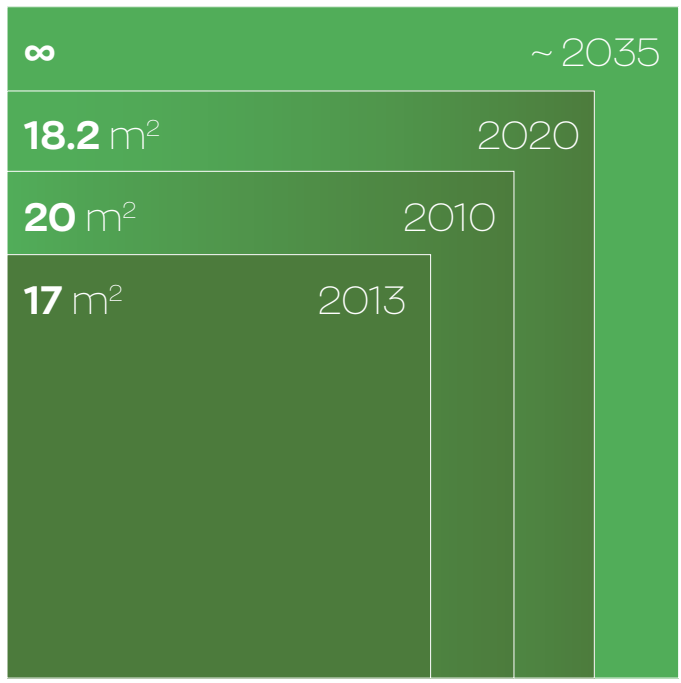
NEXT STEPS

We are currently experiencing an interesting and most-likely short-lived phase with communication technology, one where technology is trying to catch up with our new needs and issues. Current travel, health, and various other policies prevent us from being together, but we need to be more connected than ever. Tech companies are constantly coming up with new solutions hoping to make our virtual work environments as efficient as our physical ones. Digital devices and collaborative software are becoming more immersive than ever, and tech giants are heavily investing in virtual realities[12]. It is becoming more apparent that these new emerging technologies might change our offices more than ever, extending the workplace well beyond our cities and into new realms.

[12] C. Metz, *Everybody Into the Metaverse! Virtual Reality Beckons Big Tech*, The New York Times, 30.12.2021 https://www.nytimes.com/2021/12/30/technology/metaverse-virtual-reality-big-tech.html Accessed on 4.01.2022

15. Remote work
© Getty
https://www.newyorker.com/culture/cultural-comment/how-to-achieve-sustainable-remote-work, Accessed on 2.11.2021

16. Hybrid Classrooms During Lockdown © avixa
https://www.avixa.org/av-topics/articles/rapid-adaptation-in-k-12-technology-at-a-break-neck-speed-tech-learning, Accessed on 2.11.2021



17. Average office space per person throughout time

EXTENDED WORKSPACE

We are starting to see a shift in the way people work, learn and socialize. Covid-19's health regulations have required us to maintain physical distancing, bringing millions of people to online environments for an increasing range of shared human experiences. As a result, we have started to question if a part of what we do actually requires a physical presence. A significant part of our work is already done online; we share documents, collaborate, and communicate with one another using online platforms.

Do we need to be physically present at all of our meetings? Is it still necessary to spend all of our time traveling and commuting to and from our offices?

In 2021, the internet will become the "third space"[13] where we will do much of our socializing. We are starting to seek beyond video calls and turning to virtual worlds to give us the same experience as our favorite gathering locations. This online engagement will grow in 2021, as will the virtual economy.[14] The concept of going to work in a virtual space is already gaining traction in some industries In fact, many companies have started using new mediums to showcase their products or services[15] in a time where physical presence for consumption has become increasingly rarer.

[13] H. Narula, Virtual Worlds our Third Place The Wired World in 2021, 22.11.2020, p.113

[14] Ibid

[15] J. Balis, How Brands Can Enter the Metaverse, The Harvard Business Review, 03.1.2022, https://hbr.org/2022/01/how-brands-can-enter-the-metaverse, Accessed on 4.01.2022

We have even started using online platforms to seek new connections. Friendships are being made through online worlds such as Minecraft, and matchmaking companies are forecasting to have over 250 million active users by 2024.[16]

Many of these virtual interactions will evolve to be even more immersive and responsive than ever, gaining a new dimension as they enter the Metaverse. Facebook and other technology corporations want to make it the hub for various online activities such as work, play, studying, and shopping. The tech firm is so confident in the concept that it has changed its name to Meta[17] to emphasize its desire to lead the metaverse, and others are also heavily investing in promoting their vision for the future of work and social gatherings. In fact, some leaders even indicate that most of our meetings will be held in this new form as early as 2024.[18]

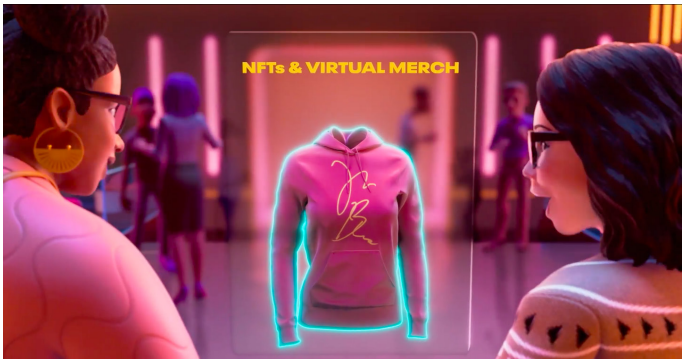
As a result of political, economic, and environmental crises, the rush towards building virtual gathering spaces has become more crucial than ever. A new form of communication that has yet to be built, one that opens the digital third dimension and therefore becomes a matter of architectural interest.

[16] Statista, Research Program, *Online dating worldwide - statistics & facts*, Statista, 26.02.2021, https://www.statista.com/topics/7443/online-dating/#dossierKeyfigures Accessed on 23.12.2021

[17] Meta, Introducing Meta: A Social Technology Company, Meta, 28.10.2021, https://about.fb.com/news/2021/10/facebook-company-is-now-meta/ Accessed on 23.12.2021

[18] S. Jones, Bill Gates says most virtual meetings will move to the metaverse within 3 years, and workers will interact using VR headsets and avatars, Business Insider, 10.12.2021, https://www.businessinsider.com/bill-gates-virtual-meetings-metaverse-remote-work-virtual-reality-2021-12?r=US&IR=T Accessed on 23.12.2021

18. Virtual reality mall lets consumers shop alongside digital giraffes and zebras
© Allison Crank
https://www.dezeen.com/2015/11/11/virtual-reality-theatre-mall-allison-crank-design-academy-eindhoven-dutch-design-week-2015/
Accessed on 15.01.2021



19. NFT's & Virtual Merch in Horizon Worlds
© Meta
https://www.youtube.com/watch?v=Uvufun6xer8&t=662s
Accessed on 15.01.2021

20. A Meeting in VR
© Meta
https://about.fb.com/news/2021/08/introducing-horizon-workrooms-remote-collaboration-reimagined/
Accessed on 15.01.2021

TERMS

Augmented Reality (AR) :
A technology that combines computer-generated images on a screen with the real object or scene that you are looking at.[19]

[19] Oxford Languages, *Augmented Reality*, 2022

Virtual Reality (VR):
Images and sounds created by a computer that seem almost real to the user, who can interact with them by using sensors.[20]

[20] Ibid, *Virtual Reality*, 2022

Mixed Realities (MR):
A medium consisting of immersive computer-generated environments in which elements of a physical and virtual environment are combined.[21]

[21] Ibid, *Mixed Realities*, 2022

Extended Realities (XR):
An umbrella term that covers the ones defined above.

Smart Objects:
Physical objects connected to a network, capturing data from their users to enhance interaction.

Augmented Space:
Physical space overlaid with dynamically changing information.[22]

[22] Lev Manovich, *The Poetics of Augmented Space*, http://manovich.net/index.php/projects/the-poetics-of-augmented-space, 2005, Accessed on 8.10.2021

Intelligent spaces:
Spaces that monitor user's interaction with them via multiple channels and provide assistance for information retrieval, collaboration or other tasks.[23]

[23] Ibid, p.7.

Haptic Devices:
Mechanical devices that mediate communication between the user and the computer. Haptic devices allow users to touch, feel and manipulate three-dimensional objects in virtual environments and tele-operated systems.[24]

[24] J.J. Berkley, *Haptic Devices*, Mimic Technologies Inc., HITLAB, 2003

The Metaverse:
A virtual-reality space in which users can interact with a computer-generated environment and other users.[25] Where our virtual constructions will be held.

[25] Oxford Languages, *Metaverse*, 2022

AN ARCHITECTURAL CONCERN

In fact, for most of human history, architecture was regarded as one of the primary means of communication. Murals and mosaics found in cathedrals would not only serve as ornaments but as symbols, and the hieroglyphics carved on ancient Egyptian columns still tell religious tales.

