



# Effects of operating electronic devices while cycling

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# Dual task performance

- › Mobile phone
  - Calling
  - Texting
  - Use of Smartphone-Touchscreen!
- › Listening to music



# Divided attention





# Use of mobile phone

- › Effects: handheld, handsfree





# Differences

- 2 vs 4 wheels (control)
- Auditory information
- speed



## Observations

- › Calling: 2.2%
- › Texting: 0.6 %
- › Music: 7.7 %
- › Talking: 2.3 %
- › Just cycling: 86.6 %
- › diffent: 0.5 %

› 2000 cyclists observed  
(video)

Anno 2008



# Three experiments





## 1<sup>e</sup>: Calling, texting, music

- › Control 2, two hands on handlebar
- › Control 1, one hand
- › Calling (easy task) [+2: 2,4,6,8,...]
- › Calling (demanding task) [-7: 846, 839, 832,...]
- › Send text message [lang zal ze leven...]
- › MP3, listening to music



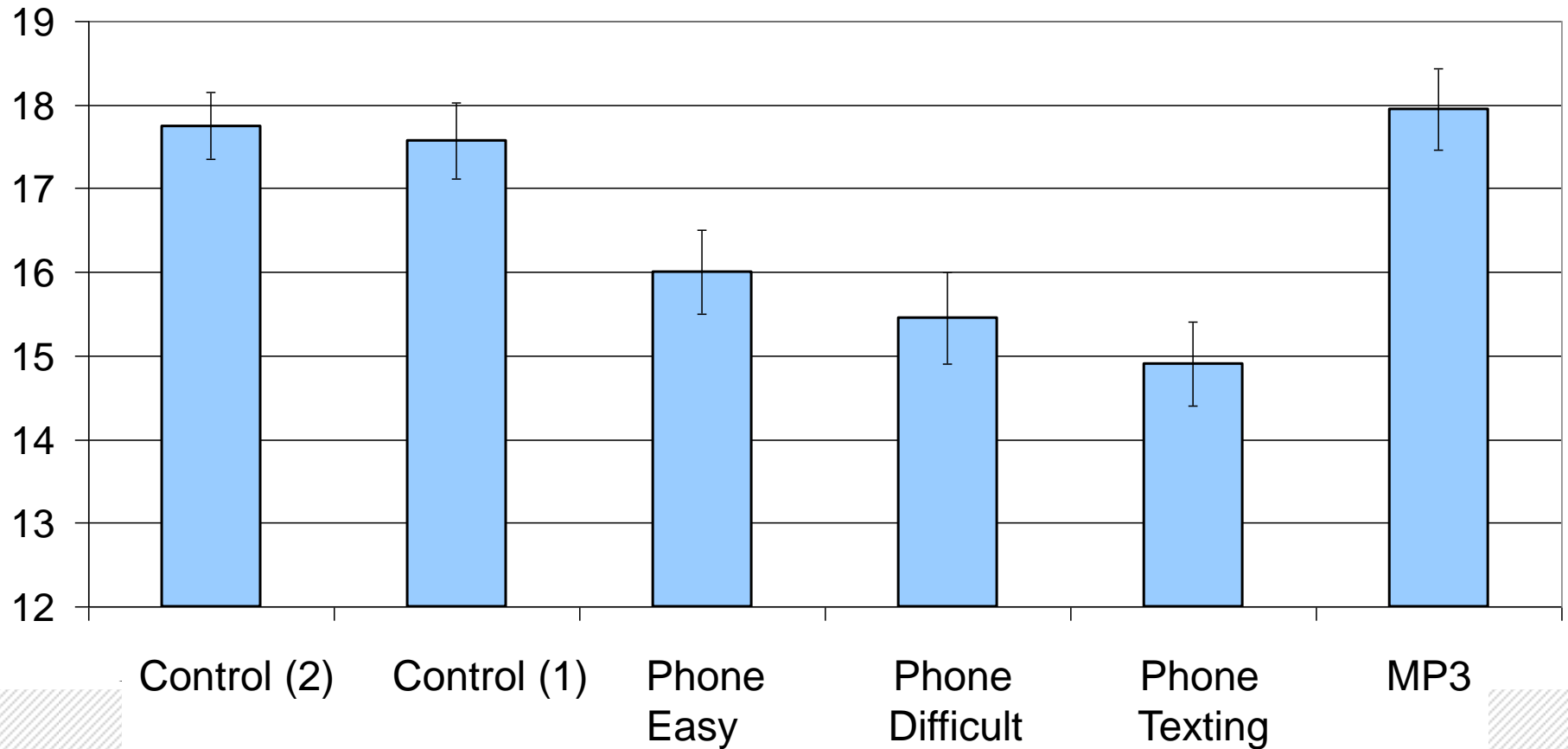


# Measurements

- › Speed
- › Location in cycle path
- › Swerving
- › Mental effort rating
- › Peripheral detection performance

