SOCIAL XR: BARRIER-BREAKING TECHNOLOGY FOR SMART SOCIETIES

TNO innovation for life

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INTRODUCTION

The coronavirus pandemic has changed our perspective forever. From the way we communicate to the way we work. From our thoughts about travel to our feelings about health and emotional wellness. Never before have so many people spent so much time communicating remotely—and never before have the limits of that remote communication become so clear.

But if we use the insights we have gathered in this challenging time to focus on a few specific innovations, we can likely address some of the other major societal challenges of our time, like climate change and resource scarcity. And also the challenges of perceived or actual distance. How? By enabling Smart Societies through the use of XR technology.

WHAT IS SOCIAL XR?

Extended Reality (XR) is the collective name for technologies like augmented reality (AR), mixed reality (MR) and virtual reality (VR). In short: technologies that can replace, blend or enhance the 'real world' with a virtual one. This is typically achieved with mobile or wearable screens, such as smartphones, tablets and—nowadays—head-mounted displays.

Social XR relates to XR-enabled applications and platforms that allow multiple persons to share, communicate and collaborate. Through shared and social XR-enabled applications, we can be more productive online, feel more connected to family and friends, and be more effective in our communication and collaboration with colleagues, partners and customers. We can enable virtual visits with elderly relatives in nursing homes, support remote education and facilitate skill transfer.

Instead of that limited, two-dimensional video call we have gotten so used to in the past year, Social XR enables you to sit around a virtual table with your colleagues, or on a virtual couch with your relatives. Doctors can perform virtual visits to elderly or infirm patients with limited mobility. Much more than simple audio and video feedback, users are able to immerse themselves in a full sensory experience: seeing, hearing and feeling the virtual environment as realistically as their own living room, office, or that live venue they used to visit watch their favourite band. And for those who think this technology is still years away from being developed, think again: companies around the globe are already releasing the first wave of XR-enabled collaboration and communication tools[1].

WHY DO WE NEED SOCIAL XR?

Hard as it may seem to imagine, the current crisis surrounding the coronavirus will soon be a thing of the past. Yet some of the biggest challenges in society will still be ahead of us. Challenges like climate change, resource and expertise scarcity, loneliness and isolation in our society. We have learned this year that we do not necessarily need to travel so much for business. However, we do indeed miss the important social interaction and handshakes that are such an integral part of business relationships. Chances are good that the future of work will include a hybrid of personal and digital interactions, and this comes with a barrage of new challenges[2]. Without question, the world of work[3,4] can be forever changed with the introduction of effective XR technologies, and the impact on every industry will be significant as a result of this change.

However things change, two-dimensional talking heads on flat screens just won't be enough to fulfil our needs[5]. From VR start-ups to big tech companies: many of them are developing XR platforms (such as the recently launched Microsoft Mesh[6]) that may be among the solutions for 'Zoom fatigue' that workers already are experiencing[7]. Several different TNO experiments with social VR indicate the potential of a more natural form of remote collaboration[8].

SOCIAL XR FOR SOCIETAL ISSUES

To truly make progress on our climate goals, we will have to find a viable alternative to travelling. Even airlines like Air France KLM are exploring alternatives to flying[9]. Social XR could enable shared virtual travel experiences—without participants actually getting on a plane. In TNO's labs, we have already shown that we can create photorealistic experiences of persons being together in one place, while in fact they were in different countries. And who knows: perhaps someday, Air France KLM will offer day trips to Mars for the whole family.

And what about medical and health experts? Today, they are only available to those who live close by, or can afford to travel to see them. With Social XR, online medical examinations—including physical touch and interaction—can be as easy as a video call, but 100 times more interactive, immersive, personal and effective.

