DIGIN

University of Maribor
Faculty of Electrical Engineering and Computer Science

A Socio-Technical Framework for Governed AI-Mediated Communication in Healthcare

From Digital Accessibility to Meaningful Participation

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Past PROJECT activities (2018 – present)

DigitalAccessibility
Certified Digital Accessibility Training project

ADORE
Accessibility in Digital Communication Higher Education Curricula

INTUX
INtroducing training on user Testing with people with disabilities into UX design and related higher education programmes

SET4Inclusion
Self-Evaluation Tools for e-Inclusion in HEI

AI-ENABLE
Enhancing Inclusive Education in Higher Education Institutions with Artificial Intelligence

Empowering Higher Education through Artificial Intelligence Integration

EHEAII
AI IN HIGHER EDUCATION

- The project aims to support higher education institutions in **responsibly and effectively integrating Artificial Intelligence into teaching**, learning, and institutional processes

Past DIGIN activities

2023

- Towards a Self-Assessment Tool for Enabling **Inclusive Digital Education**.

2024

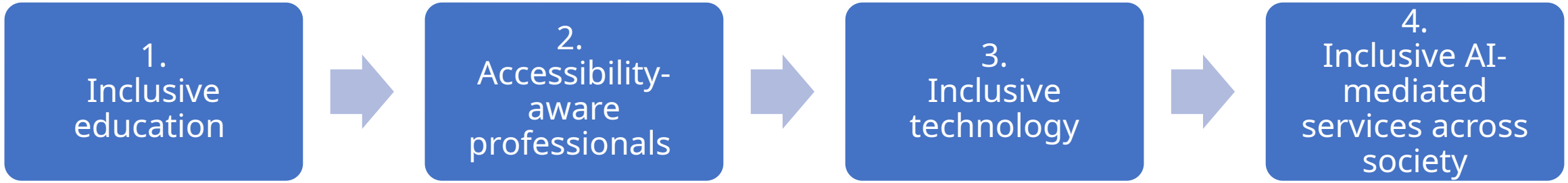
- Definition of a Framework for Self-Evaluation Tool: Optimizing Evaluation Practices for **Enhanced Performance in Higher Education Institutions**
- A micro-Learning Units Package for **Improving Inclusive Digital Education in Higher Education** Institutions
- Good practices in creating an **inclusive environment** in Higher Education Institutions

2025

- Artificial Intelligence Tools and Frameworks for Inclusive Digital Education: **Benefits and Challenges**
- Perspectives on AI in Higher Education: **Survey Insights from Teachers and Institutional Management**
- Good Practices of AI Use enabling inclusive education: **Case Studies** from Slovenia, Türkiye, Spain and Portugal

From Inclusive Higher Education to Inclusive Digital Society

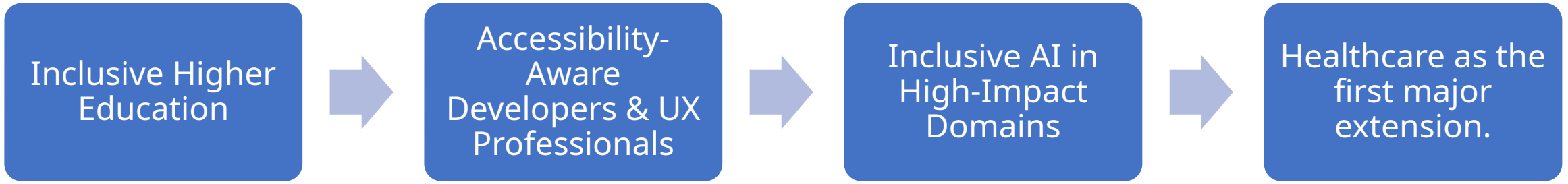
- Building inclusion into education, technology development, and real-world digital services



- Extending the Approach Beyond Education

From Inclusive Higher Education to Inclusive Healthcare

- **A Socio-Technical Framework for Governed AI-Mediated Communication in Healthcare -** Ensuring that AI-mediated communication is not only technically effective, but also **accessible, understandable, inclusive, culturally aware, and responsibly governed**.