Architecture is gaining back that purpose. The built environment is getting increasingly digitized as displays filled with dynamic multimedia information are added to the walls surrounding us. In Robert Venturi's view: displays are not an optional addition but rather the heart of architecture in the information age.[26]

[26] R. Venturi, Iconography and Electronics upon a Generic Architecture, The MIT Press, Cambridge, 1998

If we take a moment to analyze our surroundings, digital devices are already all around us. We carry our mobile devices everywhere we go. Video displays are found on buildings filled with computers and monitored by surveillance cameras. All of these and more transmit information to and from our devices. "They turn physical space into a dataspace of overlaying layers of dynamic media and information flows."[27]

[27] L. Manovich, *The Poetics of Augmented Space*, p.22

We live in a world where data constantly flows around us, adding more dimensions to our physical space. These information flows define an essential part of our daily lives. They give us directions, inform us about breaking news, help us send messages over long distances, and monitor

our health and energy consumptions. Everyday objects are getting smarter, and our spaces more intelligent, linking realities together and creating new overlayed ones. The future of collaboration will be more connected than ever; through objects and spaces, our hybrid workplaces will merge together to form single enhanced shared experiences.

Humans are increasingly immersing themselves in augmented spaces and now into new realms, which provides an opportunity for architects to reevaluate their practices, since virtual layers of information will overlay more than our built environment, or as stated by Lev Manovich:[28]

"...The layering of dynamic and contextual data over physical space is a particular case of a general aesthetic paradigm: how to combine different spaces together."

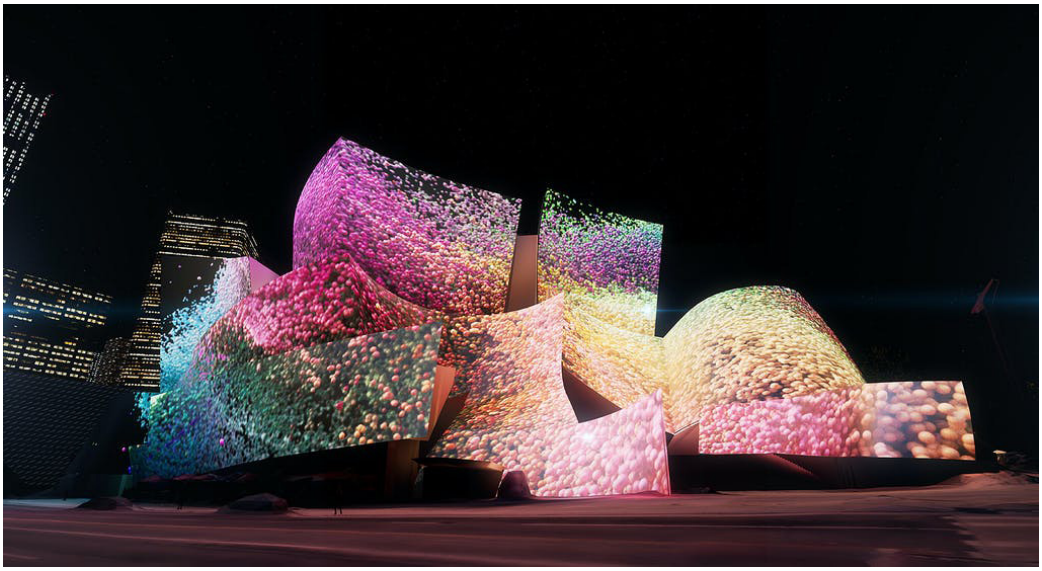
[28] Ibid

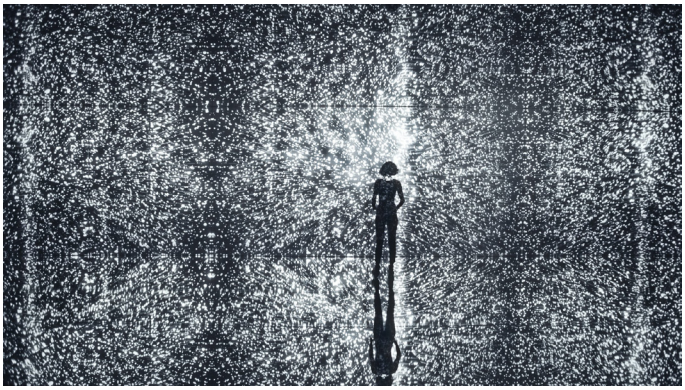
21. Augmented Public Space In Blade Runner 2049
© Blade Runner 2049 (2017)
Directed by Denis Villeneuve

"...In this context the grand advertising Jumbotrons atop buildings in Tokyo and Osaka can, along with temple hieroglyphics and mosaic iconography, work as precedent for a generic architecture employing video display systems– where the sparkle of pixels can parallel the sparkle of tesserae and LED can become the mosaics of today."

– Robert Venturi, *Iconography and Electronics upon a Generic Architecture*, 1996

22. Advertisement in Seoul
© Biego Mariottini via Getty Images
https://www.bbc.com/travel/article/20211214-where-asking-someones-age-isnt-rude
Accessed on 15.01.2021





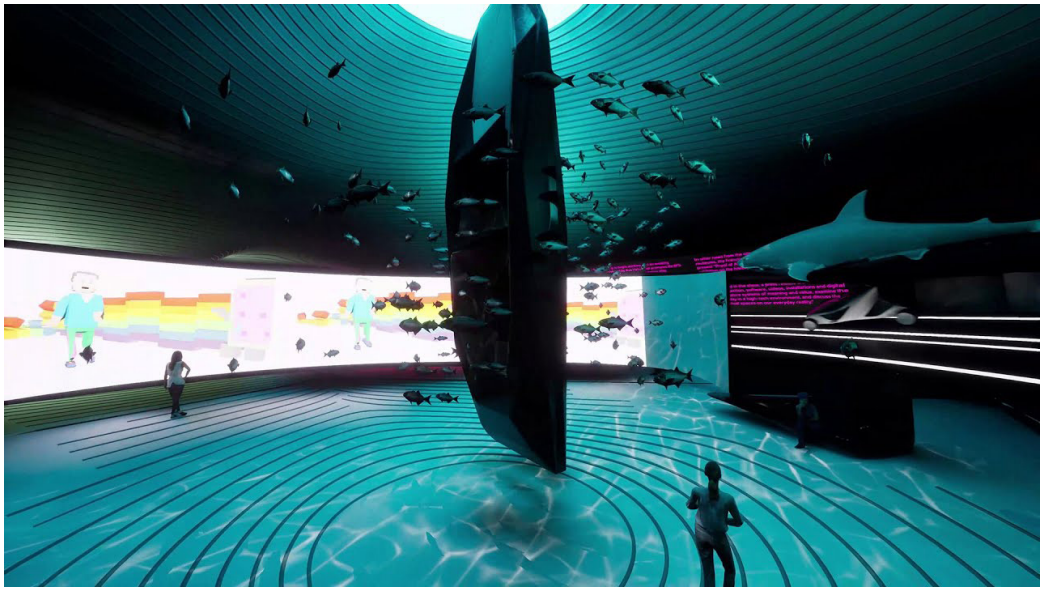
23. WDCH Dreams (Above)
© Rafik Anadol Studio
https://www.archdaily.com/902277/s-walt-disney-concert-hall-will-be-lit-by-algorithms-in-dream-like-light-show
Accessed on 15.01.2021

24. Pladis: Data Universe
© Rafik Anadol Studio
https://refikanadol.com/works/pladis-data-universe/
Accessed on 15.01.2021

"As the digital world gains a third dimension it becomes of architectural concern. Both because pages are turning into spaces, but also because digital content is emancipating from the screen and into our rooms, streets, and landscapes by virtue of immersive technologies. The internet enabled social interaction in and around previously disconnected digital assets, turning the formatting of information into the shaping of public realms."

– Space Popular, *THE CIVIC PROGRAM, ARCHITECTURE FOR THE IMMERSIVE INTERNET*

25. NFTism, at Art Basel Miami Beach © Zaha Hadid Architects https://www.zaha-hadid.com/design/nftism-at-art-basel-miami-beach/, Accessed on 15.01.2021



26. Punto de Inflexión, first ever architectural conference, © Space Popular, http://www.space-popular.com/2020---punto-de-inflexion---vii-festival-arquia-proxima, Accessed on 15.01.2021

FUTURE OF COLLABORATION

Communication devices have allowed workers to choose their work environment. Reports have shown that people increasingly use 'third' places to conduct their work, locations such as cafeterias, co-working places, and more, extending our offices to the city.[29]

[29] Gensler, *Top Performers Prefer the Workplace*.

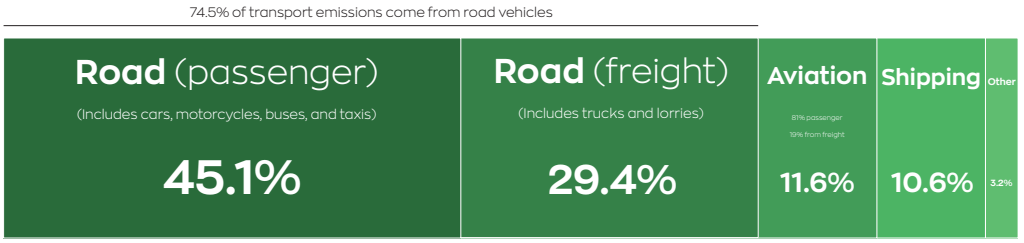
The benefits of social VR platforms will allow people to fully control their work environments. Our lives and our communication style could be fundamentally altered. Besides, our offices, cities, and VR worlds will become extensions to our workplace. Offices will be used to conduct meetings that require physical presence and VR worlds for everything else. This new medium allows for a new form of traveling, leaving ordinary ones as a last resort. As a result, we would be able to reduce long daily commutes and allow people greater flexibility to work from home or anywhere else, thus allowing them to have more time for productive work and play.

