XR4 HUMAN

June 4, 2024

Pre-conference Workshop 5: Towards an equitable, inclusive, and human-centered development, production and use of eXtended Reality technologies

Moderators: *Rigmor C. Baraas (USN), Rosemarie de la Cruz Bernabe (UIO, USN), Miltos Ladikas (KIT), Lucas Stephane (IFE)*

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Workshop Agenda

Part 1 (45 mins)

Provide information on research integrity challenges, and alternative solutions, to design and development of immersive technologies.

These include diversity, inclusivity, accessibility, and interoperability challenges.

Part 2 (1 hour)

Gather feedback, impressions, and suggested solutions through group work.

To ensure maximum participation, the CME Oslo Model for Ethical Reflection will be used.

Part 3 (1 h 15 mins)

Each group will report on their results, allowing for questions and short discussions from the audience

— followed by a plenary discussion of alternative solutions and ideas to understand level of consensus.

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XR Risks and Governing Ethical Principles

D2.1: Mapping of the ethical Issues in XR-overview of Ethical Frameworks: A Scoping Review

Presenter: *Rosemarie Bernabe, PhD*

Contact Info: *University of Oslo/University of South-Eastern Norway, rdbernab@uio.no*

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D2.1: Mapping of the ethical Issues in XR-overview of Ethical Frameworks: A Scoping Review

Authors: Shereen Cox (UiO), Ellen Svarverud (USN), Jonathan Adams (UiO), Alina Kadlubsky (OARC EU) Rosemarie DLC Bernabe (USN/UiO), Rigmor C. Baraas (USN)

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RESEARCH ARTICLE

A scoping review of the ethics frameworks describing issues related to the use of extended reality

[version 1; peer review: awaiting peer review]

Shereen Cox, Alina Kadlubsky, Ellen Svarverud, Jonathan Adams, Rigmor C. Baraas, Rosemarie D.L.C Bernabe

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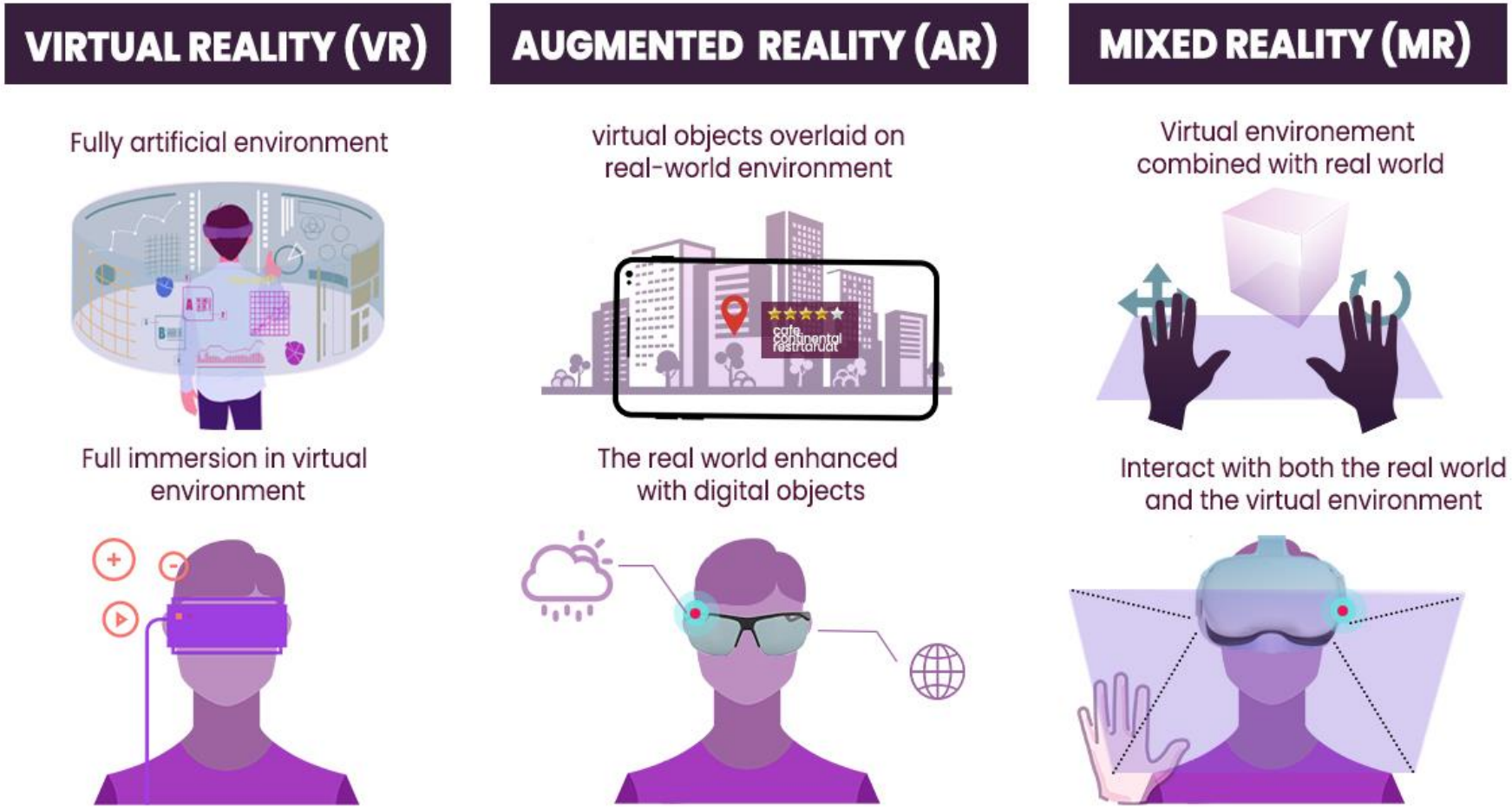
XR Technologies:
Virtual reality (VR), Mixed reality (MR) , Augmented reality (AR)



https://www.unitear.com/blog/difference-between-augmented-reality-and-virtual-reality

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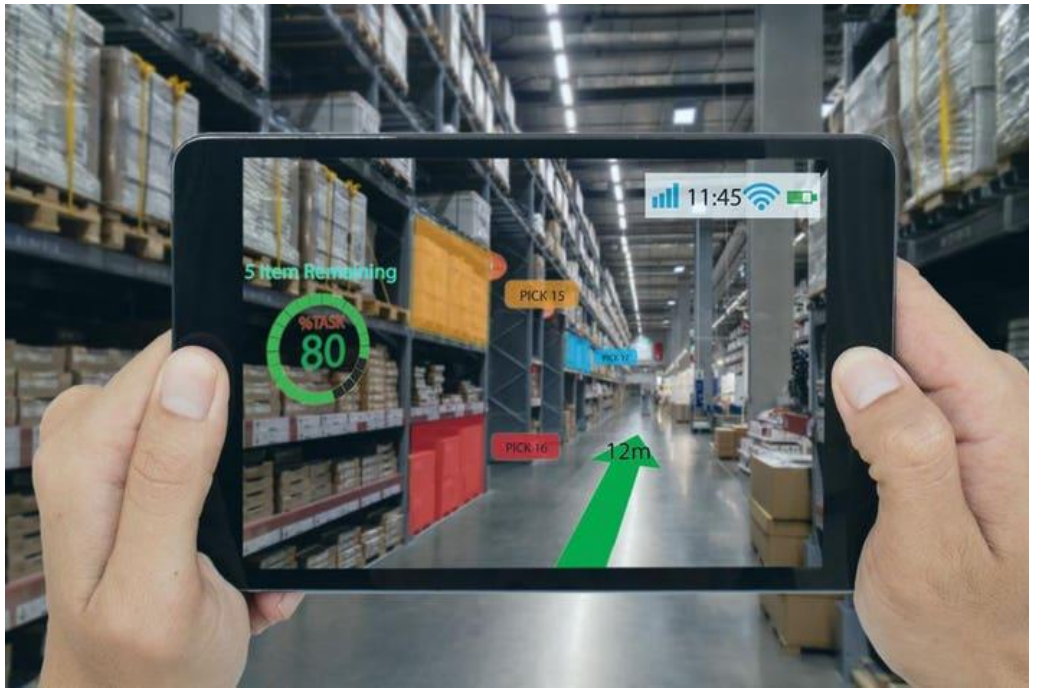

