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Information technology for learning, education and training – Human factor guidelines for virtual reality content

Part 1: Considerations when using VR content

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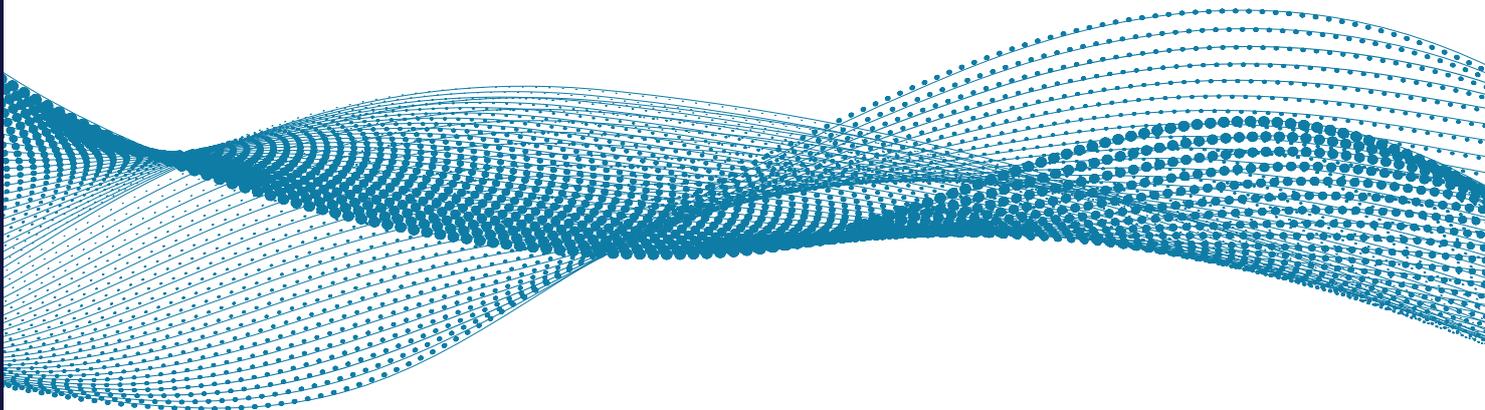
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Standards Australia/Standards New Zealand
Technical Report

Information technology for learning, education and training – Human factor guidelines for virtual reality content

Part 1: Considerations when using VR content

Preface

This Technical Report was prepared by the Joint Standards Australia/Standards New Zealand Committee IT-019, Information and Documentation, Information Technology — Learning, Education, Training and Research.

The objective of this document is to present considerations for using VR content in the learning, education and training (LET) domain for reducing reality and virtual reality crossover confusion among users and assisting users to effectively use these emerging technologies.

This document addresses VR content that uses a head-mounted display (HMD) in the LET domain. It does not address VR content using immersive technology and does not address augmented reality, mixed or merged reality content.

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Contents

Foreword

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This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 36, *Information technology for learning, education and training*.

A list of all parts in the ISO/IEC 23842 series can be found on the ISO website.

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Introduction

Virtual reality (VR) technology is expected to be introduced into the world of primary and secondary education in the next two to three years.[1] However, there are some concerns, such as health-related side effects for learners who use VR technology in their development period. These issues can be raised in any environment that uses VR content.

Concerns related to health conditions:

— Discomfort: When using VR, some people experience symptoms of discomfort, such as dizziness, headache and nausea. These symptoms are called various terms such as 'VR sickness', 'simulator sickness', 'motion sickness' and 'cyber nuisance'. When actual physical movement does not occur with respect to the visual stimulus generated in the virtual environment, discomfort can be caused.

— Eyesight problems: Many devices are located very close to the user's eyes. As a result, some people feel visual fatigue after wearing them for a long time, and some users experience blurred vision, diplopia and mechanical near-sightedness.

— Photosensitivity Syndrome: Also known as Pokemon Shock or Nintendo Syndrome, this is a condition in which seizures (epilepsy) occur due to rapid flashing light stimuli.

— Musculoskeletal disorders due to repetitive tasks: If someone repeatedly takes the same posture for a long period of time to operate the machine, pain or fatigue can be caused by continuous stimulation of the musculoskeletal system.

— Hygiene problems: If many people use the same device jointly, or even if one person uses the same device repeatedly, problems such as infectious disease or skin irritation can occur.

Concerns related to safety:

— Limitations of the user's field of view: When using a device that blocks physical surroundings from view, a user may not be able to remain aware of their physical surroundings which can lead to accidents such as collisions, falling, etc. Even if someone uses a see-through or semi-transparent device that overlaps a virtual object with reality, such distraction physical surroundings could increase the risk of having an accident, such as falling.