If we look at the main drivers of climate change, greenhouse gases are at the top of the list. Looking more closely at the European scale, all primary domestic sources of emissions have decreased across the EU since 1990 except for the transportation sector.[30] Additionally, commuting time has not stopped rising due to population growth, and travel encourages the spread of diseases. Longer commutes mean less productivity and a decline in

[30] Eurostat, *Climate Change – Driving Forces*, 17.08.2021. https://ec.europa.eu/eurostat/data-browser/view/env_air_gge/default/table?lang=enAccessed on 2.11.2021

mental and physical well-being as well.[31] Commuting and traveling less is becoming more and more essential if we wish to live healthier, more sustainable lives.

[31] L. Lambert, *Commuting hurts productivity and your best talent suffers most,* Harvard Business School, 30.03.2021 https://hbswk.hbs.edu/item/commuting-kills-productivity-and-your-best-talent-suffers-mostAccessed on 2.11.2021



However, we are still a long way from making XR good enough for it to replace most of our travels, as said by Bailenson: "Virtual technology is going to be the must-have technology when you can simply talk and interact with other people in a virtual space in a way that feels utterly, unspectacularly normal".[32] It currently cannot replace the feeling of a good handshake or replicate the useful body expressions needed when closing a deal. For these new communication devices to work, they will have to show a broader range of human gestures and emotions and allow us to interact with each other and our surroundings in more efficient ways.

27. Global CO2 Emissions from Transport (2018), Our World In Data. © Hannah Ritchie

[32] J. Bailenson, *Experience on Demand,* p.174

THE VIRTUAL EXPERIENCE

"How do you capture and convey the subtleties of human social interaction, in the movement of the face, in body language, in eye gaze? Once again, the challenges posed by VR remind us of the richness and complexity of our human experience, because to understand how to make our avatars feel real, we have to know what we humans are doing consciously and unconsciously– that makes our daily encounters in real life feel real. And that, philosophers and psychologists will agree, is a complicated question."

– Bailenson, *Experience on demand, 2018*

28. Cinema in Rec Room
© Rec Room
https://www.roadtovr.com/10-apps-hang-friends-vr/,
Accessed on 15.01.2021

THE VIRTUAL EXPERIENCE

BODY

When immersing ourselves in virtual realms, our world and bodies change with it. These new worlds are blank canvases where architects will have to think about much more than the 'built' environment, designing our avatars, and the way we interact and experience our surroundings. One of the biggest challenges for AR, VR, and MR adoption is making social interactions as meaningful as the ones we have in real life. So reaching out and touching the virtual world through our new bodies is crucial. In meetings, physical contact and gestures play a prominent role in the way we communicate. They help us convey trustworthiness and competence.

INTERACTIONAL SYNCHRONY

Studies have shown (Condon & Ogston, 1967)[33] (Kendon, 1970)[34] that humans mirror each other's movements when communicating, known as "Interactional Synchrony" this phenomenon affects our capacity to bond with each other in all sorts of encounters such as interviews, dates and so on.[35] Kendon explained that "interaction synchrony" is one of the main elements of social interactions, thus showing if individuals are 'open' to one another. People with higher non-verbal synchrony in their posture have better relationships than those with lower synchrony. Their ratings showed that they were more compatible, united, and had a better rapport. There have been scores of studies

[33] W.S. Condon, W.D. Ogston, *A Segmentation of Behaviour*, Journal of Psychiatric Research 5, 1967, p.221-35

[34] A. Kendon, *Movement Coordination in Social Interaction*, Acta Psychologica 32, 1970, p.101-25

[35] M. S. Remland, *Nonverbal Communication in Everyday Life*, Pearson AandB, 4th Edition 2009.

demonstrating this effect – nonverbal coordination is linked to better social cohesion and teamwork.[36] Avatars will have to mirror the subtle changes in our facial expressions and gestures if we wish to have fruitfull meetings in the future.

[36] J. Bailenson, *Experience on Demand,* p.184-185

TOUCH & HAPTICS DEVICES

Besides gestures, implementing touch into our virtual experience will improve digital communication. Even a short virtual touch by someone can generate strong emotional experiences, as suggested by Haans and Wijnand.[37] In their study, users equipped with haptic devices responded in similar ways to people receiving real physical contact: "a brief touch on the shoulder or arm can substantially increase a person's altruistic behavior and willingness to comply with a request."[38] Additionally, in *Experience on Demand*, Bailenson mentions a study conducted by Phillips regarding virtual handshakes[39]; they found that people were more inclined to treat others more softly in negotiations and to depict them as more likable when

[37] A. Haansm, A.I. Wijnand, *The Virtual Midas Touch: Helping Behaviour After a Mediated Social Touch,* IEEE Transactions on Haptics 2, n.3, 2009, p.136-40

[38] Ibid

[39] J. Bailenson, *Experience on Demand,* p.189-193

29. Haptic Gloves in Minority Report
© Minority Report (2002)
Directed by Steven Speilberg

given their own mimicked handshake. “The subtle effect of familiar touch was a winner”.[40] In the near future, we could imagine business leaders and politicians sending virtual “tailored” handshakes to countless people at the end of conferences and speeches across the world.[41]

Haptic devices will be one of several pieces of technology that will aid in immersing ourselves in virtual environments. As technology progresses, other senses will be experienced virtually, transforming much of the information our bodies convey into digital data, generating a sort of “data body”.[42] In order to make our experience with others seem more ‘real,’ large amounts of data will have to be collected. Some experiences might require gathering movement and others heartbeat and thermal information. “Coupled with direct bodily interfaces, such as the Apple Watch and mobile biofeedback sensors, the innermost self and its data become part of new urban spaces.”[43]

The future of hybrid work will be in an embodied Internet. We will convey a fuller range of human expression and gestures through our three-dimensional avatars than what we can virtually share today. We will use different versions of ourselves depending on the type of social interaction, photo-realistic ones for work, stylized ones for casual meetings, and a fantasy one for gaming.[44]

[40] J. Bailenson, *Experience on Demand,* p.191

[41] Ibid

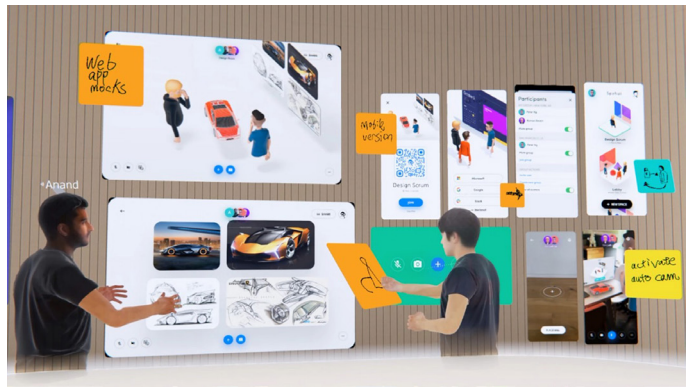
[42] M. Jahrmann, *Augmented Play, Art, and Space,* in *Architectonics of Game Space: The Spatial Logic of the Virtual and Its Meaning for the Real,* Transcript, Wetzlar, 2019, ISBN 978-3-8394-4802-1, p.261

[43] Ibid

[44] Meta, *The Metaverse and How We'll Build It Together – Connect 2021,* 6.28.2021, https://www.youtube.com/watch?v=Uvufun6xer8

30. Extend Reality Gathering
© Meta
https://www.youtube.com/watch?v=Uvufun6xer8&t=662s,
Accessed on 15.01.2021

31. Haptic Full Body Suit
© Teslasuit
https://teslasuit.io/
Accessed on 15.01.2021



32. Hybrid Meeting with Spatial IO
© Spatial IO
https://spatial.io/community
Accessed on 15.01.2021

THE VIRTUAL EXPERIENCE

BODY

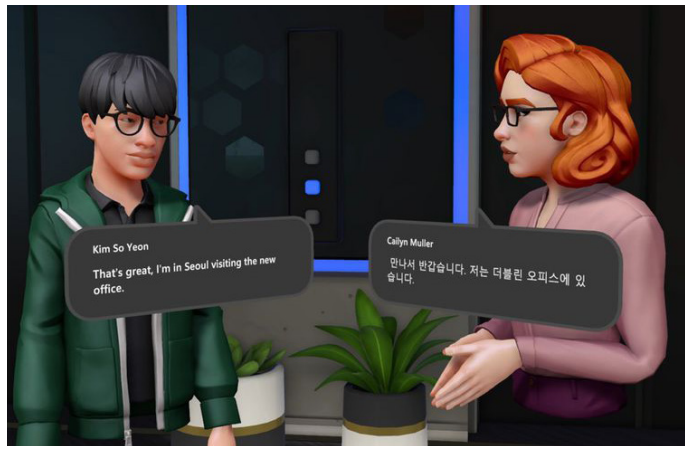
Extended realities will allow us to finally "feel" together, having a shared sense of space rather than just staring at a screen. Our experiences will be shared and interactive, thus solving many of the hybrid collaboration issues found today.

