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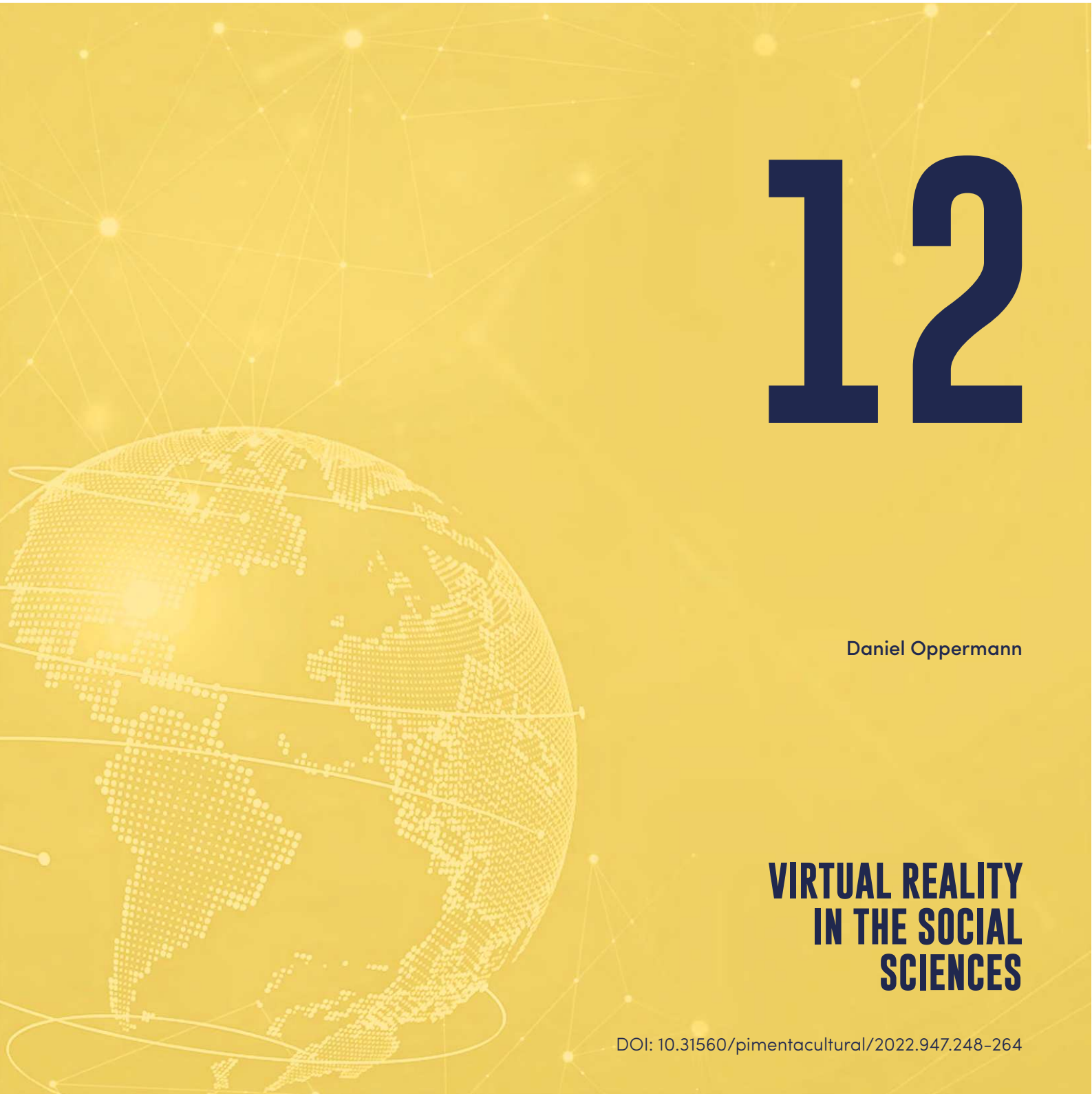

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VIRTUAL REALITY IN THE SOCIAL SCIENCES

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WORKING GROUP 2

National and International Policies for Crisis Management in Comparative Perspective

ABSTRACT

In the social sciences, teaching methods, approaches and tools have advanced over the past decades. This progress, however, has mostly taken place on a theoretical level. Very few of the ideas and findings were implemented in class. A typical class in the social sciences remains in a lecture format with hardly any technology besides slides. There are several reasons why courses like Political Science, International Relations and others have not implemented more of the methodological and technological progress that has taken place in the 20th and 21st century so far. While the COVID19 pandemic that started in 2020 has caused a major step forward towards acceptance of technologies in the social sciences there are more tools and devices that will bring further experiences to the discipline in the near future. One of the technologies that is entering higher education now is Virtual Reality (VR). This chapter will explore VR as a technology, discuss its application in higher education and analyse its contemporary and future role in the social sciences.