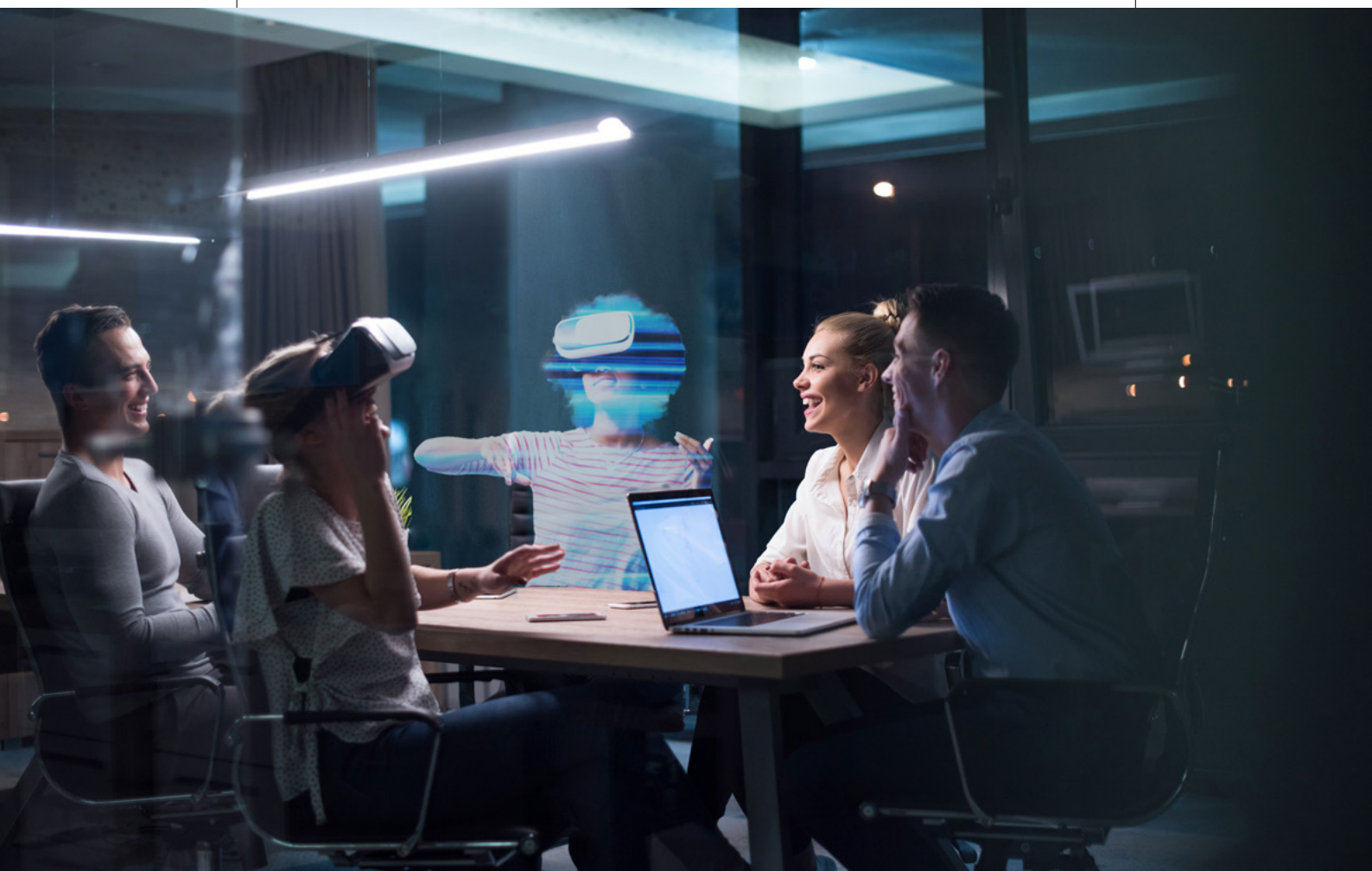
Another healthcare challenge is social isolation, for instance in nursing homes. Social XR could reduce, and ultimately remove, barriers and bring families together. Nurses and the elderly eagerly tested our social AR setup in a retirement home in the south of the Netherlands—and we plan to develop this into a working operational solution within a few years[10].

The impact of Social XR does not stop there. The implications for sport, entertainment, travel and tourism and even real estate[11] are becoming clearer every day.

REMOVING THE BARRIERS TO SOCIAL XR

So, what will it take to go beyond that two-dimensional representation in video conferencing apps, and enable true, physical interaction in the digital domain? At TNO, we are focussing on three key areas that need drastic improvement. The first of which is the representation of objects, spaces and humans in their actual dimensions and shape. To significantly improve today's photorealistic Social XR, we need volumetric visual representation, coding and transmission[12] in order to manage the vast amounts of data required to recreate the physical environment, human features, nonverbal interactions and haptic feedback that will make the experiences feel like reality. This 3D volumetric video experience should not be disrupted in any way—otherwise, the feeling of reality cannot be achieved. TNO is developing novel media formats and processing pipelines to enable real-time capture, processing, transmission and rendering of multimodal media. Among them, the possibilities of spatial computing[13]. So that doctors can touch their patients in need, and children can see and hug their grandparents from thousands of miles away.