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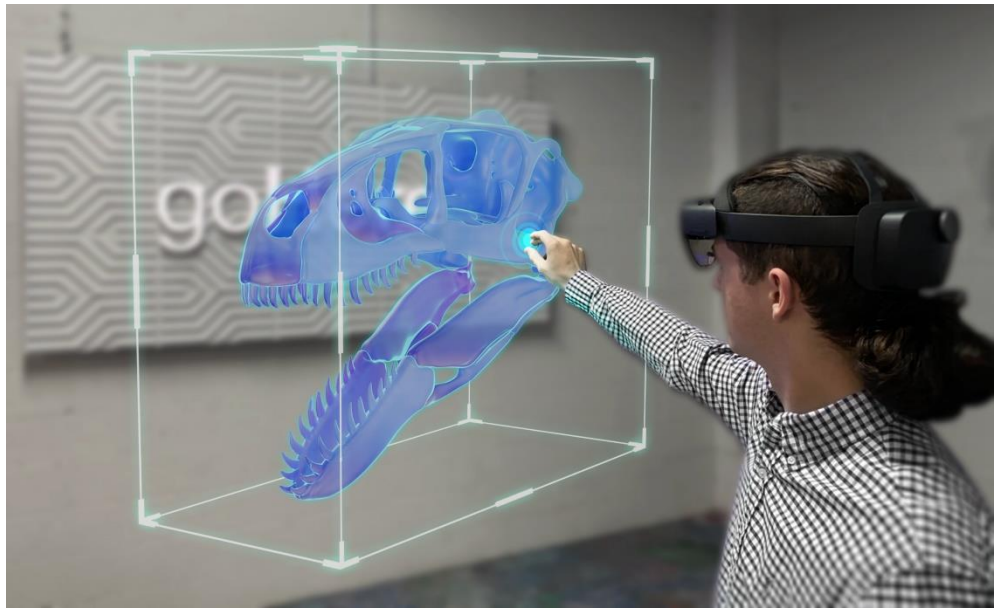

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Ethical issues on the development and use of XR and how to address these issues according to guidelines

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Key Ethical Issue 1: Data and Technology Use

Breeches of Data Privacy and Confidentiality

May be informational, volumetric or physical.

Data Misuse

May include surveillance, deception, and the possibility of covert indoctrination based on information feeds

Navigating Physical and Virtual Lives

Users of immersive technology may experience physical world re-entry problems due to issues related to virtual embodiment.

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Key Ethical Issue 2: Human Rights and Societal Impact

Human Rights

Discrimination and inclusivity, psychological and emotional harm

Society, Economy and the Environment

Crime in virtual environments, economic concerns related to monetization

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Addressing Ethical Issues

VALUES	PRINCIPLES	
RESPECT FOR PERSONS	Freedom Informed consent Inclusion Right or ability to withdraw or stop Privacy and confidentiality Tolerance	
WELL-BEING	Beneficence, positive psychological effects	Prosperity
SAFETY	Non-maleficence Equivalence	Risk and harm minimisation
INTEGRITY & TRUST	Accountability Fidelity Honesty Responsibility Sincere identity Transparency	
JUSTICE	Accessibility, Equity, Reciprocity	
RESPONSIVENESS	Anticipation Adaptivity	

Table 5.0 *Summary of foundational Values and Principles in immersive technologies*

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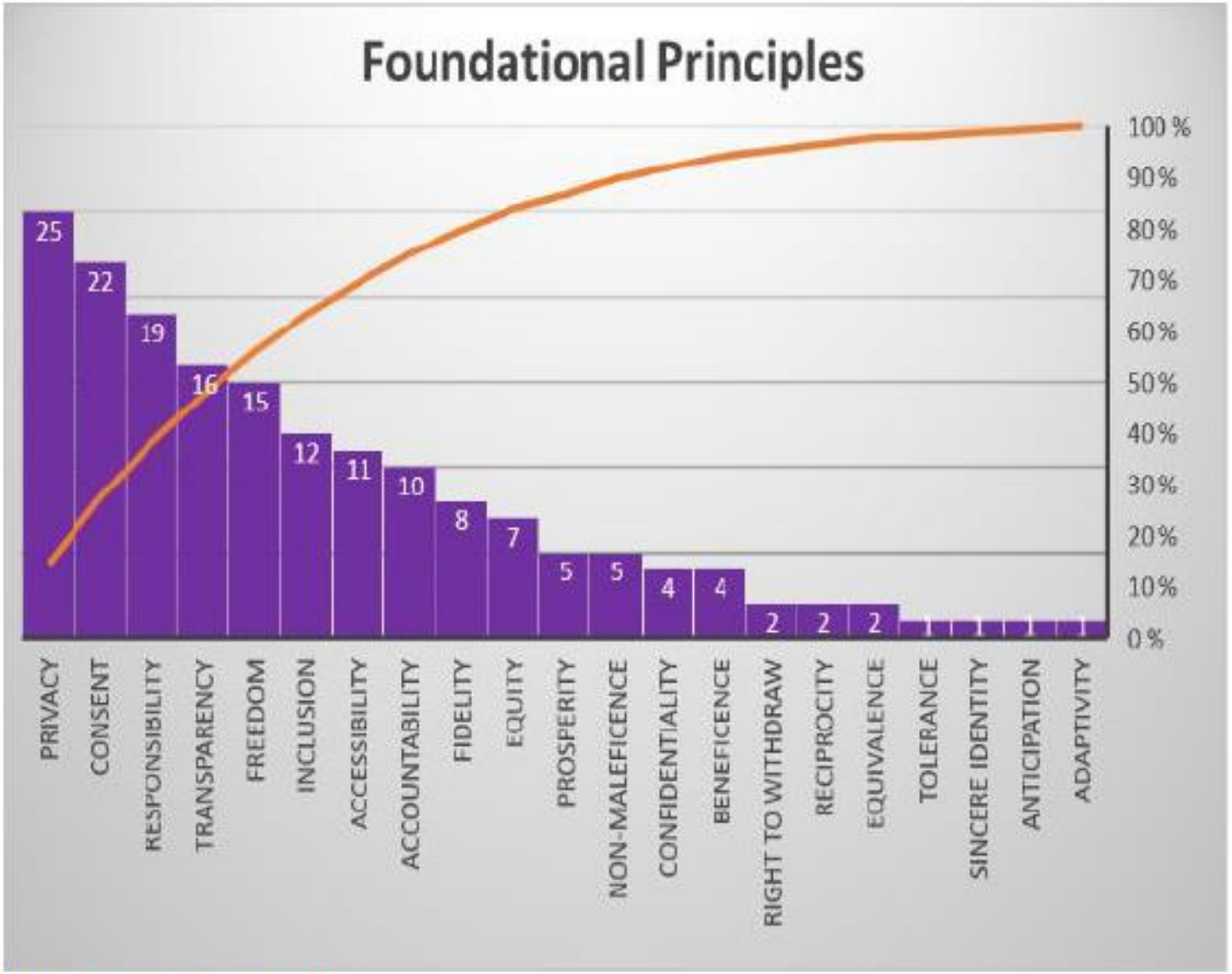

