



## **PROJECT DATA**

Title	Positioning the Dutch Media sector for business opportunities in the US in the area of existing (2D) content in Virtual Reality en mixed reality environments
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#### **SUMMARY**

- **Situation:** Today's VR developments are mostly driven by US industry. TNO, one of the DMI programme partners, is working on new VR technologies, with a focus on reusing 2D video in social VR experiences. TNO has a strong interest in exchanging ideas and knowledge with US-based experts in academia and industry, to foster collaborations and to increase the knowledge of the larger Dutch creative industry sector on VR technologies.
- **Question:** RVO has requested TNO to produce a whitepaper, demonstration setup and report on reusing 2D video in VR.
- Approach: in order to increase knowledge exchange with US-based partners, TNO has generated visibility around the topic at conferences and events in both the US and The Netherlands. In particular, TNO has provided the following three deliverables, to foster the recognition of TNO as a leading knowledge institute on VR technologies.
  - **WP1:** a whitepaper was presented and published via IBC 2017; we contributed to a social VR expert session at VR Days EU 2017
  - **WP2:** three demonstrations were given, at IEEE VR 2017, ACM TVX 2017 and VR Days EU 2017
  - **WP3:** this slide set reports on the actions and deliverables; an initial overview was presented to the Dutch media industry at MJC2017, while a final overview was presented to representatives from Dutch media industry at and TNO 'Klankbordgroep' Meeting
- Target audience: PIB DMI partners, Dutch broadcasters and service providers, Dutch media industry
- Main message: on the road towards social VR experiences, the reuse of 2D video allows for rapid prototyping of valuable social VR experiences. With the current interest in, and US-based drive on, avatar-based social VR experiences, the Dutch alternative generates significant interest.



#### 2017: THE STATE OF VR

- VentureBeat, 2017 [1]: The number of VR companies grew 40% in 2016, with the largest area of growth in content companies that create apps for head-mounted VR displays.
- Gartner, 2017 [2]: "AR and VR will transform today's user experience into a more continuous and contextual one that significantly changes how people interact with each other and computing systems. We predict by 2019, AR, VR and mixed reality (MR) solutions will be evaluated and adopted in 20% of large-enterprise businesses"
- Forbes, 2017 [3]: "Is VR is doomed to be a fad like 3D stereoscopic TVs? It's too early to tell. When VR is good, it can be really immersive and a transportive experience. But is it compelling enough for people to spend significant amount of time in VR, assuming prices come down? To date the answer is: no. But I have seen enough of a glimmer in the possibilities to keep me optimistic that we can get through this VR chasm."



Source: TheVRFund, 2017 [4]



## **2017: EMERGENCE OF SOCIAL VR**

- VirtualRealityTimes, 2017 [5]: "Virtual Reality may not bring people together in the real world but it can certainly bring people closer than they are. As VR headsets are becoming a mainstream gadget, we may soon be watching new and more interesting ways to communicate with each other using Social Virtual Reality Apps."
- Engadget, 2017 [6]: "The core of Spaces, the reason it exists, is so you can feel like you're in person with your friends. And then it's having interesting things you can do with your friends. It's not a chat room where you're just talking."
- M. Gourlay, 2017 [7]: "Capturing, conveying and machine-learning from rich social cues like facial expression and body language. In telepresence scenarios, other humans crave that information and its absence leads to otherwise avoidable misunderstandings."
- P. Rosedale, 2017 [8]: "We might be able to use VR to fold space and bring people together from far across the world to meet and get to better respect and like and maybe love each other."





## **TOWARDS SOCIAL VR EXPERIENCES**

- VR technology will create new ways to connect and feel like you're together even when you're apart
- VR allows you to be with anyone, even if they're physically far from you, or not in VR at the moment
- > VR allows you to go anywhere and do anything with the people you care about

#### Our aims:

- to provide for shared and social experiences, and to enable interaction and collaboration in VR
- to provide for a photorealistic representation of humans, so you can see other persons as if they are in the same virtual environment









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## **REUSING 2D VIDEO IN SOCIAL VR EXPERIENCES**

- **Problem:** in today's social VR experiences, avatars are used as representation of human participants. We are far away from using full 3D representations of humans in VR; this requires 3D media formats such as meshes and point clouds, and/or motion capture in combination with 3D character rigging
- **Approach:** reuse 2D video technology and equipment for representing real humans in shared and social VR experiences.









