Towards Immersive Digiphysical Conference Experiences

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The organisers of the upcoming conference "Quality of Multimedia Experience" (QoMEX) to take place in Karlshamn, Sweden in June 2024 are planning to offer two remote immersive participation experiences to online participants: (1) 360-video streaming of keynote speeches, and (2) a digiphysical interaction facility between on-campus and remote participants based on Virtual/Augmented/Mixed Reality (VR/AR/MR) headsets. In this workshop, we propose to test the corresponding remote experience equipment in a realistic transatlantic mixed reality setting. The Quality of Experience (QoE) of both immersive experiences could be evaluated (and as far as possible optimized) during the workshop. The corresponding results and insights will be used for preparing the remote conference experiences to take place at QoMEX 2024.

CCS Concepts: • **Human-centered computing → Mixed / augmented reality**.

Additional Key Words and Phrases: Remote participation, 360-video streaming, Mixed Reality

1 INTRODUCTION

The worldwide outbreak of the COVID-19 virus in early 2020 pushed research communities worldwide to (re-)organise their conferences in virtual ways. For example, this happened for the series of conferences "Quality of Multimedia Experience" (QoMEX, https://www.qomex.org) in 2020 and 2021. While presentations were streamed as pre-recorded videos, the live interactive Q&A parts were run with the author virtually present at the other end. During QoMEX 2020, the poster sessions were run through Mozilla Hubs (https://hubs.mozilla.com), which provided added value in form of feelings of proximity and presence for the remote participants. However, the Mozilla Hubs experience has shown to be much more intense when using a headset, as compared to a browser.

Since the worldwide aftermaths of COVID-19 have calmed down, it seems as if researcher travel has gone back to normal, with a potential exception: As it was realised that conferences, meetings etc. can be run remotely, thus saving travel time, cost and greenhouse gases, some urge for remote participation has prevailed. Thus, conferences offer both on-site and remote participation, turning the event into a *hybrid* one. However, many on-site and remote participants have witnessed issues with hybrid settings, often related to sound (such as excessive levels and reverberations) or handling issues (eating time and causing technostress) [1].

Our contribution proposes and aims at testing a hybrid conference setting (for the upcoming conference "Quality of Multimedia Experience" (QoMEX) to take place in Karlshamn, Sweden in June 2024), consisting of two remote immersive participation experiences: (1) 360-video streaming of keynote speeches, and (2) a digiphysical interaction facility between on-campus and remote participants based on Virtual/Augmented/Mixed Reality (VR/AR/MR) headsets.

The contribution touches upon both categories of workshop papers, *position paper* (for the approach) and *system description* (in particular addressing the set-ups of local and remote equipment).

2 POSITION PART

In the course of the preparations for QoMEX 2024, there were concerns about the feasibility of hybrid settings and especially problematic conditions for onsite participants, who might have traveled from far, might have spent a significant budget for participating, and might get their on-site conference experience spoiled by malfunctioning remote presence equipment. Likewise, remote attendants might experience quite unpleasing issues such as loss of sound or extraordinary sound levels caused by echo. This brought up the idea of pre-testing and acquiring experience with the planned setup well ahead of the conference, in order to assure a good hybrid experience for all participants, no matter whether onsite or online. The latter mandates a Quality of Experience (QoE) pilot test, which we hope to be able to carry out during this workshop. From this pilot test, we hope to obtain a set of preliminary qualitative and quantitative results and a first set of indications and answers to the research questions below, to form the basis for a larger-scale study.

2.1 Research Questions for the 360-Streaming Session

RQ1: How is the QoE of the (transatlantic) 360-streaming solution judged by remote participants?

- **RQ1a**: How do the participants rate the image quality?
- **RQ1b**: Which temporal disturbance patterns are observed?
- **RQ1c**: Which configuration settings have a positive impact on the QoE?

2.2 Research Questions for the Interaction Session

RQ2: How is the QoE of the (transatlantic) interactive session judged by remote participants?

- **RQ2a**: How do the participants rate the image quality?
- **RQ2b**: How do the participants at both ends perceive delay and its impact on the interaction between them?

3 SYSTEM PART

3.1 Equipment in Sweden

(1) Insta360 camera [2], with 8 200-degree fisheye lenses, streaming 360-video (both 2D and 3D), onboard processing and stitching [3]. Depending on settings, we observed a constant latency of up to 19 s.
(2) Oculus Quest 2 and Quest Pro headsets to connect to "The Owl" [4]. The installations (in developer mode) are in progress.

3.2 Equipment at the Workshop

(1) Oculus Quest 2 headset(s) to connect to the 360-live stream. At the time of writing, the software to watch the stream on the headsets is under development. Once the software will be ready, it will be offered to the workshop participants.
(2) Nokias solution "The Owl" [4].

3.3 Description of the Experiments

(1) The 360-video will be streamed live from Sweden to the US. Workshop participants will have the opportunity to watch the stream and comment on image quality (RQ1a) and temporal behaviour (RQ1b). As far as time permits, configuration settings (such as bitrate or resolution) will be varied, and the participants will be invited to give immediate feedback (RQ1c).

(2) A participant from SE will connect to "The Owl". S/He will interact with workshop participants at the workshop site, and will be able to judge spatial issues (RQ2a) and temporal issues (RQ2b).

3.4 Post-processing

As this is a pilot study, we do not expect extensive quantitative results. We will provide a lightweight questionnaire at the workshop addressing RQ1a and RQ1b. We will a.o. use the Absolute Category Rating (ACR)-related scale (ranging from 1 = bad to 5 = excellent) and calculate a set of simple summary statistics such as Mean Opinion Score (MOS), Percentage of Good or Better (%GoB) and Percentage of Poor or Worse (%PoW) [5]. According to our experience, the latter two measures have shown to be telling even for pilot studies with a rather small number of users. Furthermore, we will also collect and summarize qualitative feedback.

4 OUTLOOK

Depending on the outcome of the pilot study, we will plan for an extended publishable study (upon ethical approval) together with interested workshop participants.

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