" Virtual spaces are perceived audio-visually, however, they are experienced multi-sensorially. This has to do with how other senses are triggered in association with what we see and hear. Thus, the richer our library of haptic sensations, the better we will be at auto-completing virtual worlds". [45]

– Space Popular, *Who Owns The Global Home?, 2019*

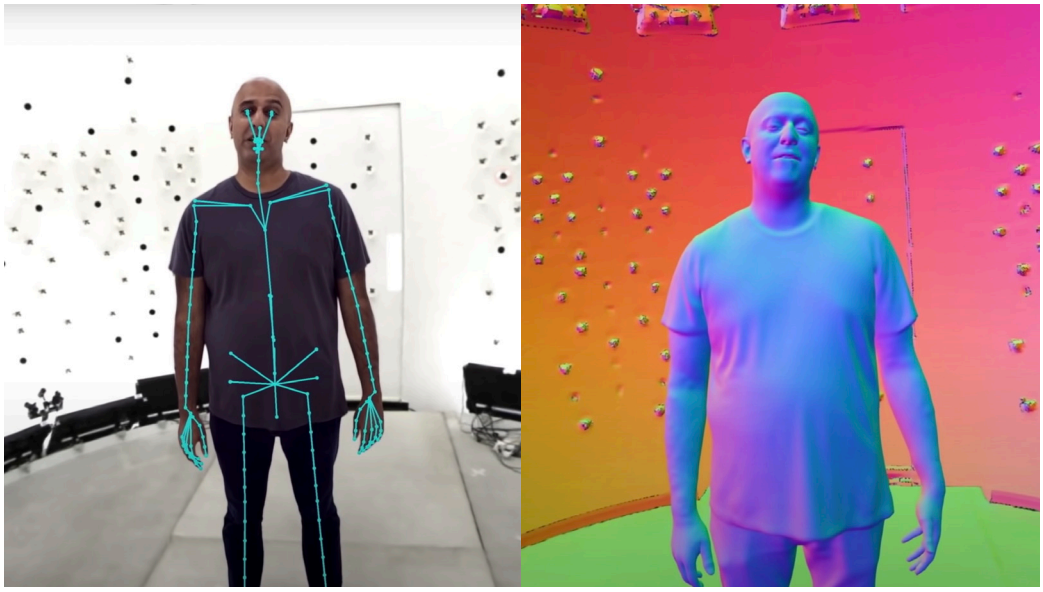
[45] Space Popular, *Who Owns The Global Home?*, in *Catalogue of the Tallin Architecture Biennale: Beauty Matters*, Estonian Museum of Architecture. Estonia, 2019, p.140-141

33. Microsoft Teams is getting avatars and will work in VR next year
© Microsoft
https://www.cnet.com/tech/computing/microsoft-teams-is-getting-avatars-launching-in-vr-and-ar-next-year/, Accessed on 15.01.2021



34. Virtual Handshake © Meta
https://www.youtube.com/watch?v=Uvufun6xer8&t=662s, Accessed on 15.01.2021

35. "Data Body" © Meta
https://www.youtube.com/watch?v=Uvufun6xer8&t=662s, Accessed on 15.01.2021



THE VIRTUAL EXPERIENCE

MIND

Back in 2015, the UN Action Campaign partnered with Vrse and UNICEF Jordan to release "Clouds over Sidra",[46] an immersive VR experience aimed to "generate greater empathy and new perspectives on people living in conditions of great vulnerability".[47] In the film, viewers follow Sidra, a 12-year-old girl, through her day at the Za'atari Camp in Jordan, one of the many camps built for refugees that fled the Syrian civil war. According to UNVR (United Nations Virtual Reality),[48] VR has been shown to raise funds twice as efficiently as traditional methods and since has been used to influence public opinion by civil societies. There are no extraordinary scenes, just mundane moments shown to viewers. "Homes after War",[49] another example, depicts the tragic, true story of a returning Iraqi family to Fallujah after having been displaced by war from their home. The audience walks through Ahmaied's home and learns about the threat posed by IEDs (improvised explosive devices), along with what it is like to fear the home you once loved. One of the main differences with VR is that immersive video gives us the feeling of being there with them and if we provide viewers with bodies, the feeling of immersion increases. In VR, identity and representation are constantly changing. Scenarios that can enable individuals to step in another's shoes through a perceptual illusion called embodiment, also known as the body ownership illusion or body transfer[50] (M. Slater, M.V. Sanchez-Vives, 2016). This phenome-

[46] Within, *Clouds Over Sidra,* 27.01.2016, https://www.youtube.com/watch?v=mUosdCQsMkM

[47] UNVR, Syrian Refugee Crisis, http://unvr.sdgactioncampaign.org/cloudsoversidra/#.YeLw-ZFjMKw3 Accessed on 4.01.2022.

[48] Ibid.

[49] Oculus, *Home After War, Oculus VR for Good Creators Lab,* 27.01.2016, https://www.youtube.com/watch?v=xF1fUT-NXHc

[50] M. Slater, M.V. Sanchez, *Enhancing Our Lives with Immersive Virtual Reality,* Frontiers in Robotics and AI, 2016.

non allows greater feelings of empathy and can help us adapt to new environments and settings, paving the way for a new kind of immersive education. These methods are already widely used in many fields. Surgeons, aviators, police officers, and soldiers commonly use these devices that allow for a safer and cheaper alternative to learning before being confronted with real scenarios. Learning retention has proven to be more effective by 30% in 3D.[51] We can prevent more casualties, create safer assembly lines, and reduce work-related accidents. Mixed-Reality devices like Microsoft's HoloLens[52] are already increasing productivity in some workplaces by aiding employees with remote assistance and guidance. In other cases, some experiences have shown to be effective in relationship building and in developing soft skills, according to some tech leaders.[53] Which brings us to our next point; aside from preventing health-related concerns, better work environments are also among the benefits. By letting people experience another's perspective, XR's can help avoid stereotyping and false conforming narratives by enhancing empathy.[54] Upon seeing one's avatar, whether it be from the first person looking down at the digital body or through a virtual mirror, a person takes ownership of it and becomes like it,[56] the Protheus effect[41]. "People in taller avatars negotiate more aggressively, people in attractive avatars speak more socially, and people in older avatars care more about the distant future".[57]

[51] CNBC, Why Microsoft Uses Virtual Reality Headsets To Train Workers,https://www.youtube.com/watch?v=Rnk_akgSjq, Accessed on 4.01.2022.

[52] Microsoft, HoloLens 2,https://www.microsoft.com/en-us/hololens, Accessed on 4.01.2022.

[53] P. Sisson, How VR Training in the Workplace Is Transforming Learning on the Job, Redshift, https://redshift.autodesk.com/vr-training-in-the-workplace/ Accessed on 4.01.2022.

[54] J. Bailenson, *Experience on Demand,* p.83

[55] Ibid.

[56] N. Yee, J. Bailenson, *The Proteus Effect: The Effect of Transformed Self-Representation on Behavior,* Human Communication Research 33, DOI: doi:10.1111/j.1468-2958.2007.00299.x 2007.

[57] J. Bailenson, *Experience on Demand,* p.83

THE VIRTUAL EXPERIENCE

MIND

An increasing number of companies have started using VR for corporate diversity and inclusion training programs that are proving to be more effective than traditional methods.

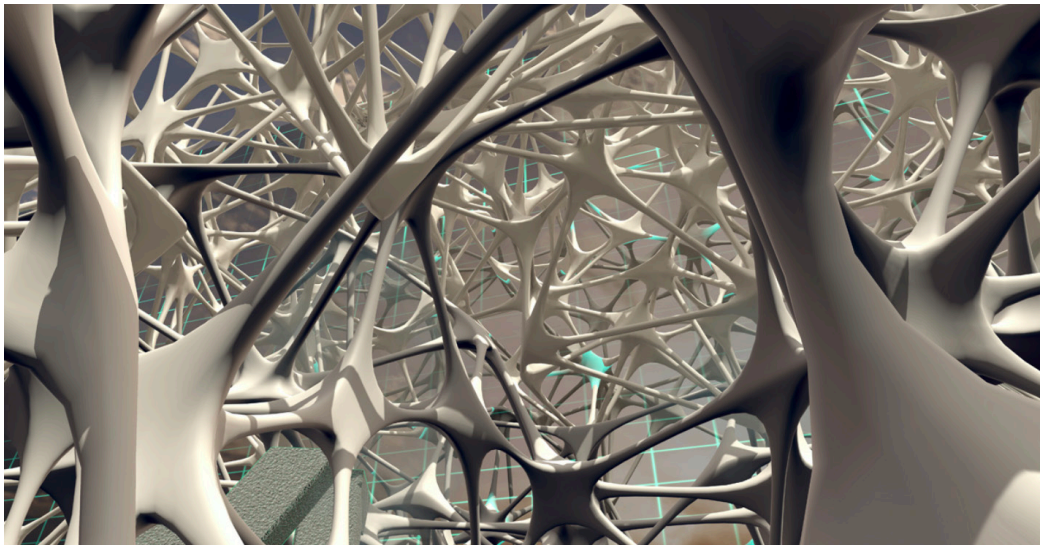
There is a clear growing trend in educational VR. Employers are starting to use this technology to improve different aspects of their workplace environments, as the demand for these services keeps on growing.

Designing virtual environments implies more than thinking about spatial qualities; it also demands taking into account the more intimate, the one that helps us define who where are and how we interact. We are part of space.

