Safe Use of Immersive Technologies: Virtual Reality (VR), Augmented Reality (AR), Mixed Reality (MR) Guidelines

Scope and Purpose

These guidelines apply to staff, students, visitors and contractors of Monash University in Australia, who are involved in the planning, development and implementation of immersive technology experiences.

These guidelines have been prepared to assist areas in understanding and mitigating the risks of the use of immersive technologies. The technology in the field of immersive reality (including Virtual Reality, Augmented Reality and other mixed modes) is rapidly evolving, becoming both increasingly immersive and increasingly accessible. Hazards from the use of immersive technologies can include both the physical and the psychological.

Abbreviations

OHS	Occupational Health and Safety
OH&S	Monash Occupational Health & Safety team, led by the Health, Safety and Wellbeing Manager
S.A.R.A.H.	Safety and Risk Analysis Hub

Definitions

A comprehensive list of definitions is provided in the Definitions tool. Definitions specific to these guidelines are provided below.

Virtual Reality (VR): a computer-generated simulation of a three-dimensional image or environment that can be interacted with in a seemingly real or physical way by a person using special electronic equipment, such as a helmet with a screen inside or gloves fitted with sensors

Augmented Reality (AR): technology that superimposes a computer-generated image on a user's view of the real world, thus providing a composite view

Mixed Reality (MR): immersive computer-generated environments in which elements of a physical and virtual environment are combined

Hazards

1. Physical Hazards

1.1 From the device:

The hardware manufacturer will supply safety instructions, which will include warnings such as: ergonomic hazards; fire/heat hazards; electrical hazards; warnings for persons with medical conditions or implanted medical devices.

Other potential hazards which may need to be considered:

- Injury due to headset wiring. If the headset needs a wired data or power connection, or there is tethering of the device to avoid theft, there may be a risk of tripping, entanglement or neck injury
- Transfer of bacteria/viruses/allergens from shared equipment
- Eye and muscle strain, particularly from extended use

1.2 From interacting with the content:

- Injury due to loss of balance (e.g. falls)
- Injury due to not being aware of surrounding environment (e.g. collision with objects)
- Injury due to a strong physical reflex
- Injury due to prior medical conditions

2. Psychological Hazards

2.1 From the immersive experience:

Immersive experiences can invoke a sense of "presence" to the extent that users cannot fully override their bodies' natural survival instincts and reflexes. Mental health risks thus exist in terms of triggering underlying cognitive (e.g. reasoning, attention, judgement), psychological (e.g. anxiety or trauma) or neurological (e.g. balance problems) issues.

2.2 From the content

Virtual environments can elicit emotional responses similar to comparable real environments. Virtual environments may expose individuals to environments that may trigger underlying mental illness or trauma (e.g. anxiety, panic, depression). This is particularly true of environments used to explore the impact on behaviour or mental illness, whether they are in clinical or research contexts.

Hazard controls

1. Hardware safe guidelines for users

Safety instructions provided by viewer/headset manufacturers should be reviewed in the context of the intended use, and controls incorporated as necessary into the design of the experience.

If there is a risk associated with a person using the viewer/headset without being aware of the manufacturer's safety instructions, those instructions (or a summary of the relevant points) should be provided to users prior to use. This information can be given:

- Verbally by an experienced supervisor; or
- Displayed or provided to users in writing. In particular, if equipment is being provided to remote users without supervision, this information should accompany the viewer/headset as a leaflet, or, as a minimum as a link to the safety instructions, with the instruction that the information must be read before use of the device. For immersive technologies used for teaching purposes, the safety information or link can also be included in the unit coursework.

2. Control of other physical hazards

Beyond correct use of the headset/display, the manufacturer's information will also include guidance on control of associated hazards:

- Setting the device experience to be sitting, or within a user defined safe boundary from objects;
- Safe charging procedures; and
- Safety considerations for device storage and placement (e.g. avoiding direct sunlight on lenses).