At the same time, those large and uncomfortable goggles used in XR interactions are already becoming a thing of the past. XR glasses are becoming slimmer, sleeker, and more comfortable. And sometime soon, they will evolve into something similar to regular reading glasses, before they disappear altogether. This trend can only be sustained if all the complicated and power-hungry processing is provisioned through other resources. This is where the mobile communication network infrastructure comes into play. Think it is difficult now to control a video call with 40 participants and keep each participant connected and engaged? Consider the challenge of ensuring that all of those people have a realistic experience in a virtual 3D environment. Particularly when some of those participants are on the move and connect on mobile networks.



The introduction of 5G is an excellent start for offering initial AR and VR services, and large European telecom operators like Deutsche Telekom and Vodafone are already launching their first XR offering. This is just the beginning. Because for truly convincing Social XR services, we will need to vastly improve 5G's reliability, increase bandwidths and eliminate delays. This allows us to keep participants in their realistic environment, even when they are moving around. Slim and sleek XR glasses will increasingly depend on the network to do the heavy lifting when it comes to complex processing of data. TNO is working on improving the mobile network infrastructure to make mobile XR interactions as realistic and delay-free as they need to be.

The third—and perhaps most often overlooked—challenge is the human experience. TNO's expertise stretches beyond the technology and innovations needed to enable Social XR. We also explore the human factor. How likely is it that people will actually use this technology when it is available? What barriers stand in the way of their adoption? What social parameters need to be adhered to, and which social cues are most important to transfer at the highest quality? And of course, how can we protect users' privacy when they enter the virtual world? European regulation such as GDPR already offers great protection for our online data. But what will be required of governments to ensure that users are protected when their actual physical likeness and physical interactions enter the XR world, and the data to construct their virtual self—their 'digital' twin—may be captured, stored and processed by global and dominant platform players?

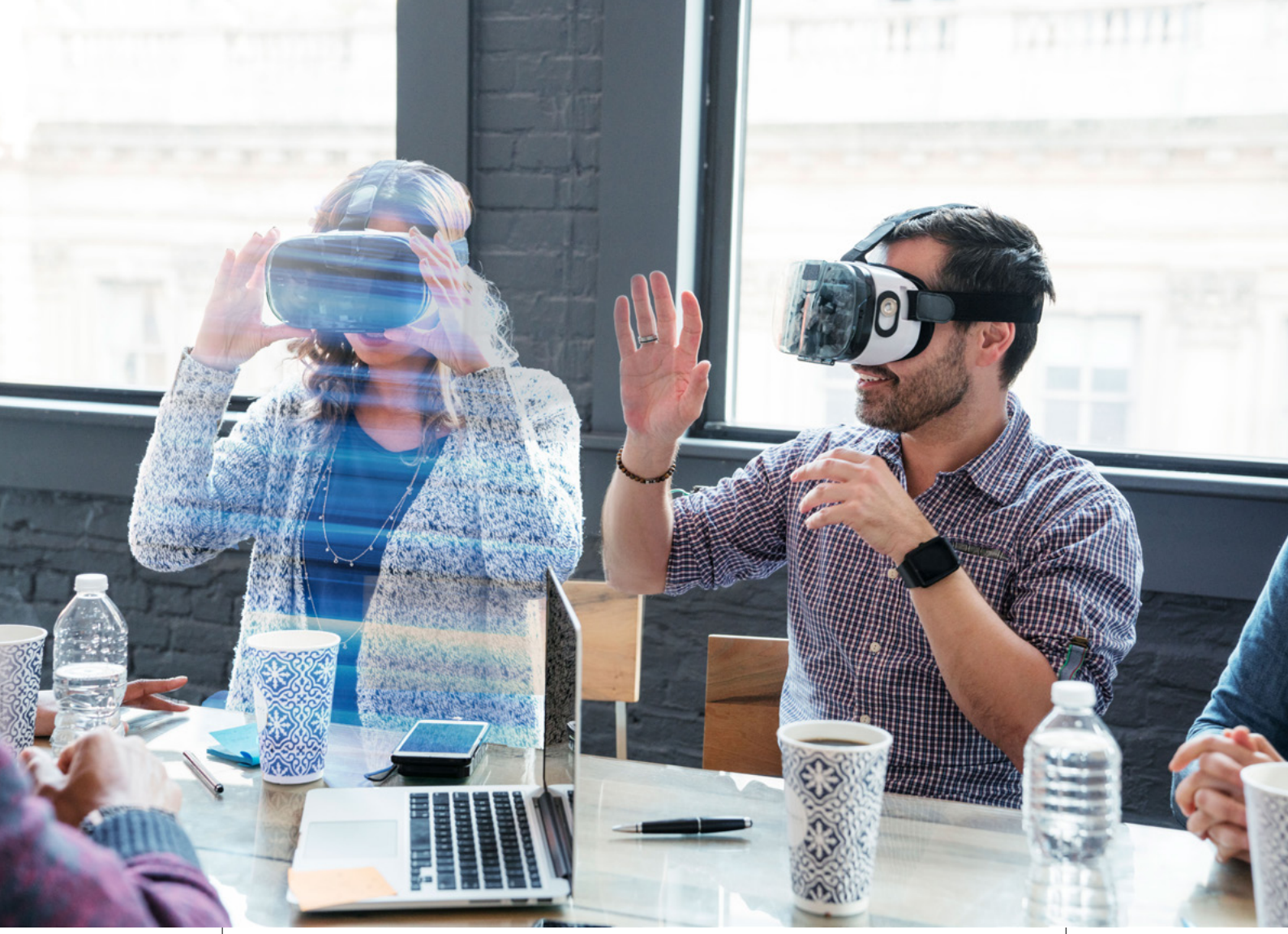
Using a multidisciplinary approach, TNO is exploring the social ramifications of this barrier-breaking technology, to understand what it will mean and how it will impact society when the real world and the virtual world are seamlessly connected. Especially in the contexts of culture, language and experience.