Figure 6.0 Distribution of Principles

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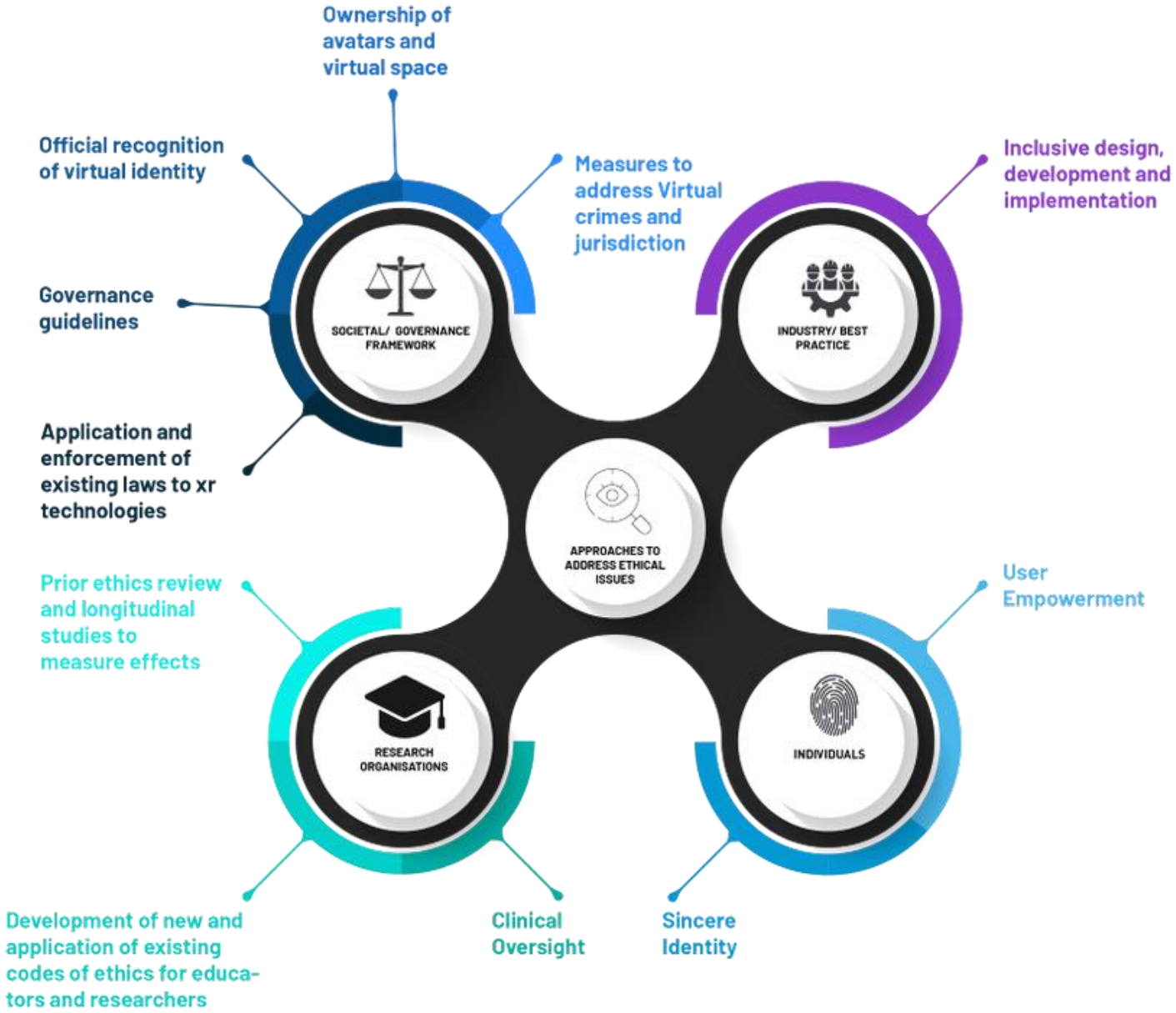

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Regulatory and Governance Issues of XR

Presenter: *Miltos Ladikas*

Contact Info: *Karlsruhe Institute of Technology,*
miltos.ladikas@kit.edu

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Dimensions of Harm

Physical: 3D vision, eye health, brain health, etc.

Psychological: reality perception, isolation, socialisation, etc.

Societal: privacy, neglect of environment, risky content, etc.

Financial: identity theft, virtual ownership, data monopolies, etc.

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Media and entertainment sector

Benefits

Leading XR industry, improved experience (gaming, social media, live entertainment, adult entertainment, etc.)

Risks

Physical risks (rapid movement commands, detachment from environment)

Psychological risks (level of immersion, addiction, depersonalisation, abuse)

Privacy risks (surveillance, collection of biometric data)

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Work and production sector

Benefits

Improving the manufacturing process and employee training

Risks

Differences in digital literacy levels

Employers' access to employees' personal data

Cybersecurity breaches

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Medical and healthcare sector

Benefits

Assisting in training of professionals, patient diagnosis, treatment

Risks

Inappropriateness as medical devices

Processing of patient's biometric data

Simulator sickness, social isolation, PTSD from unexpected horror/violence exposure, lack of ground truth

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Education sector

Benefits

Student immersion, simulation of practical tasks or operations

Students with disabilities improve communication and collaboration skills

Risks

Inappropriateness for certain disabilities

Unequal technological literacy among educators

Protection of personal data

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Marketing and retail sector

Benefits

Higher consumer engagement, better retail offer

Risks

Data safety

Violations of consumer rights (manipulation)

Infringement of intellectual property rights

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Regulatory Gap Analysis: Relevant Regulations

