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Gaspard holds a Msc degree in Industrial Design Engineering from TU Delft with a specialisation in Sustainable Development. He has worked on a very wide degree of technical and societal projects in many different capacities, but since 2010 all of them have been with a sustainability transitions theme; portable weather stations for arctic explorers, human powered high speed transport, electrical mobility, plastics recycling and product upcycling with 3d-printers and more. Lately his work has focused more on the digital aspect of sustainability transitions.

Digital Society School is part of the faculty of Digital Media and Creative Industries at the Amsterdam University of Applied Sciences. Gaspard works there in the capacity of Digital Transformation Designer. In this role, he coaches teams of trainees from all around the world in solving challenges of commercial or academic partners related to the UN Sustainable Development Goals, as well as developing prototypes for new types of education using extended reality technologies.

In 2017, he was also selected as part of the Talent Development cohort of 20 Dutch designer talents of the Creative Industries Fund NL. In this program he was able to dive into questions around the use of data as a material in the design profession. In

the projects he developed he addressed the concerns around privacy, ethics and dispositions of power in the creation of digital systems. As a result he also published and presented about the philosophical branch of 'new materialism' as an approach to understanding these developments.

He is also a fellow at Blue City, an incubator in Rotterdam for startups in the Blue Economy, where he regularly coaches teams on developing new product propositions together with local governments to eradicate waste, drawing on his own experiences setting up ventures, acquiring funding, testing propositions in the market and reflecting on the desired societal impacts of these ventures. His own startup Good Fashion Friend was supported by the Rotterdam municipal funds program Citylab 010 .

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ISSN: **2582-8304**

Extended Reality (XR) in Education, Between Promise and Practicalities

Reflecting on prototyping augmented reality video filters from a transition framework perspective

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Keywords:

Education, practical, soft skills, extended reality (XR), virtual reality (VR), augmented reality (AR), video meetings, digital divide, accessibility, inclusivity, embodiedness, experience, learning, transition, transformation, society, equal opportunities, sustainable development goals, prototyping, tools, implementation, application, paradigm change, socio-technical regime, remote, hybrid

Abstract

A digital transition in education is underway and the recent pandemic and lack of embodied experience in video meetings is creating the need for innovations. Three experiments were conducted at the Amsterdam University of Applied Sciences (AUAS) - Digital Society School with the use of augmented reality (AR) filters for video meetings. We've found through these experiments that the element of fun is something that was sorely missing in video meetings and is even crucial in creating better bonded and therefore better performing teams. We look at these experiments as niche innovations and as points of departure for analyzing how the current socio-technical regime might be changed using the Dutch Research Institute for Transitions (DRIFT) framework. We question how much this transition is

inclusive by considering the accessibility and usability of these innovations and speculating on further developments by unpacking recent market events. The AR filters require some installation which limits accessibility and AUAS work culture seems to be resistant to adopting remote work practices. We describe the promises that extended reality (XR) technology brings to education while questioning which of these promises find practical fits and for which groups of people. The young and techy for example are already used to AR filters on smartphones. This helps us glimpse how the transition might unfold.