AVOIDING THE RISKS

There is no question that Social XR can revolutionise the way we communicate, interact, and address societal challenges. But as with any major technological advancement, developing Social XR is not without risks[14]. The first—and very real—risk is that the very few major players already investing in the technology will dominate the Social XR technology landscape. If we do not manage to get key industry parties such as hardware vendors, developers, network providers and legislators involved in these early stages, the world will be forced to comply to the parameters set by a few players. That increases the risk that access to—and security within—an XR environment will be under the control of a select few, who may be able to use the technology for commercial dominance instead of cooperation.

XR, in general, expands the definition of personal information that must be protected. Recent XR headsets can infer detailed biometrical data. And in today's Social XR platforms, data on communication and interaction becomes a prevalent and valuable source of revenue. Governments need to be aware of the importance of establishing new standards of privacy and security that protect users in this new and highly personal domain[15]. So that users are, at minimum, aware of and consent to such highly personalised information being captured, used and shared.

And last, but certainly not least, ethical considerations need to be taken into account during the design phase of Social XR, and not as an afterthought or retrofitting procedure. In addition to privacy, consent and tracking, we need to think about empowering individuals to define their own cyber-physical presence and also about preventing harassment in digital worlds.



LEARNING FROM THE CRISIS

Imagine how much more bearable and less disruptive the coronavirus crisis would have been if Social XR had already been part of our technology landscape. Imagine how much we could advance our efforts to reverse climate change if we could replace in-person conferences and international meetings with realistic and virtual ones. Imagine how much more accessible resources and expertise could be if they were available at a click, without sacrificing the benefits of interpersonal interaction.

The only thing you do not have to imagine is Social XR itself. After all, it is already starting to emerge. The technology is gradually becoming available to create real-life, tactile and physical experiences in a virtual environment. We only need the ambition and willingness to collaborate on making it a reality that is accessible to the world. The Netherlands is already leading the way in advancing the technology in Europe[16]. Combine this with Europe's leading position when it comes to digitally protecting its citizens, and it is clear that we are in a good position to take it to the next level.

Now, TNO is ready to take our explorations to new heights, and involve industry players, network providers and governments in the realisation of seamless, realistic communication that can make a real impact on the world in which we live. If we wish to establish a foothold in the communication technology of tomorrow, research and technology organisations, public institutions and private industry must all work on it together, today.

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