

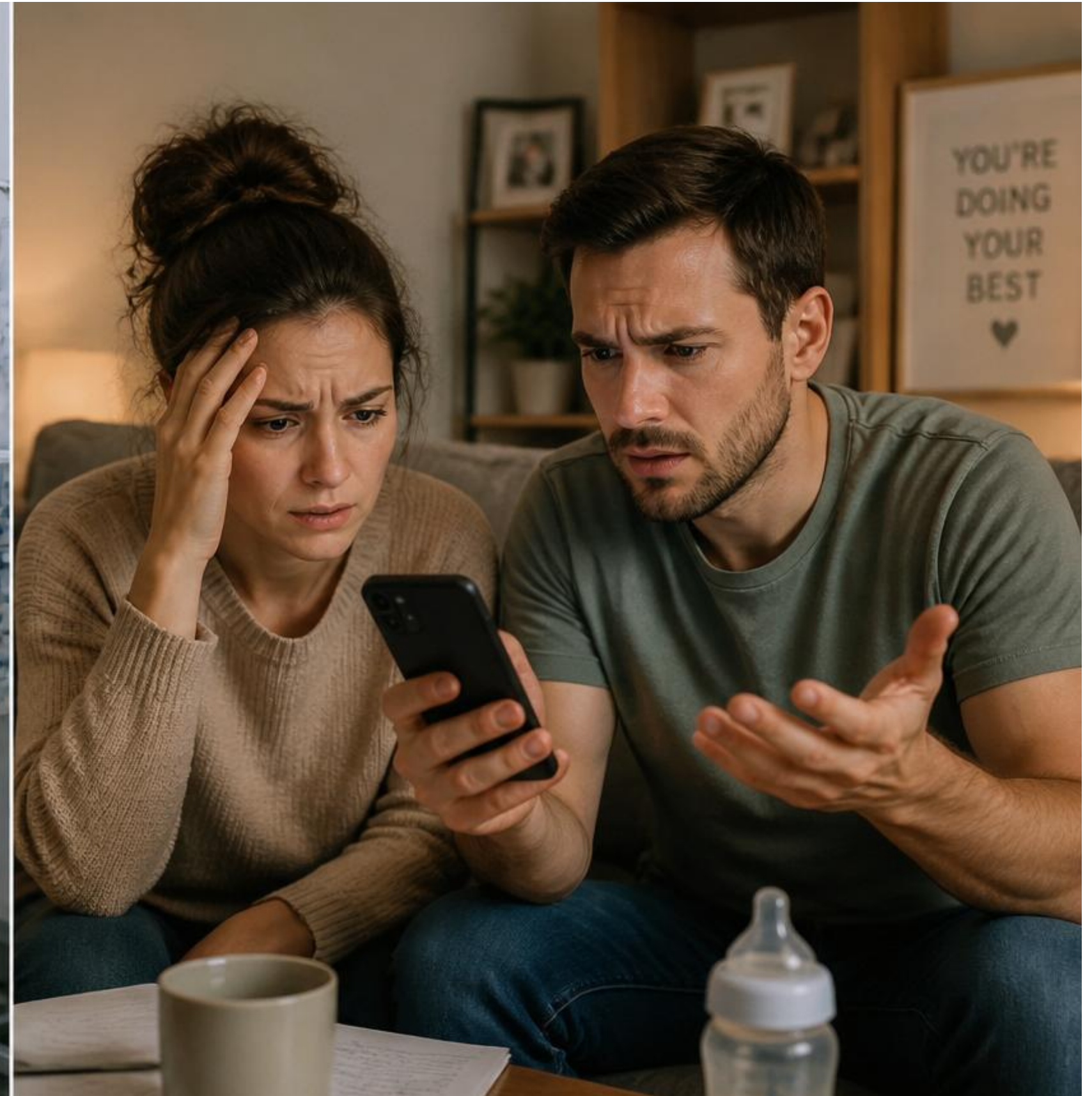


Visualizing the Invisible

A Human-Centric Barrier Layer for Healthcare Systems Requirements Modeling

Keren Segal
Meira Levy
Irit Hadar





The Invisible Barrier Problem

Key Challenges

Healthcare Information Systems (IS) are vital for delivery support
Human barriers to adoption remain largely overlooked in requirements specification and traditional models.