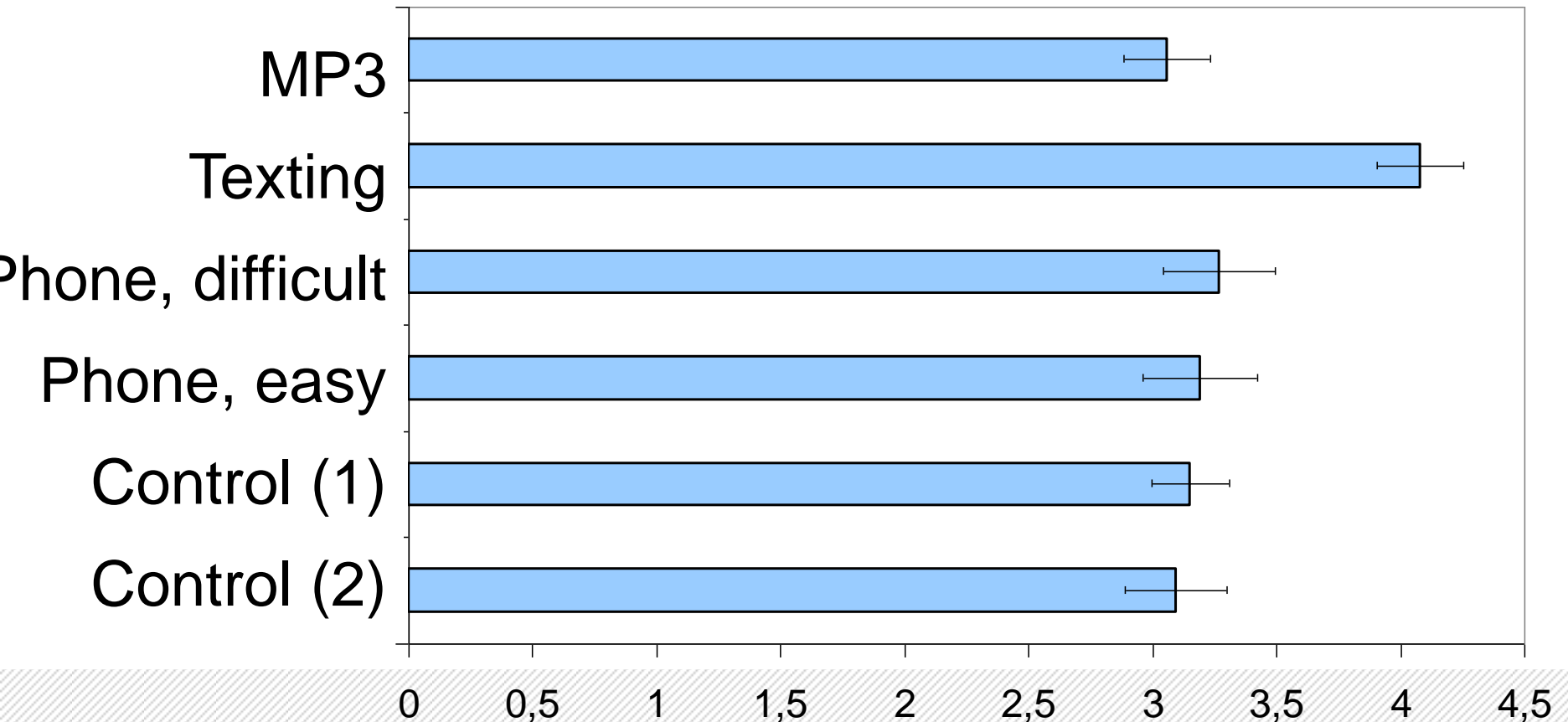


# Speed



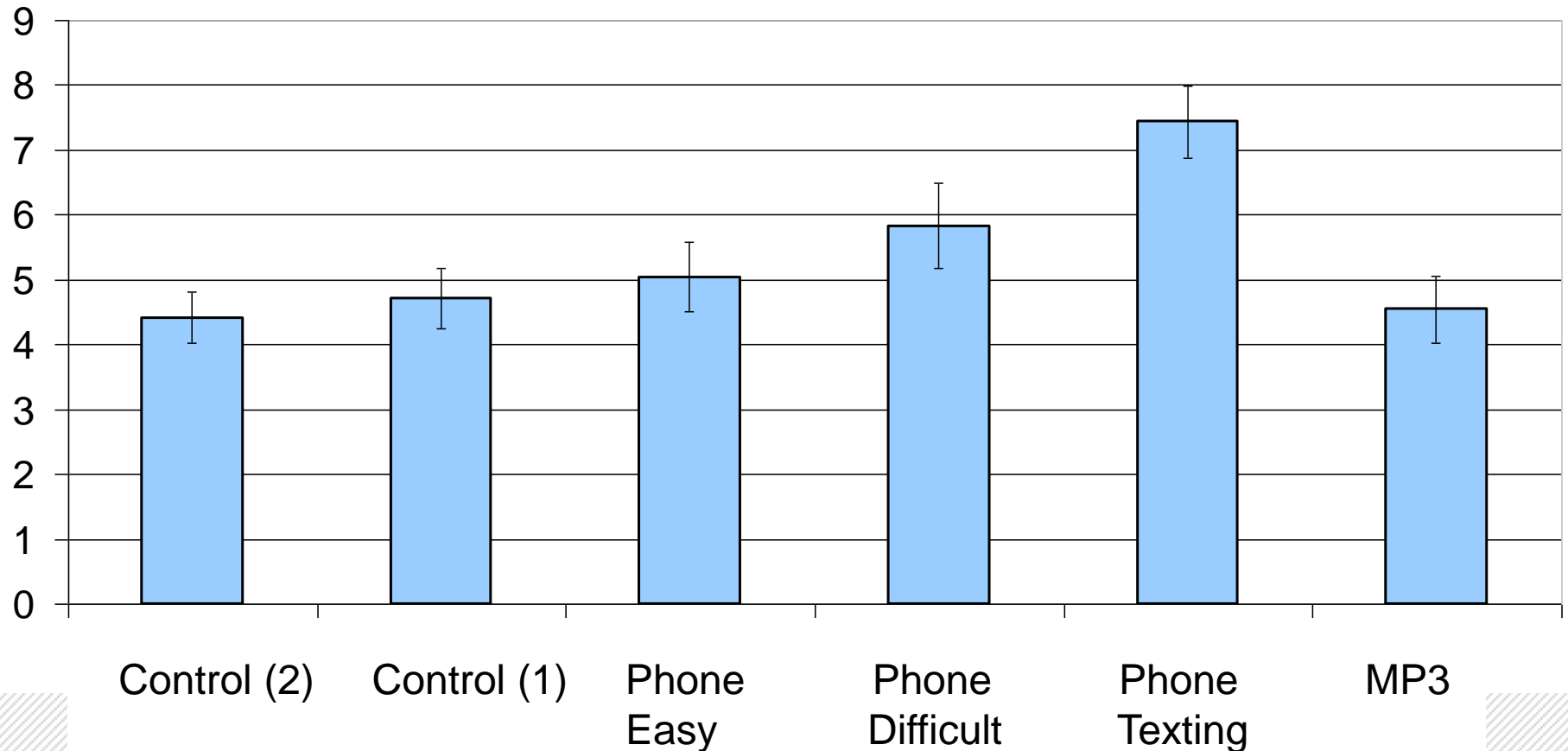


# Position on cyclepath ( “strip”)



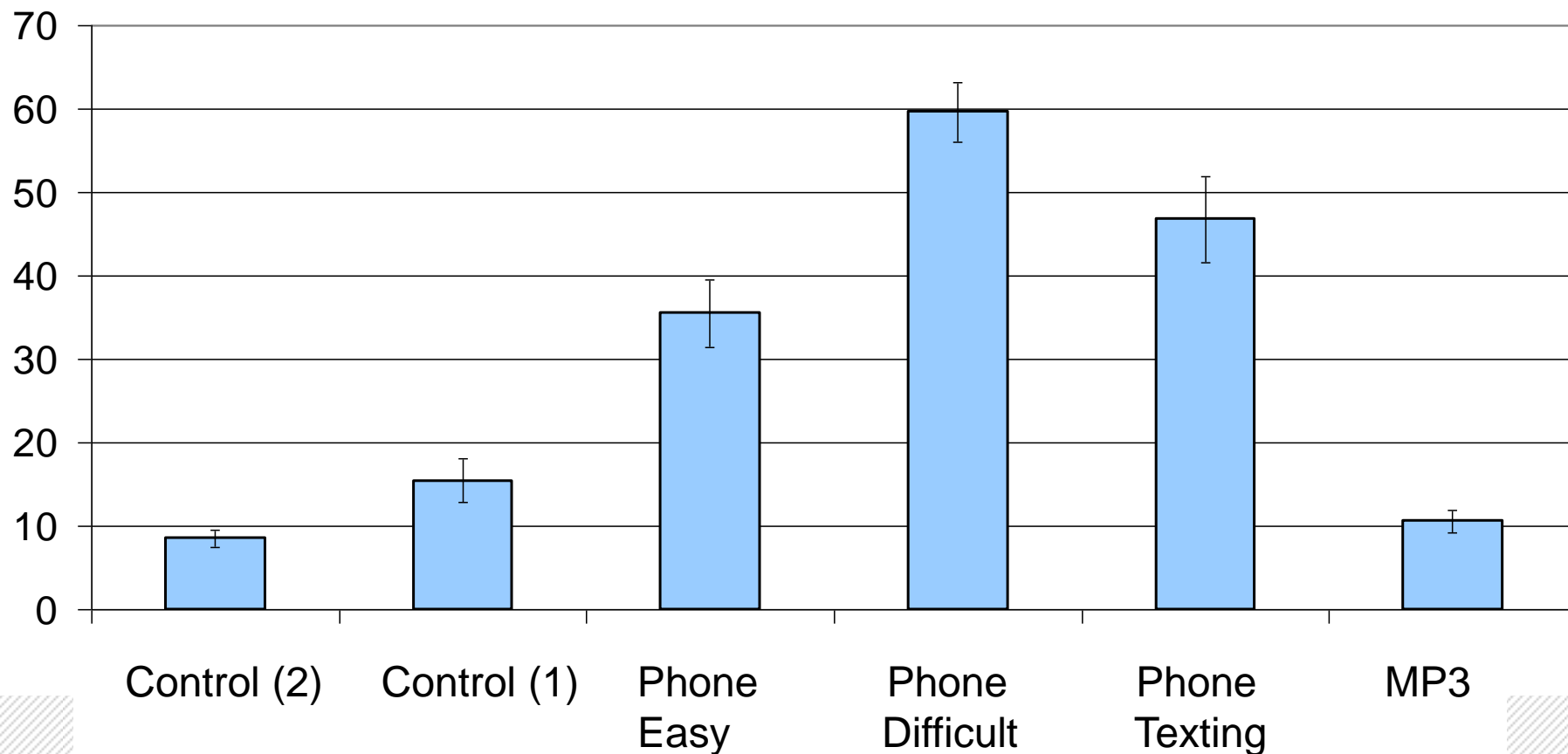


# Swerving: no. strip changes



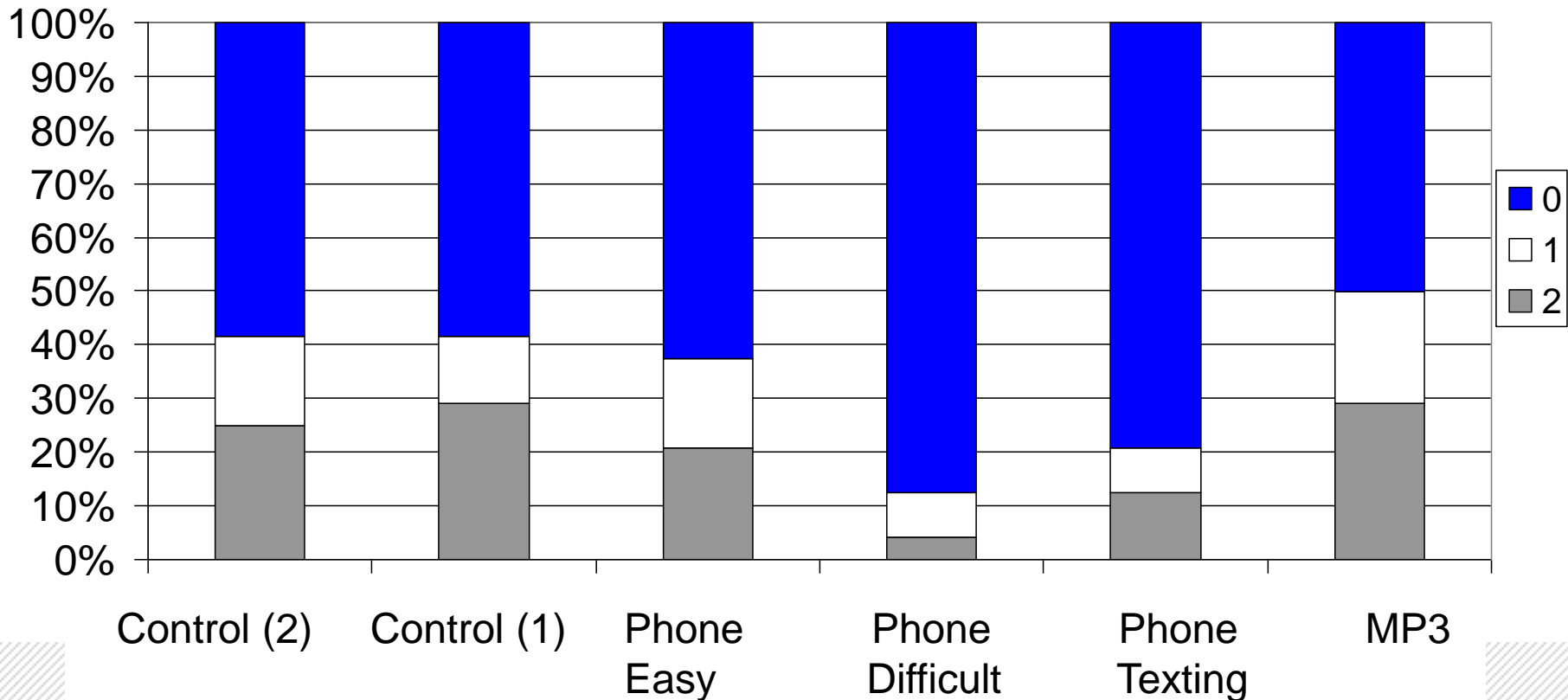


# Mental Effort rating (RSME)





# Peripheral detection





# Calling & texting

- Slower speed
- Detection
- Lateral control
- Increased mental effort
  
- Largest effect: texting



## Study 2: Music & Handsfree calling







# Conditions

- › Two Control conditions (1, 2 hands)
- › Two Phone conditions; handheld and handsfree demanding task [-7: 834,...]
- › Music conditions: ...