Regulation list

Office on the web Frame

Topic	Name
Privacy and Data	General Data Protection Regulation (GDPR)
	e-Privacy Directive
	Data Act
	Data Governance Act
Intellectual property	Directive on Copyright in the Digital Single Market
	Regulation on the EU Trademarks
	Directive on the Protection of Trade Secrets
Consumer and competition law	General Product Safety Regulation
	Unfair Commercial Practices Directive (UCPD)
Media and online services	Audiovisual Media Services Directive (AVMSD)
	Digital Services Act (DSA)
	DSA+- Proposed Child Sexual Abuse Regulation
	Digital Market Act (DMA)
Cybersecurity	Network and Information Security Directive (NIS2)
	Directive on the Resilience of Critical Entities (CER Directive)
	Convention on Cybercrime
Accesibility and Non-Discrimination	European Accesibility Act (EAA)
	Web Accessibility Directive
	Employment and Equality Directive
Sectoral law	Clinical Trials Regulation
	Medical Devices Regulation
Technology law	Artificial Intelligence Act (AI Act)
Finance law	Consumer Rights Directive (CRD) and its Guidance
	Unfair Commercial Practices Directive (UCPD):
	Digital Content Directive (DCD):
	Product Liability Directive (PLD)
	Anti-Money Laundering Directive (AMLD)
	Electronic Money Directive (EMD)
	Markets in Crypto-Assets Regulation (MiCAR)
	Regulation for the Digital Operational Resilience for the Financial Sector (DORA)

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Rating system and educational toolbox for end-users

Presenter: *Lucas Stephane (IFE)*

Contact Info: *lucas.stephane@ife.no*

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- XR **literature & technology** review
- Elicitation of **needs, requirements & experiences** from stakeholders: survey
- Rating system and educational materials

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D7.1: The State of the Art in Ethics for XR

Authors: Lucas Stephane (IFE), Sathiya Kumar Renganayagalu (IFE), Faisal Mushtaq (UNIVLEEDS)

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XR literature & technology review: 125 published studies

Sampling methodology

26% of experiments that did not specify their recruitment method (n = 35), of the remaining experiments 96% used opportunity sampling (n = 94) or purposive sampling (4%, n = 4).

Sampling characteristics

80% reported data on age (n = 106), 82% reported gender (n = 109), 23% reported ethnicity (n = 31), 24% indicated visual status (n = 32), 61% indicated education level (n = 81) and 95% indicated the location of recruitment (n = 127; see Figure 5). In total, 7,117 individuals participated in the experiments. Sample sizes ranged from 1 to 208 (M = 53.51, SD = 45.15).

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Figure (A) Sample size distribution across the studies; (B) Mean Age and Standard Deviation across Studies; (C) Distribution of studies on the cultural fixation index, where 0 represents USA; (D) Gender Diversity across Studies. Each tick on the x axis represents a single study from the selected sample, ordered from largest value to smallest. Note. Gender diversity: 1 = 100% male; 0 = 100% female.

