A Social Influence on Self-selected Walking Speeds

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Summary

Few gait studies have assessed preferred walking speeds due to social influences, despite their ubiquitous role in our daily lives. Here, we used a load-retrieval task to test the effect of a social interaction (handing off the load) on walking speeds. We found that individuals increased their speed when the experimenter held out a large package for them to retrieve, perhaps due to perceived additional effort on the part of the experimenter. This study can help improve our understanding of factors that determine the biomechanics and control of gait in a more ecological context.

Introduction

Despite longstanding data of humans walking at speeds coinciding with the minimum cost of transport, or energy per unit distance travelled [1], gait speeds vary with a variety of factors including age [2], walking distance [3], and even the population of the city where you live [4]. However, few studies have tested walking speeds in response to social interactions, which often play a prominent role in our daily lives. Here, we test the effect of a social interaction on self-selected walking speeds, in order to elucidate social factors that may have an influence on movement strategies.

Methods

The study used a load-retrieval task to assess a social influence on selected walking speed. Specifically, nine participants (6 female, 3 male) were asked to walk towards a package (a weighted box), retrieve it from the experimenter during a hand off, and carry it back to their starting point. Experiment parameters were varied in 98 trials in random order, including 4 walking distances (2.5-10 m), 4 package sizes/masses (0-6.8 kg), and 3 experimenter poses during hand off (standing next to the box lying on the ground; holding it at their waist; holding it out towards the participant with outstretched arms). Higher walking speeds were predicted at longer distances and when the box was held by the experimenter during hand off. Inertial measurement units (IMUs; APDM Opals) were placed at the participant's feet, wrists, and lower back; the resulting data were integrated twice between successive steps to calculate step length, step time, and step speed during the approach. Regression analysis was used to characterize the average approach speed as a function of walking distance and package mass.

Results and Discussion

In general, participants used faster speeds when approaching more distant packages (e.g., 10 m vs. 2.5 m), but speed increases tended to asymptote at longer distances, regardless of package size or experimenter pose. The approach speed at long distances decreased slightly with box size when the box was resting on the ground but increased when the experimenter held out the box during the hand off (see Fig. 1, blue vs. red curves). For example, individuals walked at speeds about 7.1% higher when the box was held out to them vs. when it was sitting on the ground.

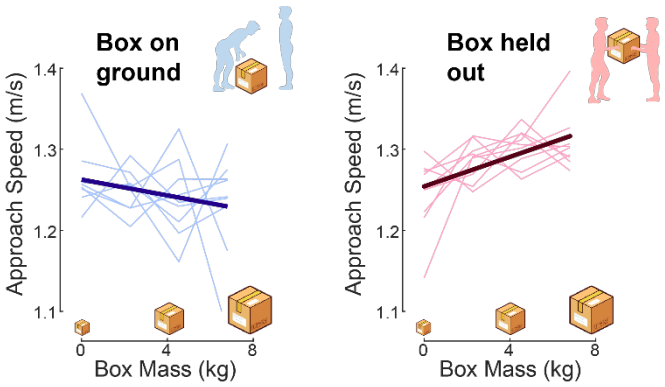

Figure 1: Participant approach speed vs. package mass is shown at long distances (i.e., >10 m). Individual subjects are shown in thin light lines and linear regression results are shown in thick dark lines. Results are shown for experimenter poses where the box is left on the ground (blue, $R^2 = 0.84$) and when the box is held out to the participant during the handoff (red, $R^2 = 0.87$).

Previous studies have shown that an optimal trade off between energy and time can explain self-selected walking speeds when walking over short distances [3]. One interpretation of the current study is that individuals may also be influenced by the social cost of others expending energy and/or time on their behalf, thus causing them to walk more quickly in an effort to reduce the burden on others.

Conclusions

We used a load-retrieval task to assess a social interaction for its influence on self-selected walking speeds. We found that individuals approached a larger box more quickly when it was held out by the experimenter before the hand off, but this result was most apparent at long walking distances. Although more research is needed to assess a multitude of factors such as sex of the participant, sex of the experimenter, personality (e.g., empathy, etc.), perceived effort during the hand off, etc. we have shown that a social interaction influences gait strategies during a relatively ecological load-retrieval task.

References

[1] Ralston HJ. (1958). *Int. Z. Angew. Physiol. Einschl Arbeitsphysiol.,* **17**: 277-83.
[2] Carlisle RE & Kuo AD. (2023). *eLife*, **12**: e81939.
[3] Himann JE, et al. (1988) *Med Sci Sport Exer*, **20**: 161-6.
[4] Bornstein MH & Bornstein HG. (1976). *Nature*, **259**: 557