## Music conditions

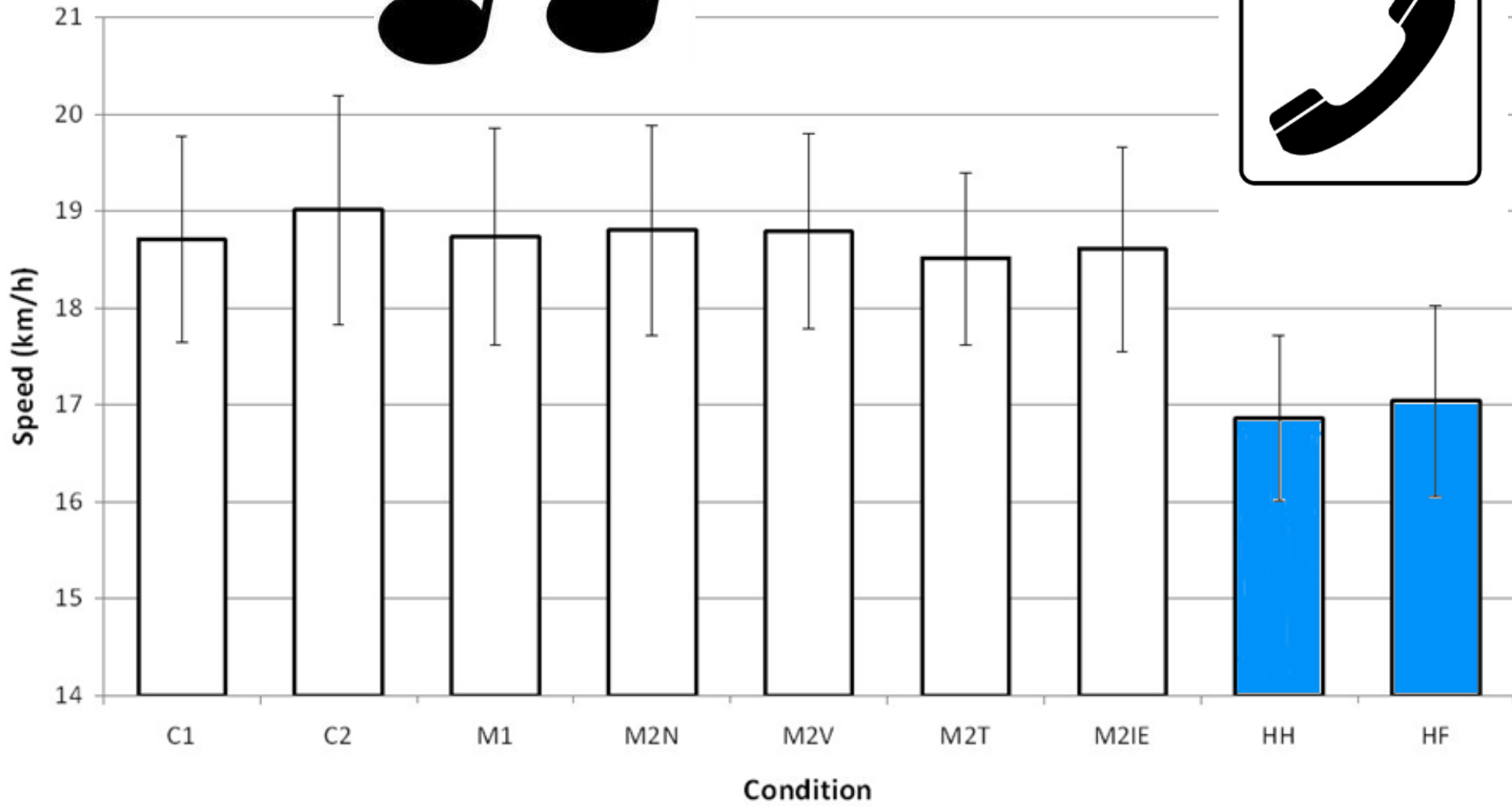
- › M1            one earbud (left ear)
  - › M2N           two earbuds – normal
  - › M2V           two earbuds – high volume 89 dB
  - › M2T           two earbuds – high tempo 180 bpm
  - › M2IE           two earbuds – in-ear
- 
- › **Normal = 74 dB, 120 bpm (beats/minute)**



