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The virtual reality questionnaire toolkit

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The Virtual Reality Questionnaire Toolkit

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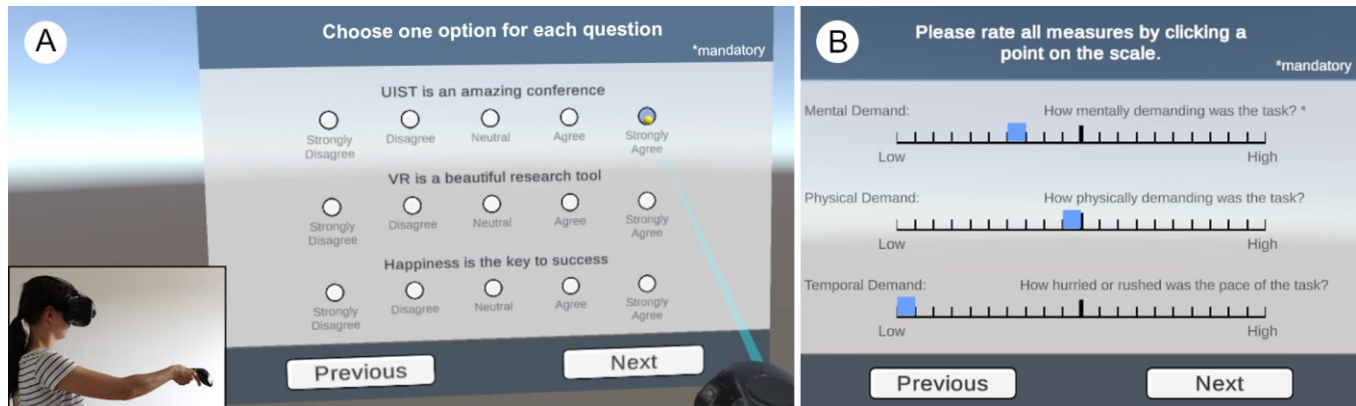Saarland Informatics Campus　　　　　　　　　Faculty of Information
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ABSTRACT

In this work, we present the VRQuestionnaireToolkit, which enables the research community to easily collect subjective measures within virtual reality (VR). We contribute a highly customizable and reusable open-source toolkit which can be integrated in existing VR projects rapidly. The toolkit comes with a pre-installed set of standard questionnaires such as NASA TLX, SSQ and SUS Presence questionnaire. Our system aims to lower the entry barrier to use questionnaires in VR and to significantly reduce development time and cost needed to run pre-, in between- and post-study questionnaires.

Author Keywords

Virtual Reality; Mixed-Reality; Toolkit; VR Questionnaires; User studies

CSS Concepts

• **Human-centered computing~Human computer interaction (HCI)**; *User interface toolkits*; User studies.

MOTIVATION

Questionnaires are one of the most common and well-established research methods in e.g., human-computer interaction and psychology. These communities have developed standardized procedures such as the NASA TLX

[3] enabling researchers to assess task load across different systems and modalities.

In the last decade, VR technology has gained considerable attention and rapidly evolved to one of the larger research fields in the HCI community. In the vast majority of work in this field, researchers have adapted this well-known procedure in their VR experiments [1]. Even though they execute experiments in a virtual environment, researchers mostly rely on paper-based or screen-based questionnaires. Thus, participants need to leave the virtual world to self-report their experience. Most recently, Putze et al. [5] and Schwind et al. [8] found that taking subjects out of the VR environment before filling out the questionnaire, may introduce a systematic bias in their subjective responses due to break in presence. In line with other research, they strongly suggest using VR questionnaires to find more reliable self-reports [1, 3, 4]. Tackling the question of how these questionnaires should be designed, Alexandrovsky et al. [1] studied various design choices and found that participants generally prefer filling in questionnaires in VR, but also experience slightly raised physical and mental demands in doing so.

Our questionnaire design incorporates many of their findings, and is, therefore, the first open-source toolkit which's design is based on a solid academic ground. For instance, we chose pointing as a selection technique and world-anchoring rather then using a trackpad and body-anchoring [1].

Our work marks a technical contribution aiming to lower the entry barriers to use questionnaires in VR. Moreover, for researchers building or running VR experiences or

```
"pId":"2",
"qType":"radio",
"qInstructions":"Choose one option for each condition
"qData":[
    {
        "qId":"q1",
        "qText":"UIST is an amazing conference",
        "qMandatory":"false",
        "qOptions":[
            "",
            "Strongly Disagree",
            "Disagree",
            "Neutral",
            "Agree",
            "Strongly Agree",
            ""
        ]
    },
```

Figure 2: JSON snippet corresponding to Figure 1 (A).

experiments, it significantly reduces time and cost needed to run pre-, in between- and post-study questionnaires in their experiments by allowing them to collect questionnaire data *in situ*.

IMPLEMENTATION
The toolkit was developed under Unity3D (v. 2019.2.17f1) using C#. In order to work with Valve's HTC Vive system[1], it requires SteamVR[2] and Vive's Input Utility[3]. We provide an easy-to-use unitypackage allowing researchers to integrate the VRQuestionnaireToolkit into existing projects via Drag & Drop [6]. Our toolkit comes with a documentation, examples, a pre-installed set of standard questionnaires [2, 3, 4, 6, 8], and the open-source code[4].

Architecture
A questionnaire is described by a `.json` file which specifies its structure. The tool generates all required components based on the .json file during runtime. In the first version, we provide up to 10 questionnaires in a single Unity3D scene. Each questionnaire is composed of pages which then host up to three questions of the same question type. Through an interface class, they can be turned-on/off on demand allowing experimenters to gather subjective data between study conditions. The system automatically exports the collected data as a *.csv* or *.txt* file.

Question Types
In the first version of this toolkit, we provide six different question types: radio (see Figure 1 (A), and corresponding json file (see Figure 2)), radioGrid, linearGrid (see Figure 1 (B)), linearSlider, checkbox, and dropdown. These question types were chosen based on previous findings [1]. Detailed information regarding the provided functionalities can be found in the documentation.

FUTURE WORK
We do not see our work being done here. Especially in the light of the most recent work in this domain, we rely on the

community to establish standardized designs for VR questionnaires. We contribute to this movement by providing a platform incorporating the first validated design choices. Moreover, we plan to constantly update the VRQuestionnaireToolkit's design and its functionalities.

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