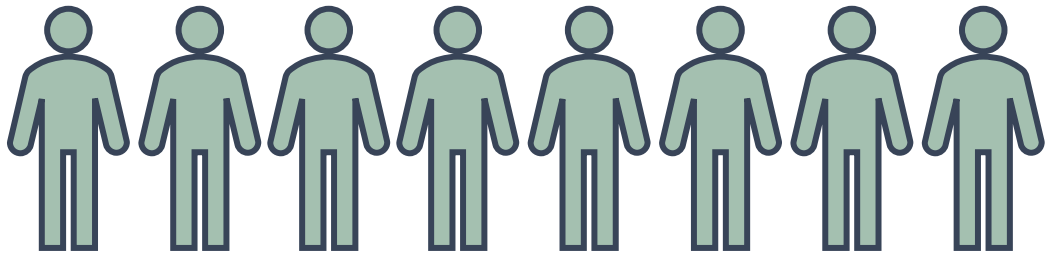
Digital inclusion is more than access

- Being able to access information does not necessarily mean being able to participate.
- Digital inclusion means moving from **access to meaningful participation**

Access → Understand → Express → Clarify → Verify → **Participate**

Who may be excluded from communication?

- 1 out of 9 persons / 12%
  - autism
  - intellectual disability
  - brain injury
  - stroke
  - dementia
  - progressive neurological conditions
  - …



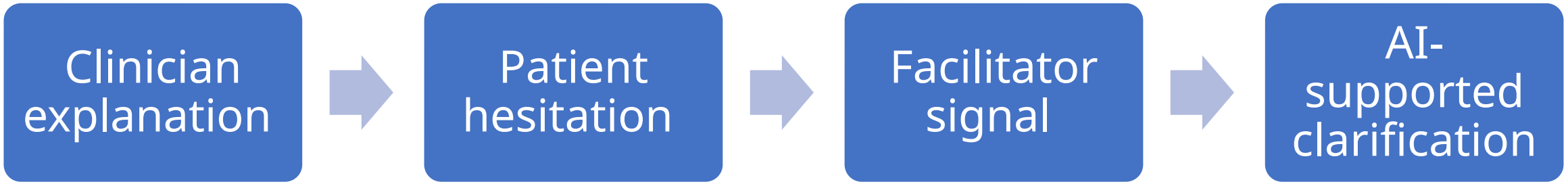


- The barrier is not only within the person. It emerges from the interaction between the person, other participants, technology and context.

Healthcare scenario: a simple clinical encounter

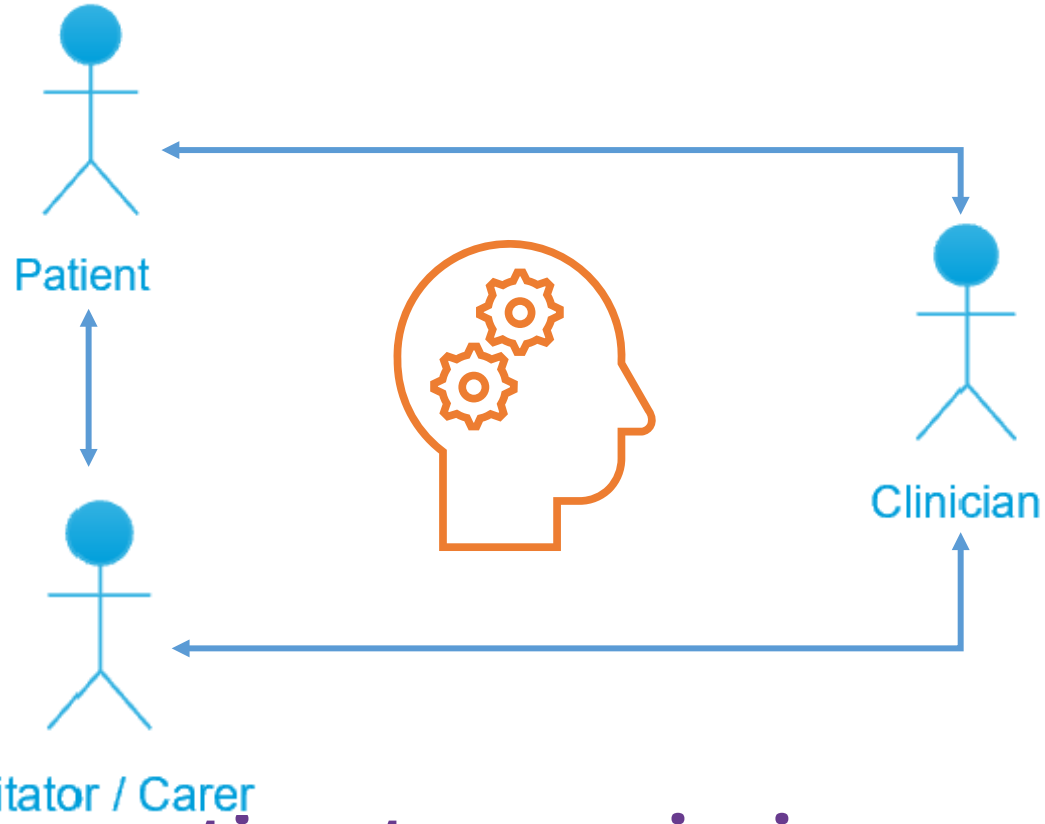
A clinician explains a treatment. The patient does not fully understand it, but does not say anything. A caregiver notices the hesitation.