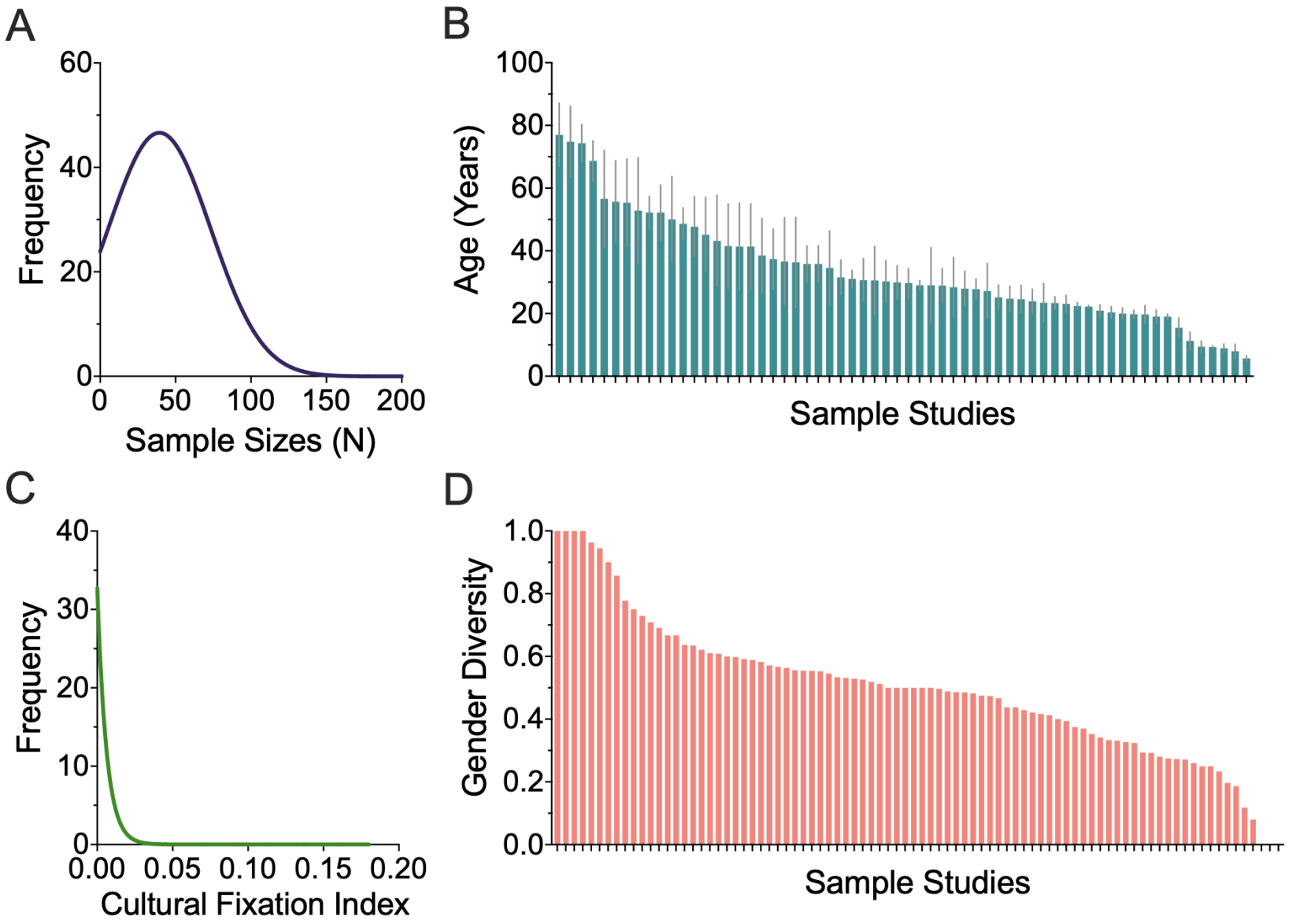

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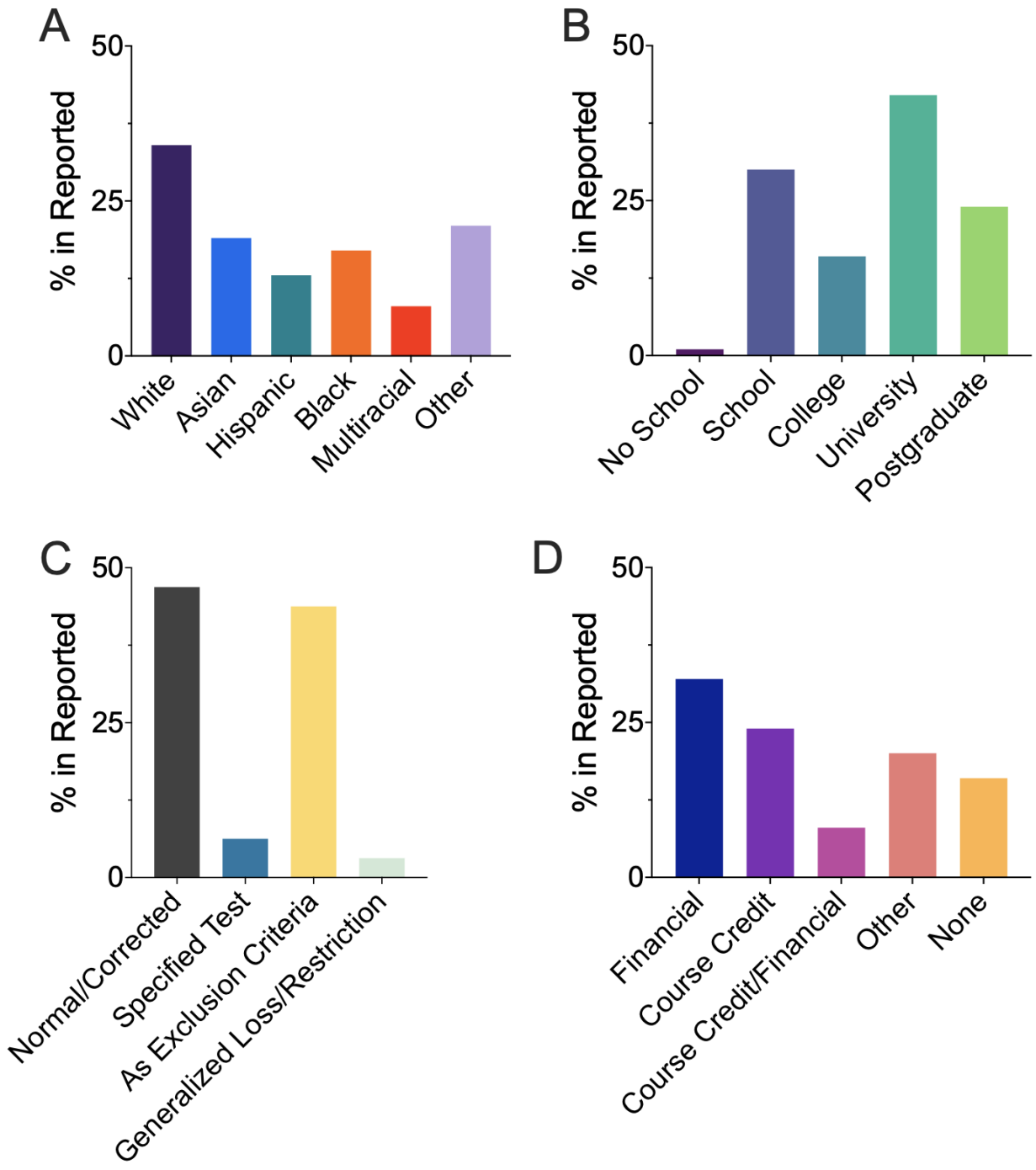
Figure showing participant demographics, separated by (A) ethnicity; (B) education level; (C) visual status; (D) method of participant remuneration.



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XR literature & technology review: 125 published studies

Ethical considerations

Ethical approval was not reported for 10% of experiments (n = 13). For the remaining experiments, 7% were exempt (n = 9) and 93% were approved (n = 111).

Regarding ethical considerations, 78% of experiments reported that participants provided consent (n = 104), but only 4% stated that participants were informed of their right to withdraw (n = 5) and 5% acknowledged how they handled data security (n = 6; see Figure 5B).

Only 15 (12%) experiments specified the use of a scale to identify cybersickness symptoms. Of these, 53% used the Simulator Sickness Questionnaire (SSQ; n = 8), 13% used questions adapted from the SSQ (n = 2), and 33% used other scales (n = 5).

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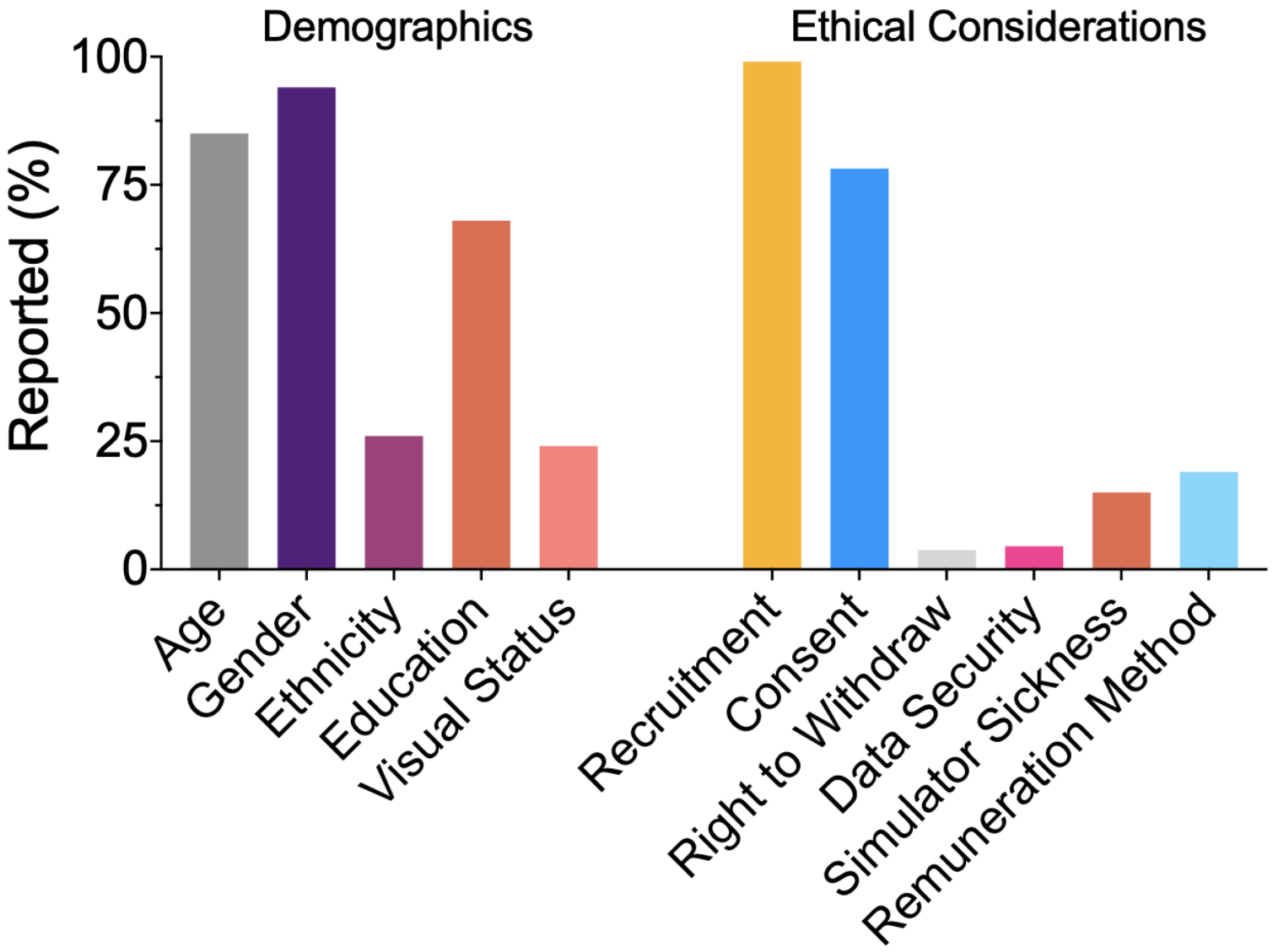
Figure (A) Reporting of participant demographics and (B) information related to ethics in a sample of 125 XR literature studies.