rijksu  
gronir

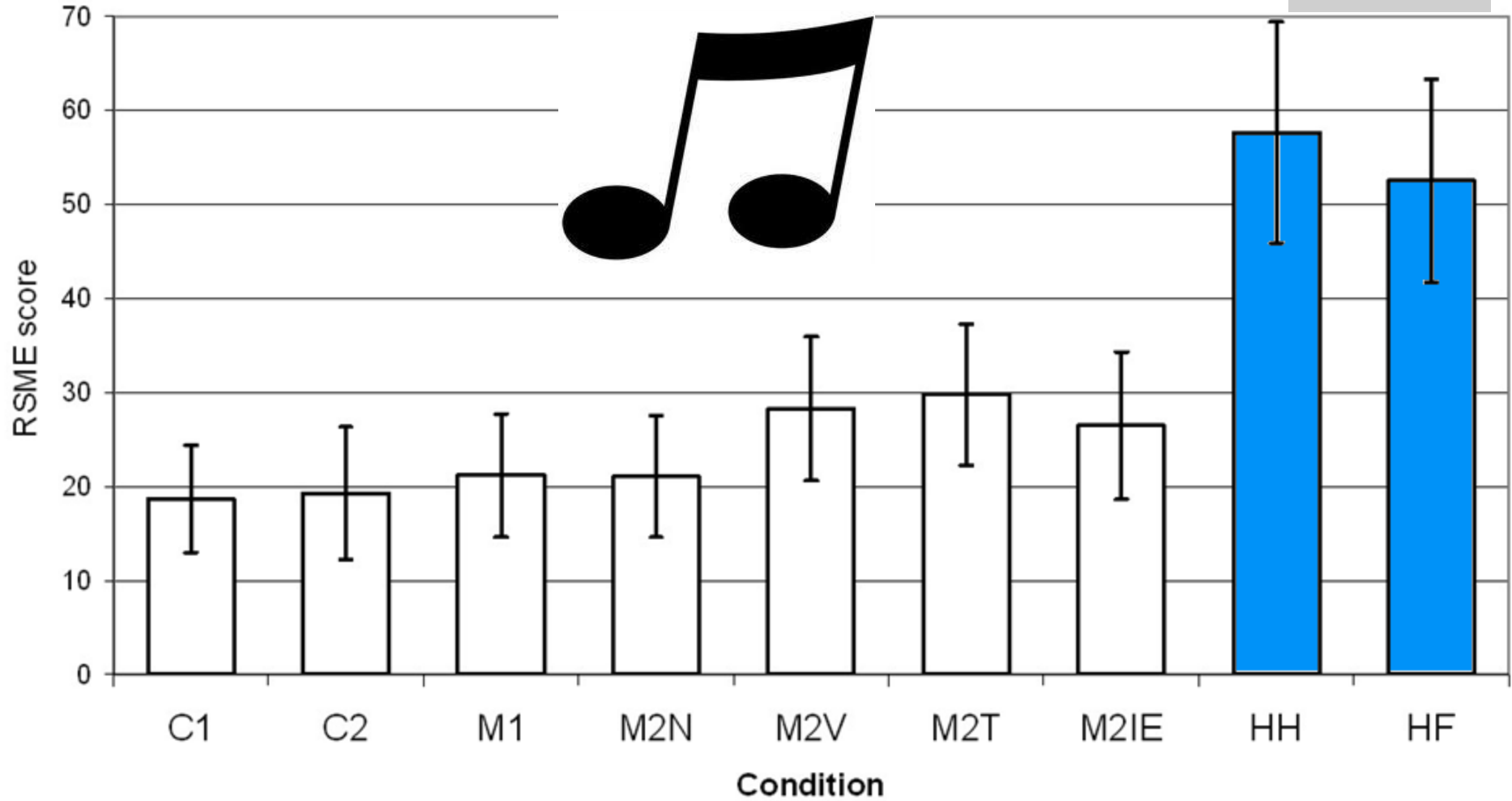


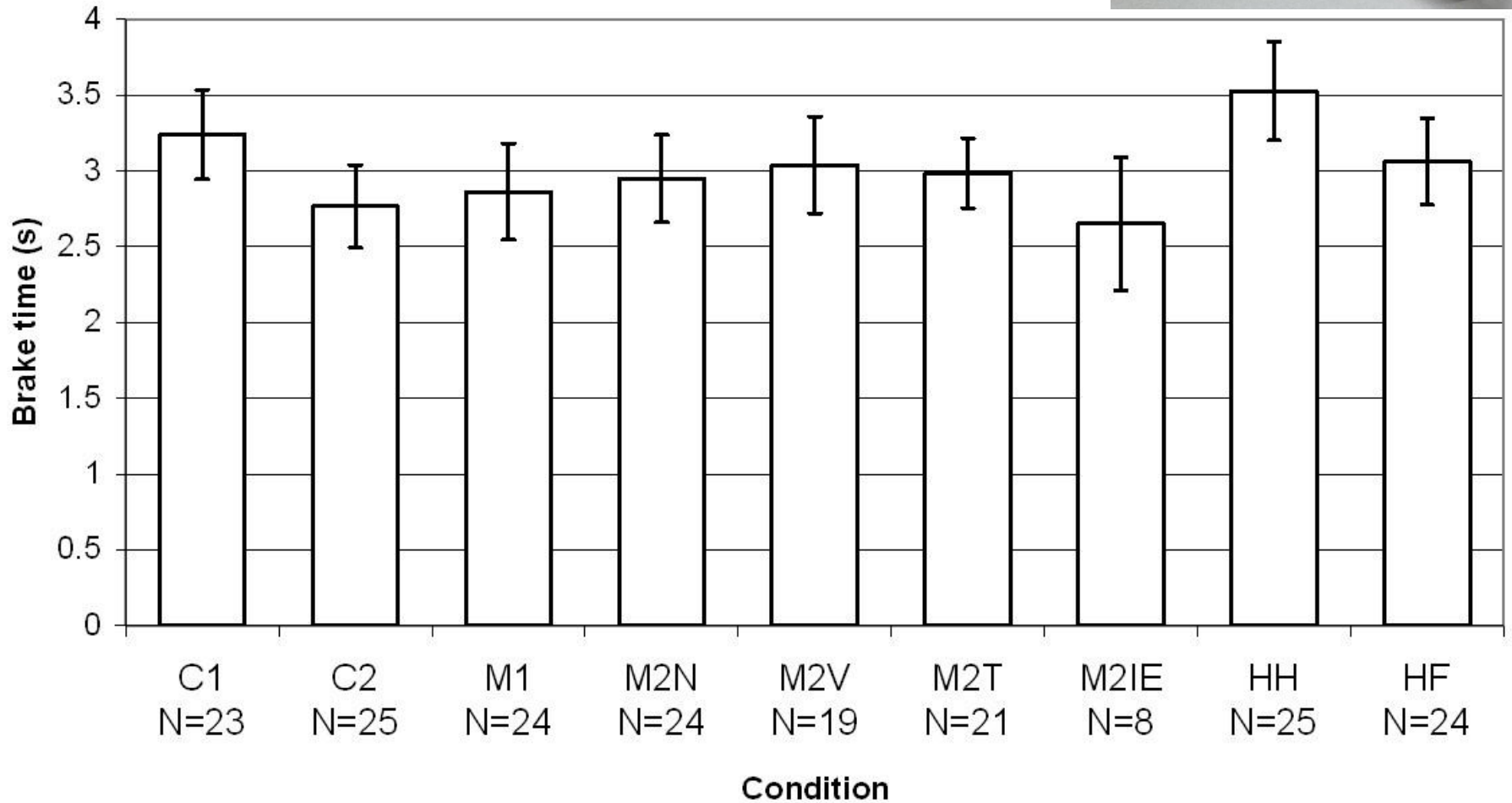
Speed

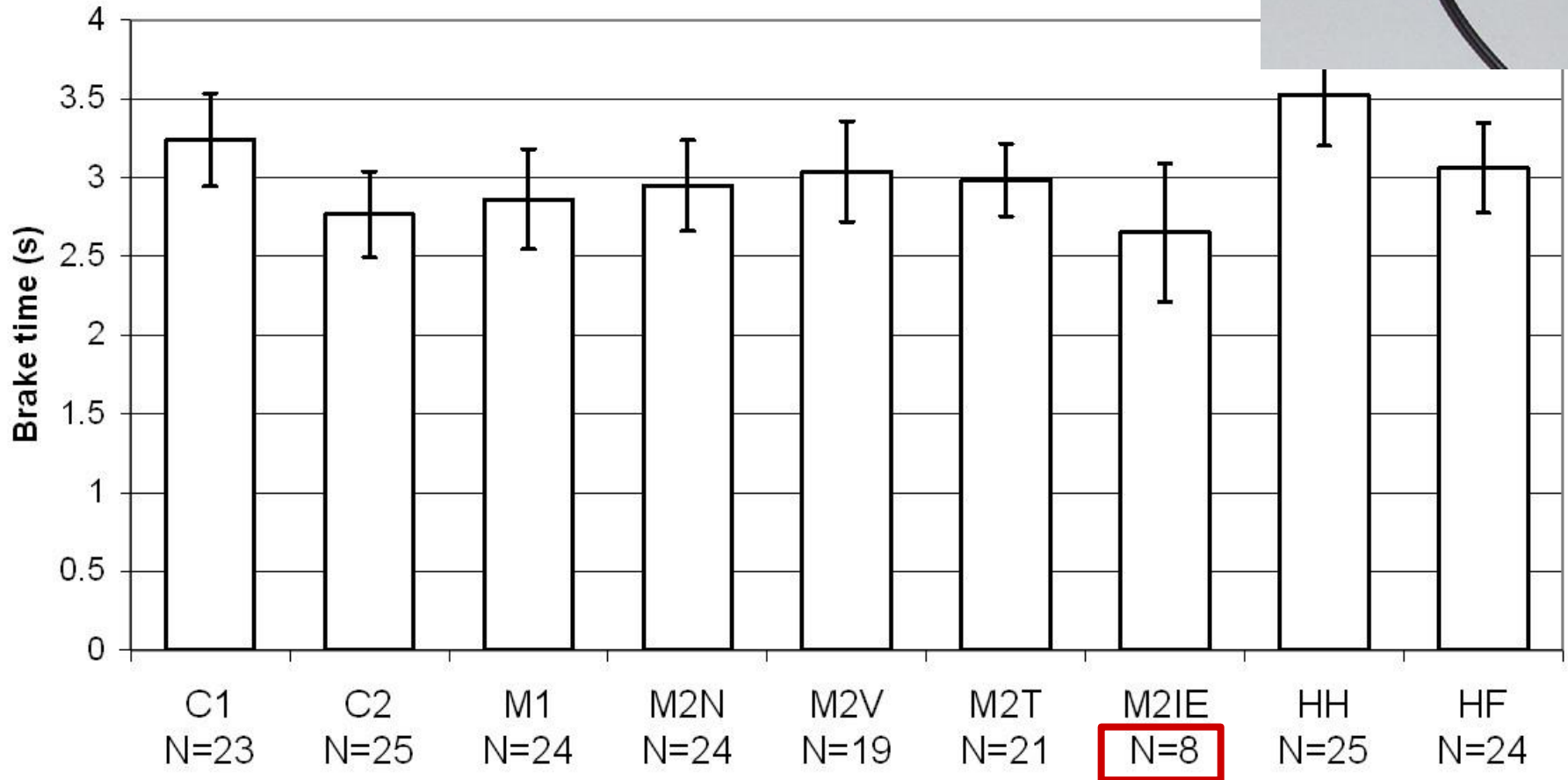