Where should AI intervene?



Healthcare scenario: a simple clinical encounter

- Where can exclusion happen?
  - Who notices the misunderstanding?
  - Who can ask for clarification?
  - Whose interpretation is heard?
  - Who remains in control?



- **Communication is not only information transmission**

Communication is not information transmission

- Communication is not just sending information from one person to another
  - Effective communication relies on **feedback**, **repair**, and redundancy to reduce **noise** and **bias** and to align interpretations over time.
  - This view is central in transactional (Barnlund) and interaction-based (Schramm) communication models and **it becomes even more important when communication is mediated by technology**.

Communication is not information transmission

- Communication is not just sending information from one person to another
  - Both communicators act as **senders and receivers at the same time**, continuously monitoring the conversation and **repairing communication breakdowns** through repetition, rephrasing, or elaboration.

Effective communication is central to clinical care

- Effective patient-provider communication is critical in achieving **positive patient health outcomes** and behavioral change.



- **The main question:** can the increased demand for „repair“ of conversational misunderstandings and communication breakdowns in the triadic setting (**physician, facilitator, patient with cognitive challenges**) be mitigated by involving a modular multi-agent pipeline for a sychronous AI assisted communicaiton?



Additional Coordination Challenges in Triadic Communication

- The clinician remains responsible for medical information
- The patient must retain agency and the opportunity to question or reject an interpretation
- The facilitator or carer may support understanding without speaking on behalf of the patient
- AI must not silently reframe, filter, or prioritise information

The key shift

- From accessible information to communicative capability

Traditional question	Inclusion-oriented question
Can AI simplify the text?	Can the person understand?
Can AI generate a summary?	Can the person verify it?
Can AI recognise speech?	Can the person express themselves?
Can AI answer questions?	Can the person initiate clarification?
Is the interface usable?	Can the person influence the decision?

- Technology is only a resource. **Meaningful participation is the goal.**

Meaningful participation - What should inclusive AI enable?

- **Six communicative capabilities**
  - **UNDERSTAND -** clinical information
  - **EXPRESS -** symptoms and preferences
  - **CLARIFY -** ask when something is unclear
  - **VERIFY -** how one's words were represented
  - **CONTROL -** AI mediation
  - **PARTICIPATE -** in decisions

