# XR User Needs and Requirements

## 4.1 User needs definition

This document outlines various accessibility related user needs for XR. These user needs should drive accessibility requirements for XR and its related architecture. These come from people with disabilities who use assistive technologies and wish to see the features described available within XR enabled applications.

User needs and requirements are often dependent on context of use. The following outline some accessibility user needs and requirements that may be applicable in immersive environments, augmented reality and 360° applications.

These following are neither exhaustive, nor definitive but are presented in order to help orientate the reader towards understanding some broad user needs and how to meet them.

## 4.2 Immersive semantics and customization

User Need 1: A user of assistive technology wants to navigate, identify locations, objects and interact within an immersive environment.

REQ 1a: Navigation mechanisms must be intuitive with robust affordances. Navigation, location and object descriptions must be semantically accurate and identified in a way that is understood by assistive technology.

REQ 1b: Controls need to support alternative mapping, rearranging of position, resizing and sensitivity.

## 4.3 Motion agnostic interactions

User Need 2: A person with a physical disability may want to interact with items in an immersive environment in a way that doesn't require particular bodily movement to perform any given action.

REQ 2a: Allow the user performing an action in the environment, in a device independent way, without having to do so physically.

REQ 2b: Ensure that all areas of the user interface can be accessed using the same input method.

REQ 2c: Allow multiple input methods to be used at the same time.

## 4.4 Immersive personalisation

User Need 3: Users with cognitive and learning disabilities may need to personalise the immersive experience in various ways.

REQ 3a: Support Symbol sets so they can be used to communicate and layered over objects and items to convey affordances or other needed information in way that can be understood according to user preference.

REQ 3b: Allow the user to turn off or 'mute' non-critical environmental content such as animations, visual or audio content, or non-critical messaging.

## 4.5 Interaction and target customization

User Need 4: A user with limited mobility may need to be able to hit a larger 'Target size' for a button or other controls in immersive environments.

REQ 4a: Ensure fine motion control is not needed to activate an input.

REQ 4b: Ensure hit targets are large enough with suitable spacing around them.

REQ 4c: Ensure multiple actions or gestures are not required at the same time to perform any action.

## 4.6 Voice commands

User Need 5: A user with limited mobility may want to be able to use Voice Commands within the immersive environment, to navigate, interact and communicate with others in XR environments.

REQ 5a: Ensure Navigation and interaction can be controlled by Voice Activation.

## 4.7 Color changes

User Need 6: Color blind users may need to be able to customise the colors used in the immersive environment. This will help with understand affordances on various controls or where color is used to signify danger or permission.

REQ 6a: Provide customised high contrast skins for the environment to suit their particular luminosity and color contrast requirements.

## 4.8 Magnification context and resetting

User Need 7: Screen magnification users may need to be able to check the context of their view in immersive environment.

REQ 7a: Allow the screen magnification user to check the context of their view and track/reset focus as needed.

## 4.9 Critical messaging and alerts

User Need 8: Screen magnification users may need to be made aware of critical messaging and alerts in immersive environments often without losing focus. They may also need to route these messages to 'second screens' (see REQ 1).

REQ 8a: Ensure that critical messaging, or alerts have priority roles that can be understood and flagged to AT, without moving focus.

## 4.10 Gestural interfaces and interactions

User Need 9: A blind user may wish to interact with a gestural interface, such as a virtual menu system, using gloves and a head set.

REQ 9a: Using a virtual menu system - enable a self-voicing option and have each category, or item description spoken to them as they receive focus via a gesture or other input. As the blind user gestures to trigger both movement and interaction. The user may get more detail about items that are closer to them, if navigating a virtual store the user must be allowed to query and interrogate items and make selections.

## 4.11 Text description transformation

User Need 10: A deaf or hard of hearing person, for whom English or any other written language, may not be their first language and may have a preference for signing of text alternatives or equivalents.

REQ 10a: Allow object or item text descriptions to be presented to the user via a signing avatar.

## 4.12 Safe harbour controls

User Need 11: People with Cognitive Impairments may be easily overwhelmed in Immersive Environments.

REQ 11a: Allow the user to set a 'safe place' - quick key, shortcut or macro.

## 4.13 Immersive time limits

User Need 12: Users with cognitive impairments may be adversely affected by spending too much time in any immersive environment or experience, or may lose track of time.

REQ 12a: Allow the user to set a time limit for any immersive session.

## 4.14 Reset focus and orientation

User Need 13: A screen magnification user or user with a cognitive disability or learning impairment may easily lose focus and be disorientated in immersive environments.

REQ 13a: Ensure the user can reset and calibrate their orientation/view in a device independent way.

REQ 13b: Ensure field of view in Immersive environments, are appropriate, and can be personalised - so users are not disorientated.

## 4.15 Routing to second screens

User Need 14: A deaf-blind user communicating via a RTC application in XR may have sophisticated 'routing' requirements for various inputs and outputs.

REQ 14a: Allow the user to route text output, alerts, environment sounds and audio to a braille or other devices.

## 4.16 Interaction speed

User Need 15: Users with physical disabilities or cognitive and learning disabilities may find some interactions too fast to keep up with or maintain.

REQ 15a: Allow users to change speed at which they travel through an immersive environment, or can perform interactions.

REQ 15b: Allow timings for interactions or critical inputs to be modified or extended.

REQ 15c: Provide an XR angel or helper for the user with a cognitive or learning disability.

REQ 15d: Provide clear start and stop mechanisms.

## 4.17 Avoiding sickness triggers

User Need 16: Users with vestibular disorders, Epilepsy, and photo sensitivity may find some interactions trigger motion sickness and other affects.

REQ 16a: Avoid interactions that trigger epilepsy or motion sickness and provide alternatives.

REQ 16b: Ensure flickering images are at a minimum, will not trigger seizures (more than 3 times a second), or can be turned off or reduced.

## 4.18 Binaural audio track alternatives

User Need 17: Deaf and hard of hearing users may need binaural recordings of audio content in order to perceive it.

REQ 17a: Provide alternative binaural audio recording tracks to emulate 3 dimensional sound forms in immersive environments.

## 4.19 Subtitling customization

User Need 18: Users with vision impairments may need to customise subtitles and other text in immersive environments.

REQ 18a: Allow customisable context sensitive reflow of text and subtitled content in XR spaces. The suitable subtitling area may be smaller than what is required currently for television [[inclusive-seattle](https://www.w3.org/TR/xaur/#bib-inclusive-seattle)].

## 4.20 Mono audio option

User Need 19: Users with hearing loss in just one ear may miss information in a stereo or binaural soundscape.

REQ 19a: Allow mono audio sound to be sent to both headphones so that the user can perceive the whole soundscape through either ear.