36. Ahmaied walking us through his home in "Homes After War" © NowHere Media https://www.youtube.com/watch?v=xF1fUT-NXHc, Accessed on 15.01.2021

37. AR for Construction © Microsoft https://www.microsoft.com/en-us/hololens, Accessed on 15.01.2021

38. Spine Days VR, an immersive educational medical VR experience. © Numena (Architects) https://www.numena.de/, Accessed on 15.01.2021



THE VIRTUAL EXPERIENCE

SPACE

As workplaces start adopting XR solutions to improve many of the challenges found in our hybrid offices today, we can expect a large part of human-centered interactions to occur in new immersive environments in the years to come. Some of those environments that might seem new for work have long existed in the video-game industry. Games have evolved from single-level maps to shared sandboxes (where players can travel and edit their virtual space) to shared 'infinite' universes. In fact, recreational virtual "work" is already widely used today, with many online multi-player games offering collaborative solutions.

Games are spatial experiences where aesthetic and social qualities also have real effects on coexistence and actions. In Second Life (secondlife.com), users from around the world come to socialize, play and work through their digital personas. The world of Second Life is built and modified by communities of virtual players, where virtual spaces are often inspired by real-world architecture. 'Buildings' are symbolic; virtually, a structure does not need to protect itself from 'real' problems (air circulation, light, rain, weight...). Their symbolic functions help give meaning to otherwise abstract spaces.[58]

But in a world where real world factors do not constrain architecture:

[58] S. Doesinger, *Space Between People: How The Virtual Changes Physical Architecture,* Prestel Publishing, Munich, 2008, p.65.

"...it becomes possible to look beyond architecture and instead discuss these underlying structures of architectural production. A place where we can rethink social concepts, work, life and networks and a possibility to stop thinking about what architecture looks like and start to engage in what architecture does."[59]

Virtual architecture has the power to socially engage people much more effectively than in the real world. Architects can build spaces that adapt and change depending on avatars' movements or decisions, essentially changing throughout people's journeys inside a space and giving a much more functional approach to architecture rather than just creating meeting rooms filled with chairs and tables.

[59] D. Harry, D. Offenhuber, J. Donath, *The Social Role of Virtual Architecture*, In The Space Between People, p.70.

MIT's Media Lab explored functional social architecture inside Second Life. In The Space Between People, they described an "Agree/Disagree"world they elaborated in which the space would change depending on each person's actions and position.[60] The environment encouraged users to interact with the space and each other. A user's position would highlight their stance and thus inform others on the progress of the group's efforts to reach consensus. In addition, the space would portray the history of users' paths and discussions inside it, and avatars could emphasize their viewpoint and presence. Actions, movements, and dialogue are translated into visual form. The space records change and allow for a clear understanding of

[60] Ibid, p.66-67.

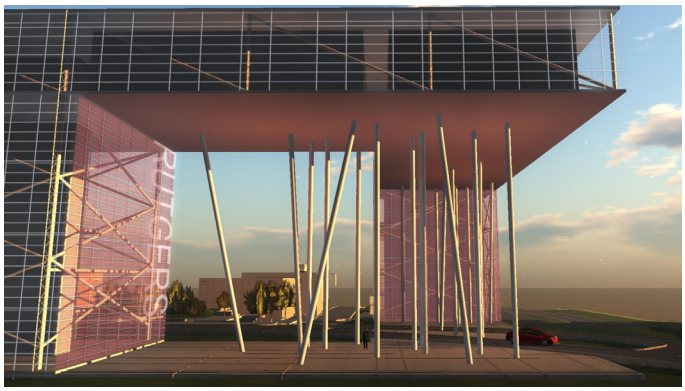
the group's collective views through the changing landscape of space.

Most current VR workplace solutions that aim to replace physical meetings do not utilize the vast possibilities that virtual architecture is able to offer. They reproduce 'real' solutions in virtual form, making users experience virtually what is better experienced physically. Future architects will have to resist copying 'natural' reality and start creating spaces that can better support different types of interactions and meetings in ways that may improve the existing experience, such as spaces that can record history or change depending on users' decisions: essentially building what cannot be built in 'real' space.

"For a collaborative design process, a space can maintain copies of itself that behave like a physical wiki. In a presentation space, the presenter's slides could literally unfold into a discussion space for conversations after the lecture."[61]

[61] D. Harry, D. Offenhuber, J. Donath, *The Social Role of Virtual Architecture*, In The Space Between People, p.69.

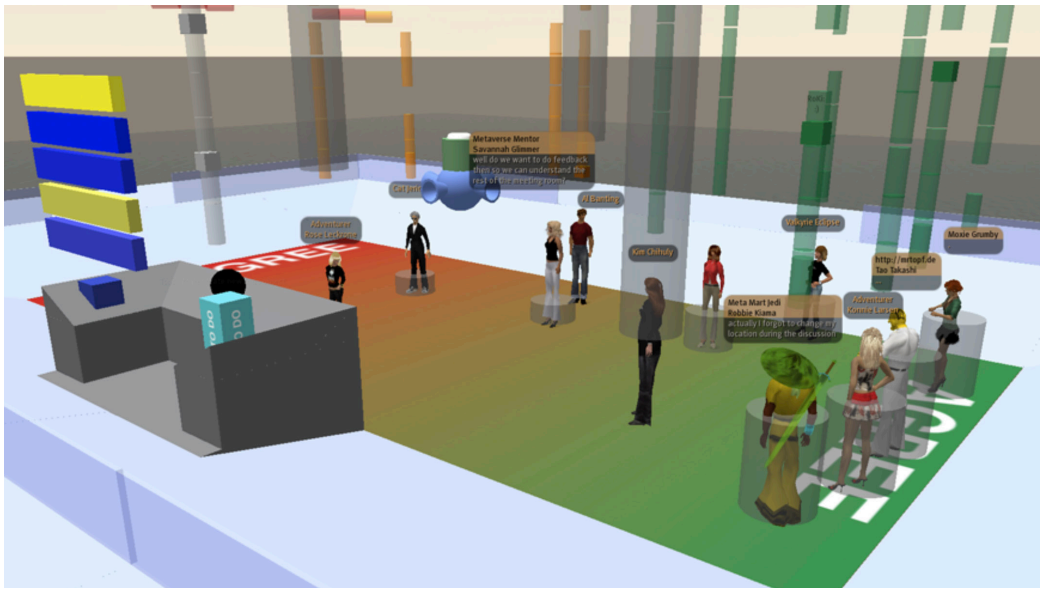
Furthermore, some games have proven to be great collaboration tools. *No Man's Sky* reevaluates the boundaries of virtual space. Here the player can explore not only the planet's depth but also entire planetary systems, galaxies, and the universe itself. Each world has its own ecosystems, species, and culture open for players to discover and collaborate in. People from around the 'real' world can work together to build bases on planets



39. Rutger Business School in Second Life © Ten Arquitectos https://archvirtual.com/2010/04/23/ten-arquitectos-design-for-rutgers-business-school-prototyped-in-second-life-and-opensim/, Accessed on 15.01.2021

40. A house for sale in Second Life © Roost via Second Life Marketplace, https://marketplace.secondlife.com/p/ROOST-Palm-View-House/9811902, Accessed on 15.01.2021

41. Agree/Disagree Space © Sociable Media Group/MIT Lab http://alumni.media.mit.edu/~dharry/infospaces/, Accessed on 15.01.2021



and travel through space with their spaceships.

Minecraft (www.minecraft.net) has created more digital environments than any other tool or software program.[62] The "sandbox" is made of hundreds of blocks representing different materials such as wood, glass, stone, etc. By virtually experiencing this new world from the perspective of the avatars, users briefly self-identify themselves in their new bodies and then turn their focus towards their environment. With no explicit purpose besides surviving, similarly to the real world, players choose to play however they wish and start to dwell and explore in their new world to fulfill their basic needs (security and food).

[62] J. Delaney, *Democracy, Video Games, and Urban Design,* in *Archecttonics of Game Space: The Spatial Logic of the Virtual and Its Meaning for the Real,* p.282

Heidegger wrote: "To be a human being means to be on earth as mortal. It means to dwell".[63]

[48] M. Heidegger, *Building, Dwelling, Thinking,* p.145

Crafting and building become essential elements of the game's experience, and players can choose to share this adventure with friends or strangers. Minecraft has a massive online community that regularly shares and collaborates on virtual environments. If seen as a CAD software, it would be the world's most popular design tool.[64]

[64] J. Delaney, *Democracy, Video Games, and Urban Design,* in *Archecttonics of Game Space: The Spatial Logic of the Virtual and Its Meaning for the Real,* p.284

"In the right hands, Minecraft transforms from a computer game into a computer-aided design tool, and moreover, it acts as an entire language of digital design, with the potential to overcome the

barriers of communication between professionals and laypeople."[65]

[65] Ibid, p.283

Minecraft introduces a new way of designing, building via our avatars. The more immersive method allows for a better sense of scale which can easily be lost when zooming in and out in traditional software with a bird's-eye view. Furthermore, when working collaboratively, users can easily interact with each other and better comprehend where each builder is located and what task they are working on, making for a much smoother and more natural design process.

42. A 'untouched' Minecraft World
© WallpaperCave,
https://wallpapercave.com/minecraft-world-backgrounds,
Accessed on 15.01.2021

43. User built Island in Minecraft
© Nvidia
https://www.nvidia.com/en-us/geforce/news/minecraft-rtx-dlss-official-release/,
Accessed on 15.01.2021

Additionally, the game's simplicity makes it easy for anybody to build and share their ideas which can prove very effective early in the stages of the design consultation, improving visual communication and accessibility to all people.[66]

[66] Ibid, p.291.