Accessibility is contextual

- **The same technology ≠ the same opportunity**



PERSONAL

language abilities
attention
memory
fatigue
preferred modality



SOCIAL

clinician communication
caregiver behaviour
trust
authority
cultural conventions



ORGANISATIONAL

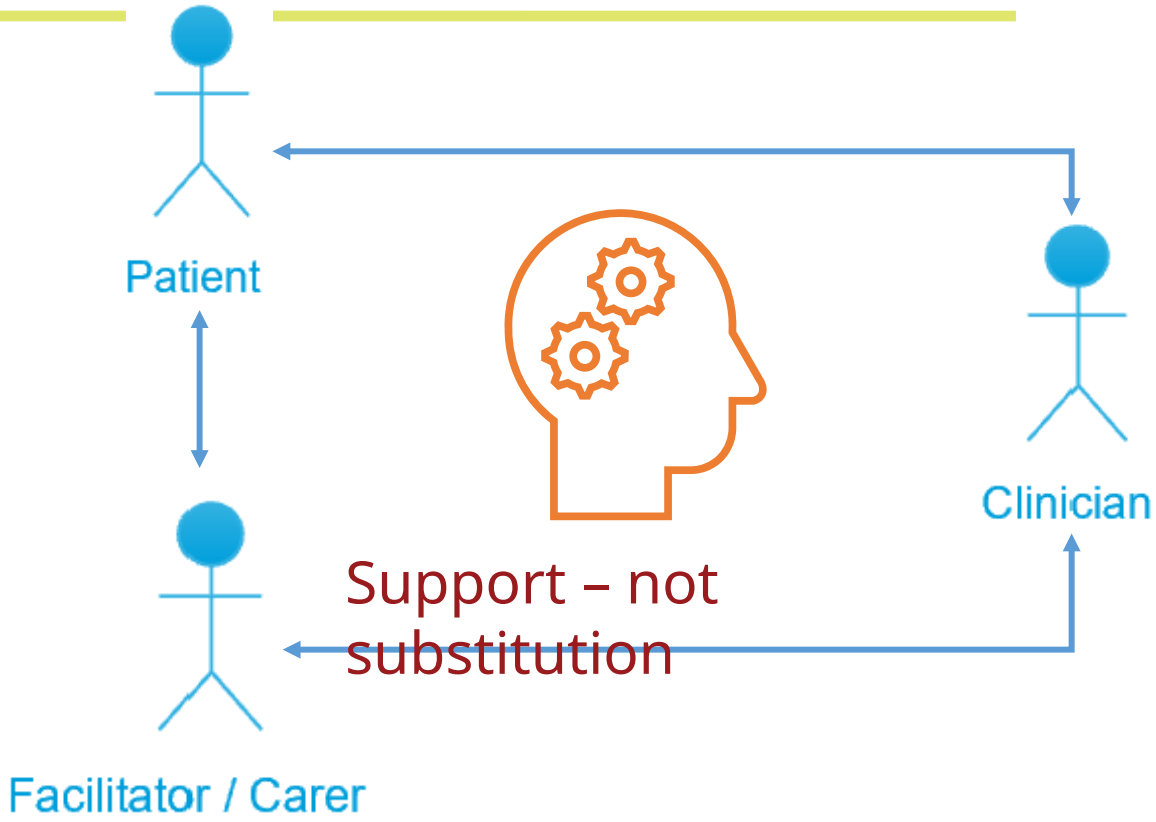
time
workflow
privacy
infrastructure
responsibility

