

## Height and End-State Comfort Effect With an Overturned Glass Task

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**Background/Purpose:** When grasping an object within the natural boundary formed an individual's maximum arm extension, a majority of individuals grip with an awkward and uncomfortable starting position in order to end the movement in a more comfortable state, known as the end-state comfort effect (ESCE). As an individual's height influences how far an arm can be extended, the purpose of this study is to determine the probability that a grasp indicating ESCE will be used by individuals of shorter stature (less than 160 cm tall) when an overturned glass is located on a high shelf. We hypothesize that shorter participants will prefer to avoid using the ESCE and grasp the glass initially with a comfortable thumb-up position and end with a thumb-down position.

**Method:** Participants ( $n= 25$ ) shorter than 160 cm were instructed to climb a step stool to reach an overturned drinking glass on a high shelf, turn the glass right-side up, and fill it with water. Videotape data of the initial grip the participants used to grasp the overturned glass was coded for analysis.

**Analysis/Results:** A majority of participants elected not to use an ESCE grasp on trials 1 (64%), while during trials 2 and 3, a slight minority (44% and 48%, respectively) elected not to use the ESCE. A Cochran's Q test, indicated that participants did not choose an ESCE grip over top-and-twist, start-state comfort, and supination grips across all three trials ( $Q(2) = 6.00, p= .050$ ).

**Conclusions:** Thus, our hypothesis was supported as individuals of shorter stature seem to prefer a grip violating the ESCE to manipulate an overturned glass on a high shelf.

\*Additional data was collected from additional participants following the abstract submission deadline. Thus, the poster reflects the full data set.

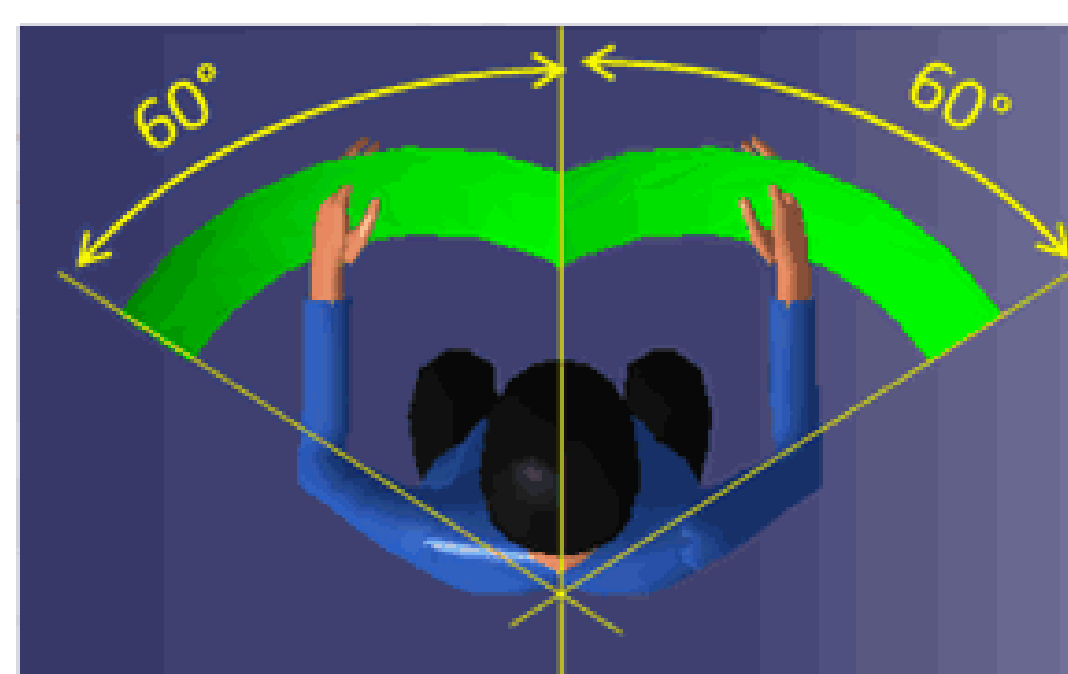
## BACKGROUND

### Degrees of Freedom Problem (Bernstein, 1967)

What drives a person to select a specific movement, or combination of movements, from the vast set of possibilities or degrees of freedom?

