Tactile ground information for navigation

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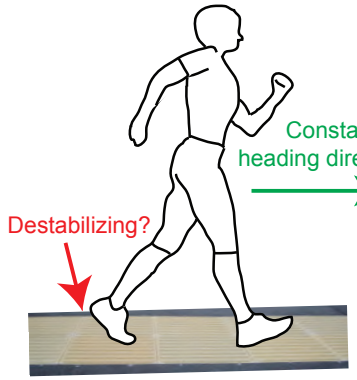
Introduction



We rely on vision to maintain heading direction.....

.....so looking at a mobile device while walking can be dangerous.

Can we use tactile information instead?

Tactile pavement:

- *Does it indicate walking direction in an intuitive way?*
- *Does it influence gait stability?*

Methods

3 Visual conditions:

- Full vision
- Reduced vision (blurring goggles)
- No vision (blind fold)

2 Types of pavement:

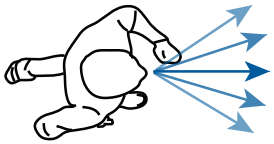
- Normal
- Tactile

Mobile phone:

- Accelerometer
- Gyroscope
- Magnetic field sensor

Task: Walk in a straight line along the path.

Data analysis

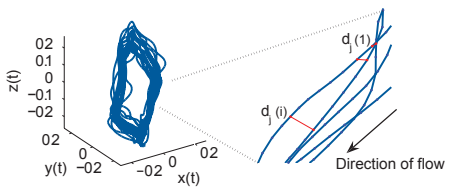


Navigation:

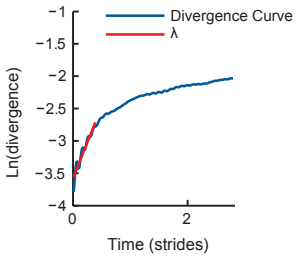
- Integration of angular accelerations from gyroscope.
- Standard Deviation of heading direction.

Gait stability:

From the accelerometer signal the local divergence component (λ) was calculated
Gait stability is negatively correlated with λ (Bruijn et al., 2013)

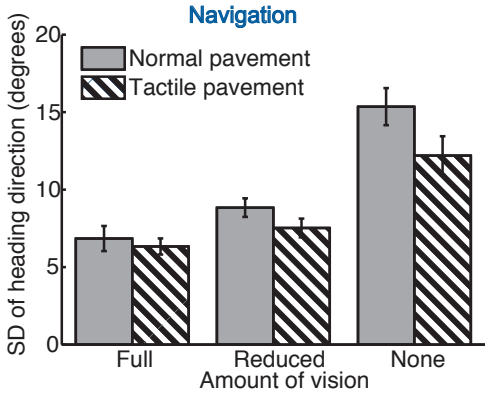


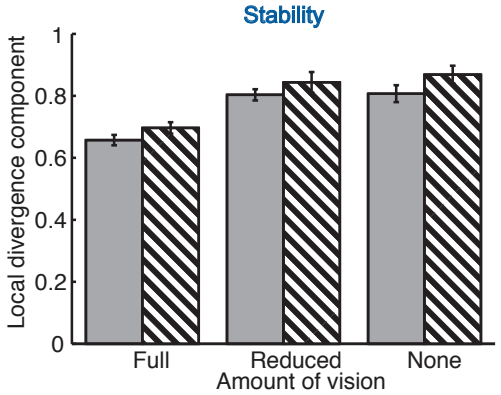
Time series of 36 strides normalised to 36 X 100 samples
A 6D state space was constructed from 3D accelerometer data plus time delayed copies (25 samples).



Divergence slope was fitted between 0 - 0.5 strides.

Results





Conclusions

- Tactile pavement helps navigation
- Tactile pavement decreased gait stability

Need to find tactile patterns that do not negatively influence gait stability

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