Bridging the Gap: Making Human Barriers Visible

The Research Gap

How can we incorporate human barriers into standard requirements modeling?

Our Goal

Propose a barrier layer to represent potential human barriers for IS adoption

Research Questions



RQ1: How can we identify and specify human-related barriers of adoption and use of healthcare IS?

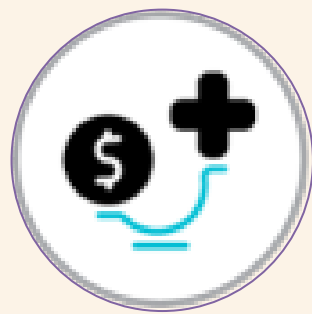
RQ2: How can we apply the outcomes of RQ1 to the case of caregivers?

RQ3: How can we specify requirements that will effectively address the identified barriers?

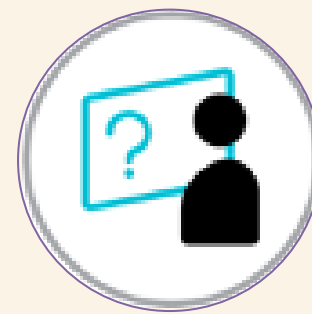
Barrier Categories and Design



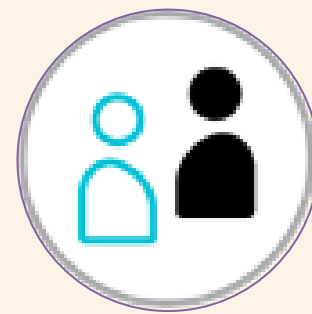
Cost



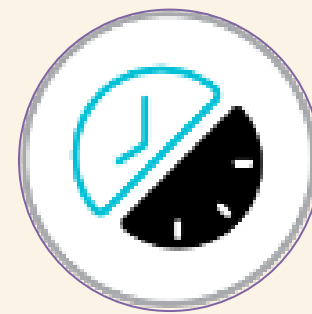
**Benefit Cost
Ratio**



**Technological
Savviness**



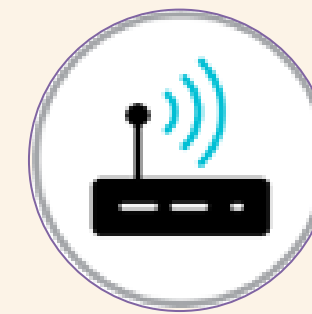
**Human
Interaction**



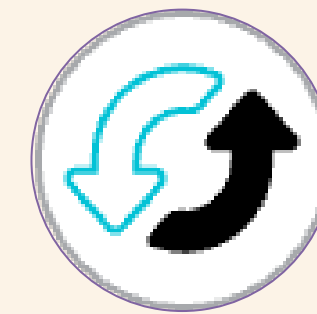
Time



Awareness



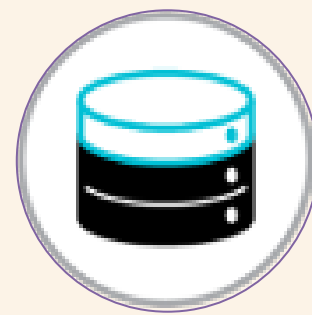
Hardware



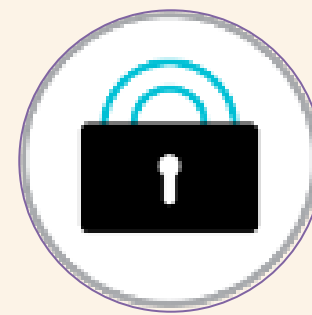
Software



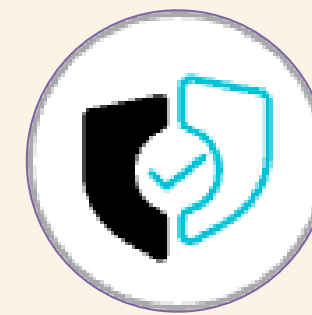
Personalization



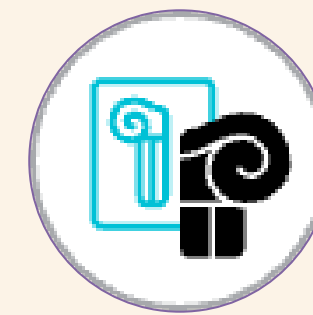
Data



Privacy

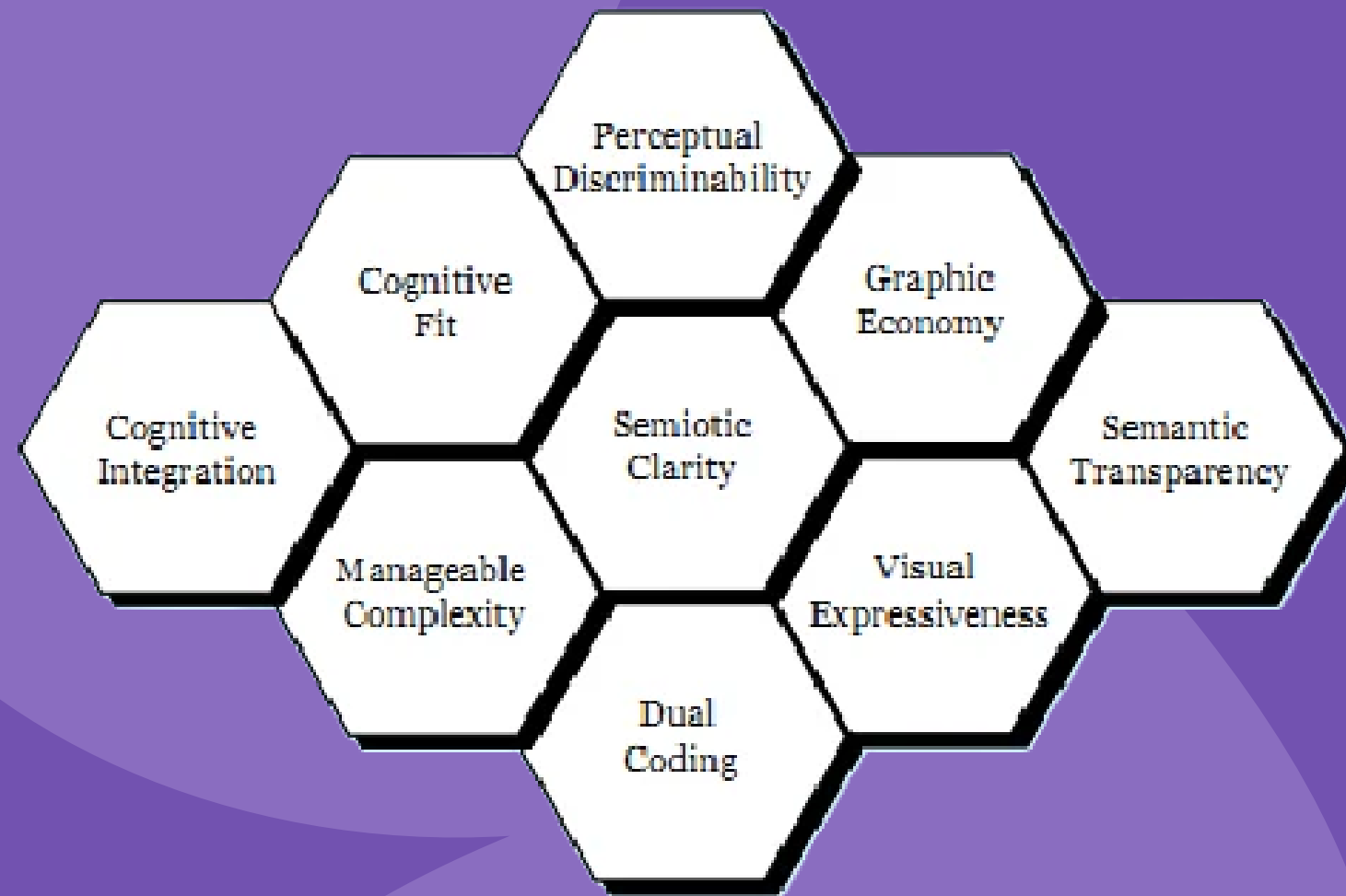


Liability



Cultural

Physics of Notations (PoN)