Introduction

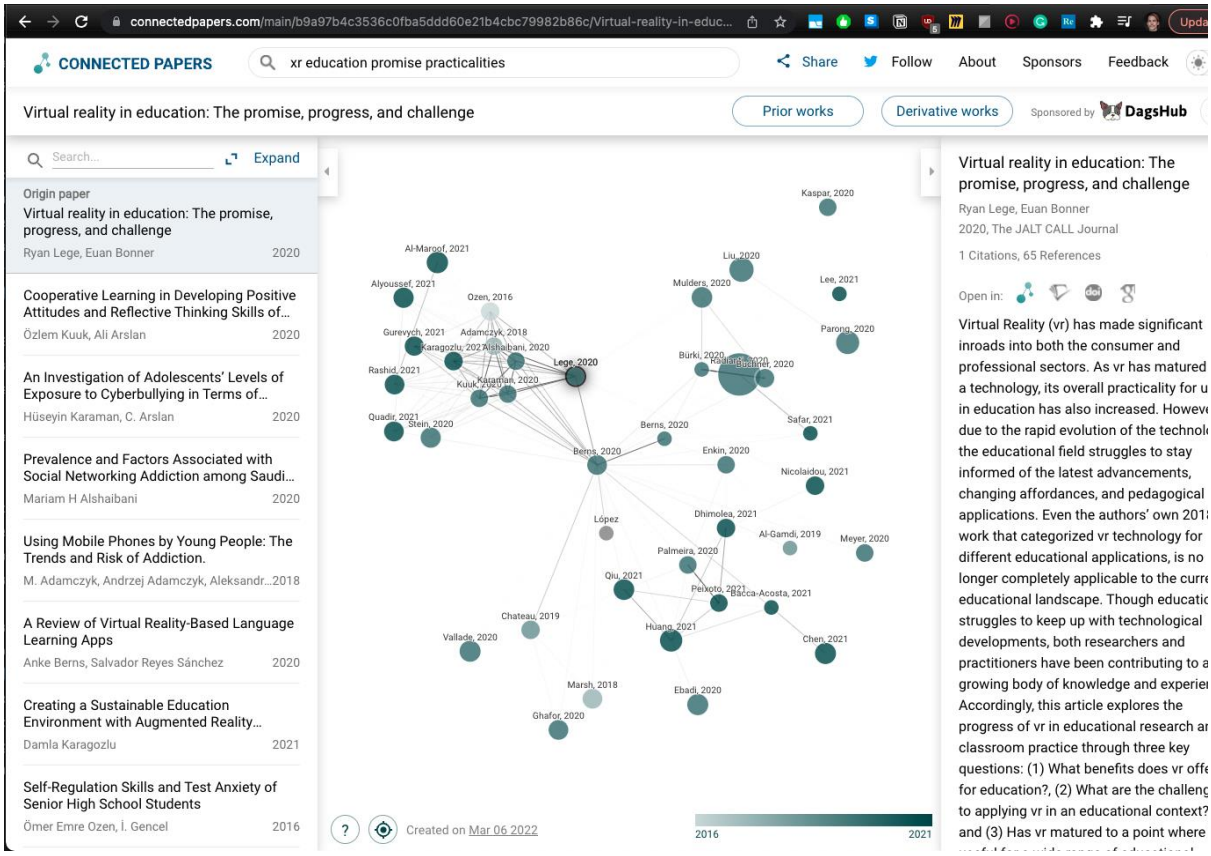

Figure 1: A mapping of research on XR in education with the connected papers tool.

This paper presents three experiments in which extended reality (XR) technologies have been applied in an educational context to reflect and speculate on the way that a socio-technical transition

might be taking place in education. These experiments have taken place at the Amsterdam University of Applied Sciences (AUAS), in the Netherlands where XR technologies are both being researched and tentatively applied in education. More specifically, the Digital Society School researched questions around the inclusivity, accessibility, and new affordances of XR technology in various projects.

We examine these experiments as niche innovations within the transition framework of DRIFT[35] to say something about their influence on the current socio-technical regime. At the same time, we attempt to distinguish between innovation versus hype in the way the Gartner Hype cycle shows us how new technologies find a lasting market fit.[36] We contrast our experiments with other projects or experiments within similar educational contexts to analyze which applications are adopted and thus seem to find a practical fit so that they might change the socio-technical regime.

Some trends and developments that influence a transition can be considered part of the global landscape. The recent rebranding of Facebook to Meta[37] is a market development. In addition, the COVID pandemic has impacted in-person teaching[38] thereby opening up the space for remote or virtual innovations. (XR ERA and Rui) The first development might mean broader accessibility to the technology, but with what kind of data will users pay for it?[39] Oculus users must login via the Facebook platform and studies have shown that VR use data can fingerprint users[40]. The

[35] https://drift.eur.nl/publications/sustainability-transitions-research/

[36] https://www.gartner.com/en/research/methodologies/gartner-hype-cycle

[37] https://www.theguardian.com/technology/2021/oct/28/facebook-name-change-rebrand-meta

[38] https://sdgs.un.org/goals/goal4

[39] https://thenyledger.com/tech/facebook-patents-reveal-how-it-intends-to-cash-in-on-metaverse/

[40] https://www.nature.com/articles/s41598-020-74486-y

latter development, COVID, has spurred very concrete needs in (remote) education. Furthermore, it has revealed the lack of certain affordances, like more embodied forms of communication, or inclusivity of prevalent technologies, like teachers and students aptitude for using digital tools. This apparent lack is what has inspired our experiments.

