HCI Assignment 1 Investigation Report:
Inclusive Interactive System Design: Image-Schematic Metaphors Across Age Groups

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1 Introduction

How to bridge the intergenerational gap in technological development has long been a long-standing topic among technology researchers. In the field of Human-Computer Interaction(HCI), we should also think about this topic. So we looked for relevant research [1] [2] [3] [4] to show that. The experimental design and data presented below are from the paper *Guiding the Design of Inclusive Interactive Systems: Do Younger and Older Adults Use the Same Image-schematic Metaphors?* by Li, Crilly, and Kristensson, etc. They investigate whether image-schematic metaphors are universally shared across different age groups. These researches aim to provide empirical evidence for their near-universality, thus informing the design of age-inclusive interactive systems.

2 Experimental Procedure

The study in focus investigates the application of image-schematic metaphors among younger and older adults through a bifurcated methodology encompassing structured interviews and interactive tasks.

Participants: The study engaged 12 younger adults (aged 21-34) and 12 older adults (aged 62-75), all English-speaking with comparable educational backgrounds. A structured questionnaire evaluated their prior technological knowledge, assessing exposure and competence with both familiar and unfamiliar technologies.

2.1 Part A: Structured Interviews

Participants were asked to describe 20 abstract concepts commonly encountered in technology learning (e.g., functionality, interface, problem-solving, assistance) using their own words. Their responses were recorded and later analyzed to extract image-schematic metaphors from their spoken language.

2.2 Part B: Interactive Tasks

Participants engaged in four technology-related tasks designed to elicit metaphoric expressions in both speech and behavior:

i **Information Search Task:** Utilizing a delivery app to modify a parcel's delivery date, requiring interface exploration or use of a search function.

ii **Problem-Solving Task:** Interacting with a train ticketing system to perform tasks such as purchasing a ticket and retrieving an e-ticket, with subtle interface challenges incorporated.

iii **Video Tutorial Task:** Following a tutorial on creating a toggle switch animation in PowerPoint, observing how participants structured and manipulated on-screen elements.

iv **Instruction Manual Task:** Assembling and operating a smartphone gimbal based on a written manual.

Throughout these tasks, participants' actions and gestures were recorded, capturing non-verbal metaphor usage.

2.3 Data Analysis

Verbal and behavioral data were transcribed and coded using a predefined set of image schemas. An independent coder analyzed 25% of the data to ensure reliability, achieving a Krippendorff's alpha of 0.792, indicating substantial agreement. The study measured the overlap of metaphors used by both groups and statistically analyzed differences in metaphor selection patterns.

3 Objective Analysis Based on the Actual Situation

The findings provide strong evidence that image-schematic metaphors can be a universal design tool for inclusive interfaces. Given that prior technological knowledge differs significantly between age groups, leveraging technology-independent knowledge, such as image schemas, enhances usability for both younger and older users.

However, some nuances must be considered:

i. **Cognitive Load Differences:** Older adults might struggle with complex metaphors or multi-layered interactions.

ii. **Behavioral Adaptations:** Younger users tend to interact with technology using a trial-and-error approach, while older adults may prefer structured guidance.

iii. **Potential Accessibility Issues:** Although metaphors are shared, interface complexity and interaction speed may still impact older users' adoption.

4 Specific Suggestions for Designing Inclusive Interactive Systems

4.1 Utilize Common Image-Schematic Metaphors

Designers should prioritize the 37 shared metaphors identified in the study, ensuring consistency across interfaces. Since these metaphors are near-universal across age groups, they provide a natural way for users to understand digital interactions. For instance, using the "More is Up" metaphor in progress indicators and volume controls aligns with users' subconscious expectations. By leveraging these widely recognized mappings, designers can reduce cognitive effort and improve usability for both younger and older users.

4.2 Simplify Complex Interactions

Older adults often struggle with multi-step interactions, particularly when interfaces require high cognitive load. To accommodate this, designers should break down tasks into smaller, manageable steps and provide clear, immediate feedback. For example, when designing form-filling interfaces, progressive disclosure can be used to display only relevant fields, reducing user confusion. Additionally, error messages should not just indicate failure but also guide the user toward corrective actions in an intuitive manner.

4.3 Adaptive Interfaces

A one-size-fits-all approach may not work effectively across different age groups. Implementing adaptive interface elements—such as customizable interaction speeds, font sizes, and simplified modes—can improve accessibility. For example, in a mobile banking app, an "Assisted Mode" could provide step-by-step guidance for users unfamiliar with digital transactions, while an "Expert Mode" could streamline processes for more experienced users. These adaptable settings empower users to personalize their experience according to their comfort level.

4.4 Multimodal Cues

Since users process information differently, relying solely on one type of feedback (e.g., visual) can limit accessibility. Instead, designers should incorporate multimodal cues, such as visual indicators, auditory signals, and haptic feedback, to reinforce understanding. For instance, when adjusting volume levels, the system can display an increasing bar (visual), play a tone that rises in pitch (auditory), and provide a slight vibration (haptic feedback). This redundancy ensures that all users, regardless of sensory preference or impairment, can interact effectively with the system.

4.5 Progressive Disclosure

To prevent users—especially older adults—from feeling overwhelmed, interfaces should introduce features gradually based on the user's learning curve. Instead of presenting all functionalities at once, systems can unlock more advanced features as the user gains confidence. For example, a smart thermostat app could initially display only basic temperature controls, later revealing energy-saving settings once the user demonstrates familiarity. This method reduces cognitive overload and fosters a more intuitive learning process.

5 Conclusion

This study provides compelling evidence that image-schematic metaphors are near-universal and can be effectively used to guide inclusive interactive system design. Future research should explore how to optimize metaphor presentation for different cognitive styles and enhance long-term usability for diverse user groups. By integrating image-schematic metaphors into HCI design, we can create more intuitive and accessible systems, bridging the technological gap across generations and fostering digital inclusivity. Meanwhile, by proposing five optimization suggestions, we can further reduce the intergenerational gap in designing inclusive interactive systems, and promote more comfortable and user-friendly human-computer interaction for the elderly.

References

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