



MOVING SIDEWALKS AND BEER GLASSES

How does the end-state comfort effect influence movement planning?

The next time you go to a restaurant with empty water glasses on the table, pay special attention to how the server fills them. Take note of how your glass is sitting on the table; some restaurants (such as outdoor caf  s) have the glass overturned. If the server is holding a pitcher of water in one hand, watch very closely what she does with the other hand as she reaches for the glass. Quite likely, the server will pick up the glass with an inverted hand position, then turn both the hand and the glass over so she can pour water into the glass that she is now holding in a comfortable hand position.

This simple observation started psychologist David Rosenbaum on a long research journey, conducting many elegant studies along the way about how we plan actions prior to movement. His observations and initial research efforts were described simply as the end-state comfort effect. The idea is that we adopt initial body postures (e.g., hand configurations) in a highly predictable manner: we sacrifice efficiency and effectiveness initially to conclude the action in a comfortable final body posture.

The end-state comfort effect occurs because we anticipate a potentially awkward final posture and make adjustments ahead of time to minimize the discomfort. Another example of this phenomenon occurs in airports. Many airports contain moving sidewalks to transport people and their luggage. Getting on and off these moving sidewalks, however, causes a disturbance to our normal posture: getting on them causes us to fall backward, and getting off them causes us to fall forward. People who fly frequently have learned to anticipate what will happen when they get on and off these moving sidewalks. To minimize the disturbance, they make adjustments in their posture just before stepping on or off the sidewalk. Perhaps they do this not just to maximize their end-state comfort but also to minimize their chances of injury.

Now consider the task of putting away beer glasses. Pilsner beer glasses are tall and thin and can be grasped at a number of locations near the middle, top, or bottom of the glass. Suppose you were putting pilsner glasses away in the cupboard and had to put some on shelves that were above your head and some on shelves that were below your waist. Rosenbaum's research suggests that you would probably grasp the bottom of the glass if you were placing one in a high cupboard and grasp the top of the glass if placing one on a low shelf to avoid having to reach higher or lower than necessary. This illustrates the end-state comfort rules again.

Now suppose that just after you placed these glasses on their respective shelves, I ask you to bring each glass back to the countertop. It stands to reason from the end-state comfort effect that because you are placing both glasses on the same spot on the countertop (i.e., the same end-state position), your initial hand position on the glass would be the same, perhaps somewhere near the middle. Instead, Rosenbaum found that his participants did not perform as expected. When asked to immediately replace an object, Rosenbaum's participants adopted a hand position that was similar to the grasp used just moments ago. In other words, a memory effect took precedence over the end-state comfort effect.

These studies, elegant in their design yet simple in methodology, suggest that actions are planned on the basis of various strategies. The reasons for acting spontaneously to maximize our end-state comfort are pretty straightforward: effectiveness, efficiency, and injury prevention probably all play important roles. The reasons for a memory effect are much less clear, however, and research continues to uncover the effects and roles of recent memory in our moment-to-moment actions. Both effects, however, show a powerful effect of memory: both recollective memory (of the recent past) and prospective memory (for activities to occur in the future) influence our present behavior.

SELF-DIRECTED LEARNING ACTIVITIES

1. Explain the end-state comfort effect in your own words.
2. Describe two other activities of daily living in which the end-state comfort effect determines motor behavior.
3. Describe another activity in which recent memory of a previous action plays a dominant role in how the action is repeated.
4. Develop a research methodology to explore the maximizing of end-state comfort when passing objects from one hand to the other or from one person to another.

NOTES

- Noting that David Rosenbaum's experiments are simple is certainly not intended to be a slight to his research. Just the opposite is true: his experiments are simple in their methods, elegant in their design, and complex in their implications.
- David Rosenbaum's website describes some of his most recent research activities:
http://cls.psu.edu/people/affiliated/rosenbaum_david.shtml

SUGGESTED READINGS

- Rosenbaum, D.A., Loukopoulos, L.D., Meulenbroek, R.G.M., Vaughan, J., & Engelbrecht, S.E. (1995). Planning reaches by evaluating stored postures. *Psychological Review*, 102, 28-67.
- Schmidt, R.A., & Lee, T.D. (2011). Human information processing. In *Motor control and learning: A behavioral emphasis* (5th ed., pp. 57-96) Champaign, IL: Human Kinetics.
- Weigelt, M., Cohen, R.G., & Rosenbaum, D.A. (2007). Returning home: Locations rather than movements are recalled in human object manipulation. *Experimental Brain Research*, 149, 191-198.