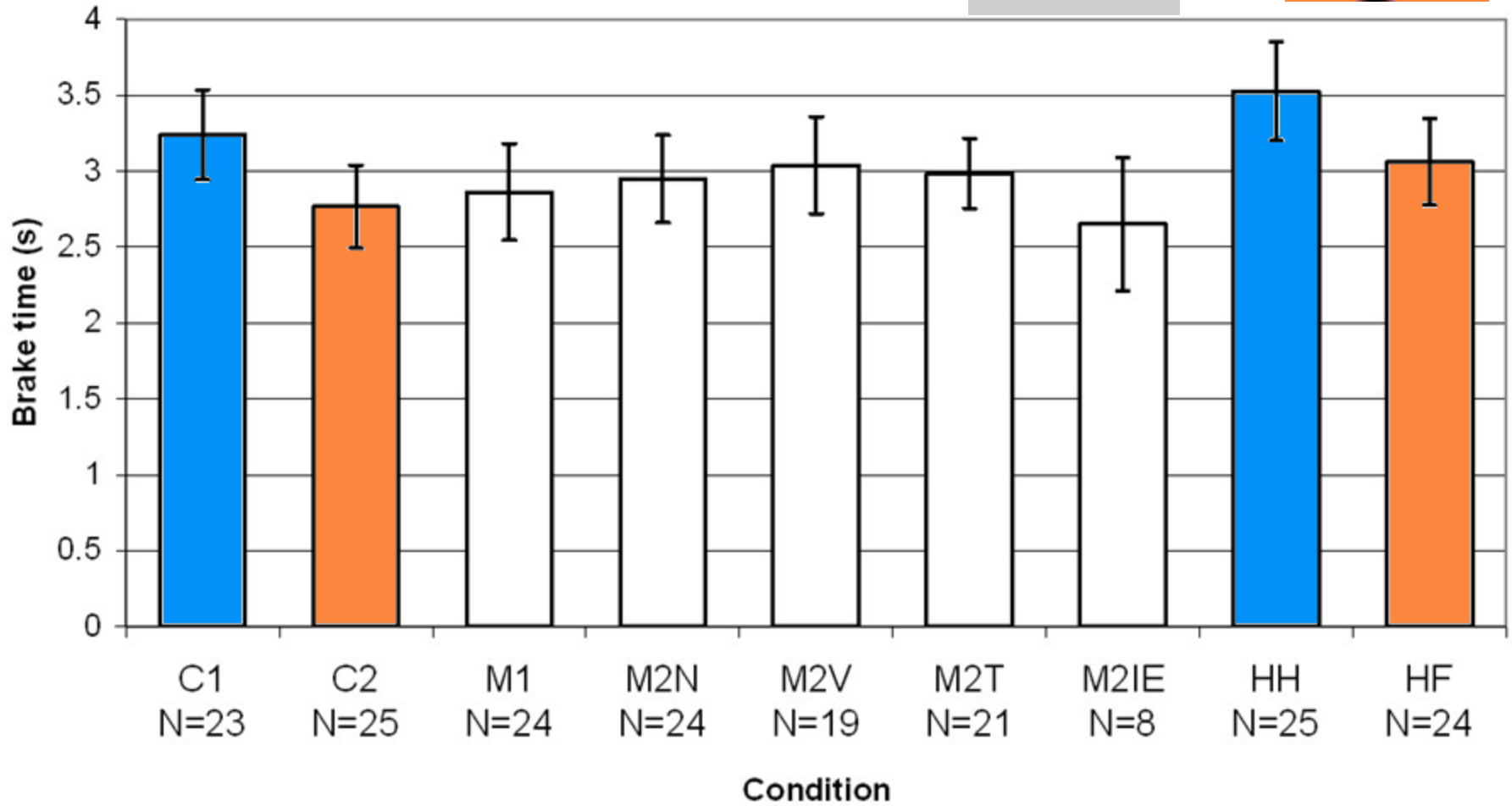
# Mental Effort rating





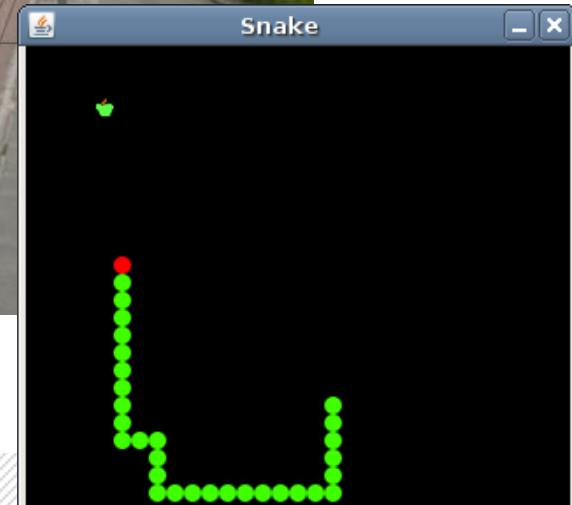


Condition  
17 participants missed this signal!!