- **Inclusion emerges from the whole socio-technical system**

AI should support, not substitute

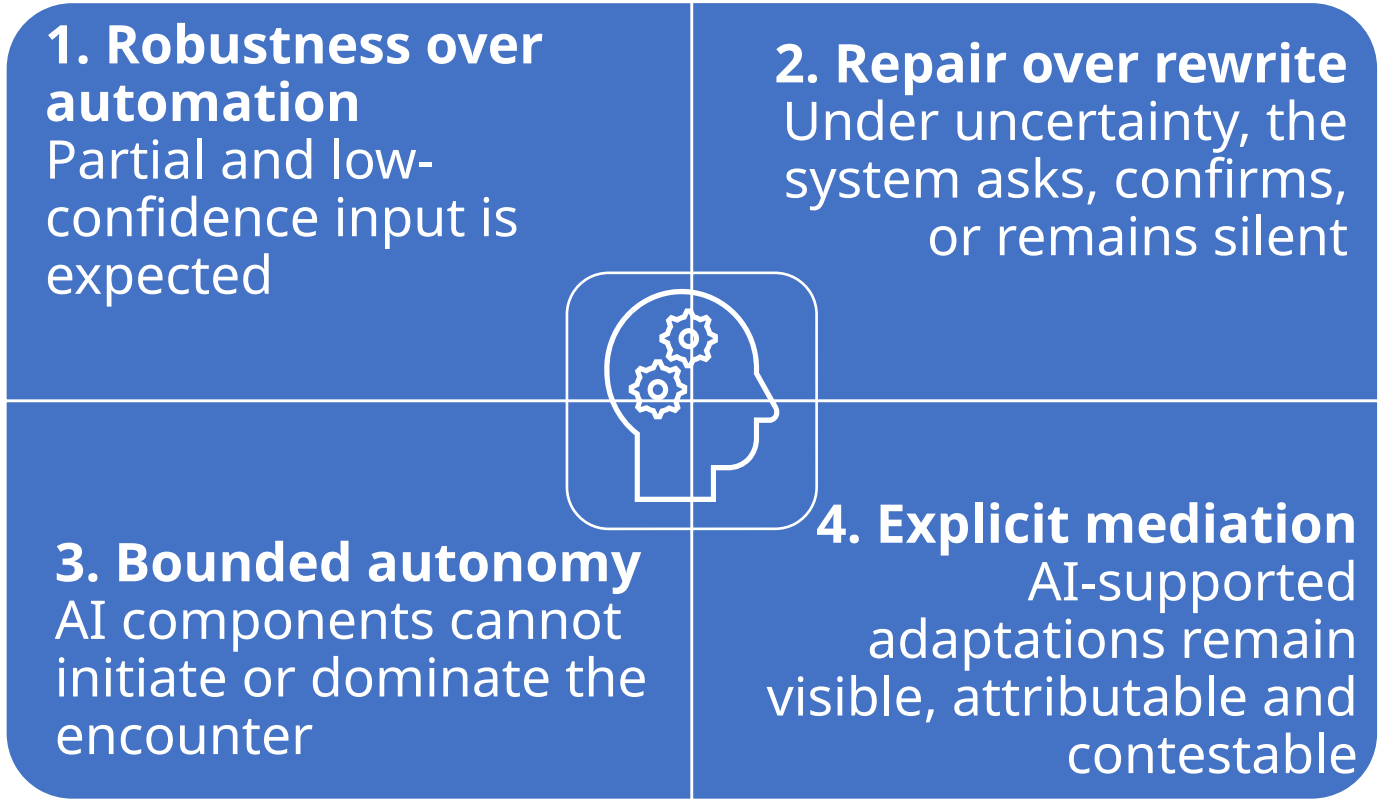
- Patient retains agency
- Clinician retains responsibility
- Facilitator supports without replacing the patient
- AI mediation remains visible and contestable

- **AI = mediating infrastructure, not an autonomous participant**



What should inclusive AI actually do?

- **Role preservation**
  Patients, clinicians and facilitators retain distinct responsibilities and control



What should inclusive AI actually do?