Architects have begun speculating what the future of collaborative work might look like outside of gaming. If we look at Soft Bodies' work, the near future is foreseen as mostly remote and solitary. The workplace is experienced virtually through mixed-reality environments and objects. MR furniture and devices would bridge different realms as users would use and experience them along with their XR headsets. "Imagining the home as a series of mixed-reality objects that enable us to share space and time regardless of where we are".[67] In Weighless Bricks Act II, Soft Bodies envisions the future of remote workers, how their shared workplace and home act as one space shared across multiple locations.

[67] P. Strunden, J. Cruwys, Brief Driems, Soft Bodies, http://www.softbodies.co.uk/brief-dreams.html Accessed on 3.01.2022.

" [...] through designing for mixed-reality, you can expand your perception of your body, and abstract banal working activities into something more physical and intuitive, which also taps into multiple senses."[68]

[68] Ibid.

Similarly, Space Popular predicts virtual communication devices will bring virtual worlds into our homes. Shared spaces created from overlapping

[69] Lara&Fredrik, The Venn Room by Space Popular - Two Dimensional Version, https://www.youtube.com/watch?v=wN-MPE_bhBZQ, 4.20.2020 Accessed on 17.11.2021

44. MR furniture in Brief Dreams © Soft Bodies http://softbodies.co.uk/brief-dreams.html, Accessed on 15.01.2021

45. Long Distance Collaboration, in Weightless Brick Act II: Collaboration (Below) © Soft Bodies http://softbodies.co.uk/wb-act-ii.html, Accessed on 15.01.2021

physical ones:

"When we gather virtually, we merge our homes with one another. From this overlay a new space emerges, a hybrid of the two, a new shared Venn room."[70]

[70] Ibid.

Our homes will integrate new devices allowing us to better communicate throughout different realms. In the virtual world, our position, movement, and ability to reach will be determined by the size of the 'real' room.[71] Needless to say, it is not only our virtual realm that is evolving but also our 'real' spaces and tools that are adapting to enhance our 'virtual' ones, just a few of the necessary steps needed toward greater remote cooperation.

[71] Space Popular, *Who Owns The Global Home?*, p.135.

46. Integration

47. Interface

48. Co-decoration

49. Still from The Venn Room Immersive Experience

46-49. The Venn Room
© Space Popular
http://www.spacepopular.com/exhibitions/2019---the-venn-room, Accessed on 15.01.2021

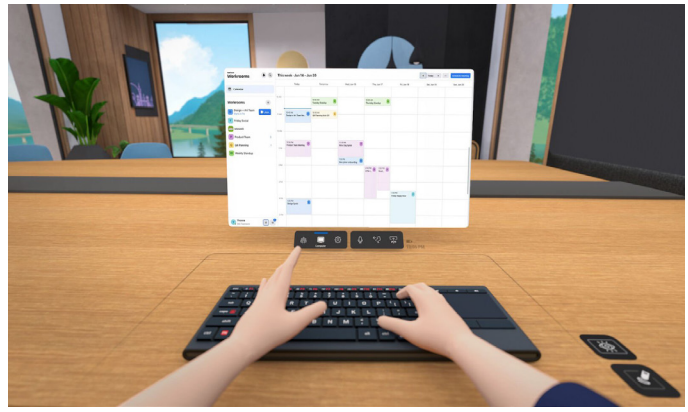
EXISTING APPLICATIONS

Many companies have started offering immersive workplace solutions as our need for remote collaboration and flexible work has continued to grow. They provide a glimpse of a future work style that is still in its early stages. Currently, these services seem to deliver more of an exciting introduction to the XR experience rather than a functional approach to immersive collaborative work.

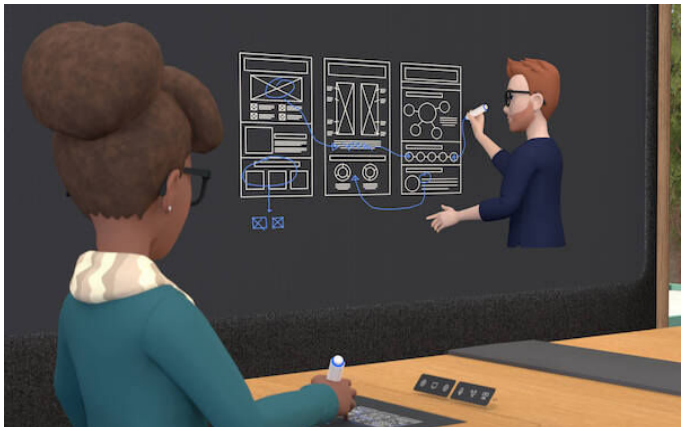
Let us take a look at Meta's (Facebook) Horizon's Workrooms. They propose versatile virtual spaces that can adapt to fit the size of the group and change depending on the type of meeting, collaboration, conversation, or presentation as defined by them.[72] Inside, users can interact with each other through their customized avatars and collaborate using a blackboard and via other services integrated into the platform. Users can enter either in 3D form (avatars) by VR headset or 2Dimensionally with their computer camera (appearing on a screen). Users can share presentations and import documents from their personal computer for collaborative work, displaying them on the virtual screen that also serves as a blackboard during brainstorming sessions. Meta's Horizon Workrooms allow us to experience a first feeling of shared presence. However, non-VR users cannot interact and are left as simple spectators, bringing the same 'hybrid' work issues found in the physical workplace into the virtual realm. On the other hand, some competitors offer a more inter-

[72] Meta, *Introducing Horizon Workrooms: Remote Collaboration Reimagined,* Oculus, https://about.fb.com/news/2021/08/introducing-horizon-workrooms-remote-collaboration-reimagined/, 19.08.2021, Accessed on 3.01.2022.

50. Hybrid work in Horizon Workroom's



51. Computer and keyboard integration



52. Blackboard collaboration

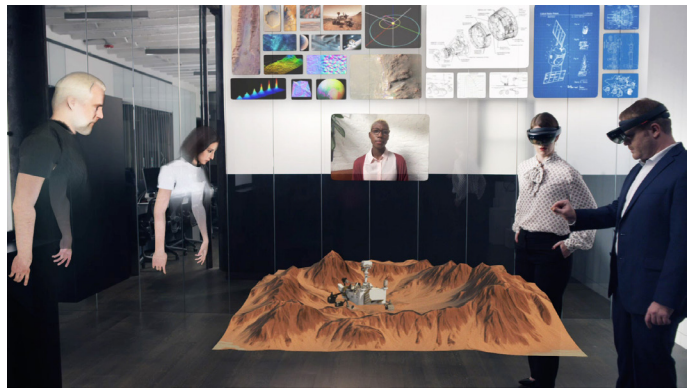
50-52 © Meta
https://about.fb.com/news/2021/08/introducing-horizon-workrooms-remote-collaboration-reimagined/,
Accessed on 16.01.2022

active solution for cross-platform work.

Spatial IO[73] allows all users to interact with their avatars, generated from images; they offer a more realistic representation of each person. This form of interaction facilitates communication between all parties and enables a more equitable form of participation. However, those joining via computer experience a third-person point of view and are naturally less immersed in their environment compared to colleagues using VR or MR headsets. Besides inserting traditional documents, Spatial IO allows importing 3D objects that can easily be scaled, rotated, and displaced inside the shared space, encouraging new ways of collaborating otherwise impossible in traditional work. Furthermore, a wider range of spaces is offered by the company. They understand that work-related gatherings may require a more extensive choice of spaces to choose from depending on use. Hybrid work can be conducted using augmented reality, or if users wish to meet in VR, they can choose a variety of locations more adapted to the type of information they choose to show; museum-inspired spaces to showcase products or different projects, meeting rooms for slide shows, large pavilions for more informal gatherings, and more importantly, users can create their own environment for a more specific use.

[73] Spatial IO, *Explore The Metaverse*, https://spatial.io/, Accessed on 3.01.2022.

53. Hybrid work in Spatial IO



54. Hybrid work in Spatial IO

55. 3D Object Integration

53-55. © Spatial IO
https://spatial.io/community,
Accessed 4.11.2021

EXISTING APPLICATIONS

SOCIAL VR

Creating and adapting the environment is part of the experience, which is why some companies have focused on doing precisely that. Mozilla Hub's[74] allows users to create environments with a large variety of tools. Users can either import their own 3D files or use the integrated online modeling software and 3D object search engine for a quicker and simpler creation process. Furthermore, users are free to choose whatever avatar they want, further enabling a more expressive and anonymous use of their gathering space in a similar way to many " Social VR" platforms.

Moreover, Social VR has seen a significant increase in users since the pandemic. People are spending more time on social media[75], and as they seek better connections, social VR platforms are becoming their spatial alternatives. VR CHAT, one of the first social platforms of its kind, has over 25'000 user-created worlds[76] and is seeing record high usage[77], a monthly increase of 1'183% in December 2021.[78] As these values are expected to increase, so further will virtual social networking and XR adoption.

"*Social VR platforms such as BigScreen VR, VRChat, Sansar, High Fidelity or Mozilla Hubs are pioneers of the immersive world that is expected to become widespread with the arrival of 5G and the mainstream headset or glasses. These spaces have emerged out of a natural evolution of the assembly space online. The chat room and later social media have become powerful extensions of physical forms of assembly in public space*".[64]

[74] Mozilla Hub, *Meet, share and collaborate together in private 3D virtual spaces,* https://hubs.mozilla.com/, Accessed on 3.01.2022.

[75] D. A. Williamson, *Uptick in US Adults' Social Media Usage Will Likely Normalize Post-Pandemic,* eMarketer, https://www.emarketer.com/content/uptick-us-adults-social-media-usage-will-likely-normalize-post-pandemic, 22.06.2022, Accessed on 3.01.2022.

