VADBA TELESA IN UMA ZA ZDRAVJE:
Fizična aktivnost in čuječnost za preprečevanje resnih psiholoških motenj

mag. MAŠA REMŠKAR, University of Bath

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VTIS Simpozij, December 2022

O MENI

- Doktorska študentka psihologije s štipendijo UKRI ESRC
  - Področje zdravstvene psihologije in vedenjske znanosti *(behavioural science)*
- Znanstvena vodja neprofitne fundacije Medito

medito FOUNDATION

- MSc Health Psychology (1st Class Hons) – University of Bath, UK – 2020
- BSc Psychology with Sport Science (1st Class Hons) – University of Exeter, UK – 2019
- IB Diploma Programme – Gimnazija Kranj, SLO – 2016

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    - Kako jih zdravimo ali preprečimo?

2. Moje delo – raziskovanje kombinirane telesne vadbe in čuječnosti
    - Zakaj kombinacija?
    - Kako deluje?
    - Kaj je že znanega?
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    - Ustvarjanje novih vsebin
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RESNE PSIHOLOŠKE MOTNJE

- **Pogoste**: > 500 000 000 obolelih z depresijo in anksioznostjo[1]
- **Problematične**: Vodilni razlog za izgubo zdravja in produktivnosti *(YLD)*[1]
- **Drage**: Stanejo svetovno blagajno > 1 bilijon USD vsako leto[2]
- **Daljnosežne posledice**: ↑ smrtnost in druga obolenja, ↓ kakovost življenja[3,4]

ZDRAVLJENJE PSIHOLOŠKIH MOTENJ

- Z zdravili – nezanesljivi učinki, pogosti stranski učinki
  - 10-30% uspešnost zdravljenja po enem letu[5]
  - 20-30% možnost prenehanja zaradi stranskih učinkov[6]
  - Antidepresivi (vrste SSRI) naslavljajo napačen problem[7]
- Psihoterapija – učinkovita, a draga in zahtevna[8]
- Vedenjska medicina *(behavioural & lifestyle medicine)*
  - Telesna dejavnost, prehrana, spanje, preprečevanje zlorabe substanc
  - Vsi lahko učinkoviti, največ dokazov za telesno dejavnost[9]
  - Redki neželeni stranski učinki, pogosti koristni stranski učinki[10]

PREPREČEVANJE PSIHOLOŠKIH MOTENJ

- Preventiva > kurativa[11,12]

- Redna telesna dejavnost
  - Stroka priporoča vsaj 150 min MVPA/teden[13]
  - Znatno zniža pojavnost depresije in anksioznosti[9]
  - Večina populacije EU ne dosega priporočil[14]

- Zakaj smo nezadostno aktivni?
  - Znanje ni problem
  - Način življenja, praktične in psihološke ovire[15]

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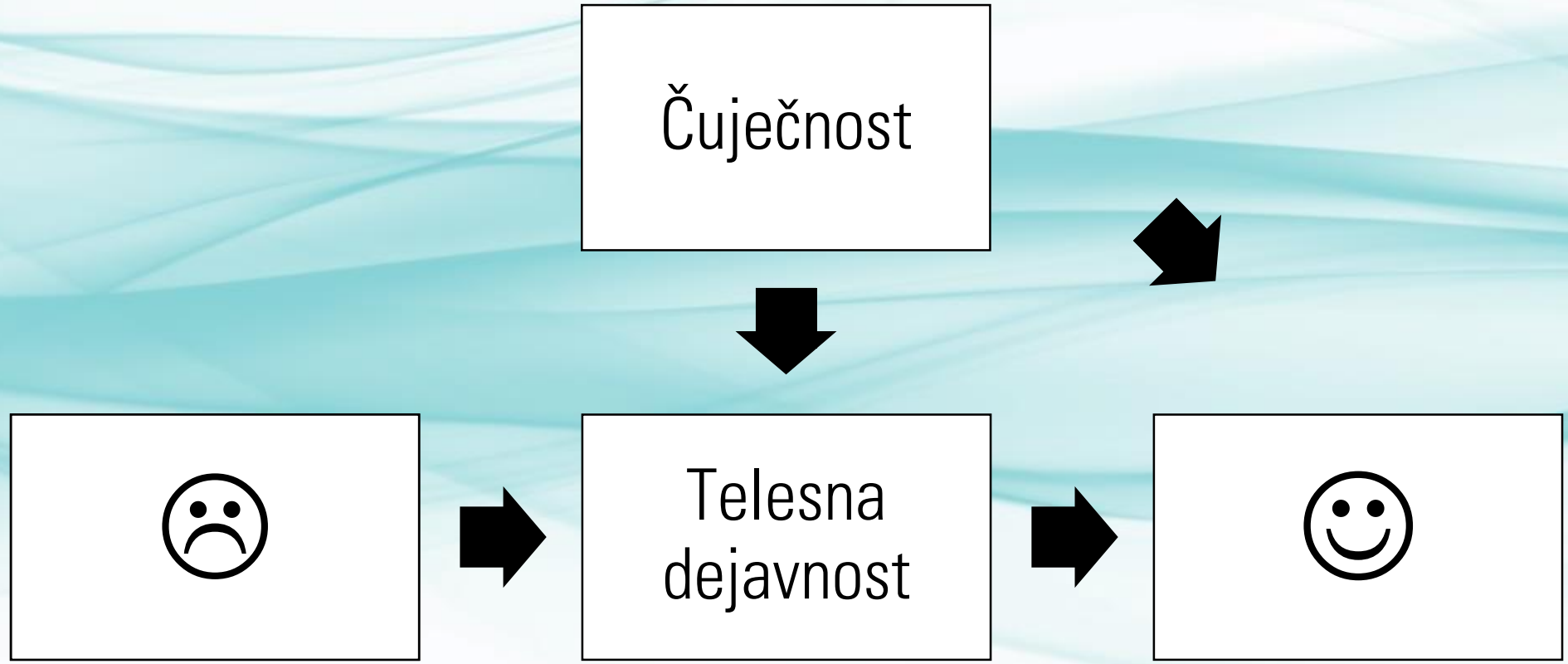
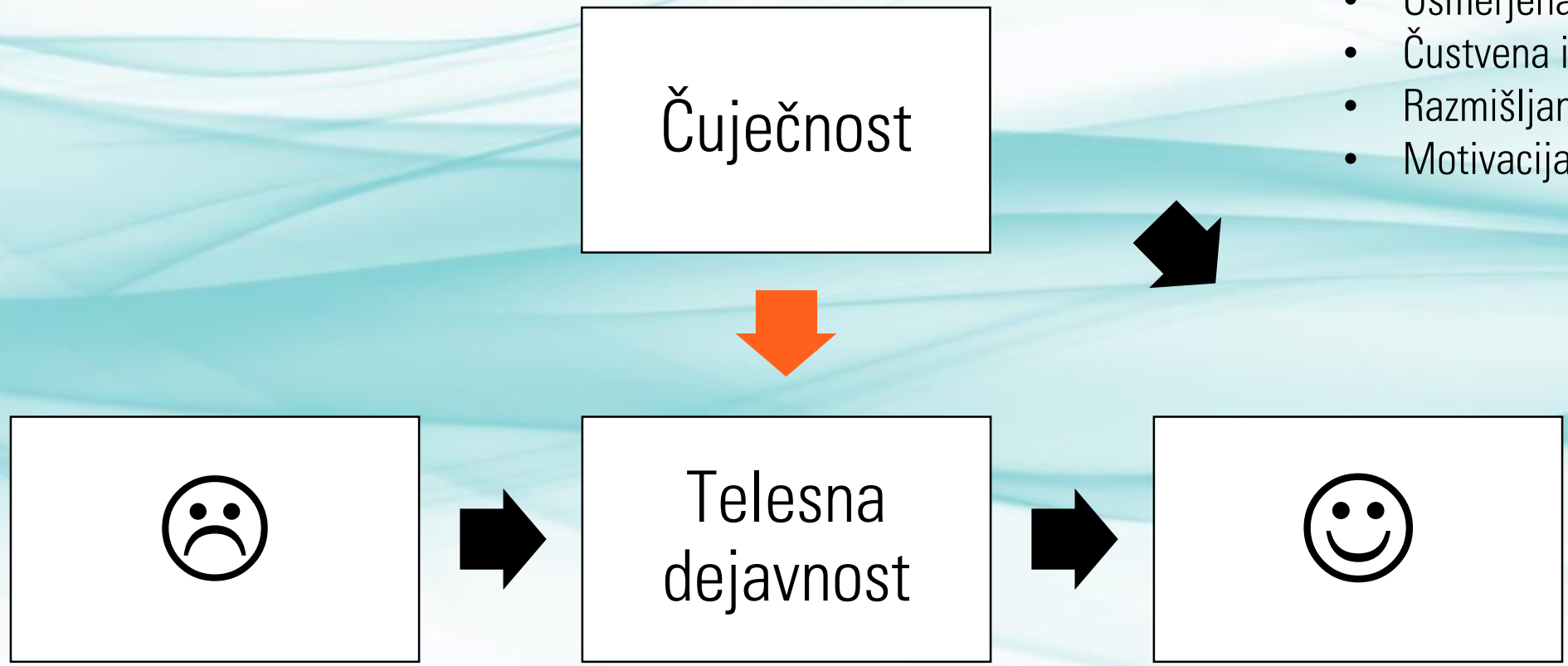
ZAKAJ KOMBINACIJA?

9, 10, 15

ZAKAJ KOMBINACIJA?



ZAKAJ KOMBINACIJA?



Kako?

- Usmerjena pozornost
- Čustvena inteligenca
- Razmišljanja o sebi
- Motivacija

19, 20, 21

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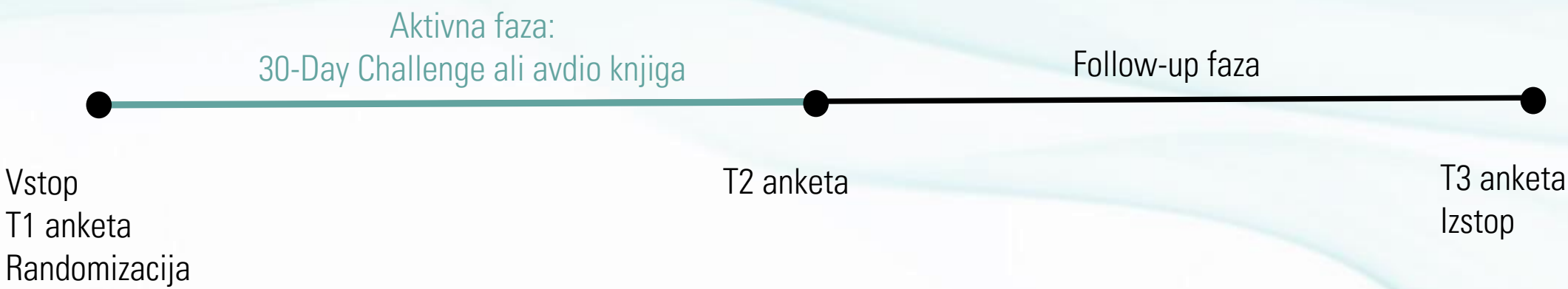
KAKO ČUJEČNOST VPLIVA NA ZDRAVJE?

- RCT študija z velikim in raznolikim vzorcem (*N* = 1247)
- Cilj: Primerjava vadbe čuječnosti z aktivno kontrolno skupino
  - 30 dni x 10 min čuječnosti ali odlomek iz avdio knjige
- Zanimali so nas:
  - Splošno počutje *(psychological wellbeing)*
  - Depresija, anksioznost, stres, kakovost spanja
  - Psihološki procesi povezani s skrbjo za zdravje *(health maintenance behaviours)*



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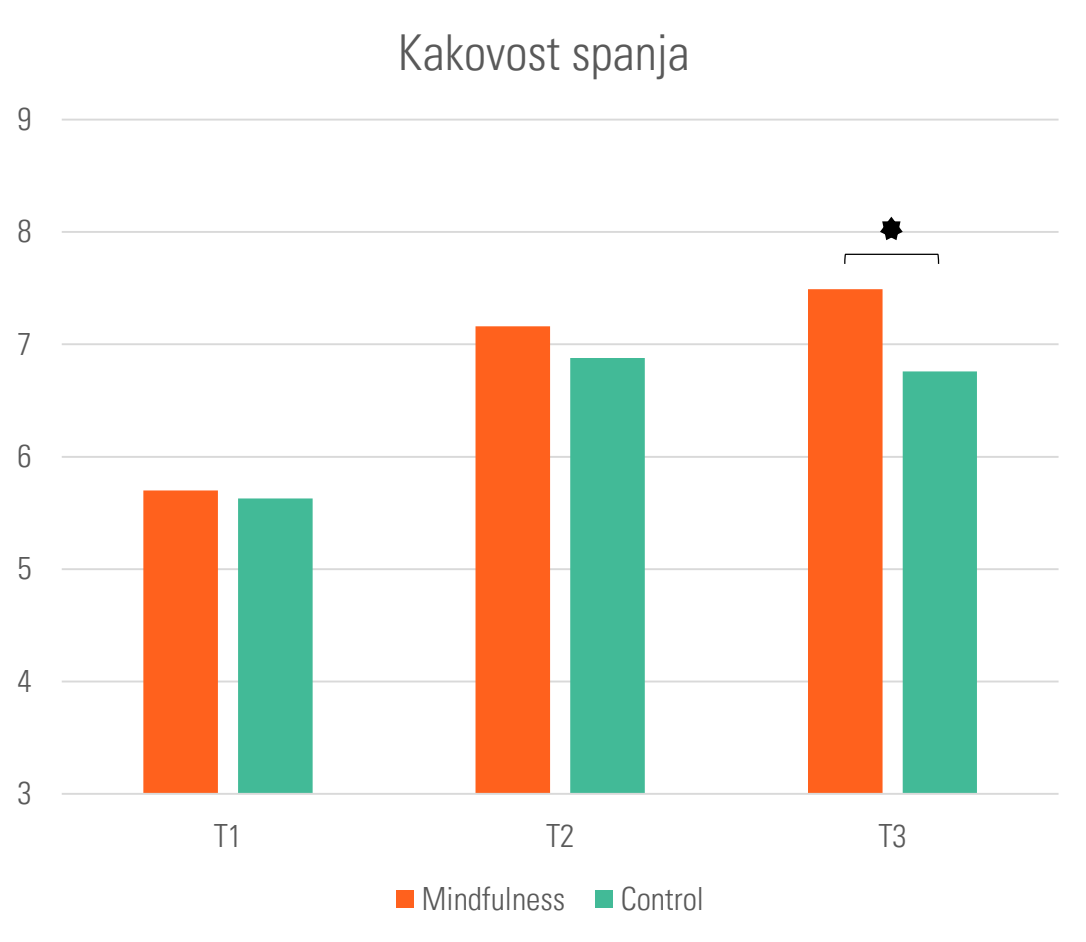