Keywords: virtual reality; social sciences; higher education; innovation.

INTRODUCTION

Teaching social sciences has become a standard procedure in many universities. Over the past decades, very little has changed in the relation between professors and students. No matter if political science, international relations, sociology or other related areas and no matter in which part of the world analysts take a closer look into classroom setups they are likely to encounter the same situation: a group of learners directing their eyes to the front where a single lecturer is "passing on" knowledge. This setting can vary slightly. In some cases, two or even three lecturers might be in the room, in other cases the seating arrangements were adapted or students were slightly integrated into the course of the lessons. In most cases, however, it remains a top-down educational model especially in the early years of studies. The reasons for the lack of flexibility are manifold. They can be identified on different institutional levels and also among class participants. On the institutional level we need to distinguish between institutions as a form of administrative power (e.g. faculties and decision-makers) and lecturers. On the classroom level we can identify students and other participants of learning environments.

On all individual levels, reasons for stagnant teaching methods in the social sciences can be singled out as 1) lack of institutional interest in innovative teaching methods, 2) lack of interest by the lecturers, 3) lack of awareness regarding innovative methods, 4) lack of technical knowledge in case new (or even old) technologies are required, 5) lack of motivation by course participants to invest time and energy in innovative learning, 6) lack of resources to implement innovative teaching methods.

Due to the differences of individual degree programs it is difficult to discuss teaching and also learning methods in higher education as a whole. Some methods like traditional lectures (MOHAMMADJANI; TONKABONI, 2015; O'BRIEN; VERMA, 2019) are commonly used in

most if not all programs and courses while other methods like laboratory experiments or practical exercises are limited to a smaller number of programs. This chapter will focus on the field of the social sciences although parts of the topics discussed here can also be transferred to other areas. While it is often expected that the social sciences as a space for critical and innovative social thinking could be more diverse in terms of teaching methods, in reality this is hardly the case. The text will discuss technologies and especially Virtual Reality (VR) in the social sciences. It will present ways to use VR as a teaching method or tool in the individual disciplines.

TEACHING METHODS AND TECHNOLOGIES

Teaching methods in the social sciences have advanced on paper over the past years (BROOKER, 2019; FOX; ARENA; BAILENSON, 2009; GUNN, 2017; KENNEDY; WAGGONER, 2021; PEYREFITTE; LAZAR, 2018) but little has changed in the classroom. The most common form of teaching in the social sciences (and beyond) is the format of a classical lecture (MOHAMMADJANI; TONKABONI, 2015; O'BRIEN; VERMA, 2019). This top-down approach is favored by both lecturers and students since it does not require too much additional equipment. Especially technical equipment most universities are also unable to provide on a larger scale. Different from other courses (e.g. hard sciences) the study of most social sciences does not depend on laboratories or similar environments. Which does not mean social sciences would not benefit from having computer labs for example, where students could actively learn about specific research methods and tools (CUENCA LÓPEZ; MARTÍN CÁCERES, 2010; LI; ZHOU; CAI, 2021). In some parts of the world such laboratories are extensively provided also in faculties of the social sciences. In middle and low income countries, though, this is hardly the case.

Lectures, however, can be developed and performed using additional elements of which some are more common like class or group discussions or a simple Q and A session. Depending on the course structure, specific elements like Pecha Kucha (COURTNEY KLENTZIN *et al.*, 2010) or lecture capture (EDWARDS; CLINTON, 2019; YU; WANG; SU, 2015) can also improve the learning experience. Besides lectures, other teaching methods like the flipped classroom approach (GILBOY; HEINERICHS; PAZZAGLIA, 2015; MCLAUGHLIN *et al.*, 2014) can also benefit participants.

Besides the theoretical approaches mentioned above, a number of technologies can become interesting additions to improve the learning process (BACKHOUSE, 2013). Among the most common approaches is the use of learning platforms or e-learning environments which can be used as an additional means, a tool for a blended learning approach or a sole measure for pure online learning (AZEITEIRO *et al.*, 2015; BHARUTHRAM; KIES, 2013). Although the first online learning platforms were launched already in the late 1990s, very few faculties in the social sciences used them actively for class preparation and implementation.