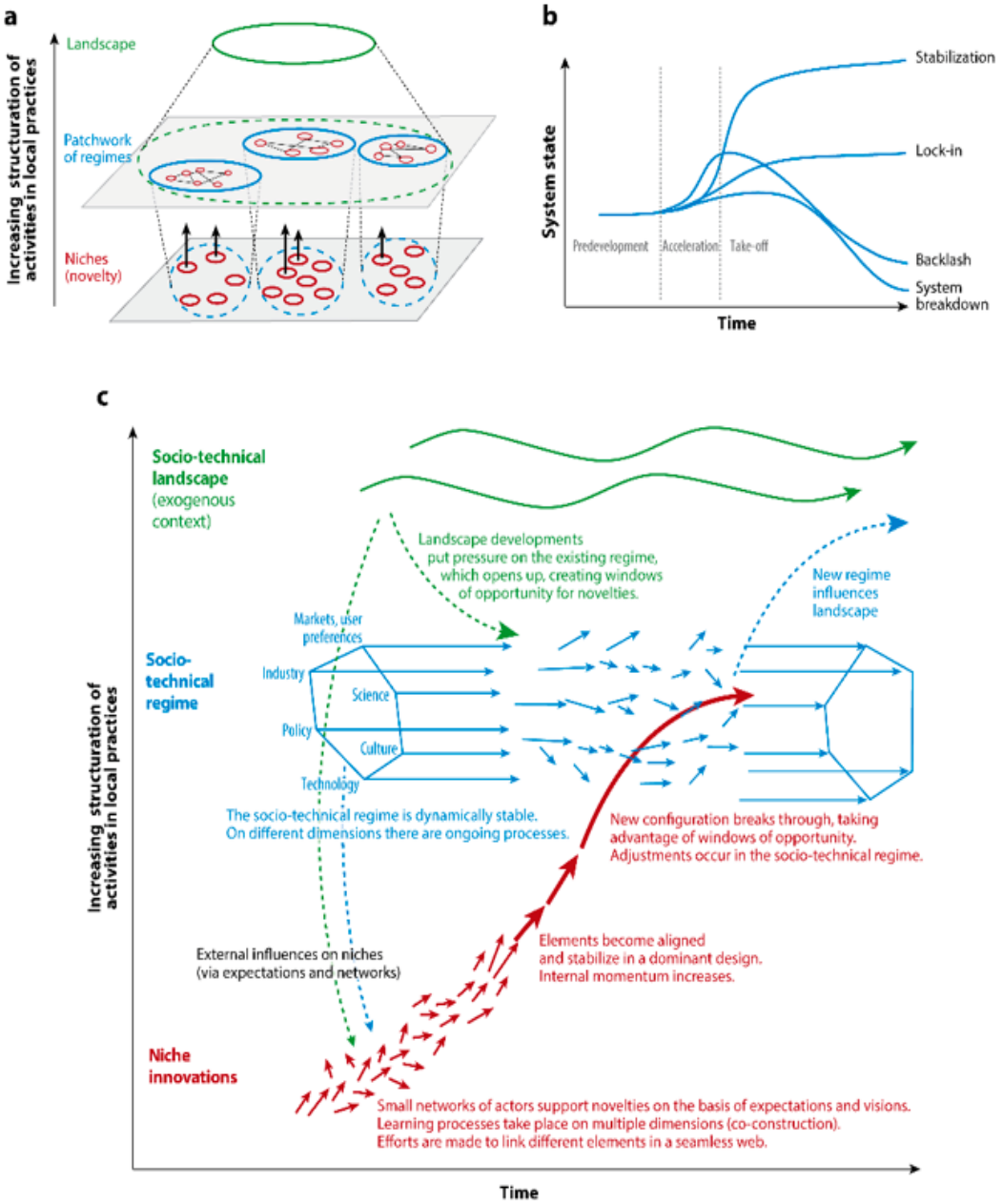

Figure 2: A schematic of the transition framework of DRIFT by Loorbach et al.

Situating our work

The AUAS is a university that places more emphasis on education and preparing students for the workforce with practical skills than on academic research as opposed to, for example, the University of Amsterdam (UVA) a sister university based in the same city. The COVID pandemic presented a challenge to AUAS. Digital channels of education delivery were shown to be insufficient to transfer hard, technical skills, as well as soft skills needed.

Practical skills in virtual or hybrid education

Theoretical or text-based research and education uses modes of learning that are more easily facilitated with today's prevalent personal computers and software than learning that happens in physical settings connected to craftsmanship. For example, learning how to work with a knitting machine at the Amsterdam Fashion Institute (AMFI) requires the development of motor skills and engages a student's creativity in more embodied ways than working on a computer, even if they are designing clothing items in 3D software.

Extended reality (XR) technologies, including virtual reality, augmented reality and combinations or extrapolations of those, create affordances beyond more conventional human-computer interfaces such as (touch)screens, keyboards and (scrollwheel) mouses. For example, XR can support learning to use machinery such as knitting machines, surgical equipment, or arduinos. AUAS has already created filmed instructions of how to use a knitting machine, as part of a growing video library[41], which saves teachers some time doing introductions but is of course no replacement for actually learning by using the machine. The

[41] ***https://hva.nl/webcolleges-met-vr-brillen-wint-3e-prijswint-3e-prijs.html***

company Osso VR[42] gives users elaborate haptic feedback through controllers that can take (part of) the form of actual surgical equipment or in the form of gloves, showing that VR can support learning in more embodied ways.