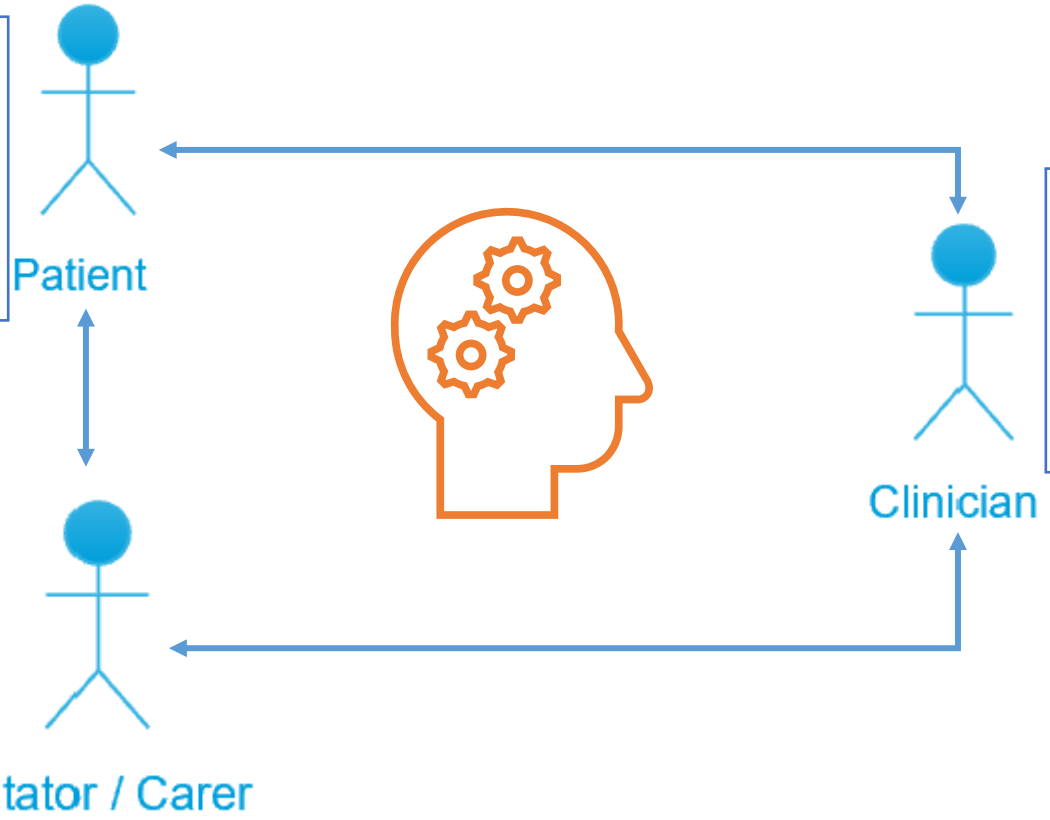
- Designing for different ways of communicating
  - Simplified text
  - Symbols
  - Pictograms
  - Body maps
  - …



- Multimodality matters only if it increases the person's ability to act.

Interaction Desing matters

- Simplified text
- Symbols or pictograms
- Touch-based confirmation
- Body maps or pain scales