This situation changed during the COVID19 pandemic in 2020 and 2021 when faculties had to rearrange their working structures and move classes to online environments to continue teaching (ALMUSHARRAF; BAILEY, 2021; FAWAZ; SAMAHA, 2021; KOMBE; MTONGA, 2021). The given circumstances downgraded learning experiences in many countries where neither infrastructure nor equipment was available to a sufficient level. The lack of devices and infrastructure contributed to the debates on social exclusion in the digital sphere. While before digital inclusion was a topic on the course schedule it now became an actual topic on the empirical level. Lecturers unfamiliar with teaching technologies were forced to adapt to the new situation. Students without access to the necessary tools, however, were unintentionally excluded from the class.

A comprehensive analysis of the impact of COVID-19 on higher education is likely to take place in the coming years. And while a reduction of learning opportunities during the pandemic is one of the probable outcomes it is clear that the utilization of technologies (and here especially learning platforms and video conference tools) have saved higher education in many countries from a complete collapse. For the social sciences, the simplicity of an average class structure came out as an advantage compared to academic areas depending on physical presence in the laboratories. The sole dependence on literature and audio/video tools was facilitating the continuation of classes. And while also in these areas students have lost precious time they could have spent in the classroom, it can be stressed that the importance of technology in higher education has now reached all faculties of the social sciences no matter how reluctant they were in the past.

Besides e-learning platforms and video conference tools, there are several additional measures related to information and communication technologies (ICTs) that could improve teaching, learning, and also research experience for students in the social sciences. Some of these measures are related to the application of existing software products, others require deeper knowledge or interest in software development skills. All of them should be addressed or offered by the faculties to allow students a more comprehensive understanding of the academic field they have chosen to study and to improve multidisciplinary learning effects. A basic step is the application of CAQDAS: computer-assisted qualitative data analysis software (SILVER; RIVERS, 2016; WOODS; MACKLIN; LEWIS, 2016). For most faculties in middle and low-income countries and some in high-income countries as well, this poses the challenge of getting access to a computer lab and the necessary software. Cooperative agreements with other faculties (e.g. computer science) could facilitate the access to the necessary hardware. Since the more complete CAQDAS tools require financial investment, faculties could opt for open source solutions to enter the path of qualitative (and

quantitative) data analysis tools. Although free and open-source CAQDAS products are available they are also very limited compared to the standard products on the market.

While CAQDAS tools can be integrated into a class schedule in a simple manner and thereby turn standard teaching and learning procedures more diversified, more complex tools like SPSS (SULISTYO; DWIDAYATI, 2021) and programming languages like R (KENNEDY; WAGGONER, 2021) and Python (BROOKER, 2019) can bring additional advantages to the study and research of the social sciences. These, however, require a more specific knowledge which if necessary could also be drawn from multidisciplinary cooperation with other faculties. Beyond these technologies that have already entered the social sciences to a certain extent (although they are still not visible in many faculties) others are likely to become more prominent in the coming years or decades.

One of them is Virtual Reality, which is the focus of this chapter (ALHALABI, 2016; DIECK; JUNG; LOUREIRO, 2021; LIU *et al.*, 2017). Virtual Reality (VR) is a relatively new technology to the average ICT user and certainly new to most faculties mentioned in this work. In fact, however, VR goes back to the 1950s although the term itself is dated from the 1980s. The following paragraphs will present VR as a technology and discuss its application in higher education.

VIRTUAL REALITY

Historical approaches to Virtual Reality (VR) reach back until the 19th century to explain the origins of some of its foundational ideas. A more solid form of VR was identified later in the works of Morton Heilig who in the 1950s and 1960s presented the first tools that helped create a more distinctive VR experience. These tools, a combination of optical, audio and additional supporting equipment can be seen as a

precursor of 21st century VR devices. Following BOWN *et al.*, "Heilig (...) envisioned his machine to be used as a training device for the armed forces, laborers, and students" (BOWN; WHITE; BOOPALAN, 2017, p. 246) which was beyond application in the entertainment and business sector. This early vision of a developer supports the argument to analyse the technology for usage also in higher education and, in this case, the faculties of the social sciences.