Practical training in "soft" skills

Not only are technical or "hard" skills a challenge to teach across digital mediums, but it is also challenging to teach "soft" skills learned through interaction with others. Indeed, soft skills were the focus of our experiments. A fashion designer must learn to pitch his, her or their designs by practicing public speaking and learning to deal with the fear of standing in front of live audiences. A surgeon must learn to have difficult conversations with patients and their families. Training these interpersonal and emotional skills is best facilitated by immersion in the real context, such as internships.

Research from the Stanford Virtual Human Interaction Lab[43] has surfaced that the conventional computer interfaces limit or skew the interactions that this kind of emotional learning requires. For example, the arrangement of cameras and screens in video calls forces users to focus intently on faces, thereby overestimating social cues and increasing stress, while in physical meetings attendants more often let their gaze drift and are not seeing an image of themselves.[44]

Research at the AUAS in the past years has focused on the use of VR to stimulate reflection on emotional competencies of staff. A

[42] https://www.ossovr.com/post/virtual-reality-for-surgical-training-101-the-ultimate-guide-to-vr-in-healthcare
[43] https://www.stanfordvr.com/pubs/
[44] https://www.stanfordvr.com/pubs/2021/12254-2/

project on the need for staff to be trained in having conversations with parents from diverse socio-economic backgrounds exemplifies how immersion in a certain storyline with unknown characters can develop better empathic and communicative skills and how such an application could contribute to equalizing opportunities in education. [45] [46] In this case VR allows staff to experiment with conversations without having to worry about saying something that they cannot take back. Another project is premised on the immersiveness of replaying class recordings in 360 view to facilitate coaching and self-improvement of staff.[47] Much like the promise of the company AION sports to simulate certain soccer match scenarios from multiple perspectives in the field[48], a teacher could take the position of their student in a class they gave.

Theory, hypotheses and experiment design

In this section we will explain how we came to our hypotheses and how we framed our experiments around them. We created our experiments by reflecting on the possibilities of XR technologies to provide missing interactions/affordances from current screen based technology, offer experiences beyond what is possible in real life[49] as well as by reflecting on how it could relieve the impossibility of meeting physically due to the pandemic.

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[45] ***https://www.hva.nl/urban-education/gedeelde-content/projecten/urban-education/het-opleiden-van-docenten-met-virtual-reality.html***

[46] ***https://www.hva.nl/kc-onderwijs-opvoeding/gedeelde-content/nieuws/nieuwsberichten/2022/02/onderzoek-oudergesprekken-trainen-met-vr-brillen-wint-3e-prijswint-3e-prijs.html***

[47] ***https://www.hva.nl/etalage/gedeelde-content/grassroots/blogs/beeldcoaching-docenten-vr/2018/beeldcoaching-docenten-met-behulp-van-vr.html***

[48]***https://aionsports.com/#Immersive-Training***

[49] ***https://researchwiki.solo.universiteitleiden.nl/xwiki/wiki/researchwiki.solo.universiteitleiden.nl/view/VR%20in%20Unity3D/1%20VR%20and%20XR%20basics/***

Using AR filters to enhance layers of context in video calls

With learning going increasingly online during the pandemic, being teachers ourselves, we reflected on how both the increase in the amount of video meetings versus the lack of physical classes were making social interactions more strenuous. Bailenson et al (Stanford Virtual Interaction Lab) explain this has to do with the increased focus on people's faces that video calls create. In addition, video interactions can be too easily stripped to the purely transactional. We miss contextual cues, e.g. provided by body language.[50]

This decreased amount of time together in real life and the increased transactionality of the video meetings may also cause staff or students to feel less connected to their colleagues or peers. This feeling of connection or belonging is important in order to foster things like trust and support that makes teams perform better. There is an urgent need to reflect on these less tangible aspects of the work in education, what value they bring and how we can recreate informal social interactions.

The first experiment was premised around adding layers of context to video meetings, by making practical use of AR filters. What inspired this experiment was to add additional layers of context into video calls and to make video calls more lightweight and fun. Students of the millennial and gen z generations are already familiar with AR technology experienced through their smartphones, therefore bringing this into the classroom could be relatively easy.

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[50]https://medium.com/included-vc/reimagining-worlds-for-w%CC%B6o%CC%B6r%CC%B6k%CC%B6-life-7177e51b9c72

To ideate on and create a useful AR filter, a collaboration was made with Sander Veenhof[51]; an artist who is pushing the limits of this technology in a creative and playful way.