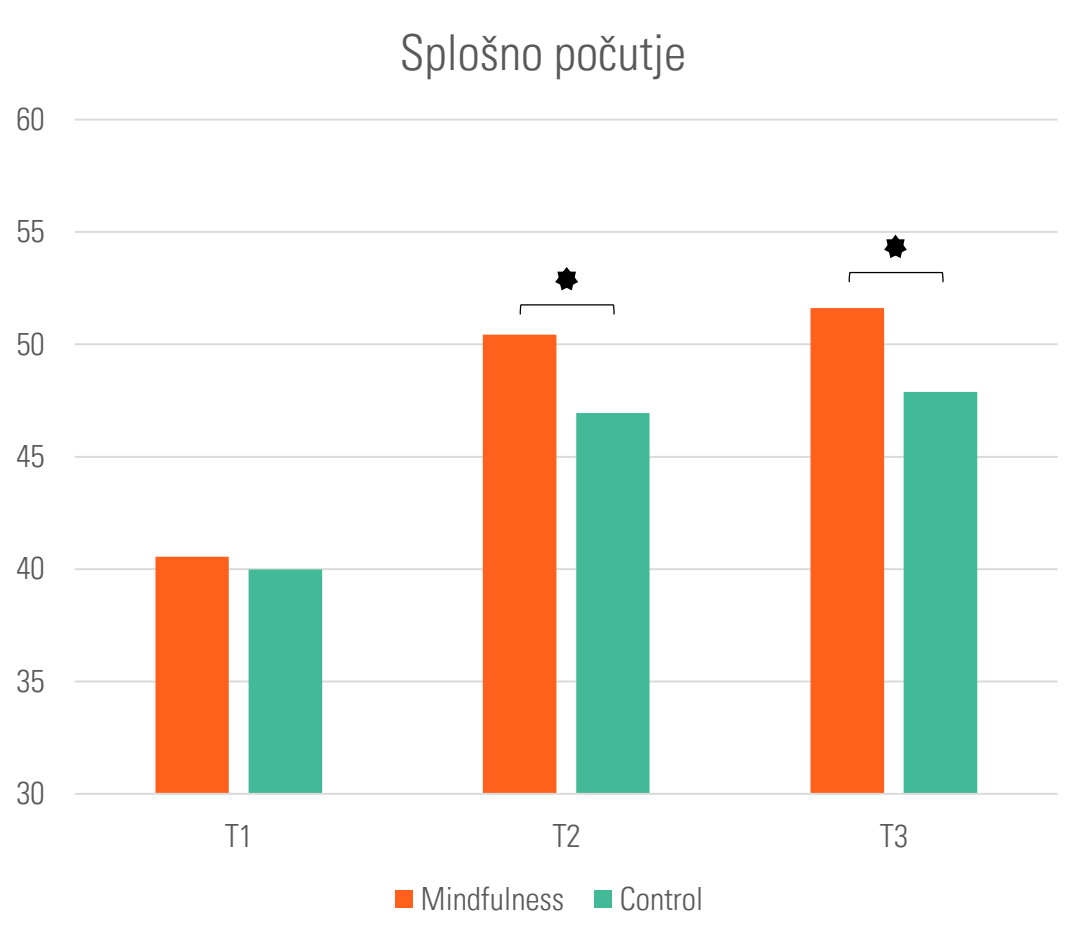

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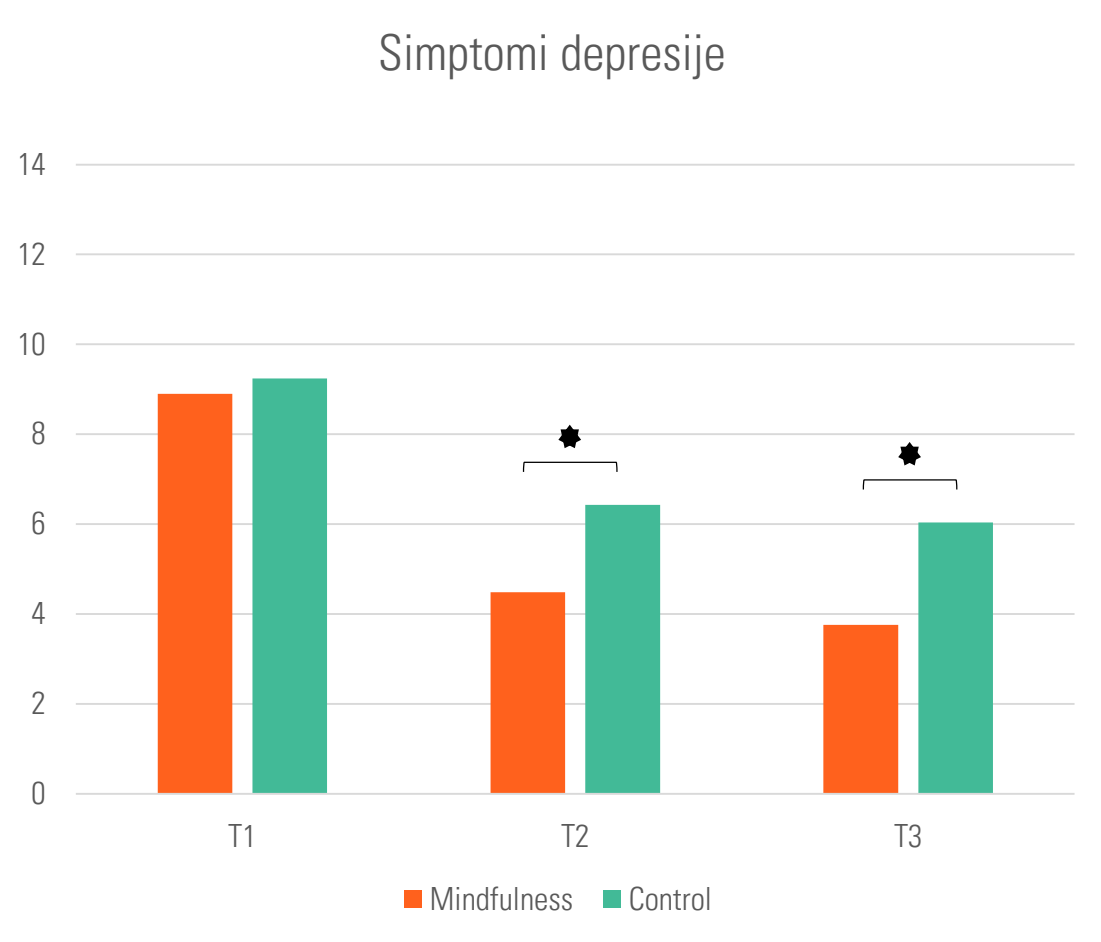

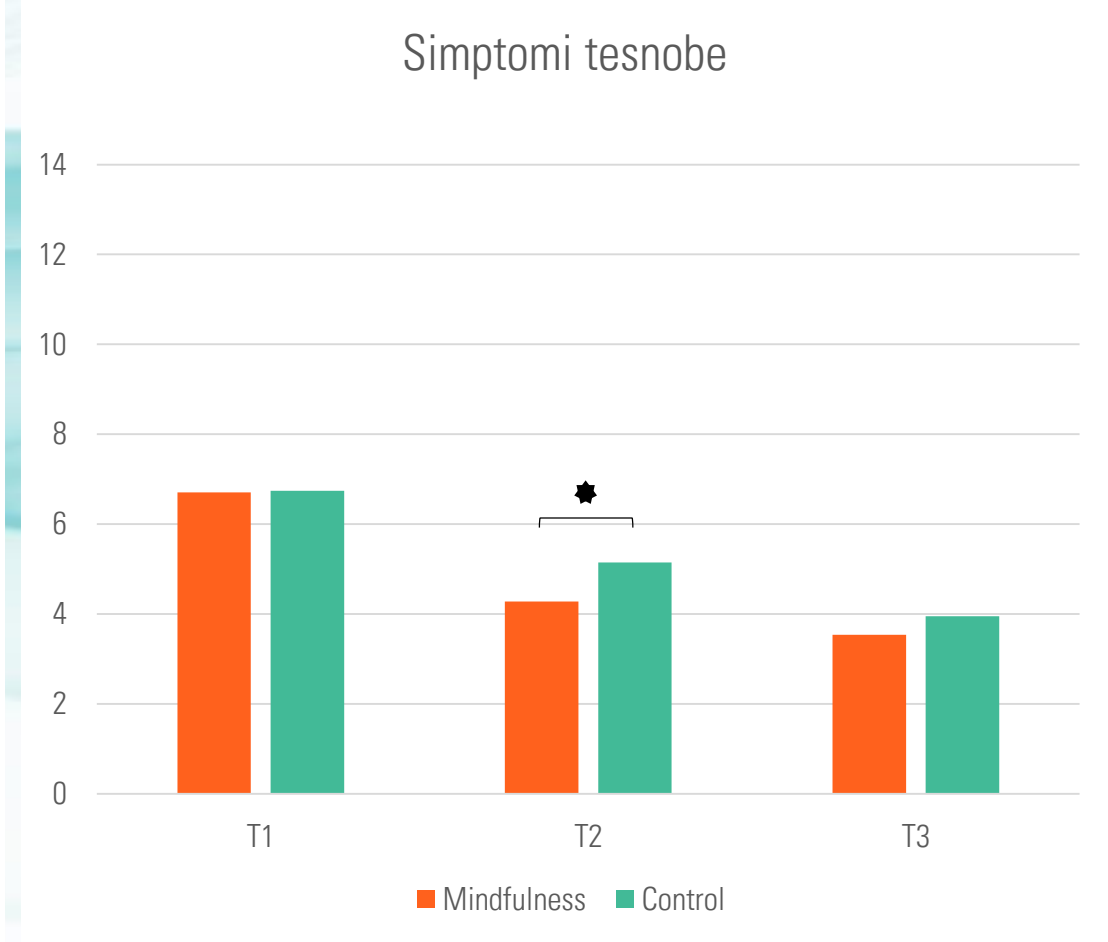

KAKO ČUJEČNOST VPLIVA NA ZDRAVJE?

- Ali se počutje izboljša zaradi psiholoških procesov, povezanih s skrbjo za zdravje? *(Longitudinal lagged mediation analysis)*
  - Da – delni vpliv na počutje in depresijo skozi **izboljšano motivacijo** in bolj **pozitiven odnos do skrbi za lastno zdravje**

- Omejitve
  - Visok osip
  - Raziskani le splošni procesi – potrebno izmeriti za posamezne navade

- Še v pripravi za objavo

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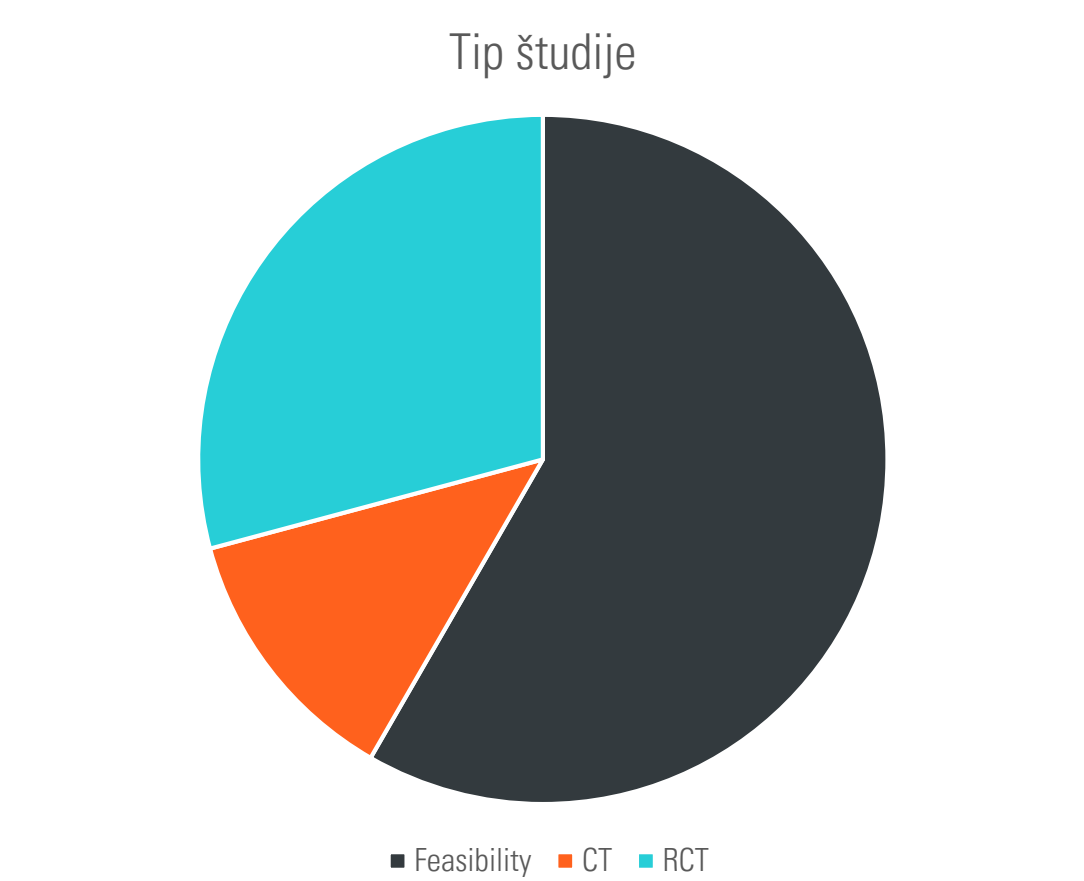
KAJ JE ŽE ZNANEGA?

- Cilj: Sistematičen pregled literature o *behaviour change interventions* s kombinacijo telesne dejavnosti in čuječnosti
  - BCI vsebuje telesno dejavnost in čuječnost v zadostni meri
  - Odrasla populacija, brez omejitev glede obolenj
  - Vsaj en psihološki *outcome*

- Šest preiskanih spletnih baz
  - PubMed, Scopus, EMBASE, PsychINFO, Web of Science, The Cochrane Library
- 6389 zadetkov
- 25 vključenih študij

KAJ JE ŽE ZNANEGA?



KAJ JE ŽE ZNANEGA?