# Study 3: Touchscreens, Gaming and more...







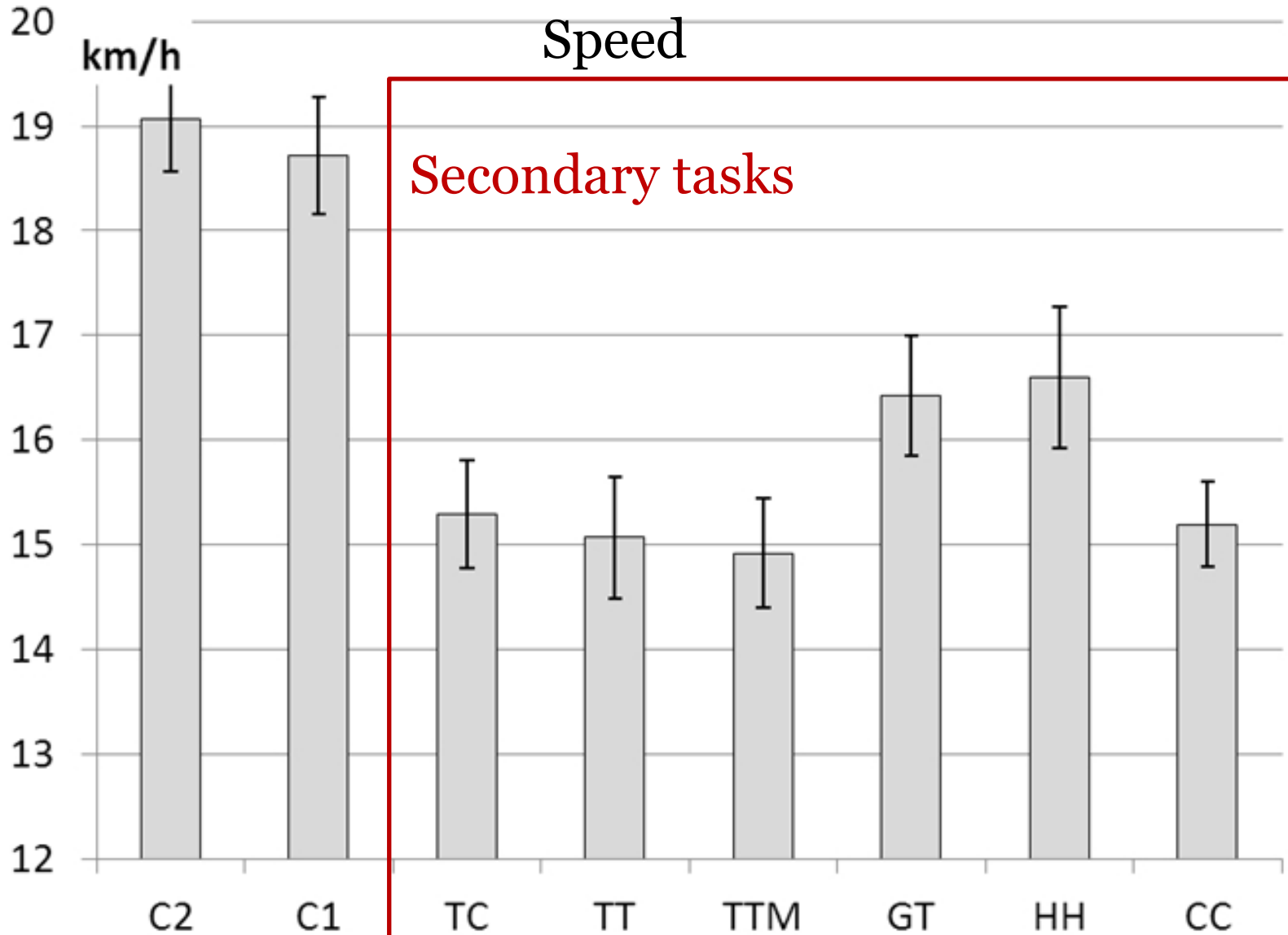
# Conditions

- › Control-conditions
- › Phone, handheld (HH)
- › Cycle companion, task (CC)
- › Texting conditions: ...



# Texting conditions

- › TC            Texting, conventional phone
- › TT            Texting, touchscreen phone
- › TTM          Texting, touchscreen phone + Music
- › GT            Gaming