The Bono's Hats AR filter

Using our reflections on the way social interactions were changed through video meetings, we thought of a method that is applied in classrooms to stimulate group interaction called: Bono's Six Thinking Hats. This method requires participants to put on a hat that represents six different dimensions of thinking or attitudes from which someone can be approaching a meeting; emotionally relating, managerially controlling, positively reinforcing, negatively critiquing, creatively associating or analytically observing. Wearing a specific hat makes both the wearer conscious of their attitude as well as making that explicit to other participants.

Our hypothesis was that wearing hats can relieve some of the strenuous focus that video meetings create by helping the wearer to communicate to others more visually and implicitly aspects around their current state of mind. At the same time, wearing different hats could break the monotony of meetings, perhaps making them more enjoyable, while having a purpose. Continuing from the reflection on the challenge for teachers to include all students in a class, we hypothesized that it could be useful to get real-time feedback on how much a student has been participating in a video meeting. This is where the possibilities of the digital medium can add something beyond what physical hats in a classroom could; time wearing a digital hat is more easily quantified.

[51] https://sndrv.nl

Prototyping with Lens Studio

The company Snapchat has a software that can be freely used for people to make their own video filters called Lens Studio. Combined with the Snap Camera software this allows people to create virtual cameras on their computers, that includes any filter created with Lens Studio, which can then be chosen as the default camera for video calls in software such as Microsoft Teams, Zoom or Google Meet. These filters cannot be used on Instagram because Meta (Facebook) has created a different software eco-system to create, host and apply filters.

At AUAS and many other educational institutes, Microsoft has become the preferred supplier of company communications software. Therefore, the choice to develop something on this platform should have a broad reach.

Experimental process and results

Bono's Hats filter meeting

After creating the hats filter we instructed a project team at AUAS to use the filter during a one hour meeting. In this meeting the team was discussing a design and how to choose from different concepts. We explained the use of the hats briefly before starting the meeting; Bono's method as well as how to change hats and see the statistics; how long any hat has been worn. In this experiment we had participants originating from Brazil, Italy, Czech Republic, Russia and the Netherlands aged between 21 and 35.

Figure 3: A screenshot of the meeting recording in which a design team used the hats.

It surprised us that the hats were also being used while people were not talking, more akin to the way that emoticons or reactions can be used in meetings to visually signal for example their appreciation. We could say that Bono's method has not been applied how it was originally intended. However, there was still a positive effect to be observed which we concluded when we interviewed the participants. One participant mentioned that the meeting became a lot more fun while remaining productive. Another participant mentioned that it was nice to be able to be more clear about their emotions or intentions with the hats.[52]

Training the trainers

Over the course of two two hour workshops, we also introduced the hats to other educators. This was a completely remote organized event in which we introduced these hats and other virtual meeting platforms as potential tools for education. In this

[52] ***Video presentation of the hats filter development process and meeting evaluation https://youtu.be/xOWAdPM2B64***

experiment, we had educators from Lithuania, Italy, Finland, Brazil, and the Netherlands aged between 31 and 45.

The most noticeable thing was how difficult it was for our participants to install the software compared to the participants of our filter-making workshop (see next experiment) in which only two or three out of twenty faced difficulties. Besides the hats filter we also explored different meeting platforms such as Gather.town and Mibo (figure 4). Since these platforms were browser-based, no installations were required, which made it easier to get started. While the participants appreciated being introduced to these different technologies, they remained critical of their application because of differences in educational approaches. (appendix B)

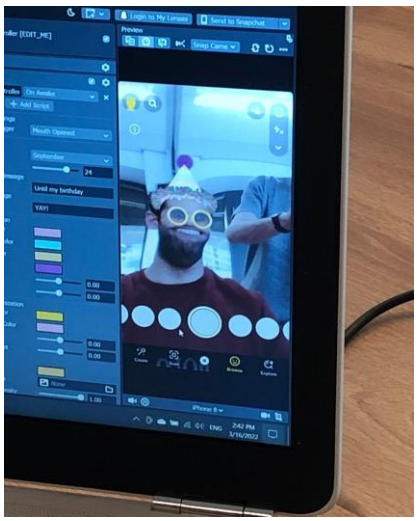
Since these workshops were held at sometimes inconvenient times because of difference in timezones, being part of a larger program, there was little previous interaction between participants and hosts. Therefore, especially during these workshops, we noticed that the element of fun that the hats and platforms brought, helped to break the ice and engage the participants.

Figure 4: A screenshot of the workshop in which the hats as well as the platform MIBO was introduced to other educators.