- Zaključki glede izvedljivosti *(feasibility & acceptability)*
  - Kombinirane intervencije dobro sprejete
  - Najbolj izvedljive digitalne intervencije in tiste, primerne začetnikom

- Zaključki glede učinkovitosti *(effectiveness)*
  - 9/13 študij prijavilo izboljšanje počutja v primerjavi s pasivno kontrolno skupino *(waitlist, TAU)*
  - 5/14 študij prijavilo izboljšanje počutja v primerjavi z aktivno kontrolno skupino, npr. telesna dejavnost
  - Mešani zaključki vpliva na količino redne telesne aktivnosti

- Omejitve
  - Zaenkrat malo literature, večina v testni fazi, različni nameni študij
- Še v pripravi za objavo

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KAKO PONUDITI KOMBINIRANO VADBO?

- Cilj: raziskati možnosti za in vtise o kombinaciji telesne dejavnosti in čuječnosti
- Kvalitativni pol-strukturirani intervjuji s 16 študenti z 10 univerz po Združenem Kraljestvu
- *Reflexive Thematic Analysis* [22]

- Omejitve:
  - Študentski vzorec

1. Dualist view of health
   - Mind & Body: Distinct but connected
   - Exercising body but not mind
2. Low-point paradox of health behaviours
3. Unfamiliarity with mindfulness practice
   - Misconceptions inhibit practice
   - Recognising mindfulness during exercise
4. Whole is greater than the sum of its parts
   - Benefits of mindful awareness during exercise
   - Barriers to mindful awareness during exercise

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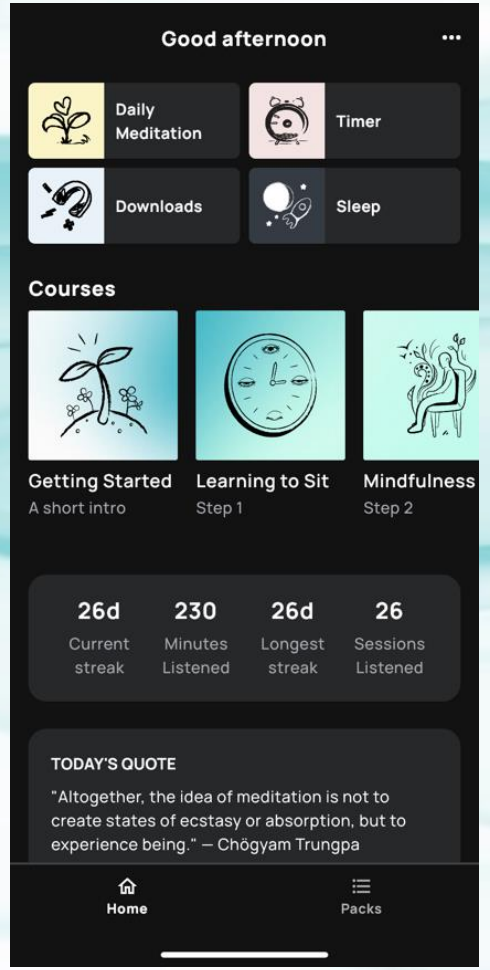
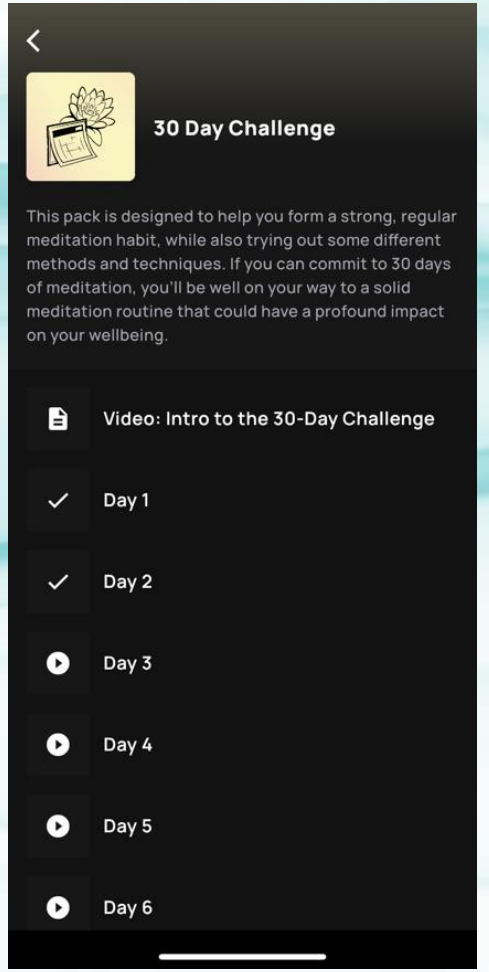
USTVARJANJE NOVIH VSEBIH

- V sodelovanju s fundacijo Medito
  - www.meditofoundation.org, mobilna aplikacija
- Dva nova sklopa za usmerjeno vadbo čuječnosti:
  - *Getting started with exercise*
  - *Staying active*
- Vsak 30 posnetkov s po 10 min vodene vadbe
- Tri strokovne skupine
  - Za čuječnost
  - Za telesno dejavnost
  - Za digitalne vsebine in uporabniško izkušnjo





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IZBRANE ZNANSTVENE OBJAVE

- **Remskar, M.**, Atkinson, M. J., Marks, E., & Ainsworth, B. (2022). Understanding university student priorities for mental health and well-being support: A mixed-methods exploration using the person-based approach. Stress and Health, 38(4), 776–789. https://doi.org/10.1002/smi.3133
- Marks E., Handscomb, L., & **Remskar, M.** (2022) "I can see a path forward now": a qualitative investigation of online groups for tinnitus in the time of Covid-19, International Journal of Audiology, 1-8. DOI: 10.1080/14992027.2022.2063195
- **Remskar, M.**, Western, M., Maynard, O., & Ainsworth, B. (2022). Exercising body but not mind: A qualitative exploration of attitudes to combining physical activity and mindfulness practice for mental health promotion. Frontiers in Psychology, 13, https://doi.org/10.3389/fpsyg.2022.984232
- Jacobsen, P., Ainsworth, B., Atkinson, M., AlBedah, E., Duncan, S., Groot, J., **Remskar, M.** & Underhill, R. (under review). Current tensions and challenges in mindfulness research and practice.
- **Remskar, M.**, Western, M., Ainsworth, B. (forthcoming). Mindfulness improves wellbeing and depression by supporting health maintenance behaviours: RCT of an accessible digital mindfulness-based intervention.
- **Remskar, M.**, Osborne, E. L., Western, M., Maynard, O., Chadwick, P., & Ainsworth, B. (forthcoming). Effects of combining physical activity with mindfulness on mental health and wellbeing: A systematic review.

LITERATURA

1. Vos, T., Lim, S. S., Abbafati, C., Abbas, K. M., Abbasi, M., Abbasifard, M., et al. (2020). Global burden of 369 diseases and injuries in 204 countries and territories, 1990–2019: A systematic analysis for the Global Burden of Disease Study 2019. The Lancet 396, 1204–1222.
2. World Health Organization (2021b). Mental Health Atlas 2020. Geneva. Available at: https://www.who.int/publications/i/item/9789240036703
3. Johnston, K. M., Powell, L. C., Anderson, I. M., Szabo, S., & Cline, S. (2019). The burden of treatment-resistant depression: a systematic review of the economic and quality of life literature. Journal of affective disorders, 242, 195-210.
4. Machado, M. O., Veronese, N., Sanches, M., Stubbs, B., Koyanagi, A., Thompson, T., ... & Carvalho, A. F. (2018). The association of depression and all-cause and cause-specific mortality: an umbrella review of systematic reviews and meta-analyses. BMC medicine, 16(1), 1-13.
5. Peterson, K., Dieperink, E., Anderson, J., Boundy, E., Ferguson, L., & Helfand, M. (2017). Rapid evidence review of the comparative effectiveness, harms, and cost-effectiveness of pharmacogenomics-guided antidepressant treatment versus usual care for major depressive disorder. Psychopharmacology, 234(11), 1649-1661.
6. Santarsieri, D., & Schwartz, T. L. (2015). Antidepressant efficacy and side-effect burden: a quick guide for clinicians. Drugs in context, 4.
7. Moncrieff, J., Cooper, R. E., Stockmann, T., Amendola, S., Hengartner, M. P., & Horowitz, M. A. (2022). The serotonin theory of depression: a systematic umbrella review of the evidence. Molecular psychiatry, 1-14.
8. Ahern, E., Kinsella, S., & Semkovska, M. (2018). Clinical efficacy and economic evaluation of online cognitive behavioral therapy for major depressive disorder: a systematic review and meta-analysis. Expert review of pharmacoeconomics & outcomes research, 18(1), 25-41.
9. Kvam, S., Kleppe, C. L., Nordhus, I. H., & Hovland, A. (2016). Exercise as a treatment for depression: a meta-analysis. Journal of affective disorders, 202, 67-86.
10. Firth, J., Solmi, M., Wootton, R. E., Vancampfort, D., Schuch, F. B., Hoare, E., ... & Stubbs, B. (2020). A meta-review of "lifestyle psychiatry": the role of exercise, smoking, diet and sleep in the prevention and treatment of mental disorders. World Psychiatry, 19(3), 360-380.
11. Craig, N., and Robinson, M. (2019). Toward a preventative approach to improving health and reducing health inequalities: a view from Scotland. Public Health 169, 195–200. doi: 10.1016/j.puhe.2019.02.013

LITERATURA

12. World Health Organization (2021a). Comprehensive mental health action plan 2013–2030. Geneva. Available at: https://www.who.int/publications/i/item/9789240031029
13. Department of Health and Social Care. UK Chief Medical Officers' Physical Activity Guidelines. www.gov.uk/government/news/new-physical-activity-guidelines.
14. World Health Organization (2021) Europe Physical Activity Factsheet 2021. Copenhagen. Available at: https://sport.ec.europa.eu/document/europe-physical-activity-factsheet-2021
15. Rhodes, R. E., Janssen, I., Bredin, S. S., Warburton, D. E., & Bauman, A. (2017). Physical activity: Health impact, prevalence, correlates and interventions. Psychology & Health, 32(8), 942-975.
16. Nymberg, P., Calling, S., Stenman, E., Palmér, K., Hansson, E. E., Sundquist, K., et al. (2021). Effect of mindfulness on physical activity in primary healthcare patients: a randomized controlled trial pilot study. Pilot Feasib. Stud. 7, 1–14. doi: 10.1186/s40814-021-00810-6
17. Lavadera, P., Millon, E. M., and Shors, T. J. (2020). MAP train my brain: meditation combined with aerobic exercise reduces stress and rumination while enhancing quality of life in medical students. J. Altern. Complement. Med. 26, 418–423. doi: 10.1089/acm.2019.0281
18. Lyzwinski, L. N., Caffery, L., Bambling, M., and Edirippulige, S. (2019). The mindfulness app trial for weight, weight-related behaviors, and stress in university students: randomized controlled trial. JMIR Mhealth Uhealth 7:e12210. doi: 10.2196/12210
19. Schuman-Olivier, Z., Trombka, M., Lovas, D. A., Brewer, J. A., Vago, D. R., Gawande, R., ... & Fulwiler, C. (2020). Mindfulness and behavior change. Harvard review of psychiatry.
20. Schneider, J., Malinowski, P., Watson, P. M., & Lattimore, P. (2019). The role of mindfulness in physical activity: a systematic review. Obesity Reviews, 20(3), 448–463. https://doi.org/10.1111/obr.12795.
21. Don, B. P., Van Cappellen, P., and Fredrickson, B. L. (2021). Understanding engagement in and affective experiences during physical activity: the role of meditation interventions. Psychosom. Med. 83, 592–601. doi: 10.1097/PSY.0000000000000909
22. Braun, V., and Clarke, V. (2019). Reflecting on reflexive thematic analysis. Qualitat. Res. Sport Exerc. Health 11, 589–597. doi: 10.1080/2159676X.2019.1628806

Hvala za pozornost,

veselim se vaših vprašanj.

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VTIS Simpozij, December 2022

VTIS Društvo v tujini izobraženih Slovencev
7. Simpozij slovenskih raziskovalcev v tujini

Preučevanje možganskih dinamik v mobilnih in ekološko veljavnih okoljih

Kognitivno-motorična interferenca in kapacitete pozornosti

Manca Peskar

mag. Biopsih, mag. Kog. Nevroznanosti

Znanstveno-Raziskovalno Središče Koper in Tehnična Univerza v Berlinu

ZRS
ZNANSTVENO - RAZISKOVALNO SREDIŠČE KOPER
CENTRO DI RICERCHE SCIENTIFICHE CAPODISTRIA
SCIENCE AND RESEARCH CENTRE KOPER

Ljubljana, 23.12.2022

Technische Universität Berlin

Pregled

Uvod v tematiko

Pionirska študija:

Gramann, K., Gwin, J. T., Bigdely-Shamlo, N., Ferris, D. P., & Makeig, S. (2010). Visual evoked responses during standing and walking. *Frontiers in human neuroscience*, *4*, 202

Uvidi študij s področja preučevanja kognitivno-motorične interference in kapacitete pozornosti

PhD Študija 1: Stroop In Motion

Phd Študija 2: Neuromuscular assessment in early Parkinson Disease Patients

Zakaj potreba po preučevanju naravne kognicije?

