Robust Experimental Evidence of Counterclockwise bias in Roaming Pedestrians

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Abstract Recently, people have been observed to spontaneously move in a counterclockwise direction in both crowded and uncrowded settings. In this work, we report six independent experimental studies carried out under different conditions and in different cultures. Together, they show that this counterclockwise bias of pedestrian motion is universal and comes from individual preferences (probably biomechanical) rather than from interactions within the group or the environment.

Keywords Counterclockwise, Pedestrian roaming, Individual bias

When people walk within an enclosed or open space without a predetermined goal, they can exhibit unexpected movement patterns. Previous work has revealed that a group of individuals tends to form circular motion that is biased in a counterclockwise (CCW) direction [1]. At first, it was hypothesized that such a bias might stem from physical interactions with the environment, particularly the walls that can trigger left turns for right-handed participants [2].

In this work, we will present new observations demonstrating that pedestrian wall interaction is not the main cause of CCW motion, and suggest that underlying mechanisms are more complex and may involve individual biomechanical factors. These new findings come from a series of six different experiments that we have performed under varying conditions and across different cultural context.

In the first experiment, we investigated whether the aforementioned hypothesis (right turners preference for left turning) could account for the CCW bias. Trials were conducted in a confined space in which participants' turning preferences were pre-determined (Fig.1a). Despite selectively recruiting individuals known to favor rightward turns when confronted with a wall, the emergent collective behavior remained CCW. To definitively exclude boundary effects, a subsequent experiment was performed in an open space—a high school courtyard with minimal environmental constraints—yet the group continued to rotate in the CCW direction (Fig.1b).

Having ruled out boundary interactions as the principal cause of the CCW bias, we next examined the role of pedestrian–pedestrian interactions, particularly avoidance maneuvers. It was hypothesized that such interactions might induce a CCW rotation in a manner analogous to the right-side lane formation observed in pedestrian counterflows. However, experimental outcomes in Japan—where left-side lane formation is typical during counterflows—did not support this hypothesis (Fig.1c).

Next, we explored whether the CCW bias might be rooted in social convention by doing a querie where participants were asked about their preferred strategies for navigation in a scenario like the one shown in Fig.1d. The responses did not indicate a clear social norm favoring CCW motion. In the same line of evaluating a possible role of social convention, we analyzed data from previous experiments conducted in a nursery school setting [3] (Fig.1e). Contrary to our expectations that younger children would display attenuated convention-driven patterns, a strongly pronounced CCW bias emerged, evidencing the tendency of children to imitate their pairs.

Finally, thousands of individual trials were conducted (Fig.1f) to assess if the bias could be attributed solely to individual-level tendencies. Notably, a majority of participants exhibited a preference for CCW motion irrespective of their laterality traits, such as handedness, footedness, or eye dominance.

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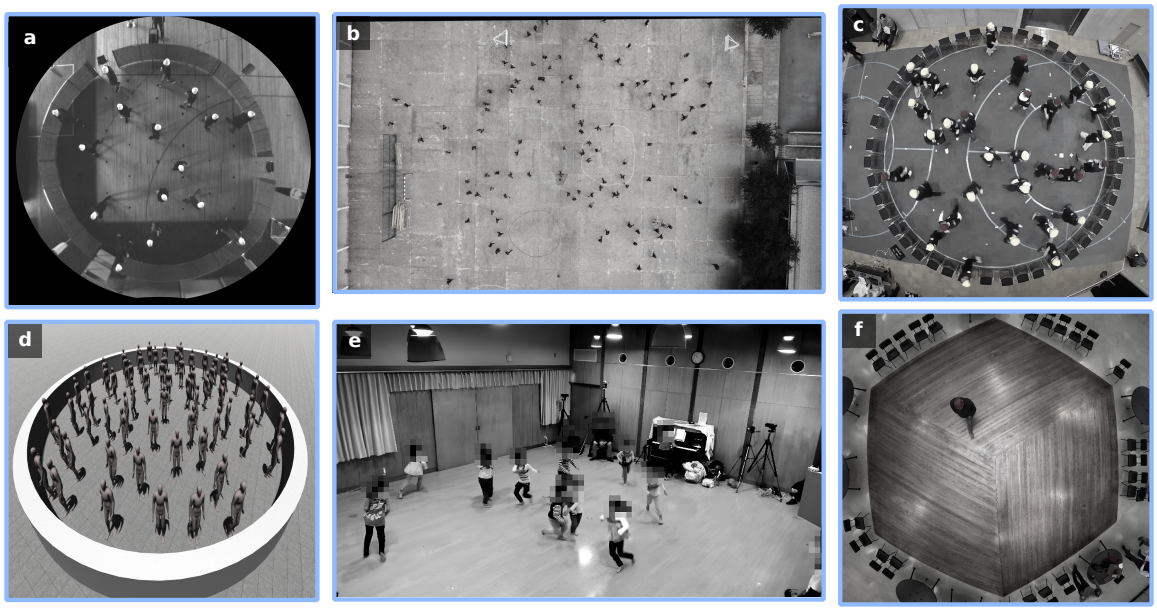

Figure 1: Six distinct experimental scenarios were investigated to assess the robustness of the counterclockwise bias in pedestrian locomotion. **(a)** Confined random motion in Spain; **(b)** boundary free movement in a Spanish schoolyard involving teenagers; **(c)** confined random motion in Japan; **(d)** virtual picture used for the elicitation of social norms in Spain; **(e)** random motion within a Japanese nursery school; and **(f)** isolated pedestrian motion in Spain.

Overall, these findings suggest that the CCW bias is surprisingly robust across a variety of conditions, including different turning preferences, cultural backgrounds, boundary setups, and age groups. Whether these results arise from a shared biomechanical factor or a fundamental social trait remains an open question, and ongoing studies aim to clarify how deeply rooted this leftward bias might be in human locomotion.

Bibliography

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