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# **REUSING 2D VIDEO IN SOCIAL VR EXPERIENCES**

Watching video together



Gaming together in VR



Video conferencing in VR



Multi-user meetings in VR





## **DEMONSTRATION: IEEE VR 2017**

- IEEE VR (Las Vegas, 2017) is the world's primary VR conference
- Key contacts with US-based VR experts, e.g. USC Institute for Creative Technologies and Unity
- We ran a 3-day demonstration and user evaluation (77 participants) to get feedback on approach and our social VR experience
- See demo video at <a href="https://www.youtube.com/watc">https://www.youtube.com/watc</a> <a href="https://www.youtube.com/watc">h?v=2Ng67blnp9c</a>



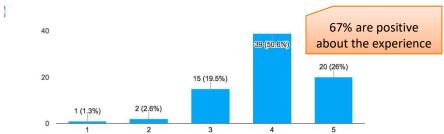
Published as "WebVR meets WebRTC: Towards 360-degree social VR experiences [9]"

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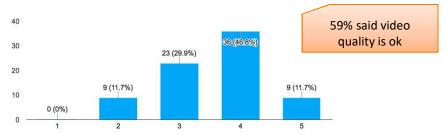


## **DEMONSTRATION: IEEE VR 2017**

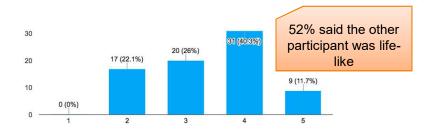
How would you classify the overall experience? (77 responses)



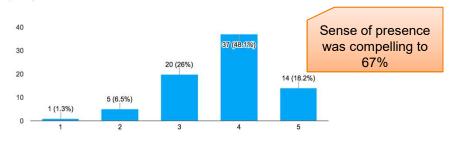
How would you classify the overall video quality?  $\ensuremath{\text{(77 responses)}}$ 



How life-like did you perceive other people? (77 responses)



How compelling was your sense of being there (in the living room)? (77 responses)



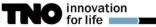
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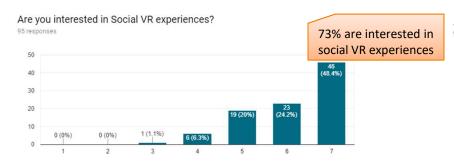
## **DEMONSTRATIONS: TVX / VR DAYS EUROPE 2017**

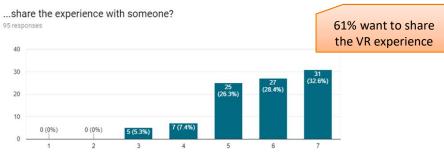
- ACM TVX (Hilversum, 2017) is the world's primary TV and online video conference, providing us with great opportunities to report back to Dutch industry and creative sector
- We ran a 1-day demonstration and received the Best Demonstration Award
- Published as "Social VR Platform: Building 360-degree Shared VR Spaces [10]"
- VR Days EU (Amsterdam, 2017) is growing into Europe's largest AR/VR event, with significant presence from US-based experts
- We ran a 2-day demonstration and user evaluation (95 participants)

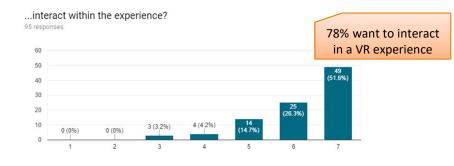


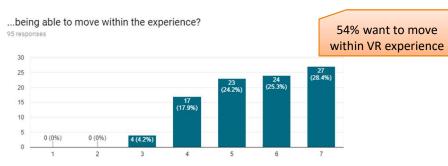


# **DEMONSTRATION: VR DAYS EUROPE 2017**









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## PRESENTATIONS: IBC / VR DAYS EUROPE 2017

- We presented our work on reusing 2D video in social VR experiences at the International Broadcast Convention IBC 2017 (Amsterdam). IBC is the world's leading media, entertainment and technology show. In a session called VR and AR the production, the potential and the pitfalls, we presented the whitepaper "TogetherVR: a framework for photo-realistic shared media experiences in 360-degree VR [11]"
- We further presented our views on reusing 2D video in social VR experiences in an expert session on social VR [13]. In this session, entitled "The Next Level of Human Communication or Just Another 'Home Alone?'", we discussed how to design for social experiences in virtual realities to keep them pleasant and safe, together with Philip Rosedale, founder of Second Life and High Fidelity.