Visoko kontrolirano okolje

Utelešena kognicija
(*Embodied cognition framework*)

EEG (elektroencefalogram) podvržen k
z gibanjem/mišično aktivnostjo povezanim
artefaktom

Kompromis med ekološko veljavnostjo in ustrezno kvaliteto podatkov

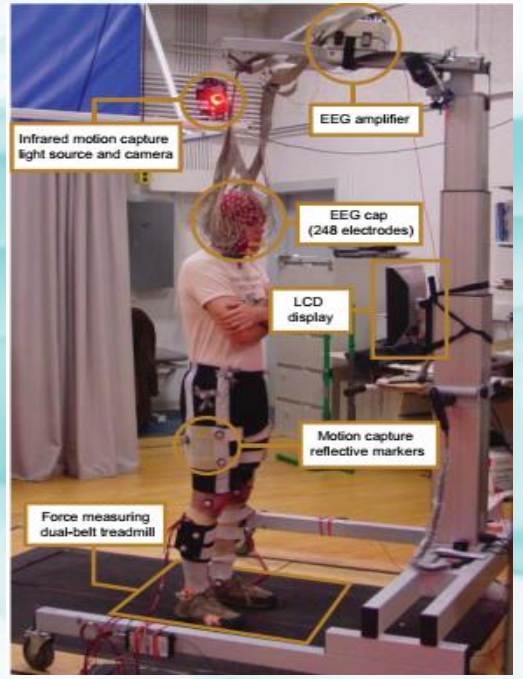
Izvedljivost preučevanja možganske aktivnosti med gibanjem

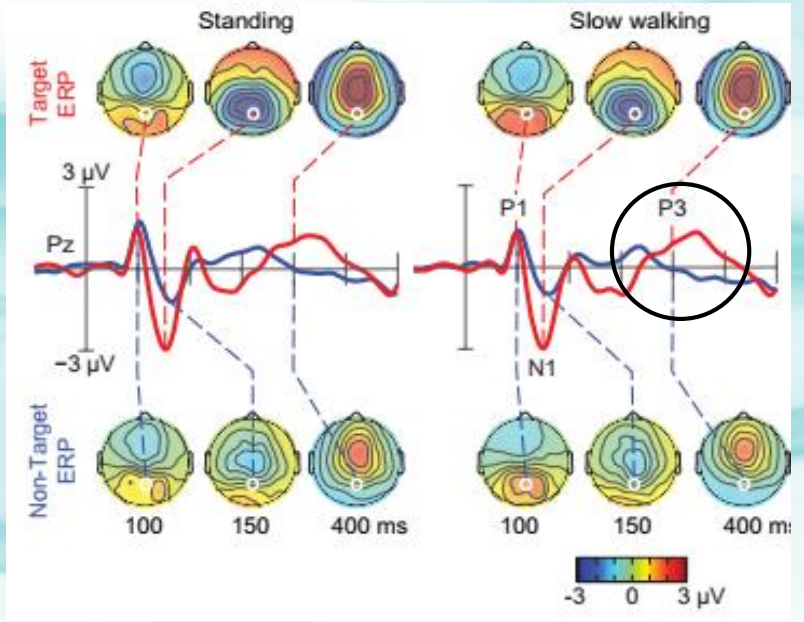
Izzivi:

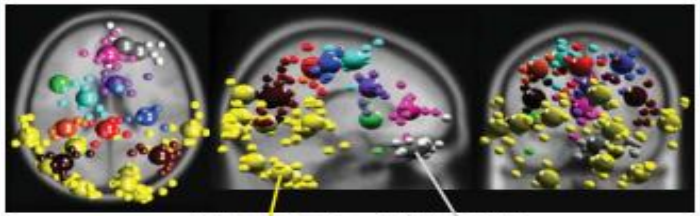
- Naprava: mobilna, (pre)nosna, brezžična, visoka časovna preciznost → EEG
- Zagotavljanje kvalitete podatkov → strojno učenje

Pionirska študija:

- Vidna naloga pozornosti stoje in med hojo
  - Event-related potential (ERP)
- Ločitev prispevka možganskih in ne-možganski virov







P3 kot indeks pozornosti

→ v neskončnost?

Gramann et al. (2010). *Frontiers in human neuroscience*

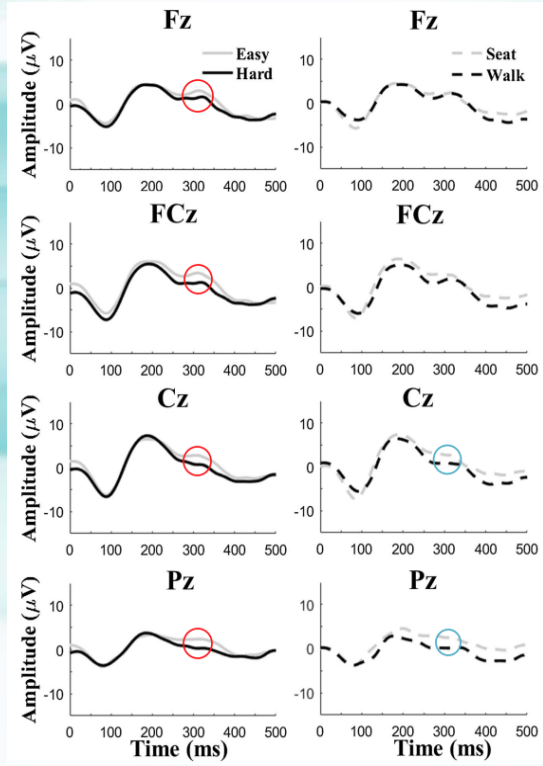
P3 odraža zahteve *in* kapacitete pozornosti

Primarna naloga (udeleženec):

- Naloga vidne kategorizacije
- Sede in med hojo po treadmilu

Manipulacija pozornosti (raziskovalec):

- Slušni dražljaji iz realnega sveta
  - → ERP: P3 modulacija v odnosu do primarne naloge



P3 amplituda odvisna od prostih resursov pozornosti

Shaw et al. (2018). *Biological Psychology*

Sinteza

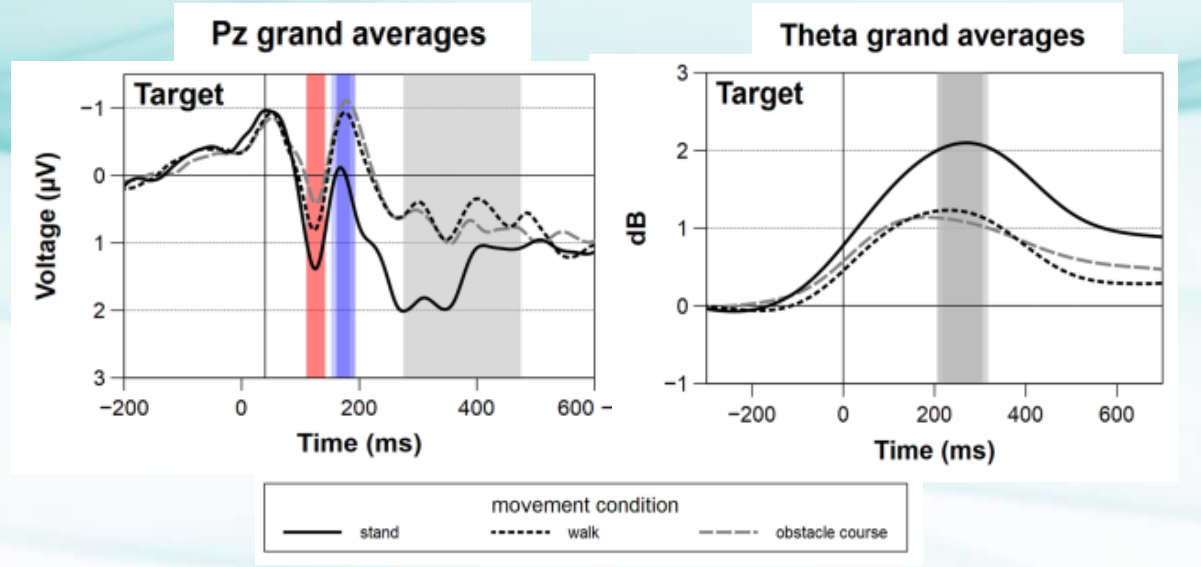
Poviševanje zahtevnosti naloge zvišuje amplitudo P3 komponente, ampak samo dokler je na voljo dovolj resursov.

Motorične in kognitivne obremenitve črpajo iz iste zaloge resursov.

Kognitivno-motorična interferenca.

Frekvenčni spekter:

- Povišanje moči teta oscilacij (4-8Hz) ob mentalnem naporu
- Pri istem nalogi med hojo pa teta nižja



Reiser et al. (2019). *Scientific Reports*

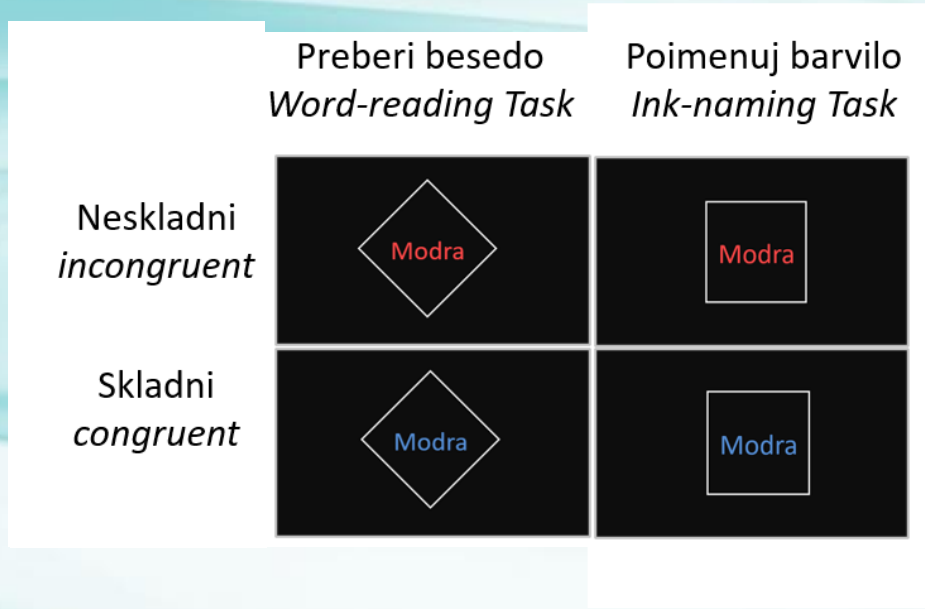
PhD študija: Stroop in Motion

Motivacija:

Sistematična manipulacija težavnosti kognitivne *in* motorične naloge [3 x 3]

- K: Preberi besedo, Poimenuj barvilo, Mešana
- M: sede, stoje, hoja

Dobro preučena psihološka paradigma, nikoli med gibanjem z EEG



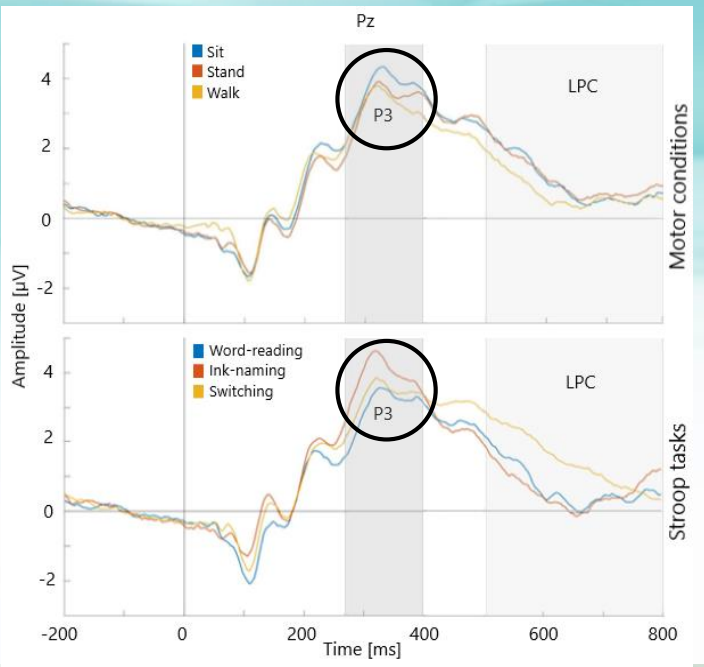
Peskar et al. *(under review)*

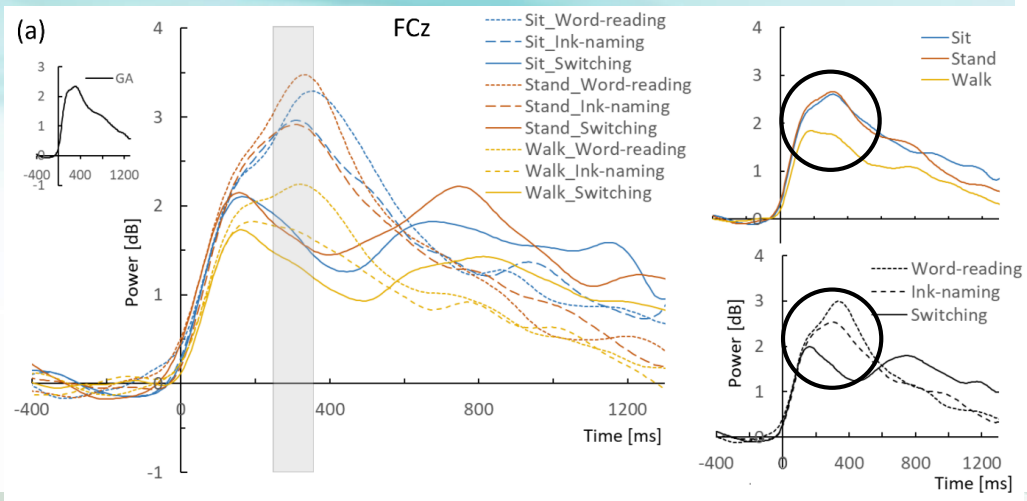
PhD študija: Stroop in Motion

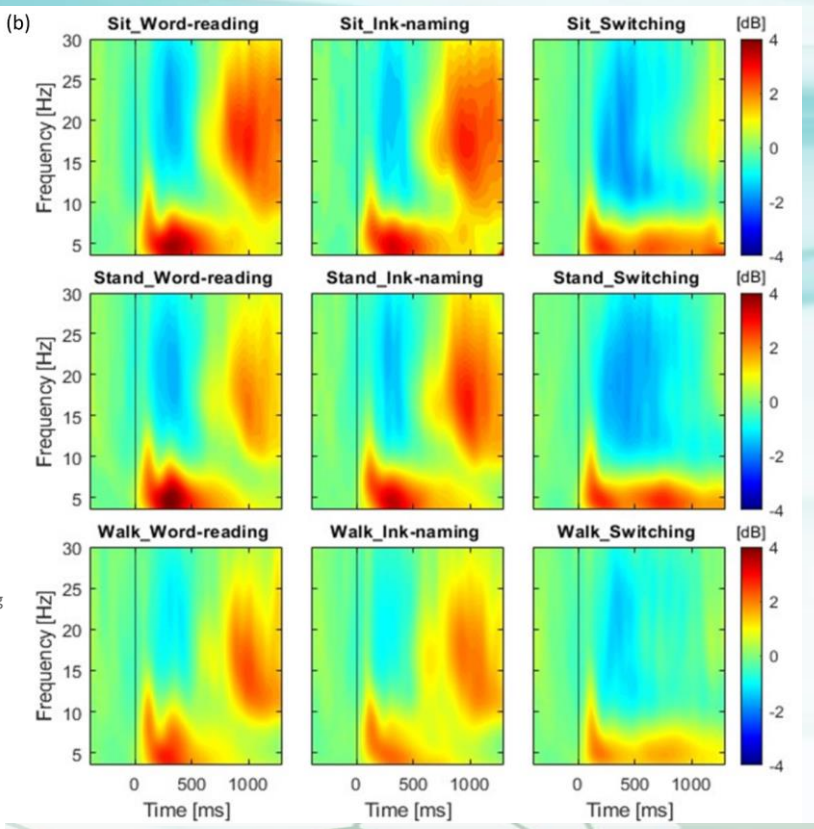
Kognitivno-motorična modulacija P3 amplitude in moči teta oscilacij