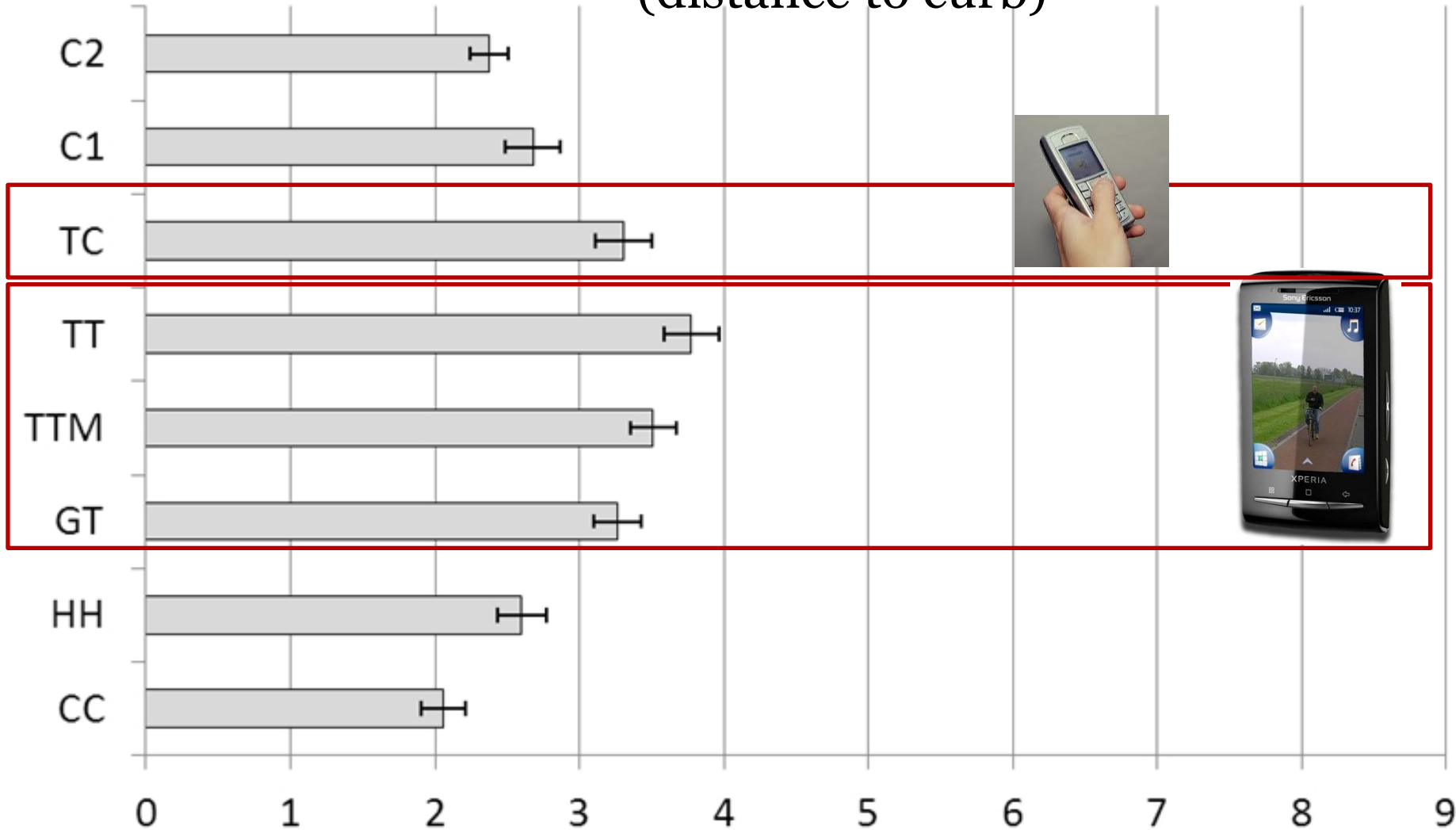


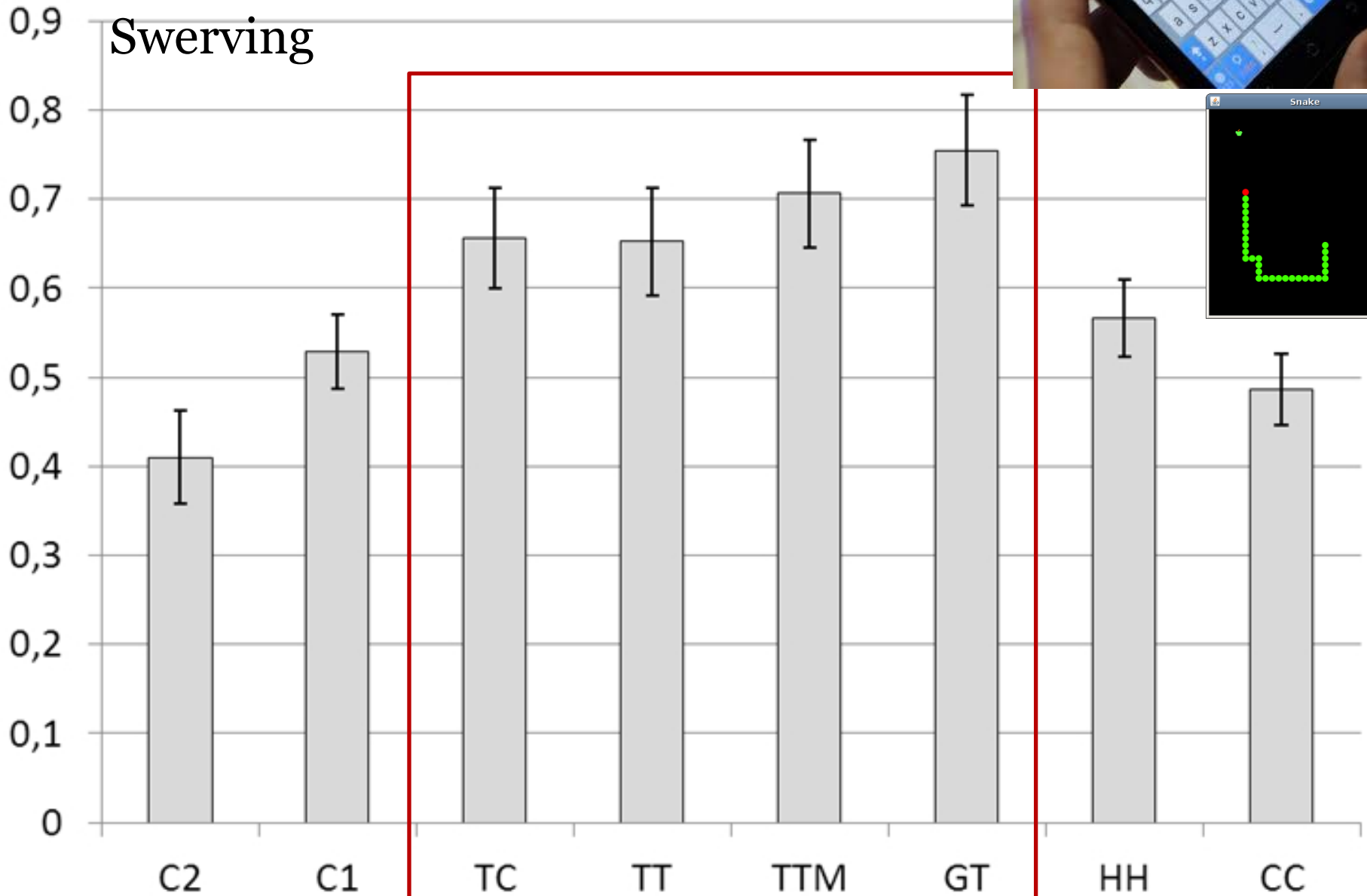
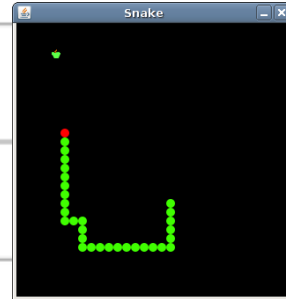
# Lane position

Right

Left

(distance to curb)







## Music and calling

- › Large effect for *calling* (speed, lat. pos., periphery)
- › Larger effect for texting
- › Even larger effect for texting on a touch screen phone
- › Advantage Handsfree calling limited
- › (German law)
- › In-earbuds = literally earplugs



# Thanks for listening



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## › References:

- › De Waard, D., Lewis-Evans, B., Jelijs, B., and Brookhuis, K. (submitted). Effects of operating a touch screen smartphone on cycling behaviour.
- › [De Waard, D., Edlinger, K.M., & Brookhuis, K.A. \(2011\). Effects of listening to music, and of using a handheld and handsfree telephone on cycling behaviour. \*Transportation Research Part F\*, 14, 626–637.](#)
- › [De Waard, D., Schepers, P., Ormel, W., & Brookhuis, K.A. \(2010\). Mobile phone use while cycling: incidence and effects on behaviour and safety. \*Ergonomics\*, 53, 30-42.](#)
- › [Goldenbeld, Ch., Houtenbos, M., Ehlers, E., & De Waard, D. \(2012\). The use and risk of portable electronic devices while cycling among different age groups. \*Journal of Safety Research\*, 43, 1-8.](#)