### Reach Envelope

Area within which a person can comfortably complete a task within a workstation (Parkinson & Reed, 2007).



### End-State Comfort Effect

Numerous studies have demonstrated the tendency with which humans have to pick up an object so that it is **most comfortable to hold at the end, rather than the beginning of the movement**. That tendency is known as the end-state comfort effect (ESCE; Rosenbaum, Chapman, Weigelt, Weiss, & van der Wel, 2012).

In previous work, Breslin, Ross, & Fischman (2013) & Fischman et al. (2010) noticed that **participants of shorter stature seemed to violate ESCE when objects were placed outside of the participant's reach envelope**. However, in both of these studies, few participants of shorter stature were included.

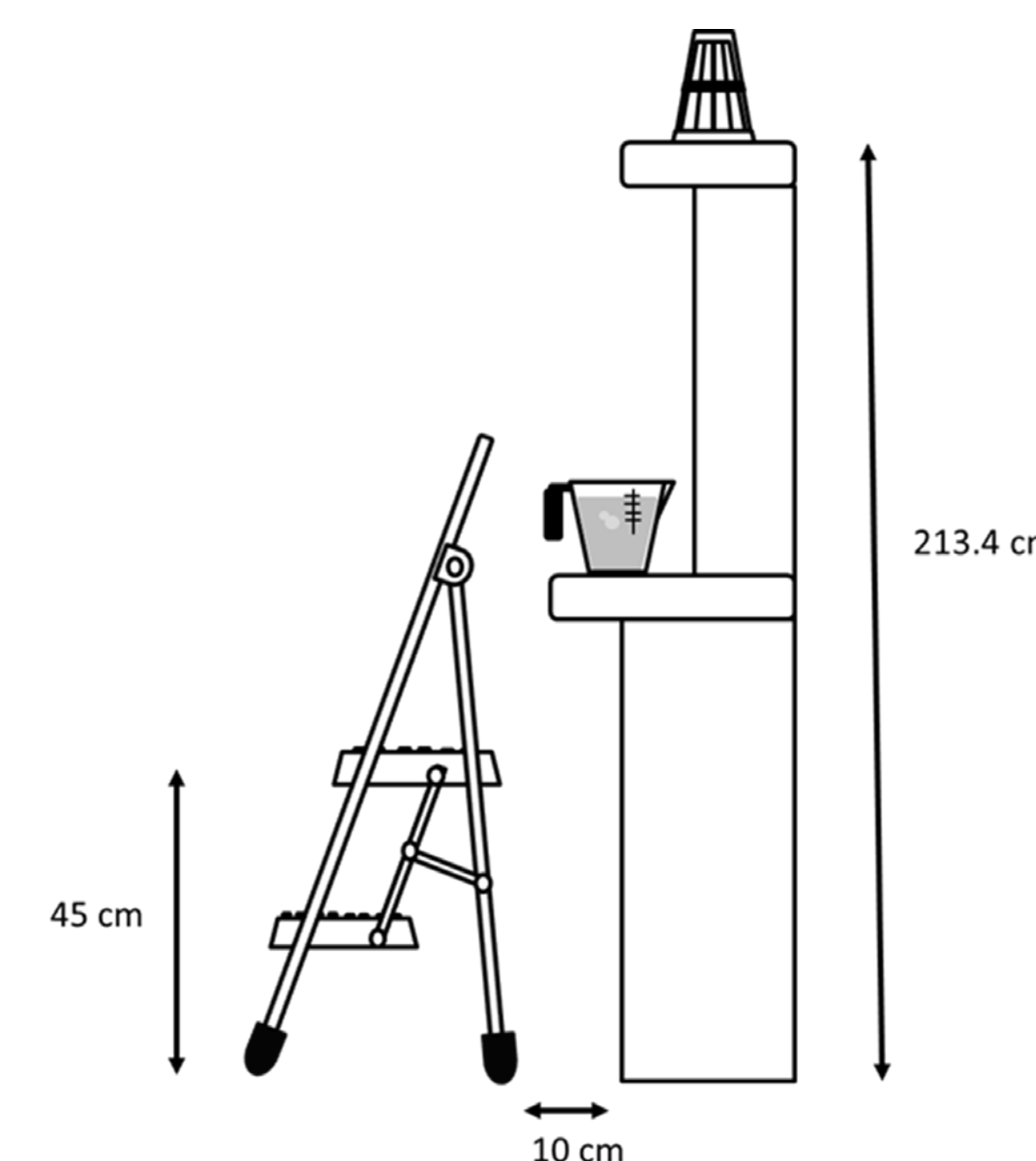
## RESEARCH PURPOSE

**Q:** Does the height of the shelf upon which an object is located influence how an individual will plan to and grasp an object?

**Q:** Does the height of the participant influence how that object on a shelf is grasped?

As an individual's height influences how far an arm can be extended, we sought to **determine the probability that a grasp indicating ESCE will be used by individuals of shorter stature** (less than 160 cm tall) when an overturned glass is located on a high shelf.

## METHODS



## EXPERIMENTAL INSTRUCTIONS

**Please climb the step stool to the second step. Do not climb above the second step as it is not safe. Please pick up the measuring cup first, then pick up the glass, and then fill the glass with water.**

Providing the instructions in this format allowed the researchers to examine second-order planning (Rosenbaum et al., 2012).

**PARTICIPANTS:** 42 healthy young participants (40 females, 2 males, mean age 20.3±1.6yrs)

**DELIMITATIONS:** Participants were shorter than 160 cm tall with no history of concussion, dizziness, vertigo, lower extremity injury, or consumption of medication that may impact balance in the previous six months.