- zniževanje P3 z zviševanjem motorične kompleksnosti
- U-trend znižanja P3 pri najpreprostejši in najkompleksnejši kognitivni nalogi
- Zniževanje teta moči z zviševanjem kognitivne in motorične kompleksnosti

Med opravljanjem najtežje kognitivne naloge manipulacija motoričnih pogojev brez učinka







Peskar et al. *(under review)*

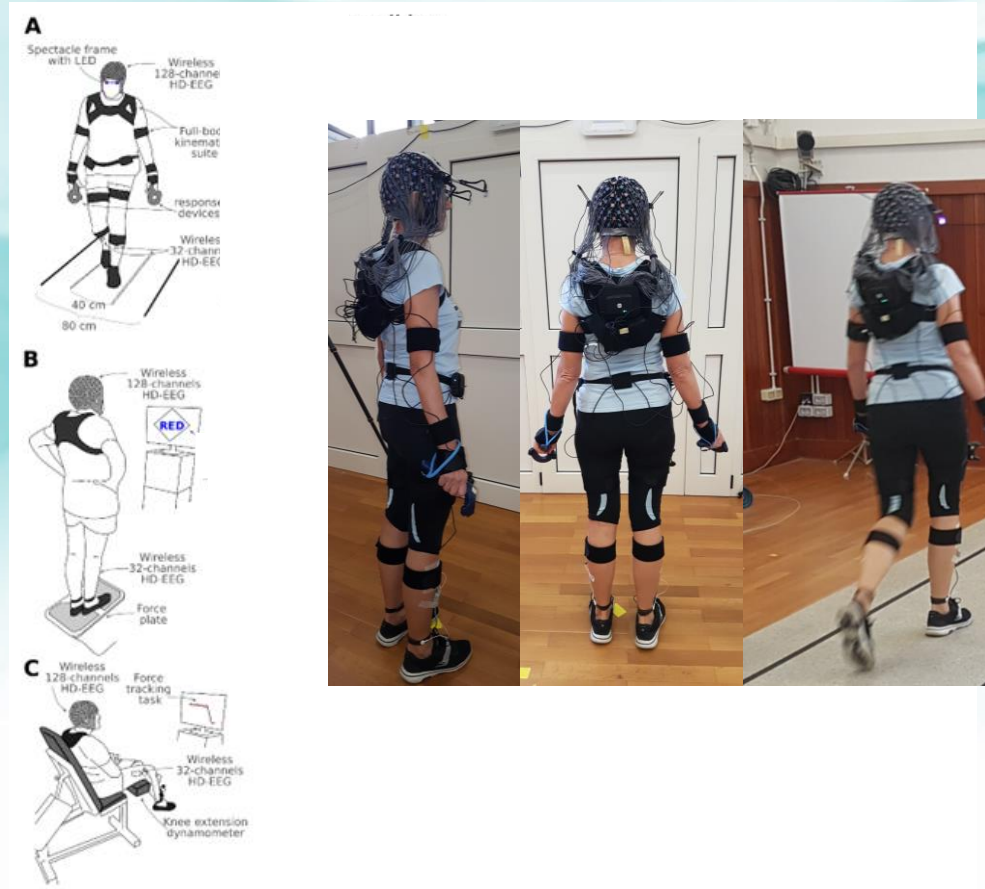
PhD študija: Stroop in Motion

Mehanizmi procesiranja informacij med gibanjem na nevrofiziološkem področju.

Konsistentnost v kognitivnem procesiranju med gibanjem.

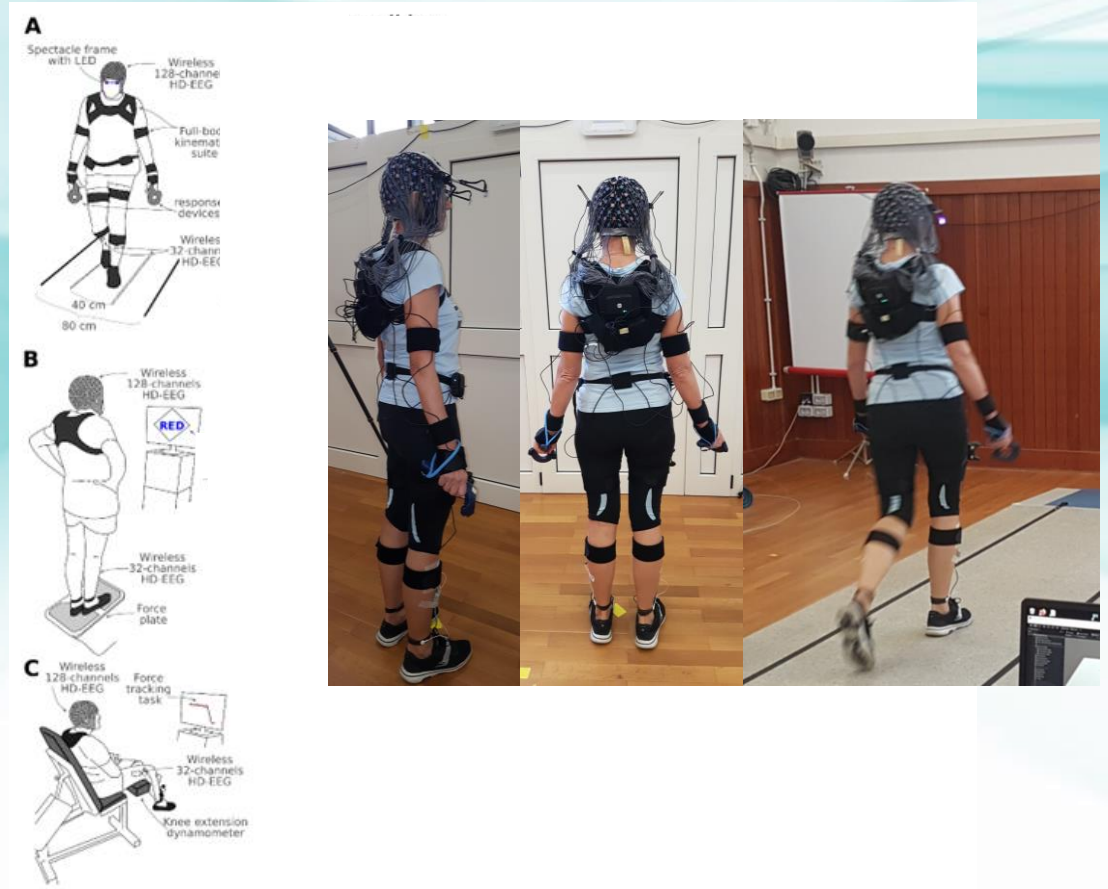
Možganski signal je multidimenzionalen: Prostorska, časovna, komunikacijska omejitev naših izsledkov.

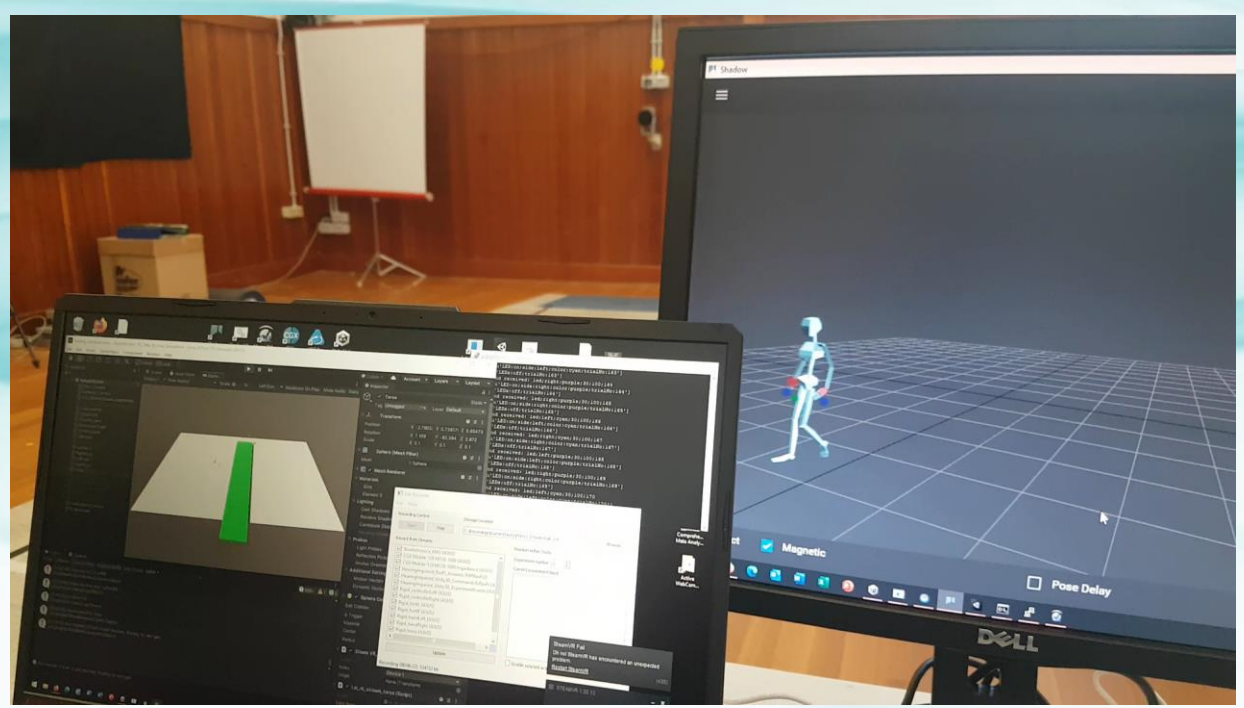
PhD študija:
Neuromuscular assessment in early PD Patients



Peskar et al. *(data collection phase)*

PhD študija:
Neuromuscular assessment in early PD Patients





Peskar et al. *(data collection phase)*

Hvala za pozornost!

Vprašanja?

Zahvale

Dr. Uroš Marušič

Dr. Klaus Gramann

TWINBRAIN

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 952401

„Posture first“ strategy

•Cilj – povečevanje ekološke veljavnosti

Cognitive effort can be assessed by EEG spectral power

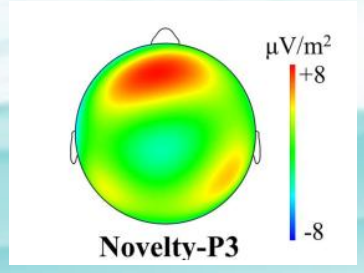
- •Increases in Frontal Theta and decrease in Alpha index
  increased recruitment of attentional resources

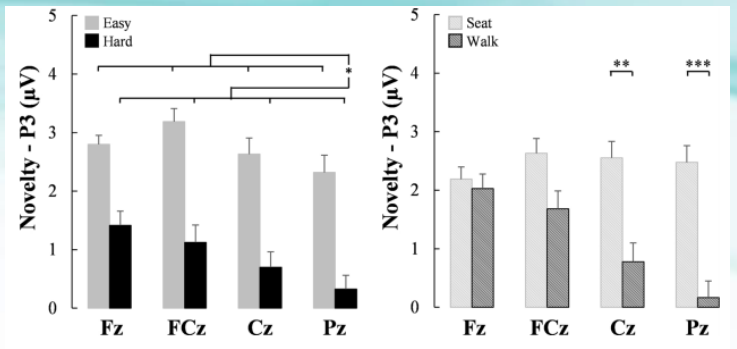
• The first study that utilized both EEG biomarkers to assess mental workload during locomotion:

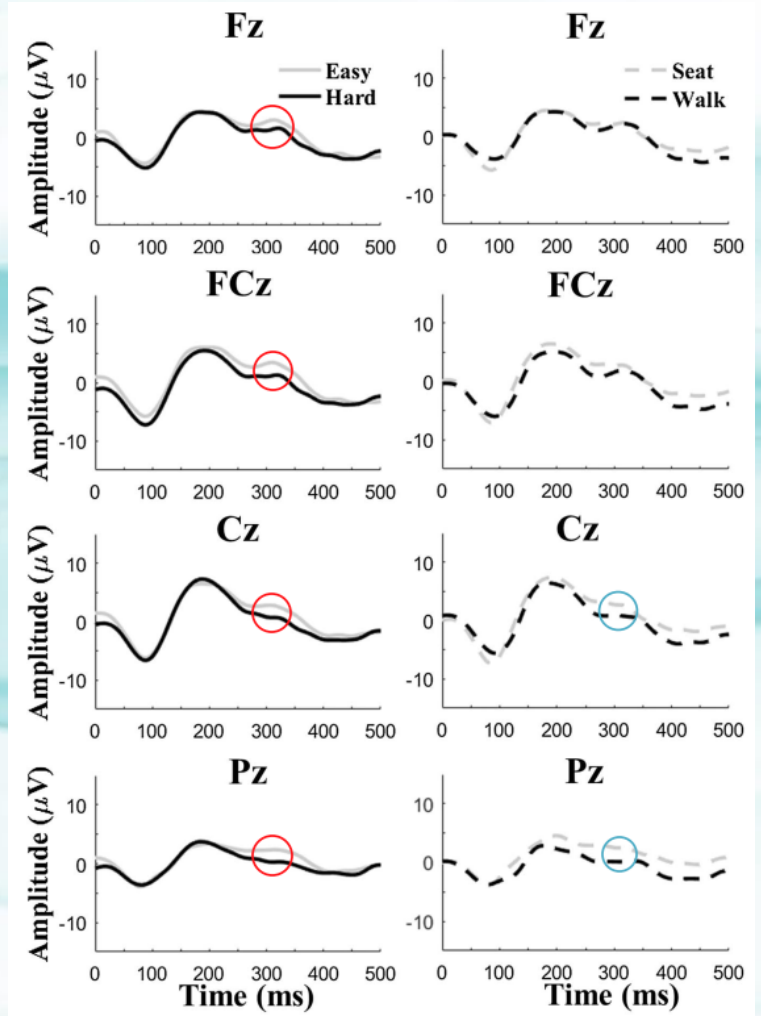
Results

ERP:

- Novelty-P3 amplitude
  - reduced in hard task compared to easy task
  - reduced in walking compared to seating at Cz and Pz





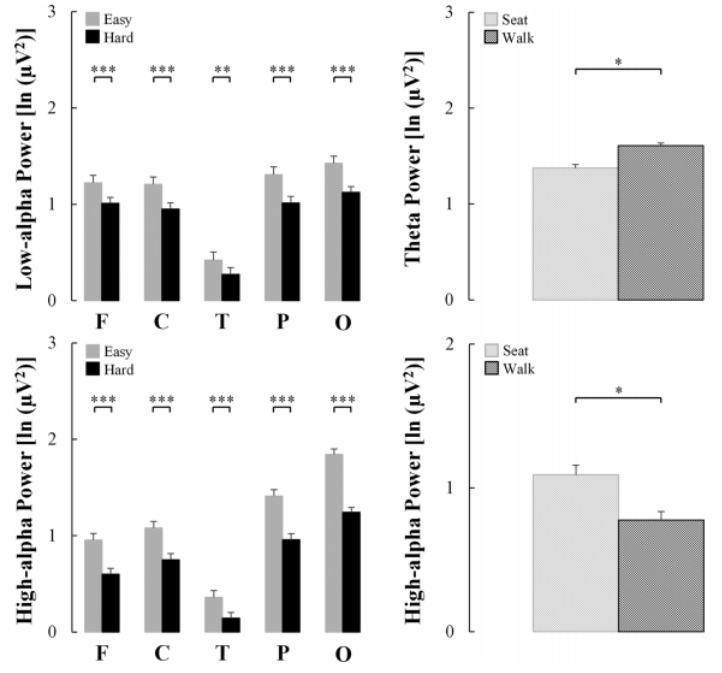


Shaw, E.P., Rietschel, J.C., Hendershot, B.D., Pruziner, A.L., Miller, M.W., Hatfield, B.D., Gentili, R.J. (2018). Measurement of attentional reserve and mental effort for cognitive workload assessment under various task demands during dual-task walking. *Biological Psychology*, *134* ,39-51.