Where equipment is shared by multiple users, hygiene of equipment to prevent transmission of disease or allergens should be maintained. This may require a cleaning schedule, to be performed by users or supervisors and/or extra or adapted equipment such as "ninja" disposable masks or wipeable inserts.

3. Content development

Differing levels of experience, both in the creators of the immersive experience and the consumers of this content, need to be taken into consideration. Content creators tend to have more exposure to VR and therefore may underestimate the risks of the content for inexperienced users, or those with underlying physical or mental health conditions.

Content that creates avoidable physical risk, such as simulated movement, should not be used where there is no requirement for the movement itself to meet learning or research objectives, unless prior experience or training can be ensured.

Monash already creates education and research content that can be physically and psychologically challenging to the user, with the purpose of creating effective learning and research outcomes. Immersive technologies will play a major role in providing more ways of teaching and researching challenging content (e.g. scenarios used in the clinical treatment of mental illness). Content creation therefore needs to adhere to already established safety procedures and guidelines for education and research content, providing the user with appropriate support when needed.

In addition to established content practices, the realistic nature of the media itself needs careful consideration to not introduce unwarranted risk.

As a general guideline, immersive technologies should not be treated as "just a game" which is not "real" and has no lasting impact.

Immersive technologies are in some cases specifically being used to induce enduring changes in brain function and structure. For example, immersive technologies are being used to treat a range of mental health conditions (e.g. phobias, Post Traumatic Stress Disorder (PTSD), Obsessive Compulsive Disorder (OCD), addiction). Research has shown that these virtual environments can elicit emotional responses similar to comparable real environments. From a risk perspective it is therefore prudent to consider the content as if it were a real experience, which the user will remember as such, and manage it in the same way with the same or comparable risk mitigation and management processes.

As a general guideline, creating traumatic and emotionally challenging experiences should be treated as a risk mitigation strategy. For example, a language interpreter working directly with clients may experience traumatic scenarios as part of their everyday work (e.g. family violence, wars, vicarious trauma). The current strategy for preparing the student for this is text and lecture based. This risk mitigation strategy does not allow the student to experience the emotional triggers of a psychologically risky situation prior to experiencing it in the workforce (e.g. working in close proximity to a violent offender). VR can be used to reduce this risk of workplace trauma by presenting a controlled scenario backed up by emotional support during and post the experience, using debriefing and guided reflection-in-action and on-action. There is a risk of emotional triggering in the VR experience but this educational strategy greatly reduces the risk to the student in the workforce.

4. Content warning guidelines

Users should have some indication of what to expect when engaging in the scenario (unless surprise is the intended experience). Through a briefing and orientation process, they should be informed of what device(s)

the content has been designed for and given warnings of possible risks, and if possible an indication of how the content has been created to minimise risk. In cases where surprise or deception is intentional, harms caused by the content should be minimal and not provide and enduring impact on the individual. Participants should also be debriefed about the reason for the content and that they will not experience any enduring harms.

If in doubt, a content warning should contain a brief overview so the user can make an informed decision based on their past history.

5. User orientation

User orientation can be through:

- explanation from a supervising person, or
- printed material accompanying the equipment or content.

Printed material could be the manufacturer's instructions/manual, or contextualised information for a specific use. Examples of printed material to accompany a fixed installation, and for an experience to be provided remotely, are given later in this document.

User orientations may not be necessary for Augmented Reality, when good connection with reality is maintained.

5.1 Orientation for a seated experience:

Users should be instructed to pay particular attention to:

- being immersed and not aware of your surrounding environment
- medical conditions that may need to be considered

And provided with:

- instructions for operating the headset and accessory equipment safely
- information on exiting the experience safely

5.2 Orientation for a standing/moving experience:

For inexperienced users, user orientation for a standing/moving experience should be preceded by a seated orientation. The participant can then make an informed decision to try more advanced immersive experiences such as standing or walking.