— Safety accidents caused by confusing reality with the virtual world: Accidents can occur in scenarios such as users trying to sit or lean against a virtual world chair or wall that does not exist in real life.

Concerns related to social aspects:

— If users cannot distinguish between the real world and the virtual world by excessive immersion into virtual reality, they may attempt to restart a real-life situation as if they were able to simply push the 'reset button' in VR.

Annex A provides examples of guidelines for users.

NOTES

Technical Report

Information technology for learning, education and training — Human factor guidelines for virtual reality content

Part 1: Considerations when using VR content

1   Scope

This document presents considerations for using VR content in the learning, education and training (LET) domain for reducing reality and virtual reality crossover confusion among users and assisting users to effectively use these emerging technologies.

This document addresses VR content that uses a head-mounted display (HMD) in the LET domain. It does not address VR content using immersive technology and does not address augmented reality, mixed or merged reality content.

2   Normative references

There are no normative references in this document.

3   Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

—   ISO Online browsing platform: available at https://www.iso.org/obp

—   IEC Electropedia: available at http://www.electropedia.org/

3.1
virtual reality
VR
virtual reality has a high level of immersiveness, fidelity of information representation, and degree of active learner participation compared to other forms of mixed reality

[SOURCE: ISO/IEC TR 18121:2015, 3.6]

3.2
mixed reality
display continuum in which both real and virtual images are combined in some way and in some proportion

Note 1 to entry: Augmented reality (AR) and virtual reality (VR) are considered to be on the mixed reality continuum.

3.3
immersive technology
tools that enable the integration of virtual content and the physical environment in a manner that supports user engagement with the resulting blended reality

Note 1 to entry: Some types of immersive activities and experiences include virtual reality, augmented reality, pervasive games, digital twins, telepresence and holography.

Note 2 to entry: Supportive technologies that are used for these activities and experiences may include a combination of different items such as speech recognition, haptics, cameras, 3D displays, headsets, audio, gesture recognition, omnidirectional treadmills, etc.

3.4
augmented reality
virtual objects superimposed upon or composited with the real world

Note 1 to entry: Virtual and real-world objects co-exist in augmented reality systems.

4   Abbreviated terms

HMD   head-mounted display

LET   learning, education and training

5   Considerations before use

5.1   General

Because the VR experience can vary greatly from user to user, it is recommended to confirm a user's reaction to a VR device before typical or regular use.

5.2   Device, usage environment and hygiene safety

It is recommended to confirm the information on the device to be used (HMD, controller, etc.) in advance, such as the suggested age, wearing method, etc. For example, heavyweight devices for users can cause negative musculoskeletal symptoms. Also, devices that do not fit or are not fixed properly can cause users to experience VR sickness. So, it is recommended to check the weight and size of the target device before use. It is additionally recommended to use devices that are adjustable to best suit the users' inter-pupillary distance.

Furthermore, it is recommended to ensure that the area for usage is adequate in size and free of potentially dangerous obstructions. When using seated-scale or standing-scale content, the radius of a user's arms can be enough. However, when using room-scale content with motion required, it is recommended that there are no protruding objects on the floor or wall. When using devices that block the user's physical surroundings, accidents such as collisions and falling may occur. Even if a user uses a see-through device that overlaps a virtual object with reality, such distraction from physical surroundings increases the risk of having an accident. It is therefore recommended to check the physical environment where usage will take place to remove any or all obstacles. If users use multiple wireless devices in the same room, device interference can also occur. If users want to use multiple wireless devices, it is recommended to check the maximum number of devices in advance.

With frequent usage of a device, attention to hygiene is also recommended for the prevention of infectious diseases such as eye diseases and skin diseases. It is recommended to use antiseptic pads, wipes or UV disinfection.

5.3   Select content considering educational purpose

If commercial content that is not intended for educational purposes is used, it is recommended to consider the curriculum or educational goals. Furthermore, it is recommended to acquire information about the content by referring to the sample image before use. Even when content intended for educational purposes is used, it is recommended to consider the effectiveness of using VR content.

In the case of commercial content, it may not be consistent with the classification criteria and suggested age with the intended educational purpose. Teachers or parents who want to use commercial content for educational purposes should check the information on its content and appropriateness rating in advance. In addition, most VR devices are designed for adults, not children. Due to the heavy weight of a device, it might not be suitable for certain ages and it may cause physical strain to the user. Though some devices are suitable for children, it is always recommended to check the suggested age for each user.