Results

Spectral power:

Alpha power
was lower (desynchrony)
for hard compared to easy condition in all regions
→ Indicating higher mental effort



Theta power was higher for
walking compared to seating
→ Indicating higher mental effort

Alpha power was lower
for walking compared to seating
→ Indicating higher mental effort

Shaw, E.P., Rietschel, J.C., Hendershot, B.D., Pruziner, A.L., Miller, M.W., Hatfield, B.D., Gentili, R.J. (2018). Measurement of attentional reserve and mental effort for cognitive workload assessment under various task demands during dual-task walking. *Biological Psychology*, *134* ,39-51.

Results

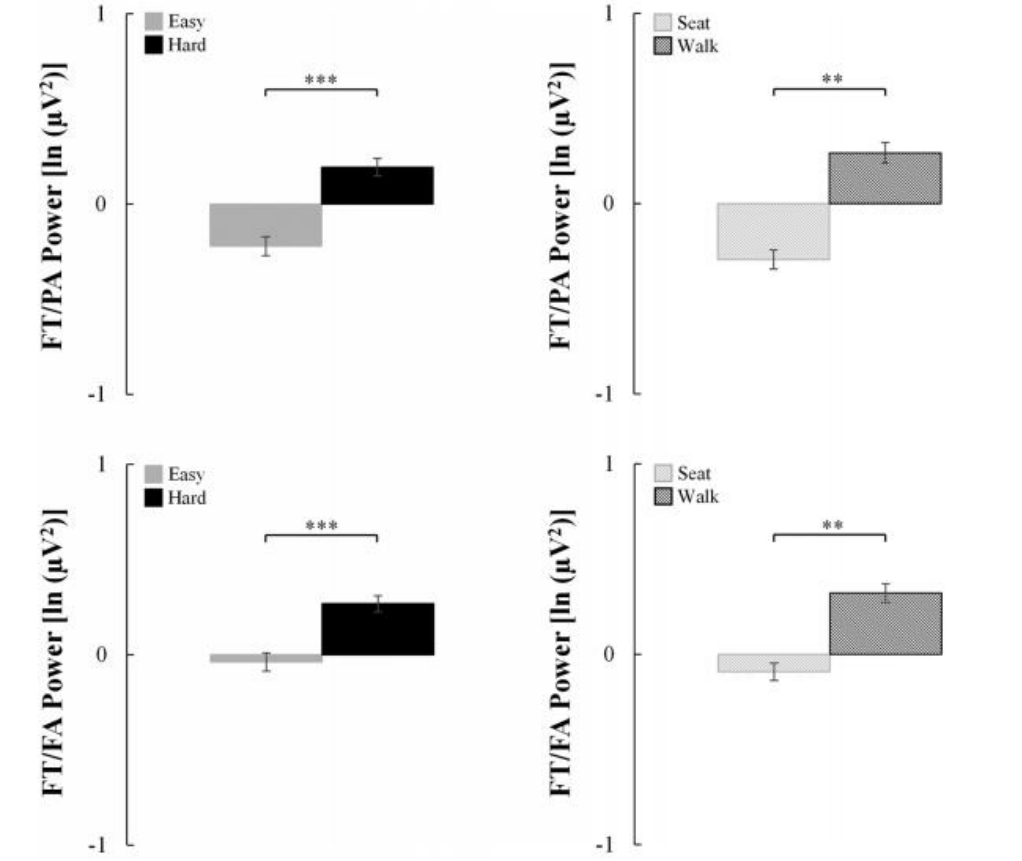
Ratios of

Frontal Theta / Frontal Alpha (FT/FA) and

Frontal Theta / Parietal Alpha (FT/PA):

- Elevated for hard compared to easy task
- Elevated for walk compared to seat condition

→ Higher ratio indicating higher mental effort



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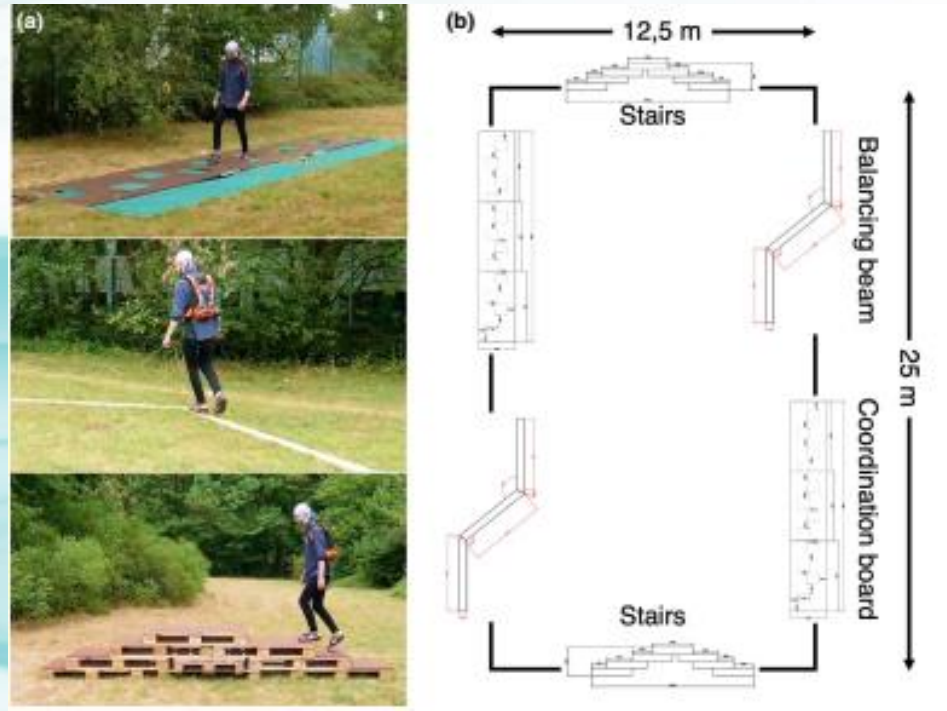
Highlights

- Validation study
- ERP and spectral power analysis can collectively index changes in cognitive workload associated with either cognitive or motor domanis
- When task difficulty increased from easy to hard in both seated and walking conditions, we observed:
  - Diminished ATTENTIONAL RESERVE indicated by decreased novelty-P3 amplitude
  - Elevation of COGNITIVE EFFORT, indicated by increased theta/alpha ratio, and decreased alpha
- Questions, comments?

Shaw, E.P., Rietschel, J.C., Hendershot, B.D., Pruziner, A.L., Miller, M.W., Hatfield, B.D., Gentili, R.J. (2018). Measurement of attentional reserve and mental effort for cognitive workload assessment under various task demands during dual-task walking. *Biological Psychology*, *134* ,39-51.

Introduction & Methods

- Cognitive task + outdoor movement conditions:
  - Standing, walking, traversing obstacle course
- 30 channel EEG
- 20 healthy participant
- Outcome measures
  - Response times, accuracy
  - NASA-TLX
  - Frontal Theta power
  - ERPs components (vary with resource allocation):
    - P2 (rearly attentional processes)
    - N2 (executive response mechanism, inhibition)
    - P3 (stimulus updating and categorization processes, negative correlation with task difficulty)



Reiser, J.E., Wascher, E. & Arnau, S. (2019). Recording mobile EEG in an outdoor environment reveals cognitive-motor interference dependent on movement complexity. *Sci Rep* 9, 13086.
Reiser, J.E., Wascher, E., Rinkenauer, G., & Arnau, S. (2020). Cognitive motor interference in the wild: Assessing the effects of movement complexity on task switching using mobile EEG. *European Journal of Neuroscience*

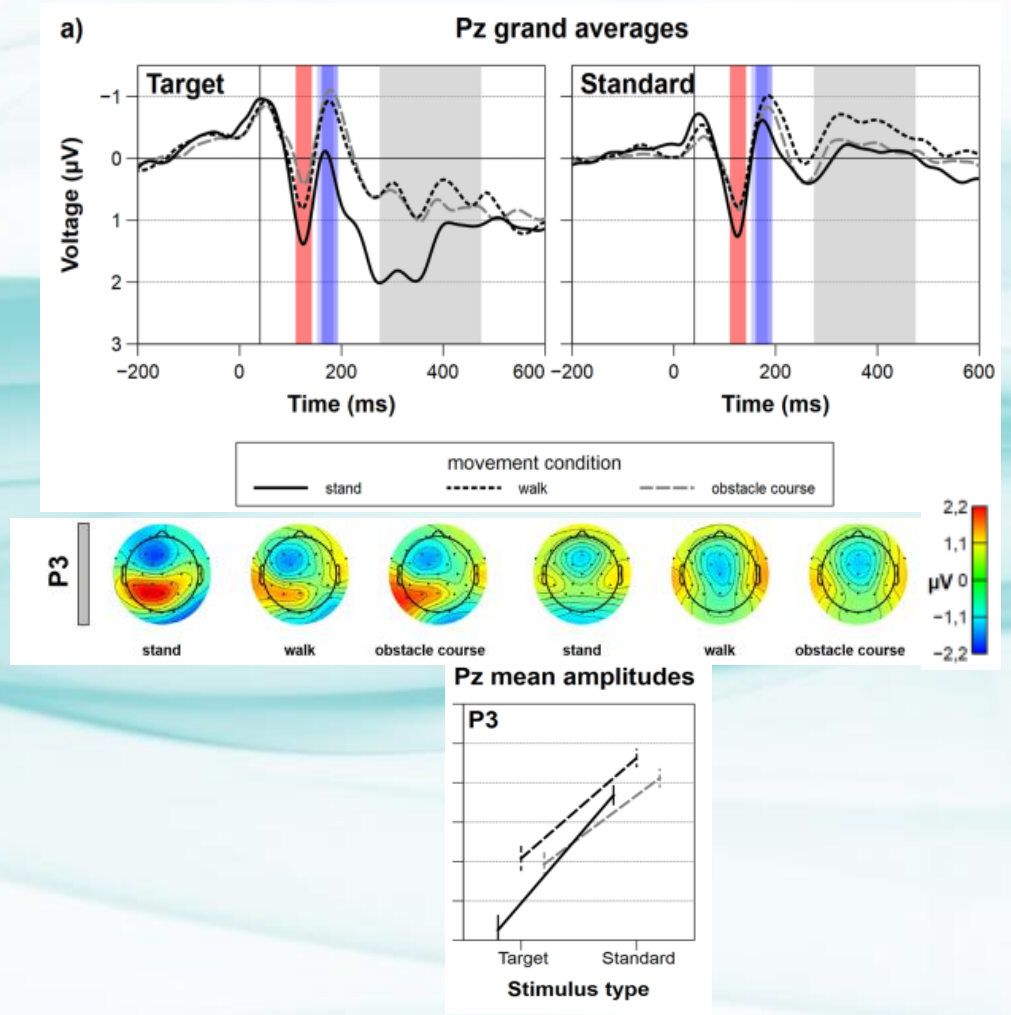
Study 1: Auditory oddbal task

- Stimuli: Standard and oddball
  - 2 pure sine waves (low=600Hz, high=900Hz)
  - Button press in response to target oddball
- Hypoteses:
  - → higher power – higher mental effort
  - → For all ERP components a high task difficulty in a dual-task setting was linked to decreased amplitudes

RESULTS

- Behavioural :
  - Response times & NASA-TLX (effort, cognitive and phisical demand) increased for more challanging movement conditions

- ERP at Pz:
  - Target stimuli exhibit more positive P3 deflection than standard stimuli
  - Larger P3 amplitudes for standing compared to walking and obstacle traversing



Reiser, J.E., Wascher, E. & Arnau, S. (2019). Recording mobile EEG in an outdoor environment reveals cognitive-motor interference dependent on movement complexity. *Sci Rep* **9,** 13086.

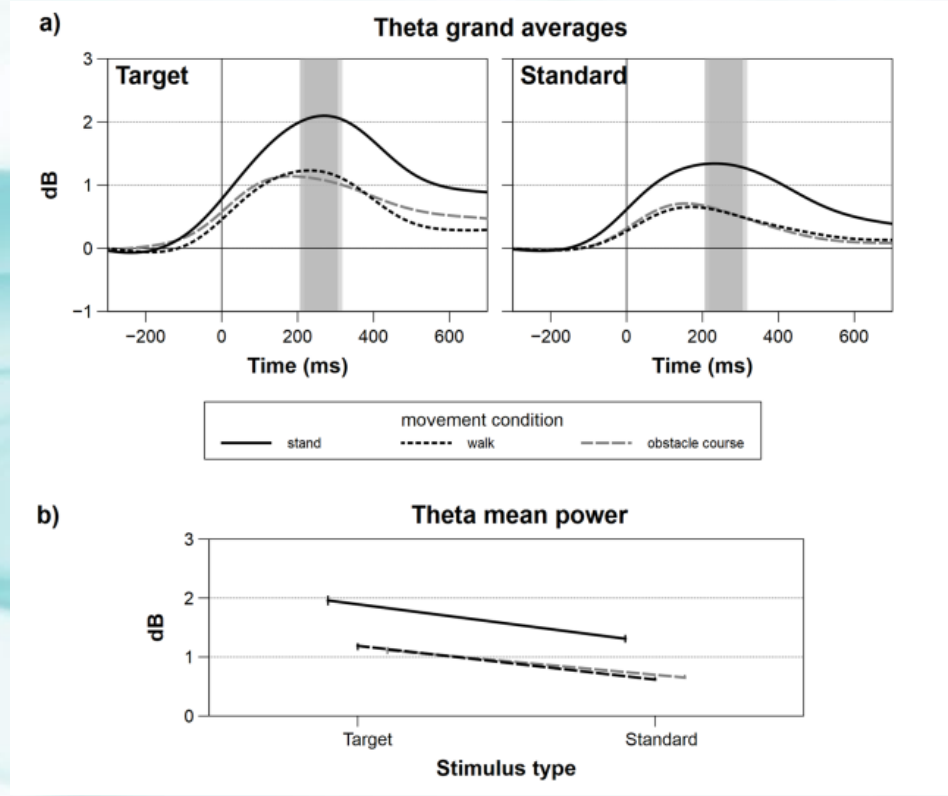
Study 1: Auditory oddbal task

- Frontal Theta spectral power
  - Increased for target as opposed to standard
  - Increased in the standing condition compared to the locomotion
    - Indicating a decline in focused attention for cognitive task during locomotion; behavioural resluts confirm this
    - Posture first?