➤ Theoretical Foundation:

9 principles for ensuring cognitive effectiveness of notations

➤ Practical Application:

Ensuring each barrier icon is instantly recognizable and meaningful.

D. Moody, "The "Physics" of Notations: Toward a Scientific Basis for Constructing Visual Notations in Software Engineering,"

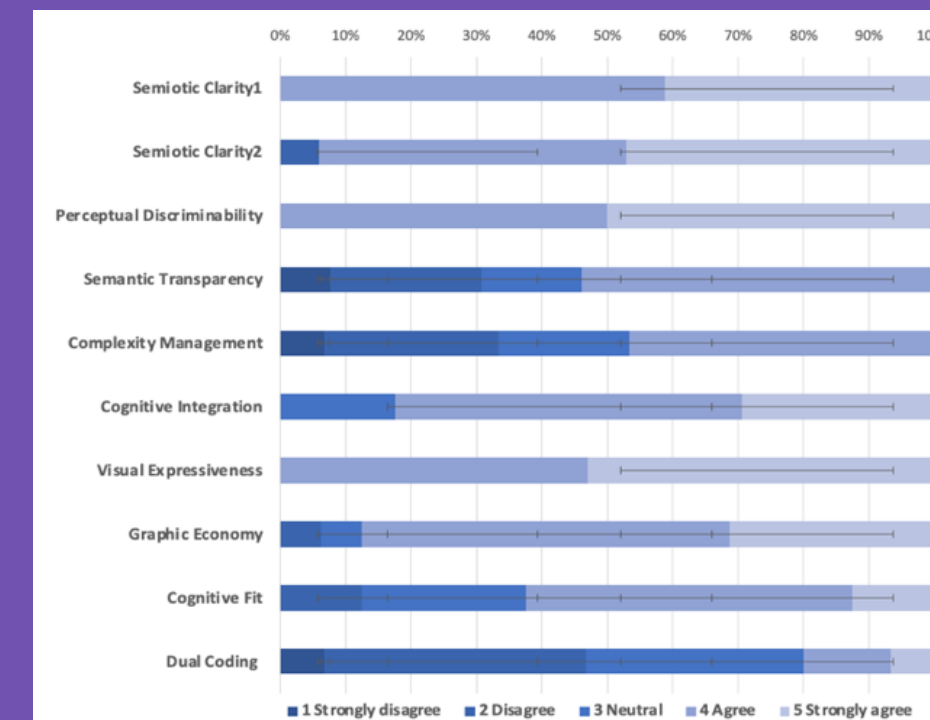
Evaluation – Experts

($N=17$)



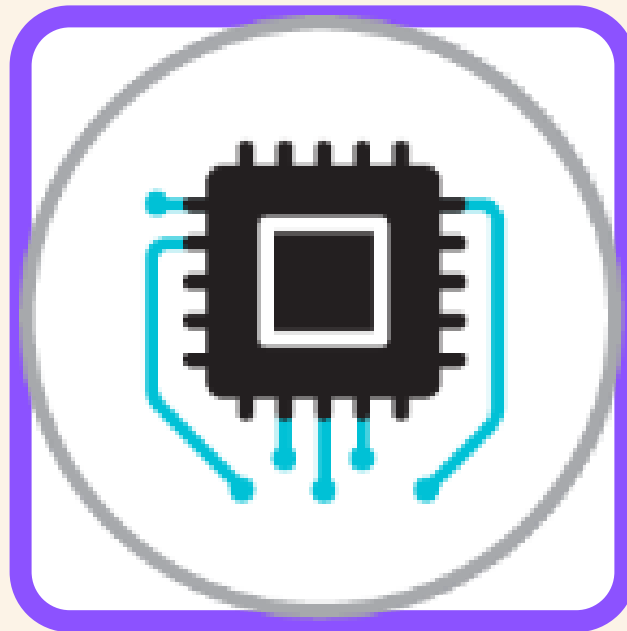
Key Findings

- Overall average of principles' assessments: 3.87/5
- Strengths: Clarity, visual distinguishability, expressiveness, and cognitive integration.
- Weaknesses: Semantic transparency, complexity management, cognitive fit, and dual coding.
- Specific improvements required identified.