[75] VR CHAT, *Create, Share, Play,* https://hello.vrchat.com/, Accessed on 3.01.2022.

[76] B. Lang, *Social VR App 'VRChat' is Seeing Record Usage Amidst the Pandemic,* https://www.roadtovr.com/vrchat-record-users-coronavirus/, 22.9.2021, Accessed on 3.01.2022.

[77] Steamcharts, *VRChat,* https://steamcharts.com/app/438100#All, Accessed on 3.01.2022.

[78] Space Popular, *The Civic Program: Architecture for The Immersive Internet,* Architectural Association School of Architecture, 2020, p.9.

56. Mozilla Hubs, generic room
© Mozilla Hubs
https://hubs.mozilla.com/oTVHtR3/vital-sharp-adventure
Accessed 4.11.2021

57. VR CHAT
© VRCHAT Inc.
https://www.oculus.com/experiences/quest/1856672347794301/
Accessed 4.11.2021

CONCLUSION

In the near future, changing workplaces will be as simple as clicking on hyperlinks to switch virtual environments as we are no longer compelled to work in a specific location as was the case since the advent of virtual communication. Work can be done from everywhere, including on the go, at home, at work, in third spaces, and soon in the metaverse, because we have access to flexible communication devices that grant us the liberty of having our documents with us all the time. This will bring about a new era of facilitating flexible employment that is no longer constrained by time or distance. Nonetheless, much-needed changes are still required to eliminate unnecessary commutes and global travel.

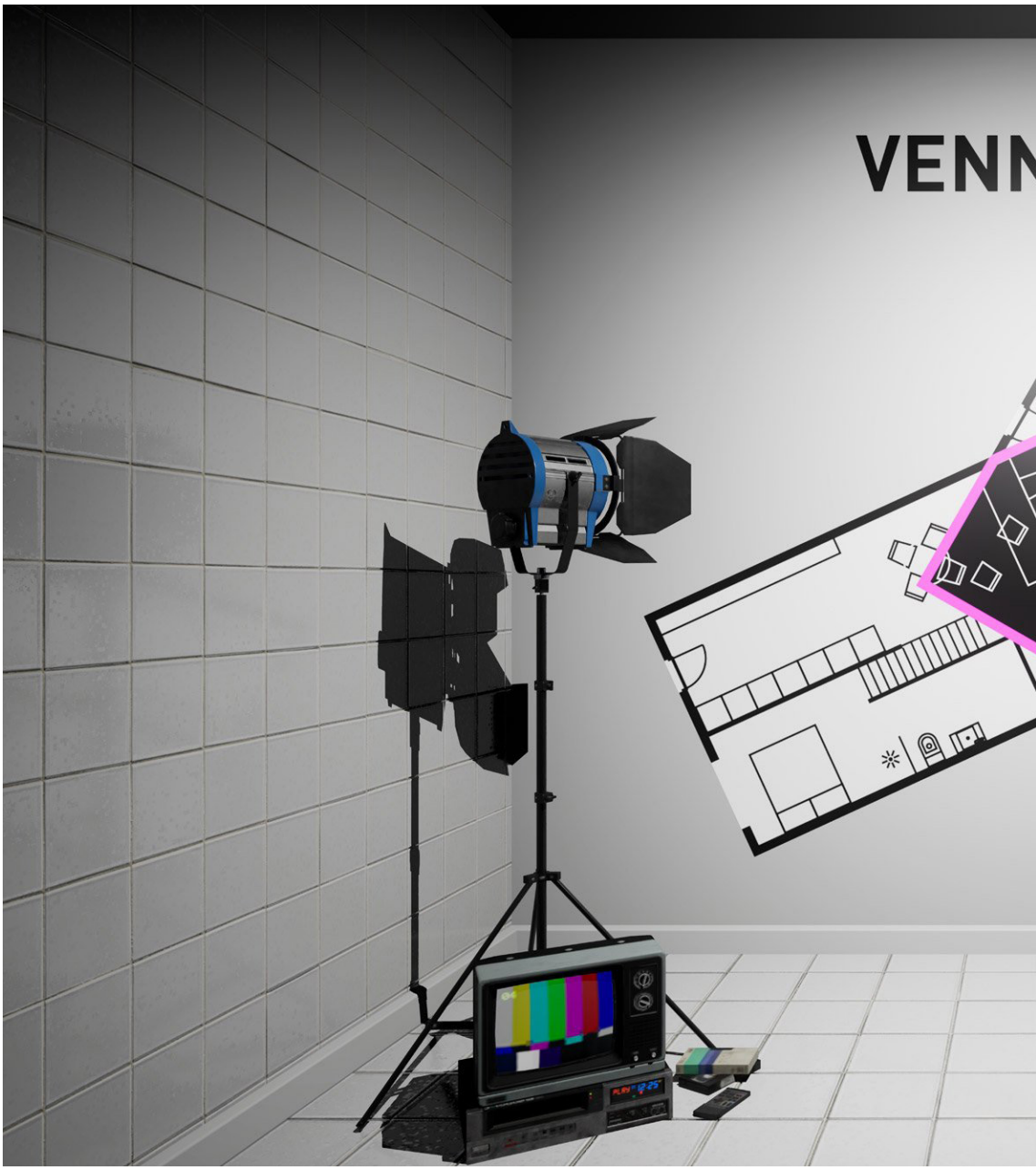
The role of architecture is emancipating from the physical realm. Digitalization is closing the gap between realities, and as they become more entwined, our reality will evolve in tangent, and in new ways, we are only coming to realize. Architects will have to break free from traditional thinking methods and learn to construct in new ways, ones that aren't bound by physical laws and that can add value and complement our 'real' world. Current solutions provide an engaging perspective on virtual meetings and gatherings, but they are unable to provide the same level of interaction and functionality as when people are physically present. Virtual worlds still have a lot of room for improvement and their interactions do

not currently appear to be capable of replicating the same facial expressions, gestures, touch, and sensations required to convey a spectrum of primordial emotions when meeting in person. No longer designing just space, architects will have to acknowledge the new possibilities and tools at hand when creating. We interact with and understand our environment and others through our bodies and our senses. Architects, for the first time, are capable of choosing how we communicate, interact with others and perceive our surroundings, thus creating a more holistic experience. New capabilities that can improve our experiences online by reducing inequalities, filtering harmful content, and improving collaboration to name a few.

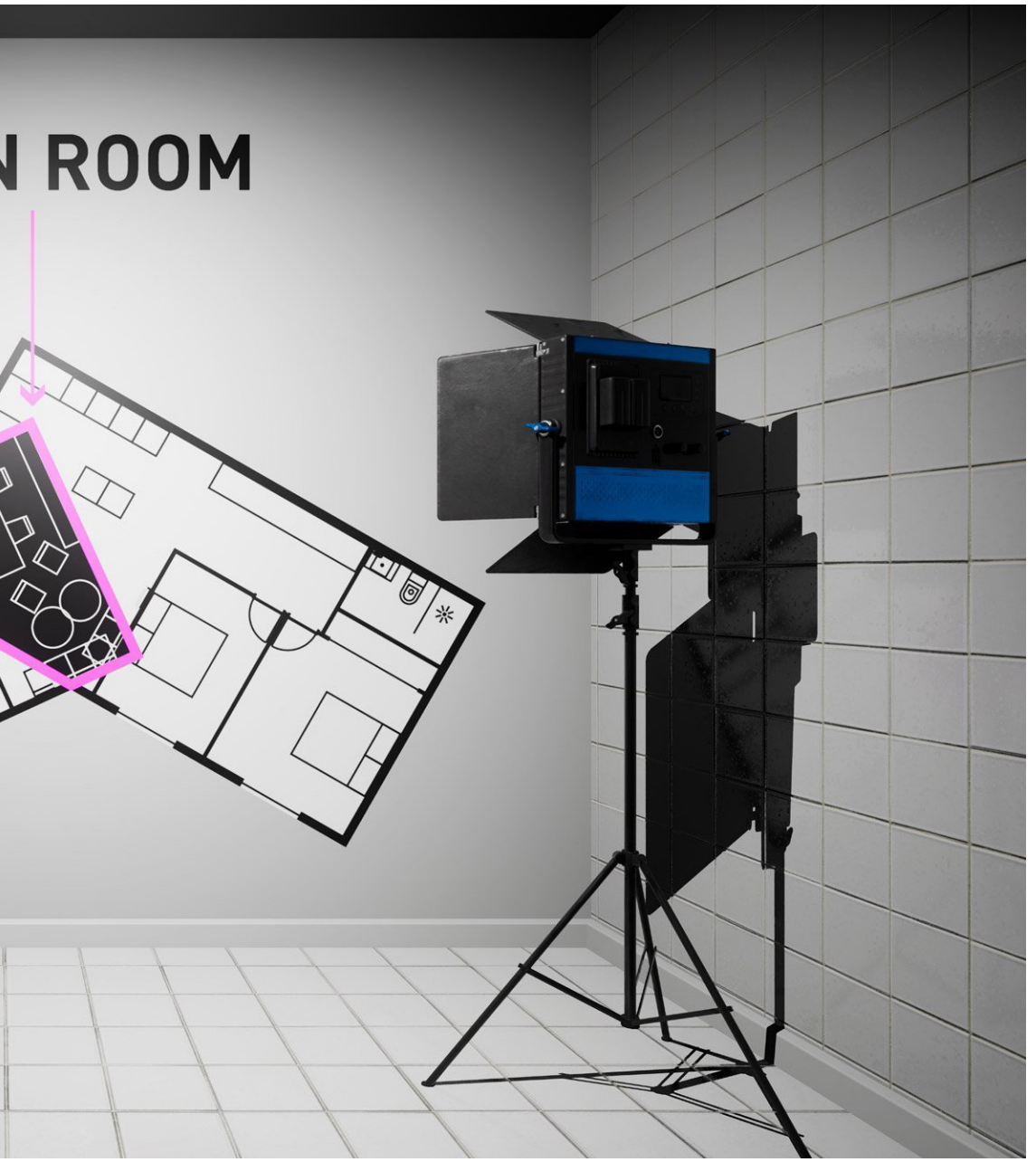
These digital reforms are vital for a sustainable future as we cannot continue to pollute our planet in the manner that we do so today. To secure a long term impact these innovations will have to be adopted by industries such as construction and transportation among other major contributors to climate change. Many other domains have begun to adapt, and it is now time for some of our most fundamental ones, such as traditional movement and space, to make the transition as well.