Today, Virtual Reality is a technology that allows individuals to virtually move into a different social environment created by software developers. This usually happens through the use of specific equipment like special glasses/headsets which are connected to a computer (WANG; HE; CHEN, 2020). The software running on the computer offers a social environment to the user (visible through the glasses). This technology is increasingly used in the gaming industry (ROETTL; TERLUTTER, 2018) where players join a different world where they have to act or interact by using the glasses and another device, which is usually held in the hand. Over the past few years, this technology became part of activities in a very small number of universities as well.

One crucial aspect of VR is the software. The better the software the more the users feel to become part of the social ambient that appears in front of their eyes. Developers of Virtual Reality have defined different levels of what is called immersion (DIECK; JUNG; LOUREIRO, 2021; KIM; JEON; KIM, 2017) to categorize the quality of the effects created by the software. The better the software the higher the degree of immersion experienced by the user. The highest level of immersion is called presence (SERVOTTE *et al.*, 2020; SLATER, 2018). This is the level where users can forget they are part of a virtual world. The software is then so well developed that users believe they are part of the social environment seen in front of their eyes. The level of presence is what software developers are aiming to achieve. It defines the highest quality of a VR software product in terms of user experience. Presence is also defined as "being there" while immersion is understood as the path to reach this goal.

So far, immersion and presence are experienced mostly in the gaming sector where they became factors describing the quality of a VR software product. In academia, SLATER defined immersion as "an objective property of a system, and higher or lower immersion as the extent to which a VR system can support natural sensorimotor contingencies for perception (...) including the response to a perceptual action" (SLATER, 2018, p. 432). SERVOTTE *et al*. (2020) mention the lack of research that has been conducted on immersion so far despite its importance for technology innovation.

Besides the technical equipment and the software, a VR user also requires a physical space where the software can be applied. This needs to be an empty room where people using headsets can freely move around if necessary. It needs to be taken into consideration that users equipped with VR headsets are blind in the real physical world since VR devices exclusively exhibit the virtual environment offered by the software. For this reason, objects in the real world (e.g. tables, chairs, and other items) must be removed from the VR space to reduce the risk of physical injuries. Professional VR spaces make assistants available to interfere in case of imminent danger.

This is certainly possible also for the academic environment for example universities usually have buildings and rooms where this technology could be applied. However, the value of the equipment is currently quite a challenge for most institutions. A good piece of equipment for one person requires an investment of around 400 USD. This value is expected to decrease in the next twenty years, nevertheless, it is quite challenging especially for institutions in middle and low income regions to provide equipment for a whole class.

Another challenge is to have the right software to be used in a teaching environment. Similar to the gaming industry, also in academic teaching environments the software product needs to be developed for exactly one specific purpose. That makes its applicability limited to a small number of occasions.

VIRTUAL REALITY IN HIGHER EDUCATION

Virtual Reality offers many options to improve training and education on several levels (ALHALABI, 2016; LIU *et al.*, 2017). The most obvious approach is to create scenarios and environments taken from the real world and show them to students through VR devices. On an advanced level, interaction through handheld devices could improve the experience of the student. This form of application of VR in education resembles the experience offered already by the gaming industry. For education, however, different types of applications and software need to be developed. As an example, a simple application could show historical or contemporary environments or events in which students would watch authentic actors working, debating etc. This should offer more than a traditional movie experience by including interactivity and immersive elements to bring students straight into the environment.

Depending on the degree program, applications could present any type of scenario. A precondition to use VR is therefore the existence of appropriate software to reflect the needs of the students in each course. Students of engineering need different software than students of medicine or the social sciences. And even within degree programs content can differ a lot. Since each application needs to be developed as a separate project programming skills or access to professional programmers is necessary for any VR project unless the software is offered by third parties free of charge as was partly happening in the following example.

Among the most recent cases of universities advancing in the application of VR for teaching is the University of Sydney's Faculty of Engineering. A laboratory run by members of the faculty and open to all other disciplines initiated its activities in 2017. The results of the first two years of activities were published by executive members of the lab in July 2021 giving details regarding the structure, equipment, investment

and outcome of the project (MARKS; THOMAS, 2021). Therefore, the laboratory developed content on its own benefiting from the skills and interest of students in cooperation with professionals that were hired to support the technical requirements of the project. Additionally, the project used publicly available content and material provided by actors from the private sector (ibidem).

Students could use the content to virtually visit real-life environments out of reach to test professional skills. The initial investment for hardware and additional equipment was defined as 117.540 AUD. An additional annual budget to cover the running costs was 29.550 AUD (ibidem). For most universities in middle and low-income countries (and some in high-income countries as well) this investment is challenging, especially for social science faculties.