Additionally, VR content can cause distractions as there are many factors that attract the attention of learners. Teachers or parents can guide the learner's attention by showing the important points to be examined or explored before using the content.

5.4   Check user's health and mental conditions

The user's health status, such as medical device usage, disease, health conditions or a combination of all of these can affect the virtual reality experience. It is therefore necessary to check the health status of each user before use. In the following cases, caution should be exercised.

— If a user is tired or has symptoms such as cold, headache, migraine, ear infection, stress, anxiety, etc. it is recommended that usage is avoided. Also, for people taking certain medications that cause dizziness, nausea, etc., it is recommended to avoid usage.

— If users experience seizures or epilepsy, it is recommended to consult with a doctor or specialist before use. Also, if users wear medical devices such as pacemakers, hearing aids, defibrillators or a combination of all of these, it is recommended to consult with a doctor or specialist before use as magnetic parts or telecommunication components of VR devices may affect medical devices.

6   Considerations in use

It is recommended to take frequent breaks while using VR devices. Heat from a device may cause low temperature skin burns and displays may also affect eyesight.

It is further recommended to notify users to stop using VR at any time if a user notices any abnormal symptoms during use. When learners are in an immersive state of mind, they may forget to limit the amount of usage or stop for breaks. If any part of the body is fatigued or sick, or if a user feels symptoms such as tingling, paralysis, burning, stiffness, seizures, loss of awareness, eye fatigue, convulsions of the eyes or muscles, unconscious movements, diplopia, other visual anomalies, nausea, dizziness, etc., it is recommended to consult with a doctor.

7   Considerations after use

It is recommended that teachers or parents notify learners that VR experiences are not real. When using VR content, users may experience confusion between the virtual world and reality. For example, behaviour in the virtual world, such as jumping from a high place, can also be attempted in the real world, but to do so would be extremely dangerous and would have a harmful (potentially fatal) outcome. This is particularly likely to be a problem for young children whose cognitive abilities are underdeveloped.

Annex A
(informative)

Examples of guidelines for users

A.1   Use cases in Korea

Contributor (name and contact)	Jae-uk EU (calla@keris.or.kr)
Source (name or url)	Barun ICT Research Center (http://barunict.kr/?p=8162)
Main stakeholders	VR user
Description	In May 2016, the Barun ICT Research Center at Yonsei University issued the VR safety guide, which was first produced and distributed in Korea. In May 2018, the second VR safety guide was further subdivided and distributed. The main contents are: — Precautions during use: When a user's physical or mental condition is or becomes abnormal, it is recommended not to use a device or to cease usage and take a break if such symptoms occur. Also, if a device and/or program are abnormal, refraining from usage is recommended. — Precautions when using the device: It is recommended to check the condition of each device, such as battery status, lens conditions, etc., before usage. It is further recommended that users do not walk or operate a vehicle when using a device. Also, it is recommended to keep the device out of direct sunlight, hot temperatures, and out of reach of children or pets. When used by many people, it is necessary and highly recommended to use disposable eyepatches or sanitary wipes. — Precautions when using the content: It is recommended to rid the area of usage from obstacles within a 2-metre radius. Also, with first time use, it is recommended to adjust the difficulty to an easy level. If a user is accustomed to using such devices, it is still highly recommended to take a break for 5 to 10 minutes after every 30 minutes of usage. — Precautions for users: Before use, it is recommended to check each user's physical and mental condition as well as to ensure that the VR device and content is age appropriate. It is additionally recommended to record the weekly amount of time VR is used and consult a specialist if addiction and/or over-dependence occurs.

A.2   Use case in Japan

Contributor (name and contact)	Hyojeong LEE (hlee@keris.or.kr)
Source (name or url)	Location-based VR Association Inc. (https://lva.or.jp/pdf/guidelines.pdf)
Main stakeholders	VR user (special in location-based VR)
Description	Location-based VR Association Inc., which is composed of the main business operators involved in the operation of the locational base VR, issued guidelines on the age for use of the installed VR content. The main contents are:
	— Children under the age of 7 should not use VR. — It is recommended to receive parental judgement in selecting VR content. — During VR content use, users should take a break for 10 to 15 minutes following every 20 minutes of use. — For children who have diplopia, abnormal eyesight or an ophthalmological disorder, it is recommended to consult an ophthalmologist. — If an abnormality with a child's eyesight is experienced after usage, it is recommended to consult a specialist as soon as possible.

Bibliography

[1]   The New Media Consortium. NMC Horizon Report 2017: Higher Education Edition.

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