Surprisingly, only a small percentage of studies reported on the visual status of participants, made a record of simulator sickness, or reported on data security within the published manuscript.



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- Elicitation of **needs, requirements & experiences** from stakeholders: survey

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Word-cloud from ‘policies’ in existing Metaverses/Social XR platforms

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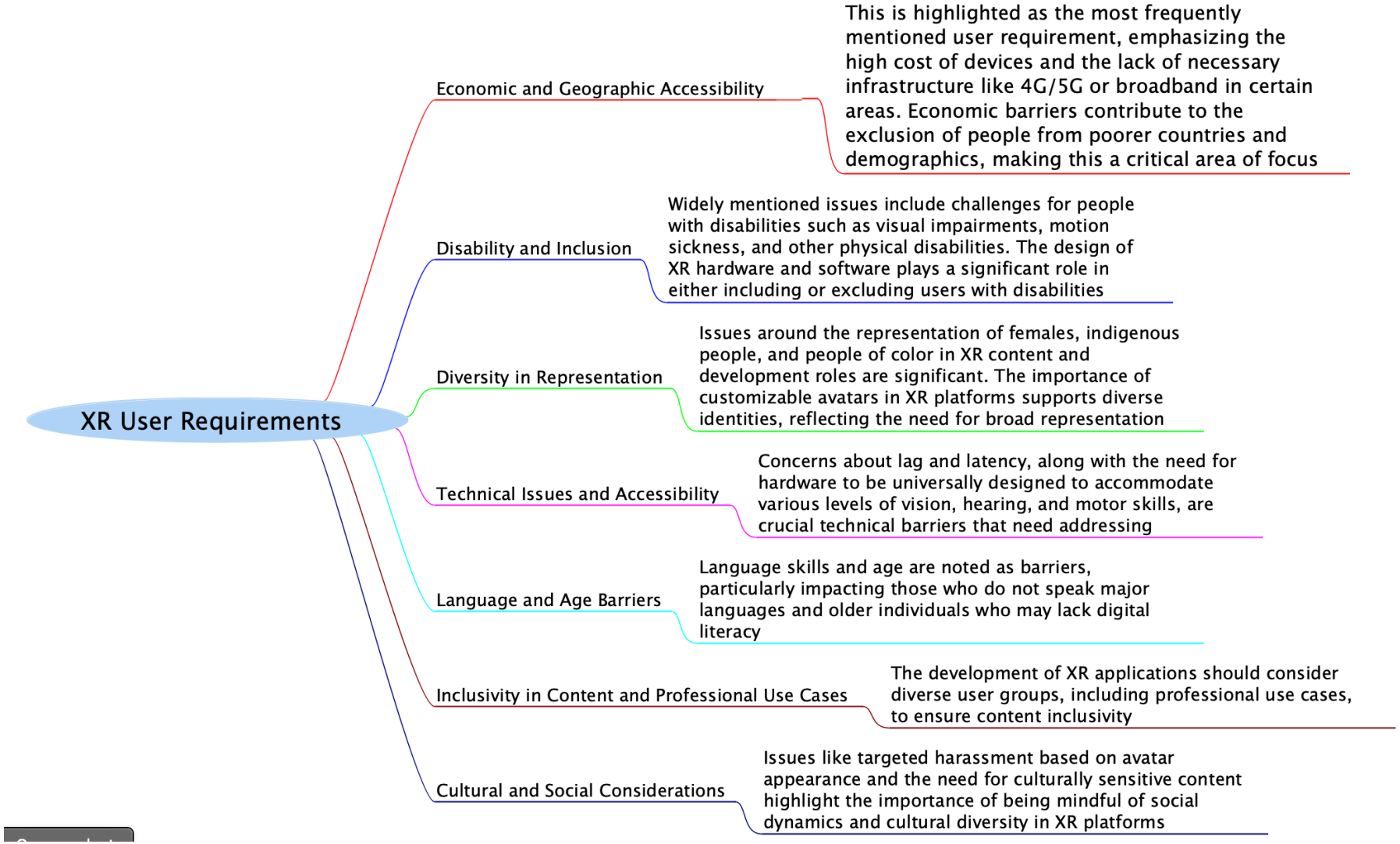
Main findings from the survey (N=112)



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Rating system for XR

Few existing rating systems

Age & Content Descriptors

- Pan European Game information (PEGI https://pegi.info/)
- Entertainment Software Rating Board (ESRB https://www.esrb.org/)

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XR Code of Conduct

Presenter: *Rigmor C. Baraas*

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The need for a Code of Conduct

Value of Human-Centred Designed technologies

Research has demonstrated the social, technical, and commercial benefits of ethically and human-centred designed technological systems since such systems, in general, increase/enhance usability, accessibility, user experience, and avoidance of harm from use. This leads to wider deployment, adoption and acceptance.

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The need for a Code of Conduct

ISO 9241-210:2019
Ergonomics of human-system interaction — Part 210: Human-centred design for interactive systems

Systems designed using human-centered methods improve quality, for example, by:

- *Increasing the productivity of users and the operational efficiency of organizations;*
- *Being easier to understand and use, thus reducing training and support costs;*
- *Increasing accessibility;*
- *Improving user experience;*
- *Reducing discomfort and stress;*
- *Providing competitive advantage;*
- *Contributing towards sustainability objectives.*

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D6.1: Identifying & selection of use cases on good practices in XR

Authors: Oliver Schreer (Fraunhofer), Faisal Mushtaq (UNIVLEEDS)

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Explorative survey among XR experts (n=38)

Sampling characteristics

67% male and 33% females (33.3%), which likely reflects the demographics of those involved in XR and the technology sector more broadly.

71% were researcher/scientist/academic.

Participants were German (42%), followed by Dutch (8%), Spanish (8%), and British (8%). The range of participants also included Italian (4%), French (4%), South African (4%), Pakistani (4%), Greek (4%), and Norwegian (4%).

29 % of participants that responded to question about ethnicity, 43% identified as White.

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Explorative survey among XR experts (n=38)

Perspectives on Accessibility

The expert ratings on the degree of accessibility suggested that current XR was only accessible to approximately half of society.

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Figure showing Expert Ratings on the degree of accessibility of current XR technologies for range of demographics. Black dots show mean accessibility ratings and error bars show +/- 1SEM. Individual data points are jittered for purposes of illustration.