VIRTUAL REALITY IN THE SOCIAL SCIENCES

The application of VR in academia as shown by the example from Sydney is one of the possible approaches to use the technology in higher education. Researchers from Stanford University have defined three categories to use VR, especially in the social sciences. Besides the *application* of VR they classified the technology as an object of academic investigation and as a method for mostly experimental research (FOX; ARENA; BAILENSON, 2009).

Analyzing VR as an object can be understood as investigating the technology itself and its effects on the user. This includes the analysis of presence as it was presented above. Besides that, the authors mention the psychological and physiological effects of VR environments including cybersickness as a possible but possibly temporary illness caused by the technology (ibidem). In a quantitative analysis of the three categories, VR as an object was identified as the category that had

generated the most publications so far (41,3%). It was closely followed by VR applications (38,7%) (FOX; ARENA; BAILENSON, 2009, p. 105).

Most of the application cases mentioned by the authors came from the areas of medicine and therapy including treatment of different types of phobias, behavioral issues, eating disorders, and physical rehabilitation. Besides that, the authors refer to flight simulations, military training and professional training in the private sector. The application of VR in fields like Political Science or International Relations is not mentioned.

With only 20% of appearance in academic publications stands VR as a method for conducting research. This category refers mostly to analysis and experimentation in a laboratory environment where experimental research is taking place. VR can be used in this context to create any type of environment necessary to realize for example observations without unexpected interferences. Also, the replication of experimental environments is more precise in VR than in empirical environments. Since everything is run as software, every detail can be predefined or removed on request (idem).

Although FOX *et al.*, (2009) approach VR for social scientists, substantial parts of the social sciences like political science and international relations are not addressed. An important reason must be the absence of research or application of technology in these fields. For political scientists and researchers of international affairs, VR is still as far away as it seems. However, this can change shortly. Just as other examples have shown, the creation of virtual environments can also focus on the needs of political science research, teaching, and learning. No matter if political theory, philosophy, or policymaking: virtual environments can serve any type of learning environment. One example is the lifelike replica of a United Nations General Assembly in which students could participate as observers or participants. The same applies to other International Organizations, national parliaments, town-hall meetings, or political party conventions. Students

could also virtually visit different parts of the planet in which strategic historical or contemporary events are or were taking place. Contemporary settlements in the Amazon region threatened by invaders (SWENSON *et al*., 2011), the 1955 Bandung conference (ACHARYA, 2016), Brexit negotiations in the UK (HEIDE; WORTHY, 2019), literally all events or topics can be replicated in a virtual environment and bring students closer to the subject of their studies. Scripts for VR environments can be based on protocols taken from historical archives to create exact sequences of empirical debates and discussions.

FINAL REMARKS

Universities and other institutions of higher education are spaces of learning, teaching, research, and innovation. They are a crucial part of social, technological, and other forms of progress in any society. To keep up with social and technological developments outside the institutions, universities need to constantly question themselves, their method,s and tools to make sure progress and innovation are not taking place without them. When it comes to the social sciences, faculties are often caught between the demand for contemporary, critical, and innovative thinking and the actual observation of and involvement in technological progress. Instead of accompanying and reaching out to progress that is shaping society and especially learning environments, the social sciences tend to hold on to solutions of the past, especially when it comes to technology.

Reluctance might require a crisis to be overcome. Although this observation is far from being new, it can be repeated consistently. When the COVID19 pandemic closed down institutions of higher education in early 2020, social science faculties (and others) had to respond by implementing e-learning platforms and additional communication tools

that had been around for years but had been ignored by many faculties in the past. The crisis caused by the pandemic forced faculties to accept technology as a last resort to keep classes going. While these older technologies have now found wider acceptance in the social sciences the next social barriers for future technologies are already in sight.

Virtual Reality has made its way into higher education in a small number of institutions and degree programs. However, it still has a long way to go to be understood and accepted as technology for teaching in areas like political science and international relations. Compared to older technologies like e-learning platforms that are available in open source editions, VR requires a substantial financial investment for hardware and software. The latter, though, can be developed by the faculties themselves in cooperation with computer science students from the same institution. The University of Sydney whose VR lab was mentioned above has shown what is possible in engineering. Social science faculties should build on that and create similar VR programs and projects aligned to their own needs and topics.

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