### **TAKEAWAY MESSAGE**

- There is an increasing interest from industry and end-users to provide for shared and social experiences, and to enable interaction and collaboration in VR. A key factor in such experiences is to have a photorealistic representation of humans, so you can see other persons as if they are in the shared virtual environment.
- In today's social VR experiences, avatars are used as representation of human participants and we are far away from using full 3D representations of humans in VR. On the road towards social VR experiences, the reuse of 2D video allows for rapid prototyping of valuable social VR experiences.
- With the current interest in, and US-based drive on, avatar-based social VR experiences, the Dutch alternative approach, led by TNO, generates significant interest.



#### **NEXT STEPS – PROBLEMS TO ADDRESS**

- **Being able to see yourself;** Currently participants cannot see their own body. A common approach taken in VR is rendering virtual arms that follow the movement of real arm movements. We are investigating to what extend we can create a selfview which allow you to see your own body.
- **High immersion and presence for communication;** We made a start with enabling photorealistic representations of other people, but in our current approach the HMD is still visible, so we intend to apply HMD removal techniques. Also, we aim to look at 3D and point-cloud based video rendering to improve the VR experience.
- Peing able to interact and engage in VR with more users simultaneously; Our current examples focus on social VR experiences for two users. In the future, we will look at accommodating more users at the same time, with all the associated communication challenges, both in terms of network and user interactions. Additionally, we like to explore other use cases to test and evaluate social VR. We are currently aiming at creating a social virtual skybox experience, in which you can watch a sports game or a concert with your friends. We also plan to investigate to what extent social VR can be utilized for educational services, for instance remote participation in a class room for sick or immobile people.



#### **NEXT STEPS - COLLABORATION - 1/2**

- **Spin off the TNO work** on field-of-view adaptive streaming to a separate market entity, to accelerate the innovation with US-based partners; TNO spinoff Tiledmedia is now working with many large US partners, such as Akamai (one of the world's largest CDN vendors) and Harmonic (the world leader in video delivery platforms
- Use the European H2020 research and innovation funding framework for increasing collaboration with Dutch and EU partners; TNO has collaborated with Dutch Centre for Mathematics and Informatics to setup VR-Together, a H2020 project on social VR experiences. This project allows both TNO and CWI to continue to build up knowledge and expertise for the benefit of the Dutch creative industry. In addition, we have sought out project partners with a strong US-based presence, such as Artanim, Future Lighthouse and Motion Spell. In upcoming H2020 calls, such as H2020 ICT-25, we can seek out strong Dutch partners for creating compelling social VR content, and seek out EU partners with a strong US-based network.
- Collaborate within the Dutch Fieldlab: Virtual Worlds, where virtual environments are employed to solve societal issues; TNO's social VR platform provides for a raid prototyping environment for shared and social VR experiences. Embedding this platform within the fieldlab will increase the reach towards the Dutch creative industry.



#### **NEXT STEPS - COLLABORATION - 2/2**

Promoting social VR within international standardization; Standardization provides for an excellent collaboration arena with US-based industry. As of now, there are no standards for the technologies that together make up a social VR experience. At a joint 3GPP SA4 & VR Industry Forum Workshop on VR Ecosystem and Standards in Santa Clara from 4th-6th December, close to 150 participants from primarily US-based companies such as Apple, AT&T, Dolby, Ericsson, Intel, Movielabs, Oculus, Samsung, Qualcomm and Verizon attended sessions on standardisation coordination, VR content production, service provider and VR Hardware/device manufacturer challenges. The workshop was co-chaired by Rob Koenen, VRIF President and Principal Consultant at TNO. TNO further participated in the event by promoting Social VR, with Emmanuel Thomas showcasing an early-stage demo that allowed visitors to get a first feel for how the project partners will enable shared and social VR experiences. The participants provided useful feedback on the relevance of social VR and the demonstrated technology, and were keen to test and use further evolutions of the technology. Interestingly, many presenters talked about the need for making VR a more social experience.



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