Filter making workshop

During a three hour workshop at Digital Society School we introduced the Lens Studio software to our trainees to see what they would make. In this experiment, we had participants from the Netherlands, Brazil, Italy, Turkey, Nigeria, Japan, United Arab Emirates, Thailand, Pakistan, Zimbabwe, Canada, India, Iran, Bosnia, Romania and Kenya aged between 21 and 36. The trainees came up with filters that had different functions like weather forecasts but also the displaying of emotions using backgrounds. The installation process as well as the available tutorials and templates made it easy to get started on the design and development process. We presented about our development of the hats filter to inspire their design process.

Figure 5: The filter making workshop we organized for our spring '22 trainee group.



Discussion

With the creation of our hats filter for video meetings we wanted to see if we could alleviate the 'zoom fatigue' that was plaguing many during the time that the pandemic was restricting in-person teaching. We found in our experiments that, more so than the intended interactive functionality that our filter provided, having something to break the ice or monotony of video calls was most appreciated. This helped participants of meetings relate to each other rather than falling into merely productive "getting-things-done" behaviors. We believe that creating this interactive functionality helped to make the use of the hats attractive because of its novelty. It is too early to say something about the educational merit of this filter and if it helps applying De Bono's method. The use of functional or fun filters in video meetings is not yet commonplace and that is why we should look at it as a niche innovation in the context of a possible transition in education.

Now that the effects and severity of the pandemic has been waning for the past half year, so have the value of the shares of Zoom.[53] Allegedly, this is due to a reflex of departments and managers that are bringing their colleagues back to the office, as is also the case at the HvA and Digital Society School. Nevertheless, overall the videoconferencing market is still growing with education being one of the fastest growers due to the pandemic.[54] It was especially disconcerting to hear stories about children's learning capacities being set back because of lack

[53] *https://www.msn.com/en-us/news/technology/zoom-is-worth-less-than-it-was-before-the-pandemic/ar-AAXlQqV*
[54] *https://www.grandviewresearch.com/industry-analysis/video-conferencing-market*

of laptops or separate rooms at home.[55] While too many video calls causes fatigue, not having any contact causes a learning deficit. And students at the HvA mentioned in a survey that they wanted to keep some of the benefits of online learning after restrictions have been lifted, such as the flexibility to save on travel time for short meetings.[56]

The nearness of people creates community and support. This poses interesting questions and challenges for educational organizations that are having to contend with students and staff getting used to remote work. How can community be maintained remotely? How does this change the quality of work? Are there ways to foster kinship regardless of our place in the world? These questions seem even more pertinent as we are to solve the world's global challenges; the sustainable development goals. These cannot be solved by only relating to the people that live, work, and learn close by us. Nevertheless, the physical lived experiences that we have in our everyday environment shape the way we think and learn through for example haptic affordances. The possibility for XR technologies to create a sense of place, closeness and foster empathy therefore seems to still be high on the research agenda.

Who is to advocate for equal opportunities and access to the latest educational technological innovations? We tried to disseminate the knowledge that we developed in Digital Society School on the basis of our AR filter in the InnoTec program[57] and in the

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[55] Klassen 4 jan 2021 21:35 - Seizoen 2020 Afl. 6 - Quarantaine time https://www.npostart.nl/klassen/04-01-2021/VPWON_1304707
[56] https://www.hva.nl/faculteit/fdmci/nieuwsbrief/onderwijs-na-corona-wat-willen-studenten-behouden
[57] https://www.facebook.com/InnoTecLab

Traineeship program[58], one being remote and the other physical-based in Amsterdam. While new startups are entering the space of video meetings that are helped us to facilitate better online teaching, such as Butter[59], there is no one solution to all remote problems and in-person time remains valuable while also more exclusive. In another experiment, we asked ourselves the question if we could bring more context into online learning by simulating the physical space of HvA[60]. Although even more tiring than a Zoom meeting, the VR environment did immerse our participants more and helped them to connect in different ways such as by having a dance contest. Might we recognize that XR brings a new mode of education rather than replacing the existing mode?

Conclusion

By using our experiments as data for the analysis of niche innovations, as well as considering market, technology and societal developments we have created an avenue to describe the transition in education and make strategic planning possible. We have described how the exogenous force of the pandemic has functioned as a shock to the current regime and further enabled the development of technical solutions that were already existing as a latent regime. That is because the transition in the educational regime does not stand alone from the larger socio-technical transition of knowledge-work from being office-based to more remote and distributed, and that is also a change in work culture and attitudes. It is furthermore important to note that we've analyzed our own context in the Netherlands and that our

[58] *https://digitalsocietyschool.org/traineeship/*
[59] *https://techcrunch.com/2021/04/08/butter/*
[60] *https://www.hva.nl/faculteit/fdmci/gedeelde-content/nieuws/nieuwsberichten/2021/06/onderzoekers-ontwikkelen-hva-campus-in-virtual-reality.html*

current political climate is liberal and our government to a large degree technocratic. This is exactly why we have looked at the space between the promise and practicalities of extended reality technologies as a driving force in the transition.