CONCLUSIONS

- With higher motor workload, decreased availability of attentional resources results in lower cognitive performance
- Support a common cognitive-motor pool of attentional resources

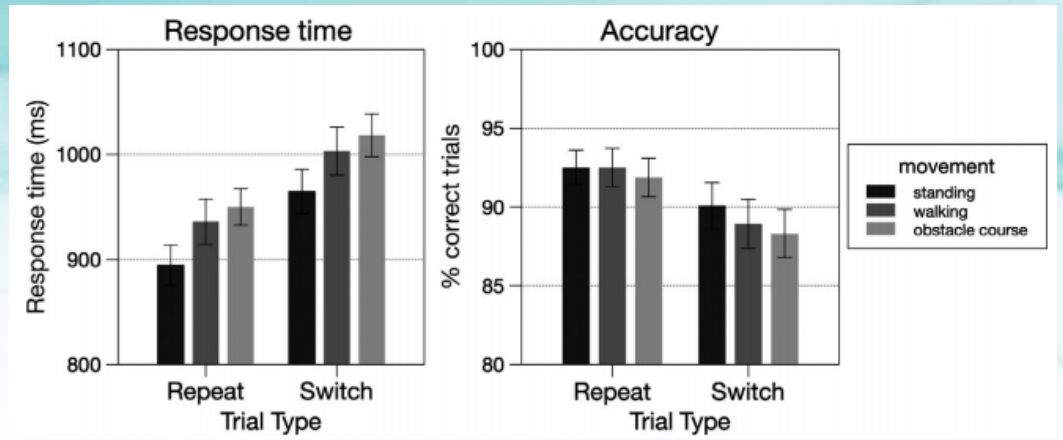
Questions, comments?

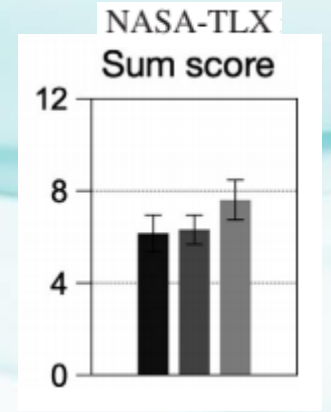


Reiser, J.E., Wascher, E. & Arnau, S. (2019). Recording mobile EEG in an outdoor environment reveals cognitive-motor interference dependent on movement complexity. *Sci Rep* **9,** 13086.

Study 2: Auditory-cued task-switching

- Stimulus Type: Cue tone and Stimulus tone
  - Cue: 2 pure sine wave tones (low=600Hz, high=900Hz)
  - Stimulus: A spoken number between 1–4 or 6–9
  - Depending on the cue, participants had to respond whether a number was odd or even, or whether it was smaller or greater than 5.
  - Repeat and switch trials

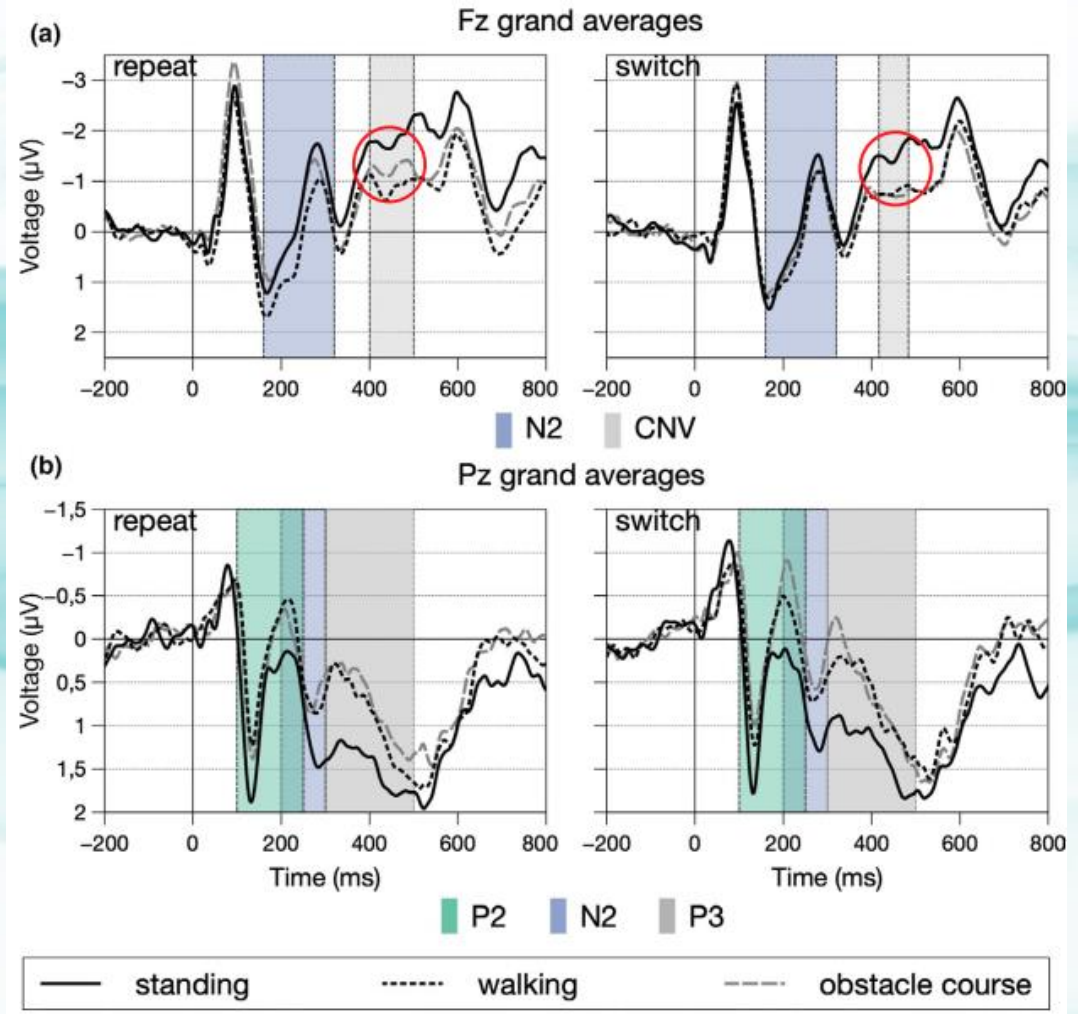




Reiser, J.E., Wascher, E., Rinkenauer, G., & Arnau, S. (2020). Cognitive motor interference in the wild: Assessing the effects of movement complexity on task switching using mobile EEG. *European Journal of Neuroscience*

Study 2: Auditory-cued task-switching

- ERP measures
  - Frontal cognitive processing
    - → Desreased negativity (CNV) in switch trials
      - Inhibiting the previous action plan
      - Anticipatory attentional processes
  - Parietal cognitive processing
    - → P2, N2, P3
    - All show movement complexity effect
      - More negative amplitudes in locomotion compared to standing might indicate that motoric tasks impede stimulus updating processes
        - Altered distribution of cognitive resources?
        - Posture first?
    - No effect of trial type in P3
      - In contrast with literature
      - P3 should signal preparatory attentional updating



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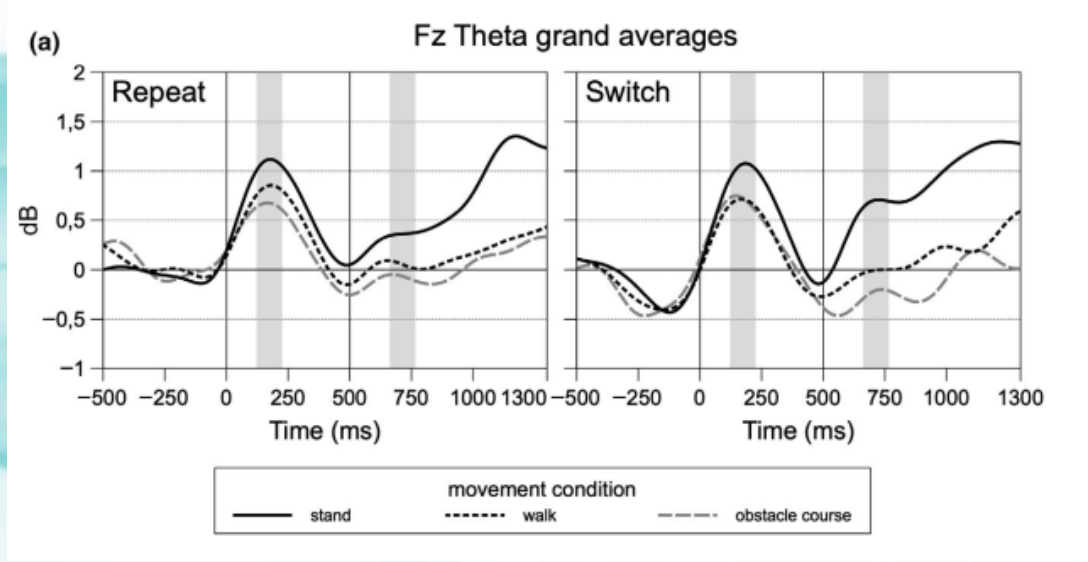
Study 2: Auditory-cued task-switching

- Frontal processing – Theta Power
  - No difference in trial type
  - Movement complexity effect after cue and after stimulus onset
    - Standing exhibited the highest theta power
    - Opposite to the literature
    - Reduction of attentional resources directed towards cognitive task?
      - Posture first strategy?



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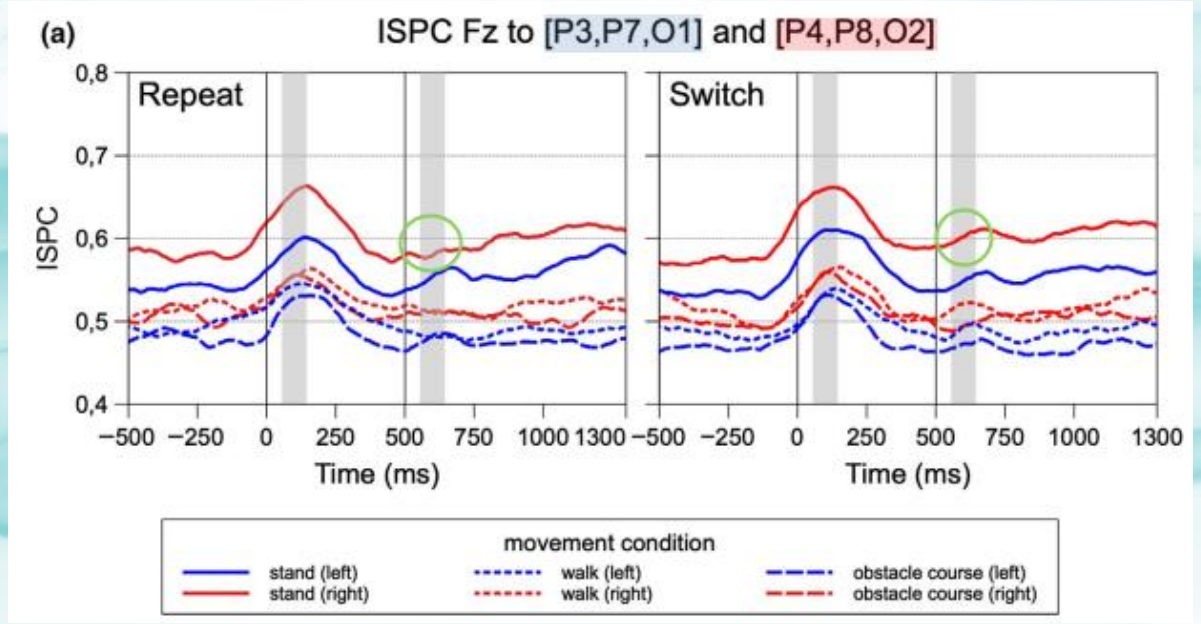
Study 2: Auditory-cued task-switching

- Theta Connectivity between central-frontal and parieto-occipital electrodes
  - ISPC = Inter-site phase coherence
  - Post-cue & post-stimulus
    - Hemispheric asymmetry – connectivity with the right cluster was higher in all movement conditions
    - Movement complexity effect – in both cluster, standing exhibited the highest ISPC correlation
      - In contrast with the literature, although methodological differences
  - Post-stimulus
  - Higher ISPC in switch compared to repeat trials for standing only (in right cluster)
    - Indicate that increased amout of cognitive resourses could be deployed to the execution of the switch task in standing position, but not in locomotion, as these resourses were depleated.



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Study 2: Auditory-cued task-switching

- Conclusion
  - Pattern of results show that cognitive resources are being shared between cognitive and motor tasks, eventuly resulting in CMI.
  - Increasing movement complexity strongly influences subjective, behavioural and EEG measures.
  - No difference between switch and repeat trials are indicating a decrease in resourse availability for cognitive task.

