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Eye Gaze Behavior during Telemanipulation of a Multi-stage Task

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Motivation

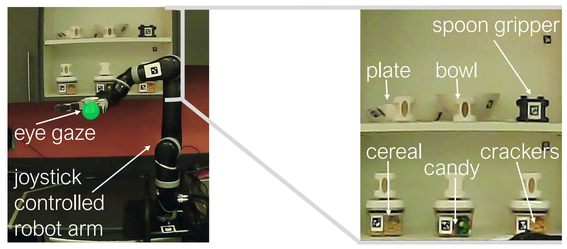
- **Assistive robotics** gives **individuals with motor disabilities** the ability to independently perform activities of daily living.
- Many **activities of daily living** are complex, **multi-stage tasks.**
- Psychology research indicates that distinct **eye gaze** behavior emerges during these complex tasks [1, 2].

Hypothesis

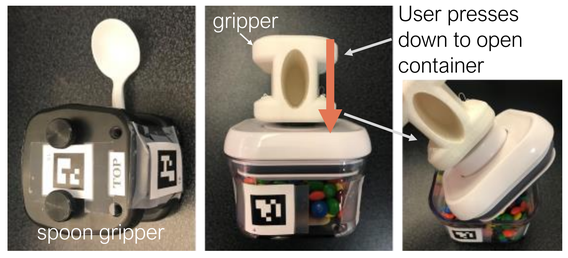
Non-verbal communication, such as **eye gaze**, can enable assistive robotic strategies **to anticipate a user's goals**.

The Multi-stage Task

Serve a snack with a robot arm

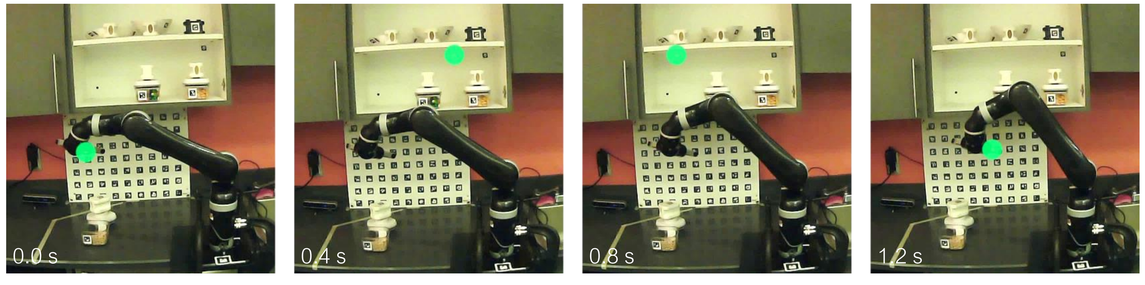


Example: "Transfer 2 scoops of candy and 1 scoop of cereal to a plate."



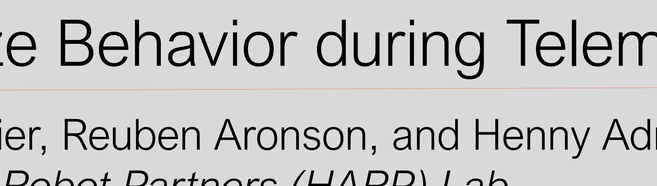
Gaze Shows User Planning Ahead

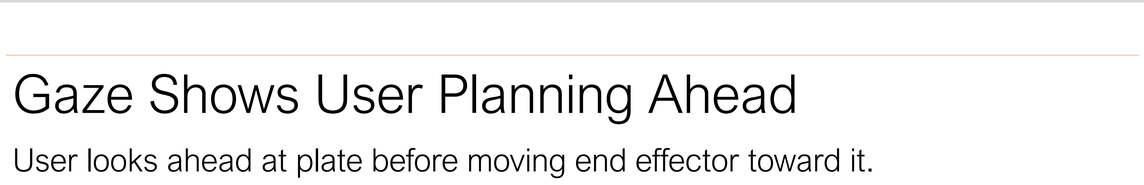
User looks ahead at plate before moving end effector toward it.



Glances to Robot Joints Reveals User's Strategy

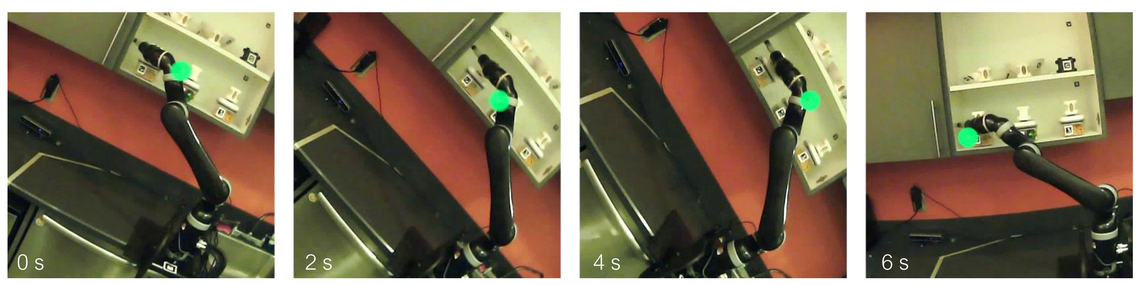
User looks at robot joints to overcome difficult robot configuration.





Head Movements Present in Object Interactions

Visual occlusion causes user to tilt head to position end effector close to object.



Significance

- These three observations provide insight into what the user does next during a task.
- Using eye gaze to anticipate the next subtask during a multi-stage task can optimize algorithms in assistive robotics.

Next Steps

- Finish collecting data for this study.
- Characterize eye gaze behavior in telemanipulation for further studies.
- Build classifier for subtask anticipation.
- Investigate the effect of task experience on eye gaze behavior in telemanipulation.

Acknowledgments

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References

[1] J. B. Pelz and R. Canosa, "Oculomotor behavior and perceptual strategies in complex tasks," *Vision Research*, 2001.

[2] M. M. Hayhoe, A. Shrivastava, R. Mruczek, and J. B. Pelz, "Visual memory and motor planning in a natural task," *Journal of Vision*, 2003.