Needless to say, each reality has something to give, and they all coexist to help us enhance our personal lives and our professional ones. Extended

realities will never be able to completely replace the experience of human connection, nor should they, but they will aid us in our task to improve the means by which we collaborate.



58. Stills from The Venn Room Immersive Experience
© Space Popular
http://www.spacepopular.com/exhibitions/2019---the-venn-room, Accessed on 15.01.2021


N ROOM

EPILOGUE

This chapter investigates the potential applications of extended reality environments in the workplace.

By 2030, XR technology would have advanced sufficiently to reduce most international travel. Transitioning from 'real' to 'virtual' spaces has become second nature for the majority of people. Mixed-reality furniture and tools, which aid in spatial awareness and interaction between realms, are now available wherever there is an internet connection.

Following the narrative of a young businessman living in one of the Middle East's most developing countries, he walks us through his day as he prepares for an important meeting with foreign clients. His company constructs and rents physical office spaces to international clients looking to enter a new market. On a daily basis, our character collaborates, meets, and presents using his extended-reality glasses. Today, he hopes to complete one of the most important deals of his life.

HOME

FOCUSED WORK

READING/PLANNING

8:00

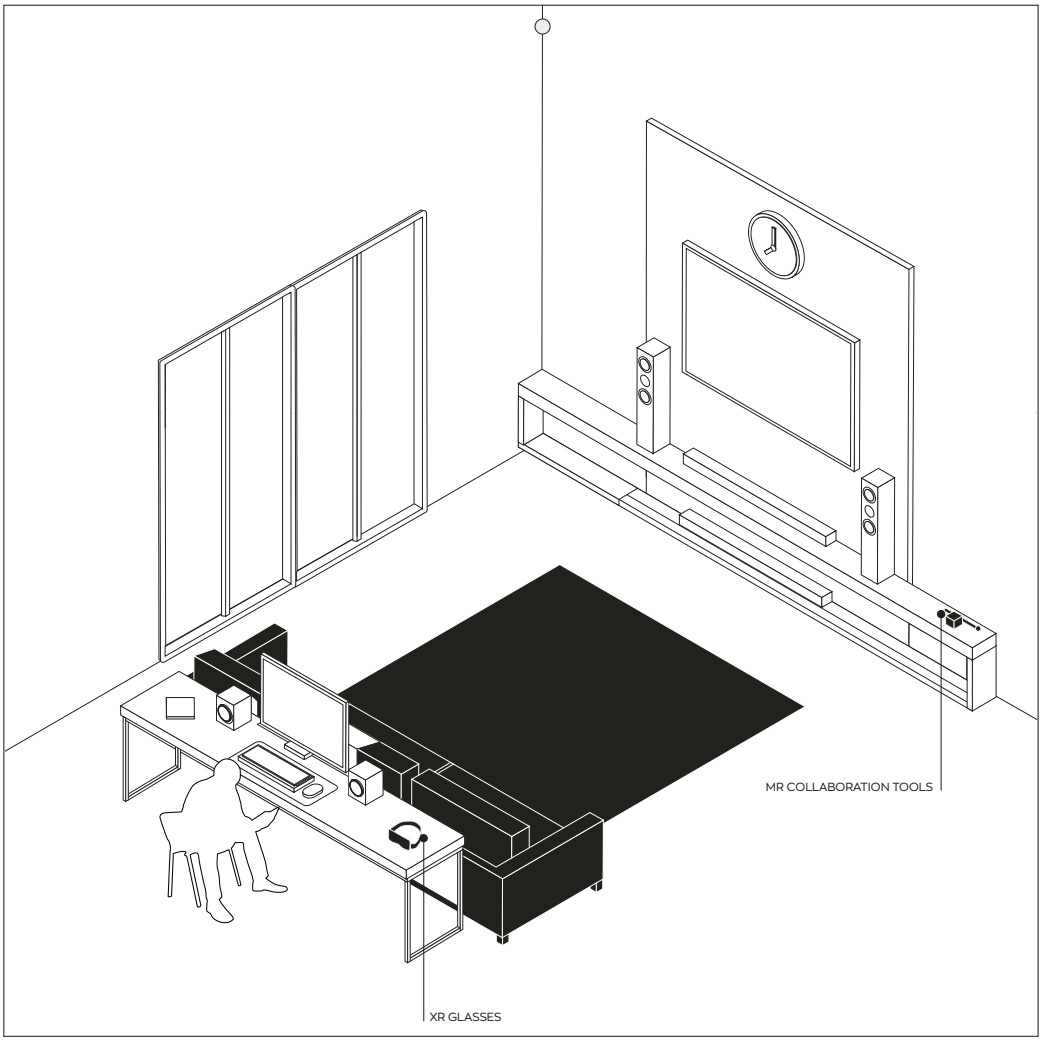
switches off alarm

It's 8 a.m., and you appear to be running late for work. You dash into the shower and change your clothes. Because of the construction near the main road, commuting time has recently been quite long. "They're putting up even more houses," you think.

You decide to put on your XR glasses to check on traffic; "estimated arrival time: 50 minutes."

But that's fine because you despise the stress of rushing to work and even more the frustration of standing in line. You'd rather spend that time with your family, eating breakfast.

You then proceed to your home office and shut the door. It's time to go through some e-mails and plan out the rest of the day.



A. Physical Space
Focused Work,
Tasks include reading, writing and thinking deeply. Distractions are unwelcome.

HOME
STIMULUS DRIVEN ATT.
COLLABORATION
10:30

A notification appears.

It's from your coworker and close friend Omar: "Quick call? Have you completed the presentation? This afternoon, we have to present it to our clients."

You initiate a SpatialCall (" Spall" as you refer to it):

“Hey! Yes, almost done; just a few last-minute changes."

You show him what you've been working on by projecting it into the room.
"What are your thoughts?"
" It's good," says Omar, "but there have been some minor changes. It's actually 45 USD per m^2 here," he adds.

He takes out an MR pen, and the two of you begin working on the document.

"We'll be faster together."

B. Augmented Space
Stimulus Driven Attention
Tasks include collaboration and ideation, scheduling meetings, and others where distractions are welcome.

CITY
DIVIDED ATTENTION
INFORMAL MEETING
12:15

You're now having lunch with Ricardo at the Italian restaurant next door; he's an architect you met abroad.

He shows you a virtual model of the office building he designed, which is the one you want to rent to your clients.

" Look, I made it interactive," says Ricardo.

"You can now move between construction phases, and I've added several portals to other areas."

You notice that the table and chairs from the restaurant have merged with those from the virtual office. You've entered virtual reality.

" I like what you did with the place; let's take a walk around."

As you walk through the space, you both begin to project the presentation's slides onto the walls and surfaces.

" It will be like walking through the presentation."

C. Extended Reality
Divided Attention
Focus directed towards multiple tasks and ideas. Willingness to attend only to relevant stimuli.

METAVERSE
EXECUTIVE ATTENTION
FORMAL MEETING
16:00

It's almost time for the meeting, so you enter one of the nearby smart rooms, put on your XR glasses, and get ready.

You're rehearsing for the pitch in VR when the two representatives appear out of nowhere. You lead them around the floor and present your proposal.

When you reach the other end, turn around and face the lobby, pressing one of the hovering buttons you've placed around the floor, the entire structure begins to change as you demonstrate the various stages of development. Structure, MEP, finishings, and furnishings all appear in chronological order in front of your eyes.

" How big is the surface area?" enquires one of the representatives.

"700 square meters per floor," you say in response to the dimensions of the space as they appear on the floor.

They seem to enjoy the space. Riccardo activates a portal and invites them to the negotiation room.

" It's time for you to close the deal," he says.

D. Virtual Reality
Executive Attention
Focus directed towards regulating responses. volontary control of behaviour in accordance with goals.

OFFICE
SELECTIVE ATTENTION
CELEBRATION
19:20

The meeting went well, and you got the deal.

You can see some colleagues preparing drinks and others bringing food to the cafeteria.

Almost everyone has arrived. Those who are currently abroad are joining via a link you sent.

You're overjoyed to finally meet them.

Omar approaches you and gives a toast.
" I am delighted to announce..."

E. Augmented /or Physical Space
Selective Attention
Ability to focus on a specific stimulus while in presence of diverse distracting stimuli.

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