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Illusory rotation of translating wheels: Kinematics override surface cues

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Gibson's ecological optics stressed the importance of ground surface affordances for locomotion. Here we ask whether ground surface properties are important for estimating object motion. This was tested by using a motion illusion in which a translating flickering wheel is perceived to rotate, suggesting that friction with the ground is inferred. Observers reported the direction of rotation of a wheel translating back-and-forth horizontally for 20 s trials. If perceived rotation reflect friction, we expect to see a higher rate of judgements congruent with the direction of the friction force for wheels presented on less slippery-looking surfaces. Wheels were shown over 'concrete', 'mirror' and 'water' virtual surfaces or over a grey uniform background. Surprisingly, surface type had little influence on congruent responses, even compared with the uniform background condition. Image inversion had also a weak effect on judgements. However, the position along the trajectory had a strong effect, with judgements going from chance level (50% congruent) to a high proportion of congruent responses from the beginning to the end of the trajectory, before the wheel changes direction. We conclude that physical context is important in disambiguating motion, but kinematics override static cues.