4-17-2013

The Effect of Context Upon the Perception of Egocentric and Exocentric Distances Using a Walkable Human Muller-Lyer Illusion

The Effect of Context Upon the Perception of Egocentric and Exocentric Distances Using a Walkable Human Müller-Lyer Illusion

Adam J. Barnas, B.S., Ellen J. Hart, & Lauren M. Pytel, & Natalya N. Lynn
Advisor: Benjamin R. Kunz, Ph. D.

Visual-Spatial Perception and Action Laboratory

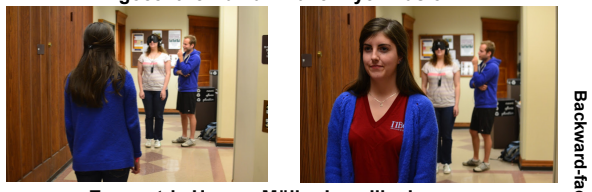
Introduction

- The Müller-Lyer illusion is a well-known geometric illusion in which pairs of lines of the same length are perceived to be different because of geomeric forms (e.g. "fins") at the ends of the lines.
- This influence of context upon the perception of line length is well-established for 2-D illusions but has also been demonstrated in larger-scale, three-dimensional spatial tasks (Wraga, Creem, & Proffitt, 2000).
- Accurate blind-walking, or walking without vision to previously seen targets is likely to involve spatial updating, the process of keeping track of locations of objects relative to one's spatial position while walking (Loomis et al., 1992; Rieser et al., 1990).
- Studies have demonstrated that blind-walking tasks are resistant to the illusory effects of a walkable Müller-Lyer illusion whereas verbal reports of perceived distance are affected (Wraga, Creem, & Proffitt, 2000).
- Across 4 experiments, we replicated and extended previous experiments by using a large-scale, walkable variation of the Müller-Lyer illusion that had human forms to manipulate context in order to examine the effect of context upon the perception of egocentric and exocentric distances.

General Method

- View a target person (egocentric) or target persons (exocentric), create a mental image of the target person(s) in the surrounding environment, and walk perceived distance to the location of the target person, walk perceived distance between the target persons, or call out perceived distance.
- Viewing **forward-facing and backward-facing** targets
  - 9 trials of 3, 4.5 & 6 or 2, 4.5 & 7 meters for each facing direction
- **Experiments 1 and 2:** Is blind-walking with spatial updating affected by an egocentric human Müller-Lyer illusion when the target is at 3, 4.5, & 6 meters and 2, 4.5, & 7 m?
- **Experiment 3:** Are verbal reports of perceived distance affected by an egocentric human Müller-Lyer illusion when the target is at 2, 4.5, & 7 m?
- **Experiment 4:** Is blind-walking with spatial updating in conjunction with verbal reports of perceived distance affected by an exocentric human Müller-Lyer illusion when two targets are 3, 4.5, & 6 m apart?

Egocentric Human Müller-Lyer Illusion



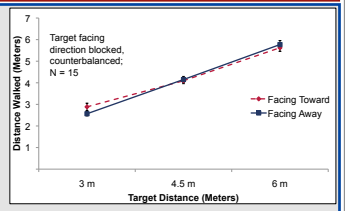
Exocentric Human Müller-Lyer Illusion

Forward-facing targets

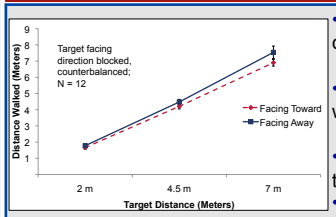
Backward-facing targets

Experiment 1 – Blind Walking with Spatial Updating

- No effect of target facing direction
  - $F(1,13) = .48$, $p = .502$
- Significant difference in meters walked between target distances
  - $F(2,26) = 324.47$, $p < .0001$
- Distance walked increased with target distance, $p < .0001$
- Underestimated target distances
  - $p = .028$ (3 m), $p = .013$ (4.5 m), and $p = .072$ (6 m)



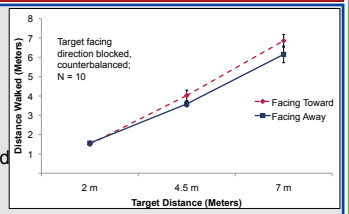
Experiment 2 – Blind Walking with Spatial Updating