New Barrier Icons —

Awareness merged with Personalization
Software renamed Maintenance
3 icons redesigned for clarity.



Hardware

Reliable internet
connectivity



Maintenance

Maintenance concerns



Personalization

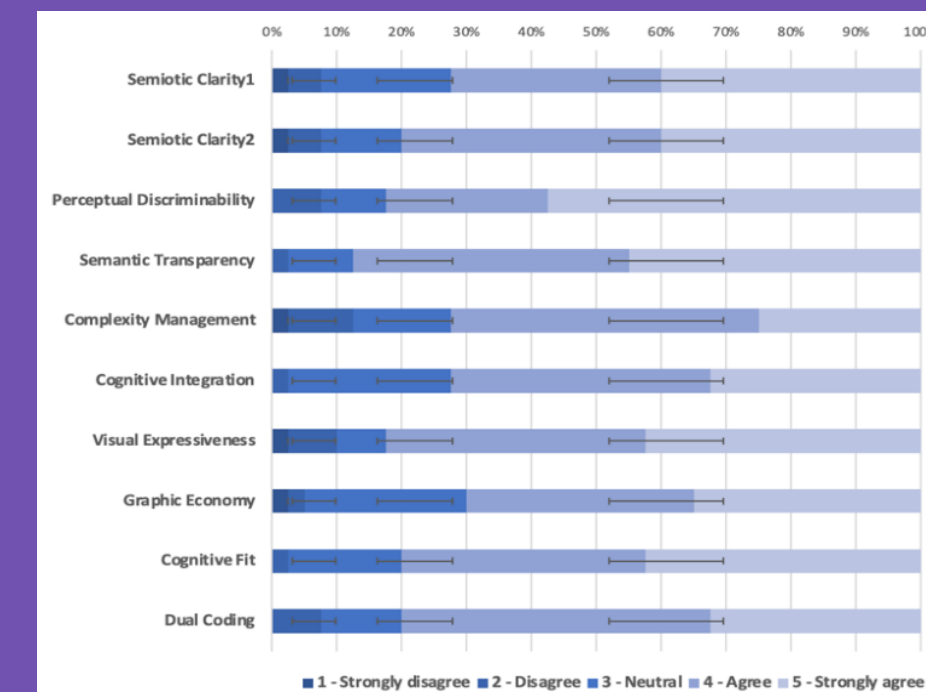
Applications and IS are not
always designed with all
types of end user in mind