XR technologies bring the promise of making education more inclusive by training staff and student's soft skills and empathy, and more accessible in an embodied way in cases where physical access to the educational facilities is constrained such as, but not exclusively, in a pandemic.

However, XR technologies require technical and operational capacities from the educational service providers or institutions as well as from the learners/students. In cases where the government does not subsidize access to education or the use of XR technologies, people without the financial means will be left behind. From an ability standpoint, not only students but also teaching staff face a divide of people that have different learning abilities or personal aptitudes for the use of digital learning and educational technologies.

It might even be that the quality of education will not necessarily be improved through XR technologies and that rather XR and remote education will become a new educational mode and regime, something for the underprivileged who pay with their data, while the privileged will have access to real teachers in real-time in real life.

The practical implementation of XR technologies seems to still face institutional and cultural barriers even though the techy ideologies of those same institutions and cultures might advocate for these innovations. The HvA is an applied sciences university

and puts a large emphasis on practical education and skills, something that also translates to more hands-on, physical, and embodied skills. This makes XR technologies in their eyes something that mitigates the troubles of not being able to meet in real life rather than being something new or an add-on to meeting in real life. We expect that this disposition will change after the reflex of being restricted by the pandemic wains, and as the fatigue problems of XR are addressed and the embodied experience and context layers are improved.

Links

The hats filter

https://lens.snapchat.com/88bb35197208471f89d8082d3bffecb2

Snap Camera

https://snapcamera.snapchat.com/

Video presentation of the hats filter development process and meeting evaluation

https://youtu.be/xOWAdPM2B64

References

Virtual human interaction lab Stanford (Bailenson et al)

1. Loorbach, D., Frantzeskaki, N., and Avelino, F.. (2017) Sustainability Transitions Research: Transforming Science and Practice for Societal Change. Annual Review of Environment and Resources, 42(1), 599-626

https://drift.eur.nl/publications/sustainability-transitions-research/

2. Gartner Hype Cycle – ©2022 Gartner, Inc. and/or its affiliates. All rights reserved.

https://www.gartner.com/en/research/methodologies/gartner-hype-cycle

3. Facebook announces name change to Meta in rebranding effort

Kari Paul in San Francisco, Thu 28 Oct 2021 21.06 BST

https://www.theguardian.com/technology/2021/oct/28/facebook-name-change-rebrand-meta

4. Goals 4 Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

https://sdgs.un.org/goals/goal4

5. Facebook patents reveal how it intends to cash in on metaverse, Financial Times Hannah Murphy in San Francisco, Publishing date:Jan 20, 2022 https://financialpost.com/fp-finance/facebook-patents-reveal-how-it-intends-to-cash-in-on-metaverse

6. Miller, M.R., Herrera, F., Jun, H. et al. Personal identifiability of user tracking data during observation of 360-degree VR video. Sci Rep 10, 17404 (2020). https://doi.org/10.1038/s41598-020-74486-y

https://www.nature.com/articles/s41598-020-74486-y

7. ONDERZOEK OVER TRAINING OUDERGESPREKKEN MET VR WINT 3E PRIJS 10 feb 2022 15:00 Hogeschool van Amsterdam

https://www.hva.nl/subsites/nl/kc-oo/nieuws/nieuwsberichten/2022/02/onderzoek-oudergesprekken-trainen-met-vr-brillen-wint-3e-prijswint-3e-prijs.html?origin=%2BXZ3fBvbRuqtJyFPKjNZqg

8. Virtual reality for surgical training 101: The ultimate guide to VR in healthcare, June 13, 2022 Eleanor Jacobson, Content Marketing Manager

https://www.ossovr.com/post/virtual-reality-for-surgical-training-101-the-ultimate-guide-to-vr-in-healthcare