A supervised orientation for a standing/moving experience should:

- Ensure safe operating instructions and warnings as for the seated induction have been provided
- Allow the user to test the immersive experience in a seated position until they feel comfortable
- Supervise the user as they test the standing position and observe for signs of losing balance (e.g. leaning when they are unaware they are leaning)

Experiences that involve standing or moving around a space should in addition have an appropriate level of supervision throughout the experience.

6. Supervision

It is possible to allow a seated experience without supervision if content and hardware pose a low level of risk to the user and safe use information is provided. Similarly, AR experiences may be appropriate to deliver without supervision.

Where supervision is being used as a risk control, the supervision needs to be performed by someone that has already experienced the content and is aware of the safety issues to be considered (i.e. at minimum should have read and understood the same information that is provided to the user).

If the immersive experience is designed to evoke strong emotional responses in vulnerable individuals (e.g. those with a mental illness), it should be supervised by an appropriately qualified clinician at all times.

The supervisor:

- directs the participants to the written safety information, or delivers the information verbally.
- confirms that the user is able to exit the experience easily
- supervises the user as they test the standing position and observe for signs of losing balance (e.g. leaning when they are unaware they are leaning)
- confirms periodically that the participant is feeling in control of the situation

The person supervising must be aware of the safety controls that have been put in place (e.g. hygiene requirements) and the procedures if a known risk occurs (e.g. what to do if someone is experiencing a seizure or has a fall).

Risk Assessment

An OHS centrally managed risk assessment *24812 Minimum requirements - Use of Virtual/Augmented reality systems* has been developed to accompany these guidelines.

If any use case falls outside the scope of the minimum requirements Risk Assessment, or if the hazard controls outlined in the minimum requirements cannot be implemented, a local Risk Assessment will need to be undertaken to determine appropriate alternative or supplementary controls.

In particular, a thorough and specific Risk Assessment should be developed for any use case which:

- requires deviation from the manufacturer's safety instructions
- has content which creates physical discomfort for the user (e.g. long use time, disorienting effects)
- has content which in a real situation would require supervised user support or the presence of an appropriately trained clinician

Example information for users and supervisors

1. User safety material for an unsupervised seated experience at a public event

Printed instructions displayed at each VR station

VR Headset Safety Guidelines

- The VR experiences are designed to be viewed while seated. Please remain seated during use.
- While using the headsets, please wear the provided disposable masks.
- Adults should supervise children during and immediately after the use of the headsets. The headsets should not be used by children under the age of 13.
- If you have a pacemaker or other implanted medical device, do not use the headset or controller as they emit radio waves.

- Be cautious of motion sickness. If you feel dizzy or become nauseous while playing, stop using the product and rest. Feel free to take off the headset if you feel ill, your eyes start to hurt, or you experience any other form of discomfort.
- Do not consume food or drink in or near the headsets.
- Please do not use the headset if it is damaged. If the headset is hot, please do not start or continue to use the headsets. Please report to staff if the headset is damaged.

2. Safety material provided with supervised standing experience at a public event

VR Headset User Safety Guidelines

- Do not use the VR experience without supervision
- Do not use VR equipment if you have electronic medical devices implanted
- Take note of your surrounding environment and cable positions before placing on the VR headset
- Virtual Reality may cause motion sickness and/or loss of balance
- If you are new to VR please try the experience seated first
- Become familiar with taking off the headset
- Report any discomfort to the supervisor
- Virtual Reality may trigger seizures in some people, please consult a doctor prior to using this experience if you have concerns
- Your time will be limited to 20 minutes

3. Safety material provided with headsets provided to students for home use

This material will in general be the manufacturer's safety instructions, plus:

- any necessary additional use instructions
- any appropriate content warnings
- a method of confirming that the safety instructions have been read and understood

Effective and Safe Use of this 360 VR Content

The video content provided has been designed for use with a MaxBox Google Cardboard. Please consult the product safety information provided with the product before using it. For reference, the latest product safety information for this device can be found here: https://www.maxboxvr.com/product-safety

If you are using another device to view the content you should always refer to the safety instructions that are associated with your particular device before using the headset. Quality and experiences may vary from device to device.