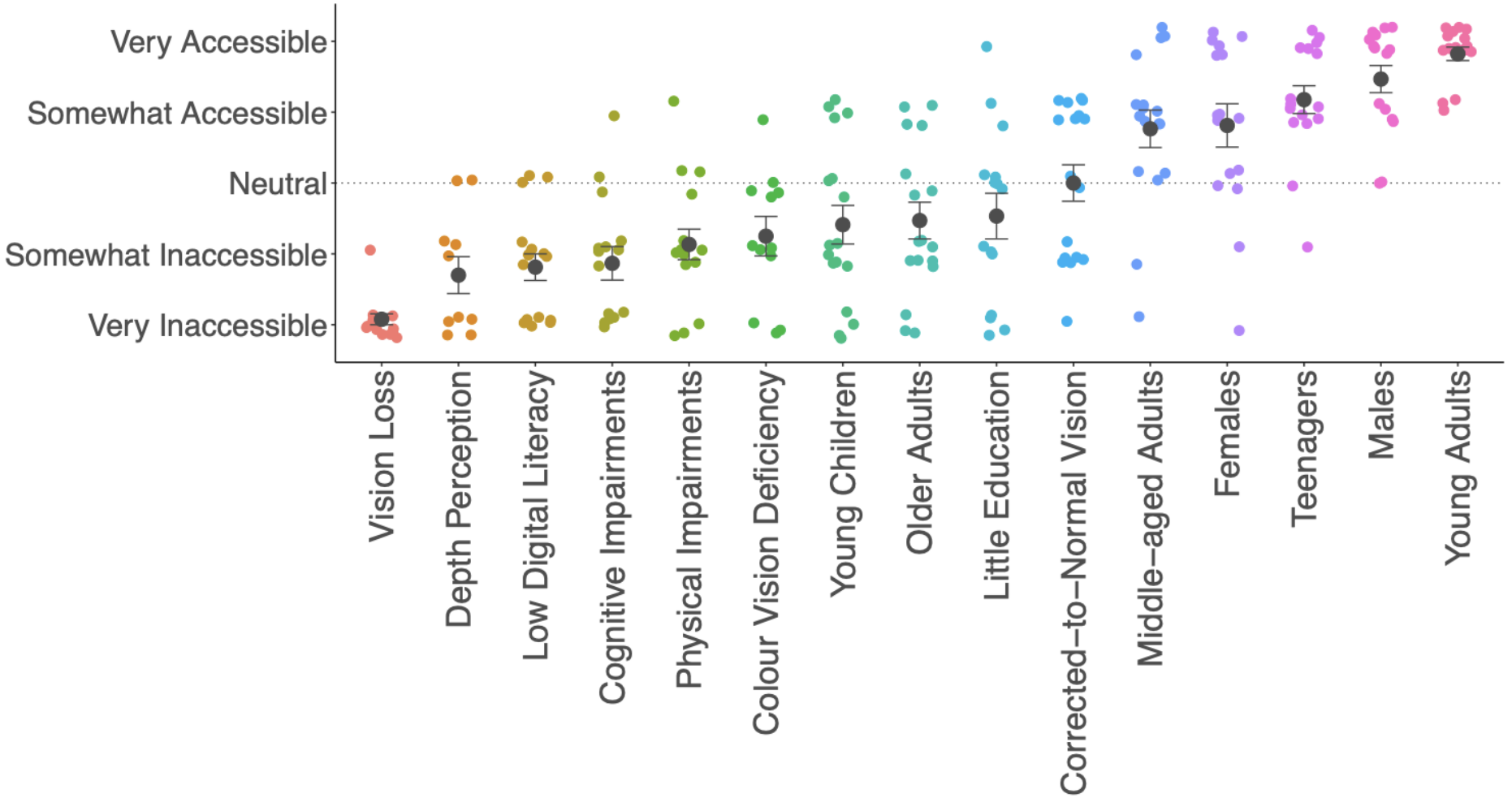

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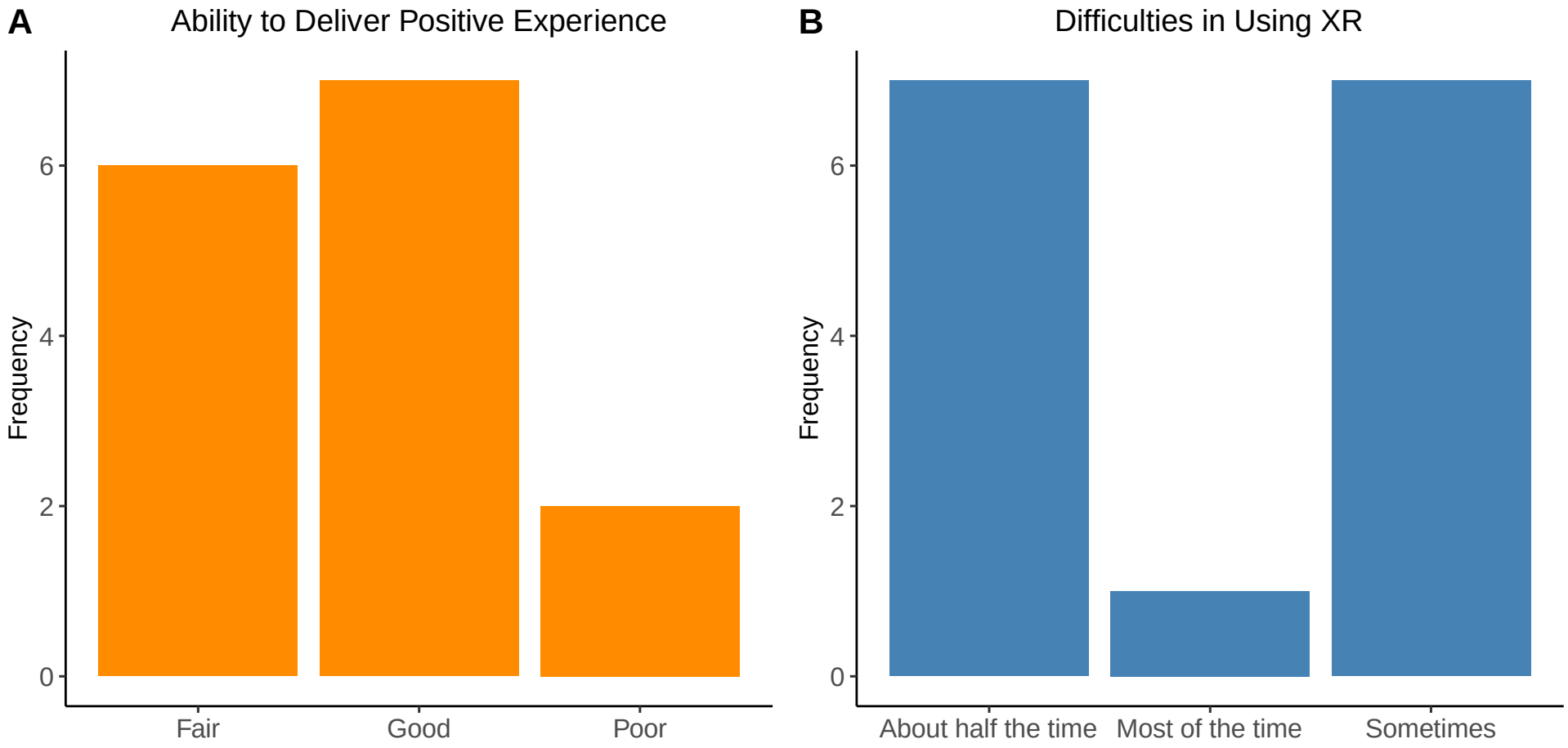
Figure (A) Participants were asked to rate the ability of current XR technologies to deliver positive user experiences; (B) the degree to which our experts encountered difficulties in using and/or navigating through XR experiences..