9. Stanford Virtual Human Interaction Lab Publications

https://www.stanfordvr.com/pubs/

10. Facial Appearance Dissatisfaction Explains Differences in Zoom Fatigue Ratan, R., Miller, D. B., & Bailenson, J. N. (2021). Facial Appearance Dissatisfaction Explains Differences in Zoom Fatigue. Cyberpsychology, Behavior, and Social Networking. doi:http://doi.org/10.1089/cyber.2021.0112

https://www.stanfordvr.com/pubs/2021/12254-2/

11. HET OPLEIDEN VAN DOCENTEN MET VIRTUAL REALIT, Gepubliceerd door Urban Education 24 april 2019 dhr. prof. dr. R.J. Oostdam lector Maatwerk in Leren en Instructie

https://www.hva.nl/urban-education/gedeelde-content/projecten/urban-education/het-opleiden-van-docenten-met-virtual-reality.html

12. ONDERZOEK OVER TRAINING OUDERGESPREKKEN MET VR WINT 3E PRIJS 10 feb 2022 15:00 Hogeschool van Amsterdam

https://www.hva.nl/kc-onderwijs-opvoeding/gedeelde-content/nieuws/nieuwsberichten/2022/02/onderzoek-oudergesprekken-trainen-met-vr-brillen-wint-3e-prijswint-3e-prijs.html

13. BEELDCOACHING VAN DOCENTEN MET BEHULP VAN VR Gepost op: 2 mei 2018 | ICT Services Hogeschool van Amsterdam Auteur: Erwin Faasse

https://www.hva.nl/etalage/gedeelde-content/grassroots/blogs/beeldcoaching-docenten-vr/2018/beeldcoaching-docenten-met-behulp-van-vr.html

14. © 2021 AION Sports Intelligence. All rights reserved. Hendrik Figeeweg 1X, 2031 BJ Haarlem, The Netherlands

https://aionsports.com/#Immersive-Training

15. VR and XR basics Last modified by Maarten Struijk Wilbrink on 2022/01/24 15:07 https://researchwiki.solo.universiteitleiden.nl/xwiki/wiki/researchwiki.solo.universiteitleiden.nl/view/VR%20in%20Unity3D/1%20VR%20and%20XR%20basics/

16. BACK TO (THE FUTURE OF) WORK II Reimagining worlds for ~~work~~ life, Shauna Jin, Published in Included VC

https://medium.com/included-vc/reimagining-worlds-for-w%CC%B6o%CC%B6r%CC%B6k%CC%B6-life-7177e51b9c72

17. Sander Veenhof (NL, 1973) https://sndrv.nl

18. Gaspard Bos and Shauna Jin, Video presentation of the hats filter development process and meeting evaluation https://youtu.be/xOWAdPM2B64

19. Zoom is worth less than it was before the pandemic

https://www.msn.com/en-us/news/technology/zoom-is-worth-less-than-it-was-before-the-pandemic/ar-AAXlQqV

20. Video Conferencing Market Size, Share & Trends Analysis Report By Component (Hardware, Software), By Deployment (On-premise, Cloud), By Enterprise Size, By Application, By End-use, By Region, And Segment Forecasts, 2022 – 2030 Report ID: GVR-3-68038-081-1

Grand View Research is registered in the State of California at Grand View Research, Inc. 201 Spear Street 1100, San Francisco, CA 94105, United States

https://www.grandviewresearch.com/industry-analysis/video-conferencing-market

21. NPO Klassen 4 jan 2021 21:35 - Seizoen 2020 Afl. 6 - Quarantaine time

https://www.npostart.nl/klassen/04-01-2021/VPWON_1304707

22. ONDERWIJS NA CORONA: WAT WILLEN STUDENTEN BEHOUDEN? Flin Wessels 19 mei 2021

https://www.hva.nl/faculteit/fdmci/nieuwsbrief/onderwijs-na-corona-wat-willen-studenten-behouden

23. INNO-TEC-LAB „Development of opportunities in the field of design for technical careers through innovation-laboratories" is a Strategic Partnership for Higher Education, co-financed by the Erasmus+ program of the European Union (Key Action 2).

https://www.innoteclab.eu/,
https://www.facebook.com/InnoTecLab

24. Digital Society School Theo Thijssenhuis (TTH)

1st Floor Wibautstraat 2-4 1091 GM Amsterdam, Netherlands

https://digitalsocietyschool.org/traineeship/

25. Butter is building an 'all-in-one' platform to run virtual workshops Steve O'Hear@sohear / 10:00 AM GMT+2●April 8, 2021

https://techcrunch.com/2021/04/08/butter/

26. ONDERZOEKERS ONTWIKKELEN KOPIE VAN HVA-CAMPUS IN VIRTUAL REALITY

29 jun 2021 10:25 | Faculteit Digitale Media en Creatieve Industrie

https://www.hva.nl/faculteit/fdmci/gedeelde-content/nieuws/nieuwsberichten/2021/06/onderzoekers-ontwikkelen-hva-campus-in-virtual-reality.html