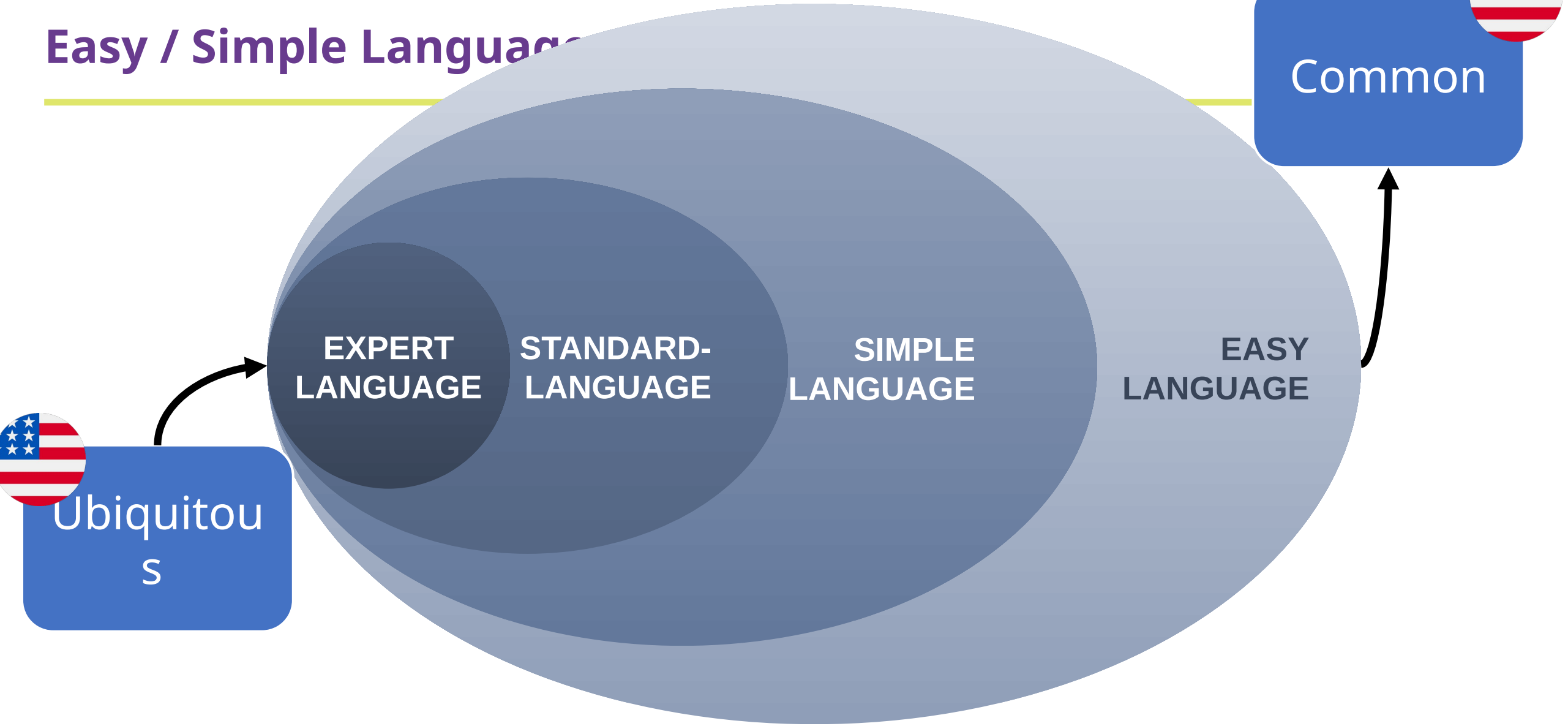


- Original message
- AI-supported adaptation
- Confidence indicator
- Approve, modify, or suppress

- Clarification cue
- Annotation
- Repair support
- Escalation option

The interface must support different roles and modalities

Easy / Simple Languag



Nothing about us without us (Participatory Design)

- Inclusive AI requires inclusive design
- We cannot design inclusive AI while excluding the people it is intended to support.

- **Not:** *"Which AI features would you like?"*
- **Instead:** *"What are you currently unable to do – but would like to be able to do?„*

- Co-design is not only a usability method.
  - It is a condition for safety, acceptability, and legitimacy.

Participation itself must be accessible

- **The design process itself must be accessible**
- **Inclusive participation requires adapted methods**
  - visual prompts
  - pictorial sequences
  - physical cards
  - role-play
  - supported conversation
  - low-fidelity prototypes
  - alternative forms of expression
  - pauses and repetition
- **The question is not only: “Can the AI communicate with this person?”**
- **The question is: “Does AI give this person a stronger voice?”**

Future work

From Digital Access to Digital Inclusion

Accessible technology

Understandable communication

Communicative capability

Agency & control

Current activities: Risk-Based Approaches

- Triadic communication settings involving vulnerable patients constitute a paradigmatic high-risk socio-technical context
- Even without diagnosing, communication systems can materially influence clinical reasoning and patient understanding
- Synchronous clinical encounters require even stronger safeguards
- Risk levels and related regulatory obligations scale according to context, potential harm, and user vulnerability and can vary according to deployment context (e.g., asynchronous vs. synchronous communication, multiple impairments, complexity of the medical subject matter)
- Risk assessment must consider situational factors and uncertainty
- Technical safety alone is insufficient for vulnerable patient populations: suitable governance principles need to be embedded directly into system architecture

Current activities : Regulatory Perspective

- Structural vulnerability due to …
  - Asymmetries in medical knowledge and communicative capacity
  - Patients may have limited ability to identify, challenge, or correct miscommunication
  - Dependence on facilitators, carers, or intermediaries increases communicative risks
  - AI systems can influence the allocation of decision-making authority in clinical encounters
  - AI systems can exacerbate risks of misrepresentation, over-reliance, and automation bias
  - AI-mediated communication affects how symptoms, diagnoses, and treatment options are understood
- This structural vulnerability leads to governance requirements that emerge from …
  - **Hard law**: E.g. regulation such as the EU AI Act, the EU Medical Device Regulation
  - **Soft law**: ethics, e.g., in the EU, Ethics Guidelines for Trustworthy AI (High-level Expert Group on Artificial Intelligence ; professional standards of doctor-patient communication
  - **Informed consent** considerations: Highly sensitive due to comprehensibility issues and dynamics of clinical encounters

Current activities: Literature review

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Thank you!

Questions

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