The following general recommendations apply for effective and safe use of 360 VR video.

Follow manufacturer's instructions and warnings and be mindful of:

- being immersed and not aware of your surrounding environment.
- medical conditions that may need to be considered
- correct operating instructions for the headset and accessory equipment

The content portrays an office scenario where the viewer sees the same discussion from different perspectives.

The video content has been designed with the following considerations in mind:

- The content is viewed in a seated position and does not require you to move around or make hand gestures.
- The content has no sense of movement included to reduce the likelihood of nausea
- The content is short to allow frequent breaks
- The content is also viewable in a non-immersive environment

4. *Supervisor instructions*

VR Headset Supervision Safety Guidelines

- Familiarise yourself with the experience prior to the event so you can effectively direct users as to what to expect and how to navigate
- Ensure every user has read and understood the "VR Headset User Safety Guidelines"
- Determine how experienced the user is before getting them to try on the headset (e.g. "Have you tried VR before?") If they are inexperienced they will need to start seated before progressing to a standing experience
- Ensure hygiene measures have been completed between users (e.g. headsets wiped or "ninja" masks used)
- Due to food allergy risk, ensure hands are clean and do not consume food to avoid risk of traces of food on equipment
- Guide user through use of headset and how to exit the experience
- Ensure the headset is set-up correctly for the user (e.g. IPD, straps, etc)
- Give an overview of content prior to the experience
- Observe for signs of motion sickness (e.g. leaning, verbal and non-verbal expressions of loss of balance or difficulty in navigation)
- Adults should also supervise children during and immediately after the use of the headsets. The headsets should not be used by children under the age of 13.
- Please do not use the headset if it is damaged. If the headset is hot, please do not start or continue to use the headsets.
- Ensure "First Aid for Seizures" printouts are available and read prior to event start.

If issues arise assist the user to seek medical help.

Medical emergencies
Ambulance - Tel: 000
Campus security - Tel: 333 (9905 3333)

Responsibility for Implementation

A comprehensive list of OHS responsibilities is provided in the document OHS Roles, Responsibilities and Committees Procedure. The specific responsibilities with respect to risk management of VR, AR and MR are summarised below.

- **Heads of Academic/Administration Units:** It is the responsibility of the Head of the academic/administrative unit to ensure that these guidelines are implemented in their area.
- **Local OHS Committees:** It is the responsibility of local OHS committees to provide advice and feedback to heads of academic/administrative units on actions needed to comply with these guidelines.
- **Supervisors:** It is the responsibility of supervisors to ensure that these guidelines are utilised in the management of activities involving VR, AR and MR, in their areas of responsibility.
- **Staff, Students, Visitors and Contractors:** All staff, students, visitors and contractors of Monash University who are planning, developing or implementing activities that involve the use of immersive technologies are expected to familiarise themselves with the requirements of these guidelines. All staff, students, visitors and contractors of Monash University who are participating in activities involving immersive technology must comply with the control measures documented for the activity.

Tools

The following tool is associated with these guidelines:

- SARAH Centrally Managed Risk Assessment #24812 *Minimum requirements - Use of Virtual/Augmented reality systems*

Legislation and Related Documents

Legislation Mandating Compliance

- Occupational Health and Safety Act 2004 (Vic)

Australian and International Standards

- ISO 45001: 2018 OHS Management Systems - Requirements with guidance for use.

Monash OHS documents

- OHS Roles, Responsibilities and Committees Procedure

Acknowledgement

These guidelines are based on work done by a collaborative team from eSolutions, the School of Psychological Science and the Turner Institute.

Document History

Version	Date of Issue	Changes made to document
1.0	September 2022	Guidelines v.1.0