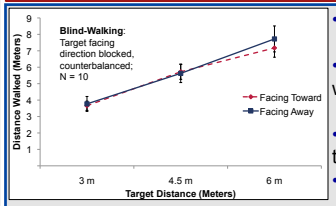
- Near significant effect of facing direction
  - $F(1,11) = .3.65$, $p = .082$
- Significant difference in meters walked between target distances
  - $F(2,22) = 590.666$, $p < .0001$
- Distance walked increased with target distance, $p < .0001$
- Accurate walking to 4.5 m and 7 m
  - $p = .008$ (2 m), $p = .254$ (4.5 m), and $p = .417$ (7 m)

Experiment 3 – Verbal Reports

- Significant main effect of target facing direction
  - $F(1,9) = 9.19$, $p = .014$
- Significant difference in meters between target distances
  - $F(2,40) = 186.26$, $p < .0001$
- Verbal report of distance increased with target distance, $p < .0001$
- Underestimated 2 m and 4.5 m
  - $p < .001$ (2 m), $p = .008$ (4.5 m), and $p = .202$ (7 m)

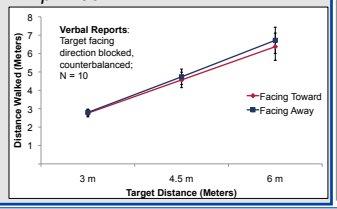


Experiment 4 – Exocentric Müller-Lyer Illusion



- No effect of target facing direction
  - $F(1,9) = .32$, $p = .588$
- Significant difference in meters walked between target distances
  - $F(2,18) = 75.69$, $p < .0001$
- Distance walked increased with target distance, $p < .0001$
- Overestimated target distances
  - $p < .061$

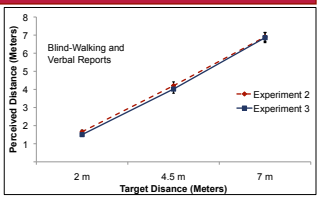
- No effect of target facing direction
  - $F(1,9) = 1.98$, $p = .193$
- Significant difference in meters between target distances
  - $F(2,18) = 40.28$, $p < .0001$
- Verbal report of distance increased with target distance, $p < .0001$
- Accurate estimates of target distances, $p > .258$

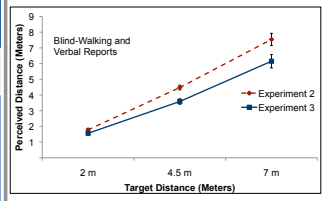


Results

Forward Facing Target Comparison

- No significant main effect of Experiment on distance when viewing forward facing targets
  - $F(1,20) = .28$, $p = .604$
- No significant differences in perceived distance between Experiments 2 and 3
  - $p \geq .228$



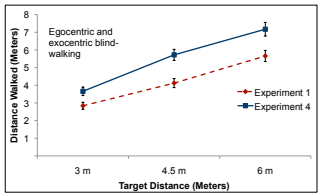


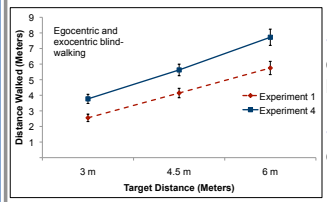
Backward Facing Target Comparison

- Significant main effect of Experiment on distance when viewing backward facing targets
  - $F(1,20) = 8.80$, $p = .008$
- Compared to Experiment 3, distance in Experiment 2 was significantly less to 4.5 m ($p = .001$) and 7 m ($p \geq .027$)

Forward Facing Target Comparison

- Significant main effect of Experiment on walking distance when viewing forward facing targets
  - $F(1,23) = 13.32$, $p = .001$
- Significant differences in walking distance between Experiments 1 and 4
  - $p \leq .026$ for all target distances





Backward Facing Target Comparison

- Significant main effect of Experiment on walking distance when viewing backward facing targets
  - $F(1,23) = 9.88$, $p = .005$
- Significant differences in walking distance between Experiments 1 and 4
  - $p \leq .035$ for all target distances

Conclusion and Discussion

- There was no significant effect of facing direction (toward) on egocentric distance judgments for blind-walking or verbal reports; however, there was a significant effect of facing direction (away) on egocentric verbal report tasks.
- There was also a significant effect of facing direction (both facing toward and away) on exocentric distance judgments for blind-walking. Specifically, the exocentric Müller-Lyer illusion was perceived as being greater than the egocentric Müller-Lyer illusion for both target facing directions.
- Future experiments include increasing the target ranges for another exocentric condition, and for replicating verbal reports at 3, 4.5, and 6 m.

References

Available upon request.

Acknowledgments

- Thanks to Ryan Fuentes, Nicole Schlater, Katherine Peters, Paul Obbagy, Ryan Robie, and Kar Yen Chai for their assistance in conducting this research.
- Thank you to Lindsey Meter and Dr. Erin O'Mara for their input on this poster.