Got it? Usability of robotic handovers with visually impaired and sighted users

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Introduction

Assisted living technologies like robots will play a key part in aging societies. A key capability of those **robots** is **handing over objects** [1]. While this process has been widely researched, literature addressing the special needs of **blind or visually impaired (BVI) users** is rare.

A robot giving feedback that matches their special needs should be equally able to assist BVI and sighted users by coordinating handovers without requiring eye contact [2].

This study gathered first insights on the **usability** of such **human-robot handovers including BVI and sighted participants**.

Method

- Sample size: **N=40** participants (26 , 14)
- Age: 18 to 71 years (***M*=41.2, *SD*=17.5**)
- BVI: 9 participants congenitally blind, 11 participants visually impaired for at least 14 years with maximum residual vision of 30%

handover experiment, 3 × 3 × 2 mixed design:
- **user group** (between): BVI sighted
- **object** (within): knife cup spanner
- **handover modality** (within): midair placing

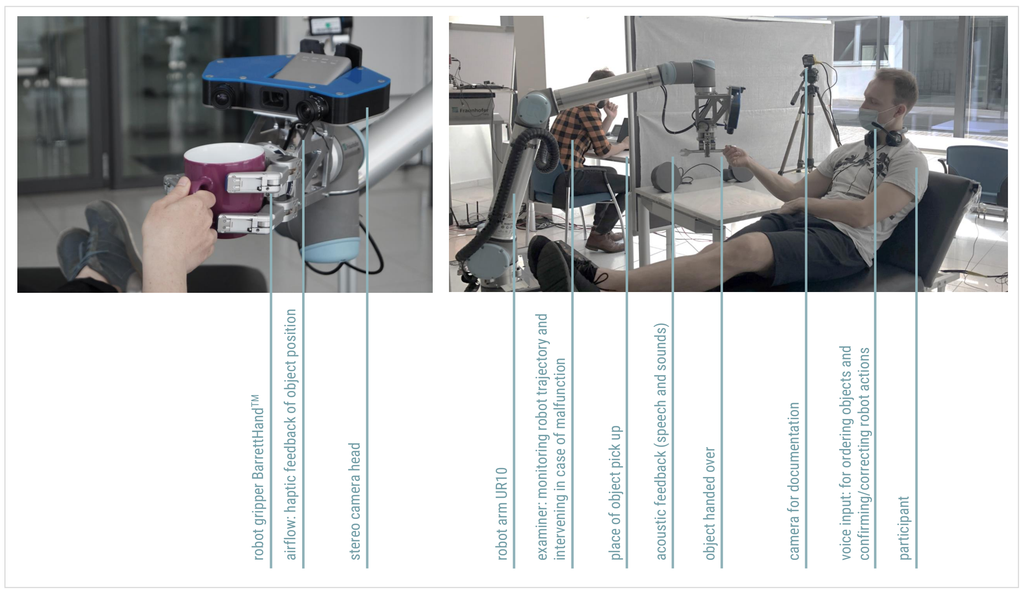

Fig.2: experimental setup with robot for handover tasks

- Subjective **user experience** and **usability**
- **success rate** of handover trials (effectivity) and **time required** (efficiency)
- Subjective **perception** of haptic feedback

Results

- **usability** and **user experience** ratings were **high**

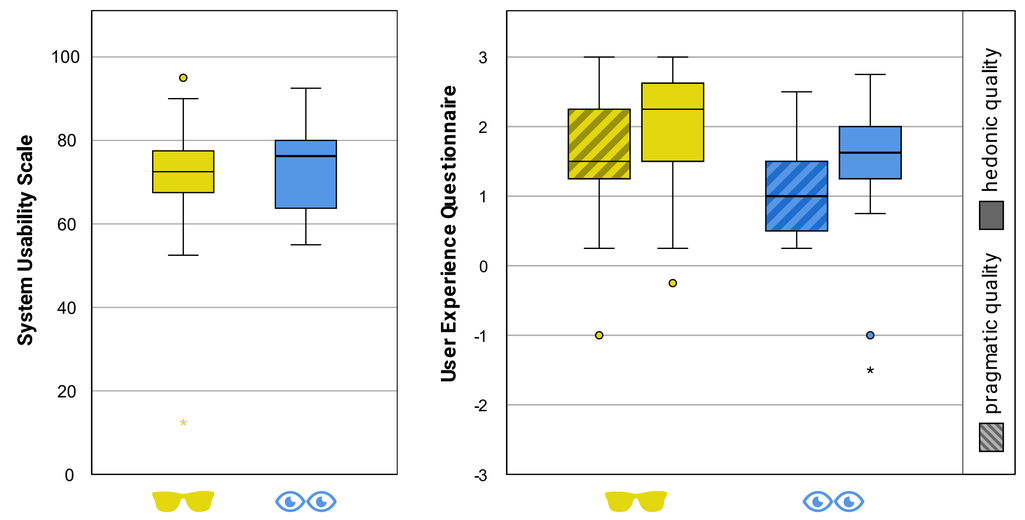

Fig.2: results of subjective usability (left) and user experience ratings (right)

- **high success** rate but handover **time too long**
- **feedback of BVI** participants **more heterogenous**

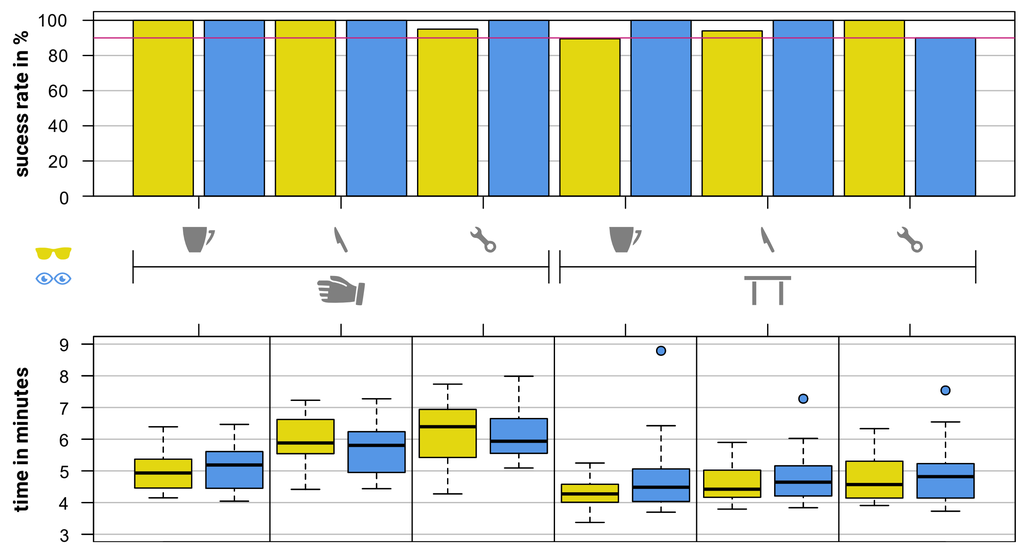

Fig.3: success rate of handover trials (effectivity) and total **time required** from ordering the object to successful handover (efficiency)

- Air flow of **haptic feedback too weak** to be noticed but rated as **helpful in case of noticing**

Conclusion

The robot proved to be **usable and enjoyable but too slow** to users of **both groups**. **BVI users** were **more critical** and had some difficulties with midair handovers. Further robot development needs to speed up some processes and haptic feedback needs improvement. Nevertheless, findings show that robots **coordinating handovers without requiring eye contact can successfully** assist BVI and sighted users, thereby making assistive robots more **inclusive** and **cross-applicable**.

References

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