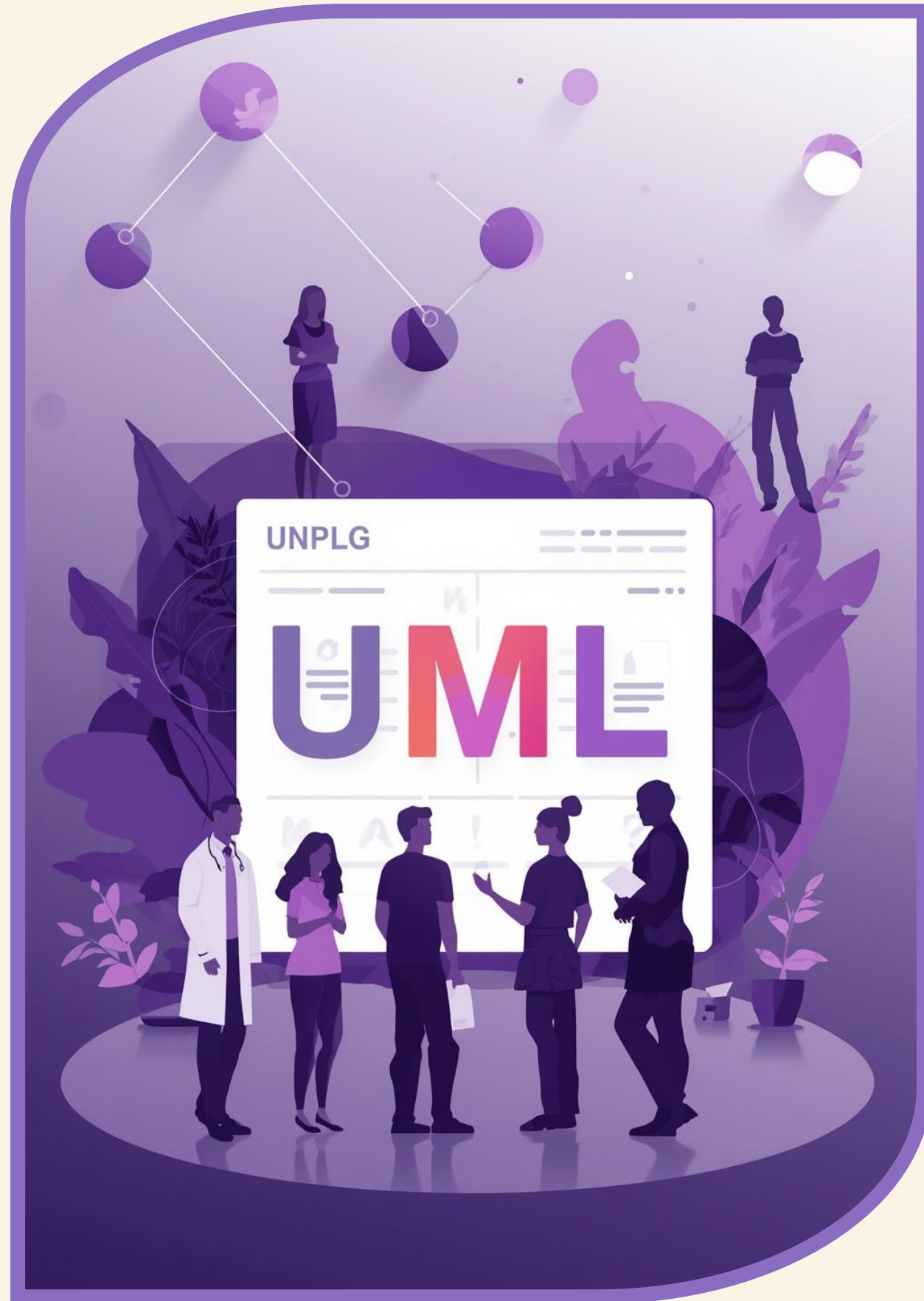
Evaluation – Novices ($N=40$)



Key Findings

- Semantic Transparency improved from 3.2 to 4.3
- Complexity Management improved from 3.0 to 3.8
- Dual Coding improved from 2.7 to 4.1
- Conclusion: The redesigned icons substantially improved the weaker metrics.





