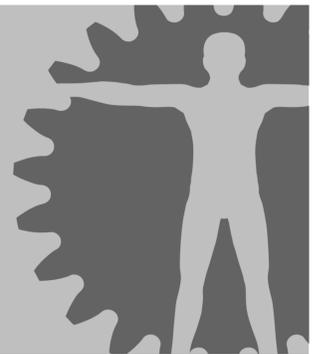


Interaction Strategies for Handing Over Objects to Blind People

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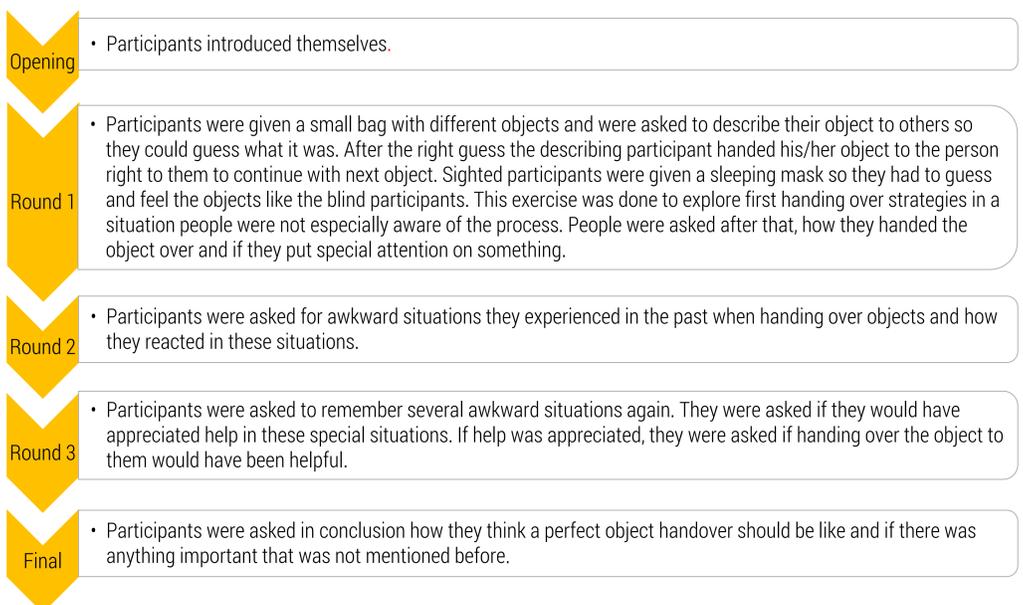
Abstract

Handing over an object is seen as basic ability in robotic systems. Since there is a growing range of application, it is necessary to cover characteristics of several user groups to design safe and intuitive interactions. One application is handing over objects to users who cannot draw on visual channel, e.g. blind people. Up to now little is known about blind people's strategies in handing over objects and in which situations these are important to them. Therefore, we designed a focus group with blind and sighted people to explore strategies and difficulties of blind people in such situations. Analysis revealed that simple handovers of objects is seldom in blind people's interaction with each other or with seeing individuals. If possible, it is preferred to put an object down on a surface so that the blind person can grasp it on his or her own. As a result of missing visual feedback, acoustic information become far more important. Blind people prefer verbal communication about what is handed over as well as objects location. Sound is additionally helpful to know where the robot and especially the target object exactly is. Dangerous objects are grasped in the same way but more cautious.

Method

A focus group was conducted in January 2018. Sighted participants were found in a list of volunteer test subjects of the TU Chemnitz. Blind participants were contacted via local association for the blind. Six people took part, two sighted and four blind, from which two were a married couple (one blind, one sighted). Most of the group participants knew each other well so there was an open dialogue atmosphere. Age of participants ranged from 38 to 55. Focus group lasted about three hours, including two breaks.

The procedure of focus group is described in the figure alongside. Focus group was video recorded and transcribed afterwards. Every line of the transcript was coded separately and then summarized into categories by two researchers. Differences in terms of content were discussed until an agreement was found.



Results

Object handing over strategies

Grasp by oneself from stable surface

Blind participants prefer to grasp objects by themselves. Usually objects are handed over by shifting them into the receivers direction on a stable surface, e.g. a table. Objects that might fall over (e.g. glasses with thin stem, such as wine glasses) are fixed until the receiver got it. Handing over without contact to a stable surface is avoided, if possible.



Sources of harm



Handing over potentially dangerous objects, e.g. knives or hot beverages, is done basically in the same way as any other object, but more cautious. Therefore, all previously mentioned strategies should be considered. Handing over these kind of objects in midair is considered as last option. Participants also wished to be informed about potential sources of harm, e.g. that something is hot.

Only one is active

Only one person is active at a time to avoid confusion. Who is active depends on the way an object is handed over.

If a blind person is grasping for an object on a table, the giver should be passive.

If handing over in midair is not avoidable, blind people prefer to be passive.



Verbal communication

Verbal communication is important, since visual information is missing.

Participants wished to be informed about an intention to hand over something, what is handed over and where. Also unusual properties of an object should be mentioned so that the blind receiver is not surprised because of an unexpected sensation (danger of letting fall down).

To avoid damage, givers should verbally reinsure that the receiver safely grasped the object before letting it go.



Acoustic signals



Acoustic, non-verbal information can be helpful. Participants announced that they use the sound an object makes when placing it on a surface to locate this object. Also approaching vehicles, e.g. cars or mobile robots, are recognized and located by their sound. This is important in terms of avoiding accidents and collisions, too.

Discussion

Results of focus group revealed some interesting and important differences in the handing-over-process of blind and sighted people. In contrast to sighted people, blind persons prefer to shift objects on a surface rather than handing them over in midair. More than sighted people they rely on verbal and non-verbal information and interpersonal coordination. This should be considered in designing applications like handing over tasks for robotic systems to achieve safe and intuitive interactions for all user groups.

Nonetheless, findings have some limitations. Our blind participants were all in a similar age and all of them were born blind or almost blind. All of them visited special schools for the blind where they were taught everyday skills which today is not necessarily the case in all blind children. Therefore, people with other visual impairments, blind children, or people who lost their sight later in life might use other and more diverse strategies and might be confronted with different issues when handing over objects. Their special needs should be assessed in further research.



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