## DATA ANALYSIS

**ANALYSIS:** Live coding of grasps & coding of videotape data

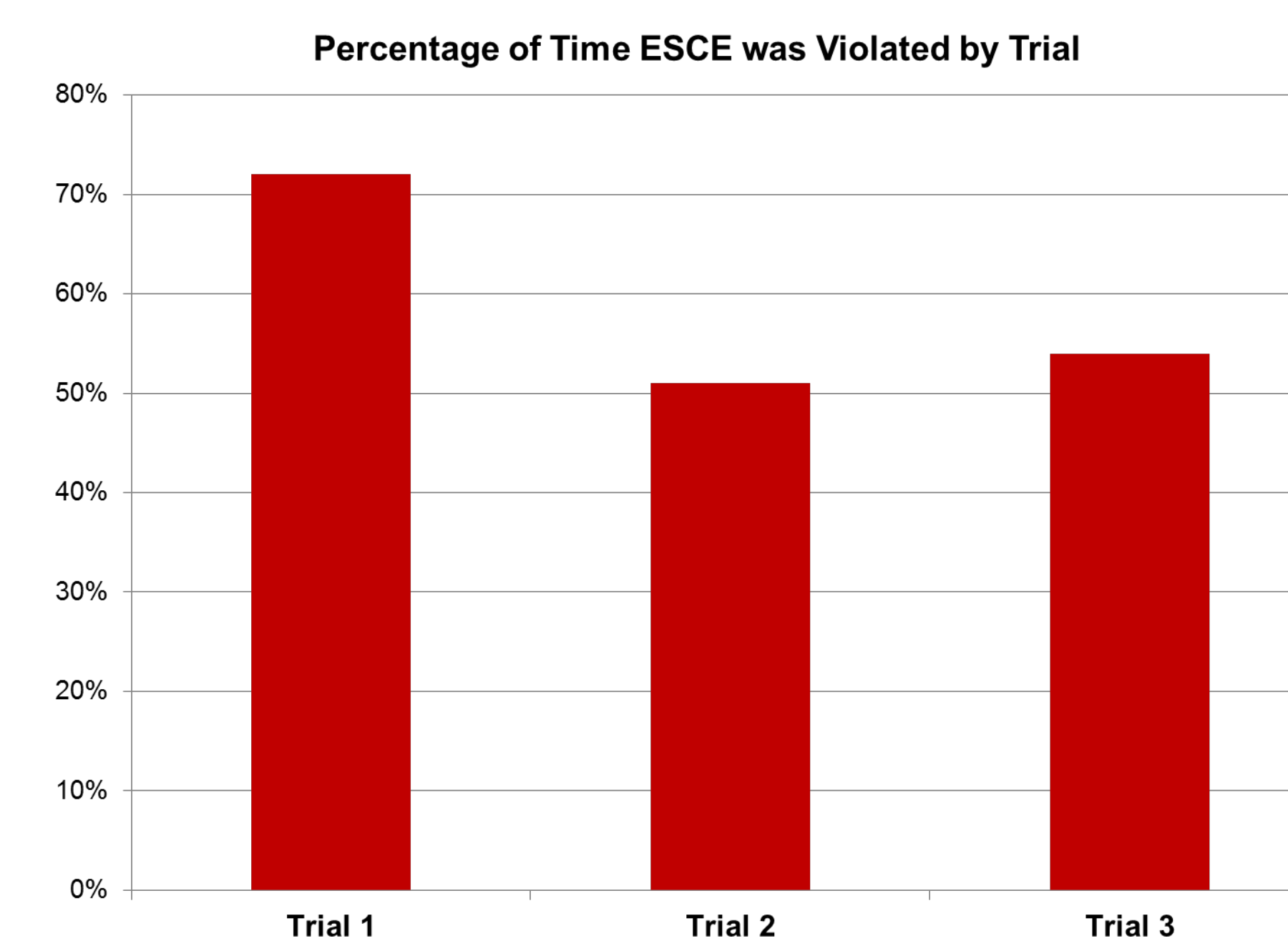
- Inter-rater reliability= 98.84%
- Intra-rater reliability= 99.60%

### STATISTICAL ANALYSIS

Frequencies of grasps in violation of the ESCE were calculated.

A Cochran's Q test to compare frequencies of non-ESCE grasps across three trials by individuals of shorter stature.

## RESULTS



### Cochran's Q Test Results

A majority of participants elected not to use an ESCE grasp on trials 1 (72%), and during trials 2 and 3, a slight majority (51% and 54%, respectively) elected not to use the ESCE. A Cochran's Q test indicated that **participants did not choose an ESCE grip** over top-and-twist, start-state comfort, and supination grips across all three trials, (Q(2) =13.273, p <.001).

## CONCLUSION

Results supported our hypothesis that **individuals of shorter stature seem to prefer a grip violating ESCE to manipulate a glass on a high shelf**.

Thus, height may play more of a **role on how an individual plans movements** in real life situations than previously considered. When constructing shelves for houses and buildings, user height should be considered.

This is the first time, to our knowledge, that it has been reported that the height of the user will influence the way in which an object located on a high shelf is grasped.

## REFERENCES

- Bernstein, N. (1967). *The co-ordination and regulation of movements*. Oxford, England: Pergamon Press Ltd.
- Breslin, C.M., Ross, A.E., & Fischman, M.G. (2013) End-state comfort effect in the overturned glass task: Influence of climbing to reach a high shelf. *Journal of Sport and Exercise Psychology*, 34 (Suppl): S622.
- Fischman, M.G., Breslin, C.M., Morera, M., Resende, S., Robinson, L.E., & Rudisill, M.E. (2010). End-state comfort effects in the overturned glass task: Influence of shelf height. *Journal of Sport and Exercise Psychology*, 32 (Suppl): S78.
- Rosenbaum, D. A., Chapman, K. M., Weigelt, M., Weiss, D. J., & van der Wel, R. (2012). Cognition, action, and object manipulation. *Psychological Bulletin*, 138, 924-946. doi: 10.1037/a0027839