Reiser, J.E., Wascher, E., Rinkenauer, G., & Arnau, S. (2020). Cognitive motor interference in the wild: Assessing the effects of movement complexity on task switching using mobile EEG. *European Journal of Neuroscience*

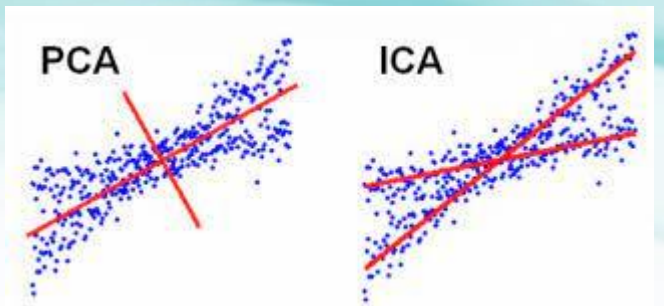
OVERALL CONCLUSION

- Electrophisiological features can serve as biomarkers in the investigations of attentional resouce allocation in cognitive-motor dual-task paradigms.
  - **Novelty-P3** – lower amplitude if attentional reserve is depleted (challanging task)
  - **P3 in an odball paradigm** - lowest amplitudes for the most challanging condition
  - **Frontal Theta Power** – higher for more challanging conditions (not in outdoor setting)
  - **CNV in Auditory-cued task-switching** – reflects ancipatory attentional processes, found to have the lowest amplitude in challenging tasks
  - Theta connectivity (ISPC) – not so clear
- Evidence is in favour of posture first strategy

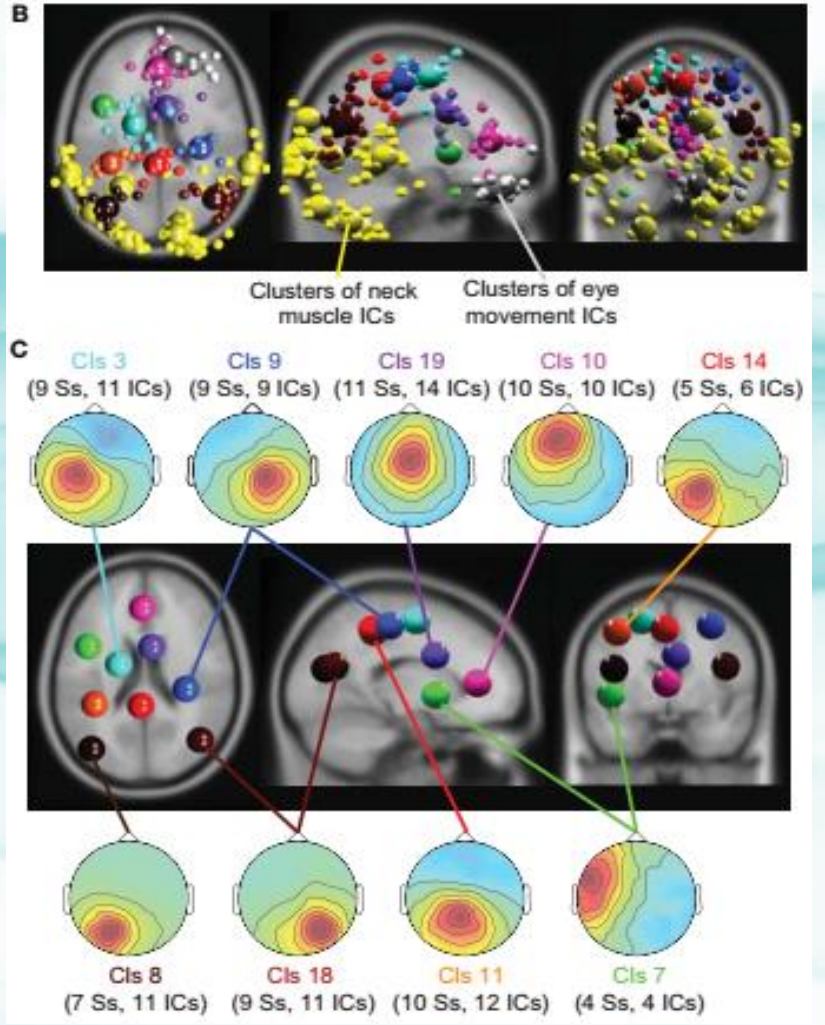
Feasibility of recording brain activity in motion

EEG analyses:

- Pre-processing
- Adaptive Mixture Independent Component Analysis (AMICA) algorithm
  - To classifiy ICs as brain / non-brain source activities based on:
    - time course, spectra and scalp topographies, current dipole models
- Data separated into 2s epochs with onset stimuli
- Using PCA to cluster selected ICs for each participant based on
  - simillarities in dipole location
  - event-related dynamics

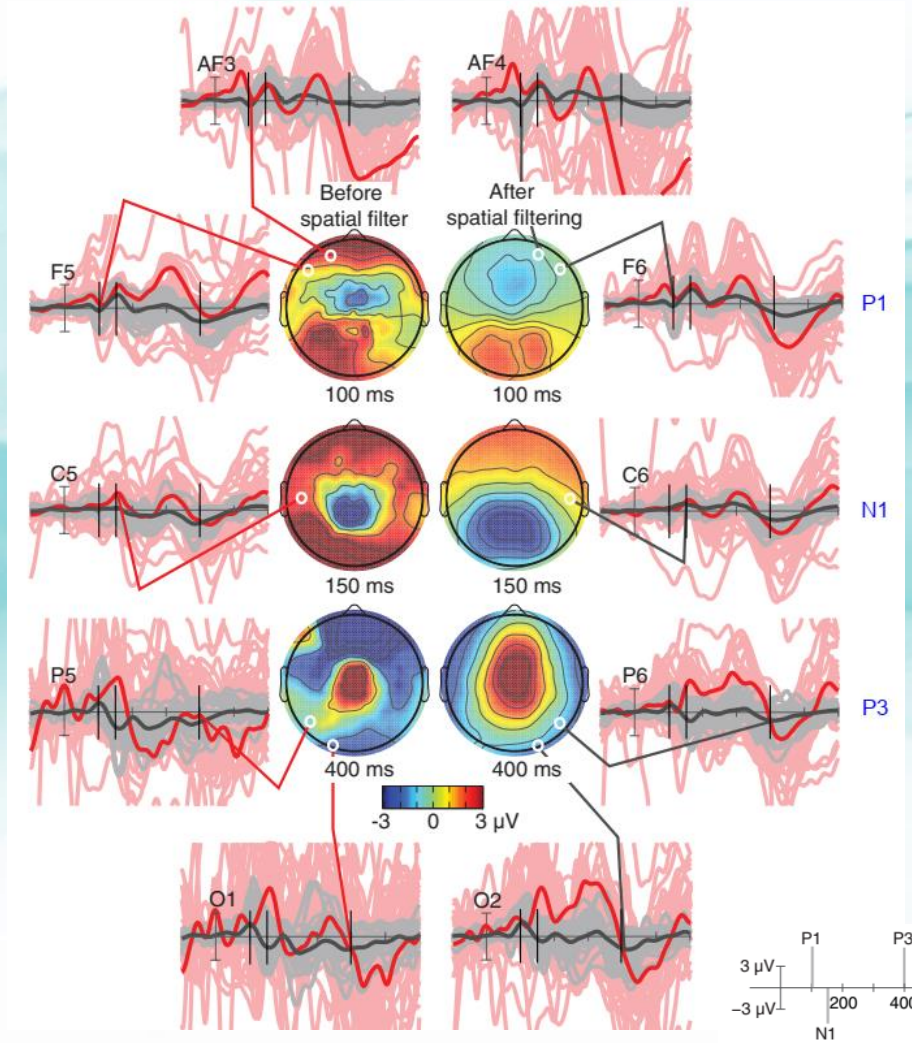


PCA finds a reduced-rank representation of data.
ICA finds independent sub-elements of your data.
PCA compresses, ICA separates.



Gramann, K., Gwin, J. T., Bigdely-Shamlo, N., Ferris, D. P., & Makeig, S. (2010). Visual evoked responses during standing and walking. *Frontiers in human neuroscience*, *4*, 202.

Feasibility of recording brain activity in motion



ERP analysis:

- Event-related potentials (ERPs) reduced to linear mixtures of brain activity only and backprojected to scalp sites

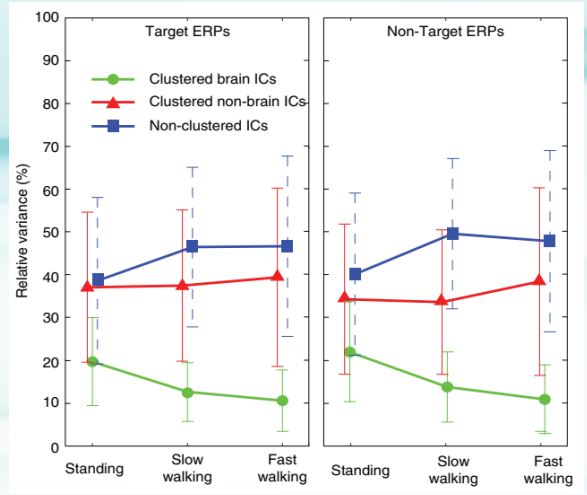
← Figure:

Scalp recorded ERP before and after spatial filtering (=IC)

→ Figure:

Relative contribution of brain, non-brain and non-clustered ICs to the overall ERP signal

- computed by percentage variance accounted for (pvaf) by each IC



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Feasibility of recording brain activity in motion

The impact of attention task and movement on ERP:

[For ERP feature (N1, P3), a 2 x 3 factorial RM ANOVA, for factors STIMULUS (target, non-target) and MOVEMENT (standing, slow walking, fast walking)]

- P1 – comparable across target an movement conditions
- N1 – in all movement conditions, N1 was larger in target
- P3 – in all movement conditions, P3 was larger in target

N1 and P3 discriminate between target and non-target in all movement conditions

.

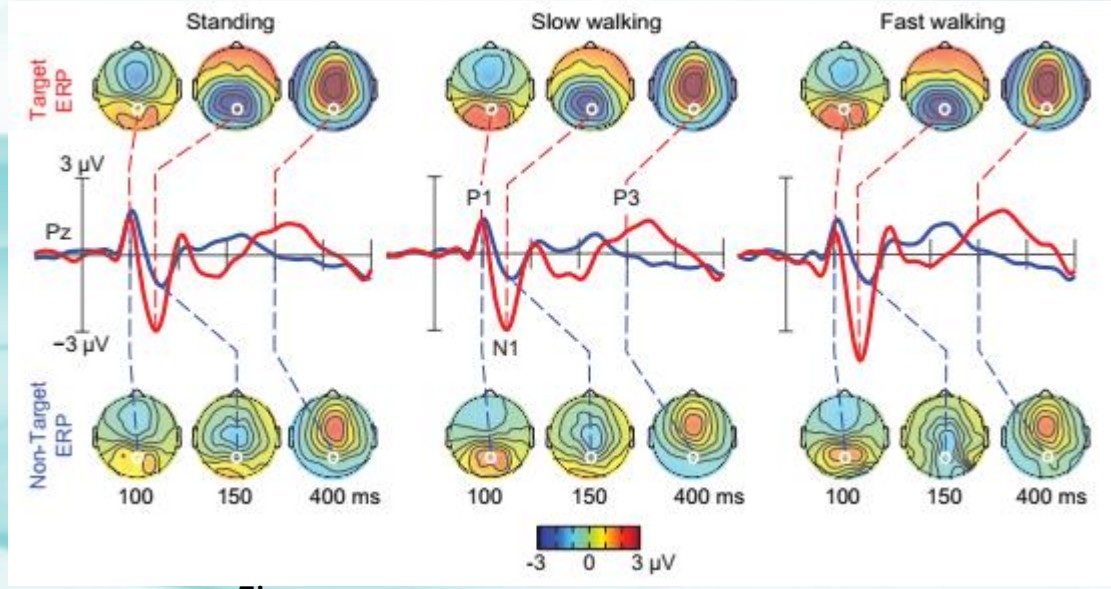


Figure:
Grand average ERPs after artifact removal

Gramann, K., Gwin, J. T., Bigdely-Shamlo, N., Ferris, D. P., & Makeig, S. (2010). Visual evoked responses during standing and walking. *Frontiers in human neuroscience*, *4*, 202.

Highlights

ICA decomposition and spatial filtering allow for the analysis of cognitive and sensory EEG brain activity while subjects perform constant whole-body movements.

Movement conditions had no effect on P3 amplitude suggests that steady treadmill walking did not pose any greater demands on performance of the visual oddball task than standing. Was the tasks too easy for healthy adults?

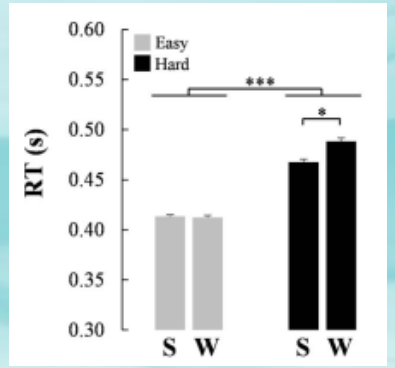
Feasibility for recording human cognition while in locomotion established.

Questions, comments?

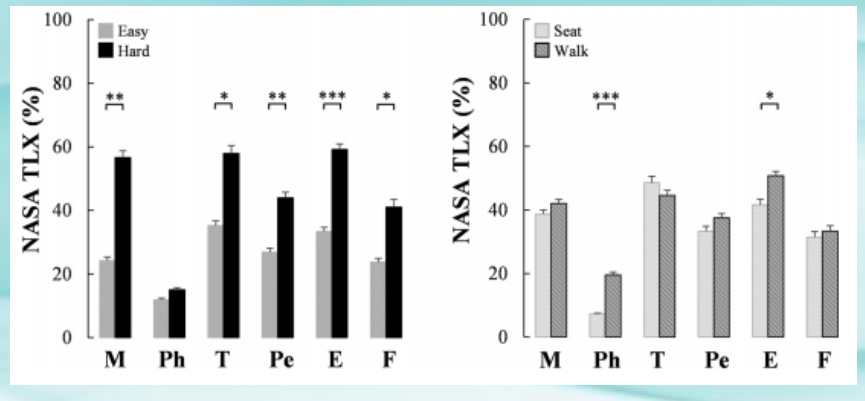
Gramann, K., Gwin, J. T., Bigdely-Shamlo, N., Ferris, D. P., & Makeig, S. (2010). Visual evoked responses during standing and walking. *Frontiers in human neuroscience*, *4*, 202.

Results

Behavioural Performance:



NASA-TLX:



M = Mental demand
Ph = Phisical demand
T = Temporal demand
Pe = Performance
E = Effort
F = frustration

Higher value = Higher demand

Shaw, E.P., Rietschel, J.C., Hendershot, B.D., Pruziner, A.L., Miller, M.W., Hatfield, B.D., Gentili, R.J. (2018). Measurement of attentional reserve and mental effort for cognitive workload assessment under various task demands during dual-task walking. *Biological Psychology*, *134* ,39-51.

	Preberi besedo *Word-reading Task*	Poimenuj barvilo *Ink-naming Task*
Neskladni *incongruent*		
Skladni *congruent*