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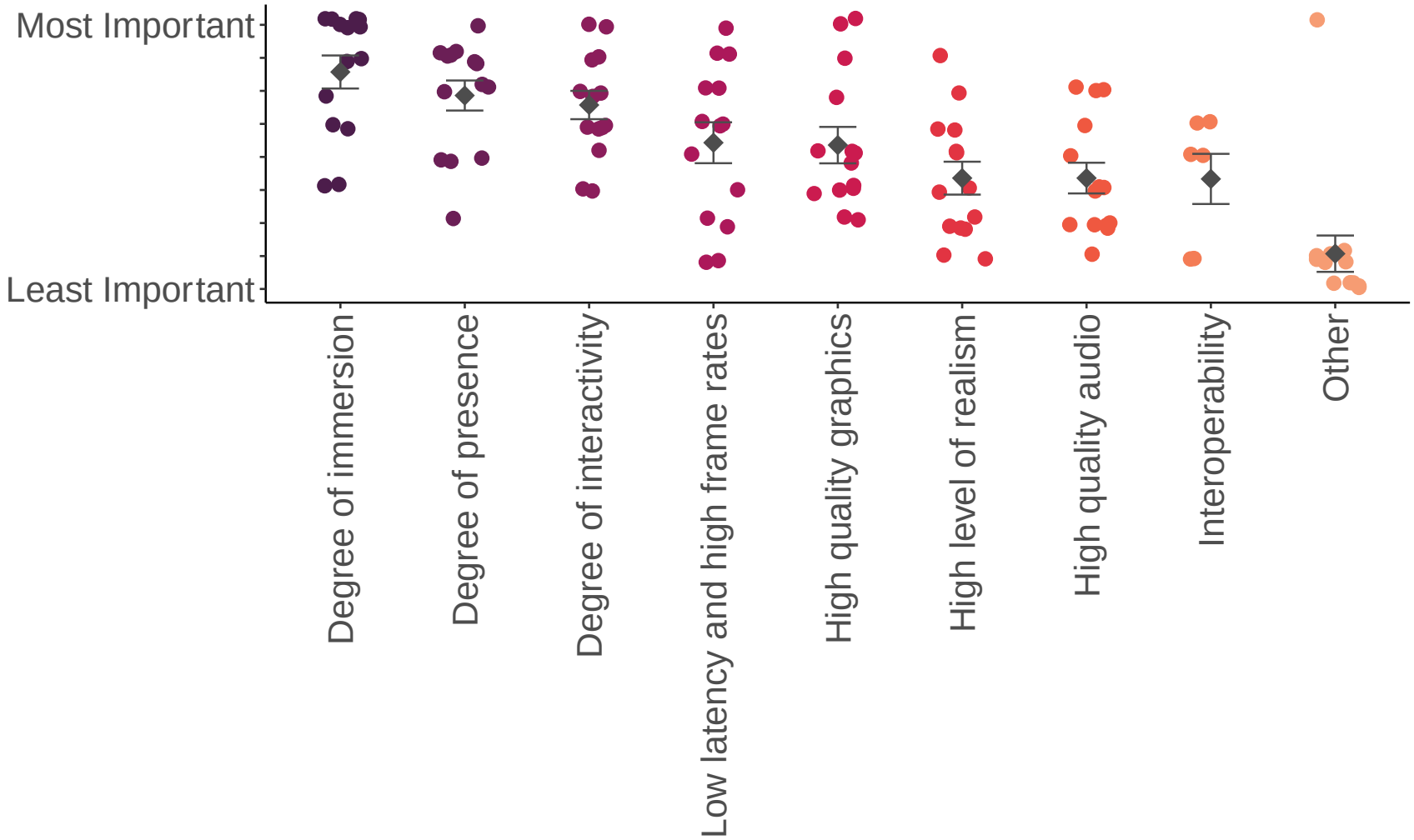
Ranking of importance of different features for delivering a good user experience in XR. Note that Other Response rated as most important by one respondent was: “Consistency of the presented virtual environment”.



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Explorative survey among XR experts (n=38)

The experts suggested that XR is not well-suited in data sensitive domains until issues of privacy can be addressed.

Activities that require using HMDs for long periods of time were also considered unsuitable given the size of current headsets, but this could be resolved in the longer term through increasing miniaturisation of hardware and optimisation.

Childcare was highlighted a specific example where XR might never be appropriate.

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The need for a Code of Conduct

For European citizens to truly and fully benefit from XR technologies and to ensure citizens' trust, freedom, dignity, rights, and well-being, the European XR environment, especially **the design, development, production, manufacture, and operations of XR technologies, should be guided by a universally accepted, validated, and living code of ethics that is duly regulated and aligned with regulations in the private and public sector from the corporate, member state, and European levels**.

To date, Europe and the World are still in the process of defining and establishing the ethics, regulatory, and governance structures of XR technologies.

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The nature of a Code of Conduct

Co-create CoC

—that guides on ethical and related policy, regulatory, governance, and interoperability issues of XR technologies within a European community of practice whilst building public trust and acceptance and a strong and competitive European XR ecosystem.

—ethical standards of good practice to guide developers and producers of XR technologies in compliance with human-centred design, ethical principles and aligned with the European ethical governance structure (i.e., “the norms, values and rules through which public affairs are managed in a manner that is transparent, participatory, inclusive and responsive”).

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The case

How can we balance the innovative potential of XR technologies with the need to address ethical concerns related to privacy, human rights, inclusivity, and societal impact, while ensuring that these technologies are developed and used responsibly in research and development?

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Group work

Part 1 (45 mins)

Provide information on research integrity challenges, and alternative solutions, to design and development of immersive technologies.

These include diversity, inclusivity, accessibility, and interoperability challenges.

Part 2 (1 hour)

Gather feedback, impressions, and suggested solutions through group work.

To ensure maximum participation, the CME Oslo Model for Ethical Reflection will be used.

Part 3 (1 h 15 mins)

Each group will report on their results, allowing for questions and short discussions from the audience

— followed by a plenary discussion of alternative solutions and ideas to understand level of consensus.

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GROUP WORK USING THE CME MODEL (6 STEPS)

PART 2

1) Define the ethical problem(s)
2) Describe all facts
3) Provide details of the parties involved
4) Identify the values, ethical principles and laws at stake

PART 3

Group presentations.

Plenary discussions:

5) Based on the above, identify and discuss possible solutions of the case

6) Conclusion, follow up and evaluation

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Thank you!

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Still looking for participants ☻

https://forms.office.com/e/zLTURKBZf7

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