UML Integration & Communication Bridge

*Bridging Stakeholder Gaps Through
Visual Barrier Notation Layer*

Case Study – NICU **Caregiver Barriers**

Design Thinking Workshop
Caregiver Perspectives

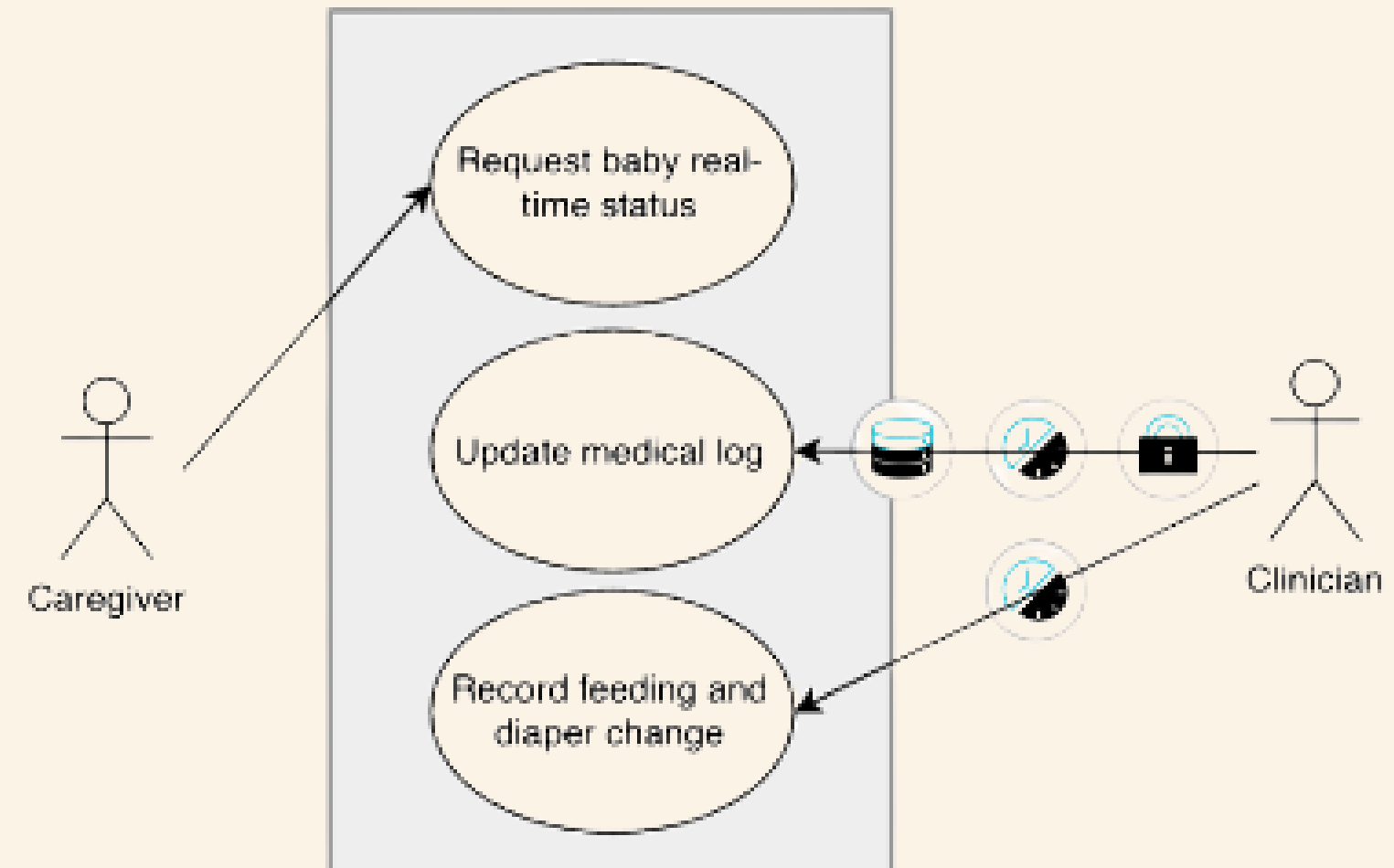
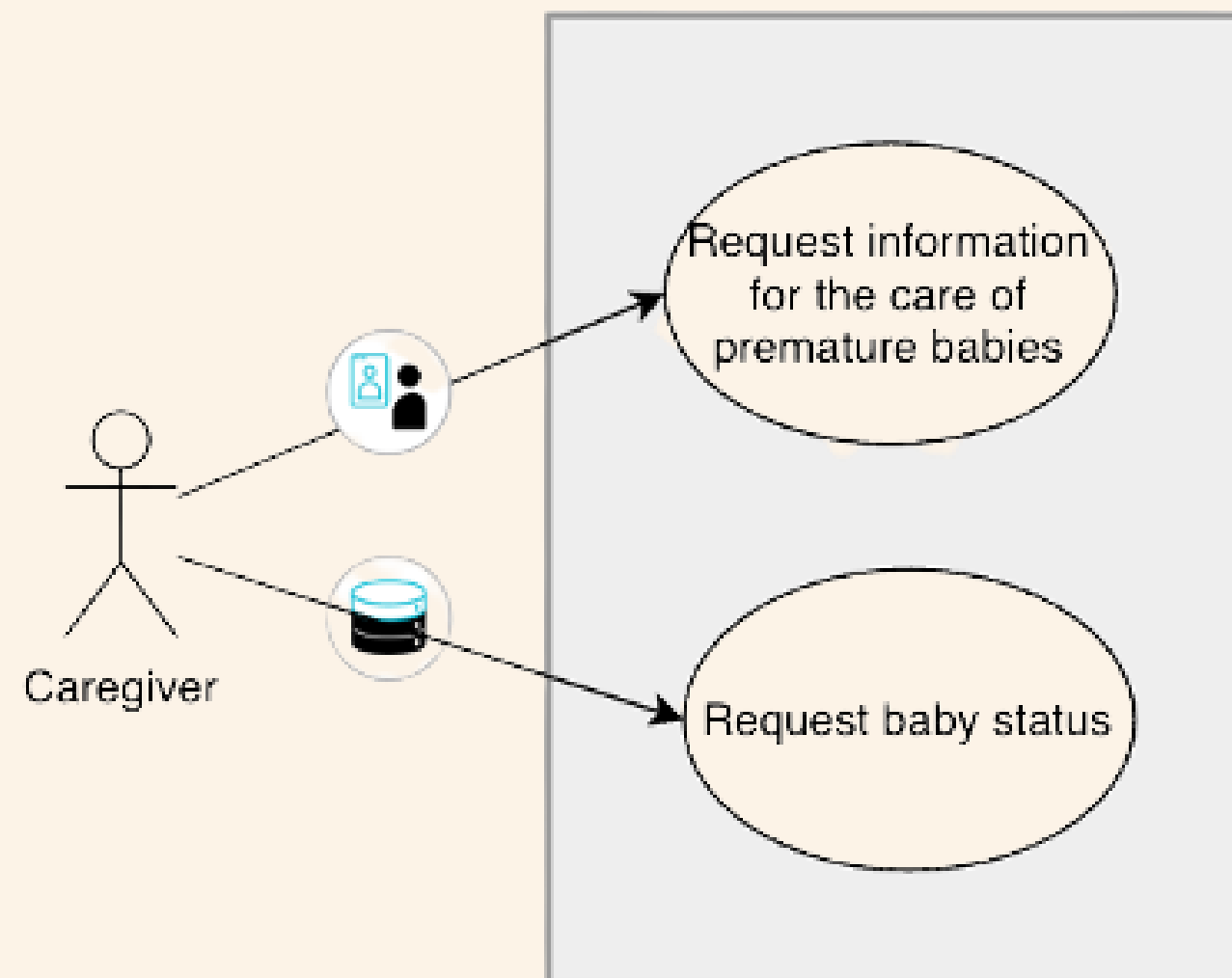
Personalization – Information Overload
Data – Lack of Real-Time Monitoring

Design Thinking Workshop
Clinicians Perspectives

Liability – Fear of Peer Opposition
Time – Lack of Time for Updates

Visual Notation System

Barrier Layer Integration over UML Use Case Diagrams



Research Contributions

- Taxonomy: A taxonomy of human-centric barriers in healthcare IS.

-
- Methodology: A systematic approach to elicit, model, and mitigate barriers early in the modeling phase.

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- Empirical Evidence: Real-world validation across multiple clinical case studies and a practical IS prototype.
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Limitations & **Future Work**

Limited sample sizes
Explore application in varied
healthcare and sociotechnical
domains
Develop additional metrics measuring
barrier impact on requirements
quality

Thank You!

Questions & Discussion

Keren Segal

University of Haifa
Max Stern Jezreel Valley College

kerens@yvc.ac.il

Meira Levy

Shenkar College of Engineering,
Design and Art
University of Haifa

Imeira@shenkar.ac.il

Irit Hadar

University of Haifa

hadari@is.haifa.ac.il