Health Benefits of Walking

- Daily step targets (7-10k/day)
- Intensity (3 METs)
- Lack of support for
  - Meeting intensity targets
  - Learning and transitioning from supported to unsupported exercise

Supporting change

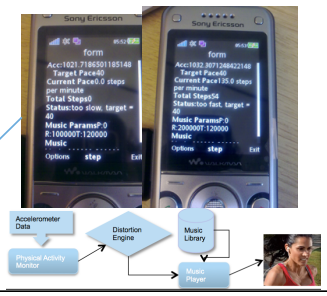
- The Transtheoretical Model of Behaviour Change
  - Precontemplation (*exer*gaming)
  - Contemplation
  - Preparation
  - Action
  - Maintenance

Guidelines (Consolvo et al.)

1. Give credit
2. Provide personal awareness
3. Support social influence
4. Consider practical constraints

- The role of music in exercise (Karageorgis et al.)
- MPTrain (Oliver & Flores-Mangas)

BeatClearWalker
- Early action
- Maintenance



Music and Exercise

- Difficult to pick appropriate rhythm music from users' playlists
  - Length of playlist vs. target exercise
  - Variety of musical genres
  - Choice of music due to mood
- What if we could work alongside existing music?
- A simple model as follows:
  - CLEAR: Listen to your music as if you would normally, when your cadence exceeds a certain threshold
  - DEGRADED: Interfere perceptibly, but not intrusively, with the music playback when cadence drops

Building BeatClearWalker

- Pedometer
- Music effects (interference)

Pedometer

- Peak detection for identifying heel-strikes.
- Adapted PeakFinder algorithm to work with 5-second sample window
- Tested with 7 users (Android)
  - Walk at 3 different cadences (90, 110 and 130 spm), using an audible metronome
  - Two minutes
  - Indoor circuit
  - Two devices, on user pocket and strapped on back
  - Also strapped on back, commercial pedometer
  - Manually counted steps
  - Results: within 6% of manual counting

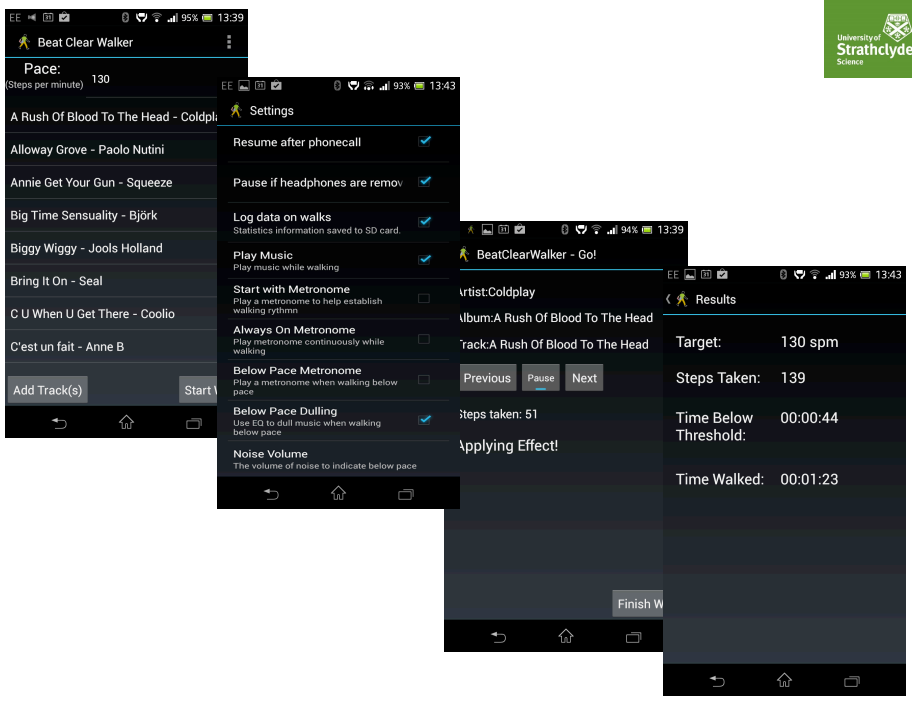
Types of intereference

- Change of tempo (Hartnett et al. 2006)
- Additional sounds (Rowe et al. 2013)

- Reverb (didn't work too well)
- Equalizer
  - Effect 1: remove the lowest frequency bands
  - Effect 2: remove the lowest and highest bands
  - Effect 3: remove a mixture of high, mid and low frequencies, leaving only the main bass line and a little melody

  - Test with 7 users, 3 genres of music (country, metal, pop)
  - Effect 1 & 2 not perceptible with country and metal
  - Effect 3 was noticeable for all genres but still relatively subtle

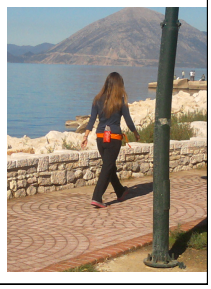
  - We augmented Effect 3 with some pink noise (bad AM radio reception)



Evaluation

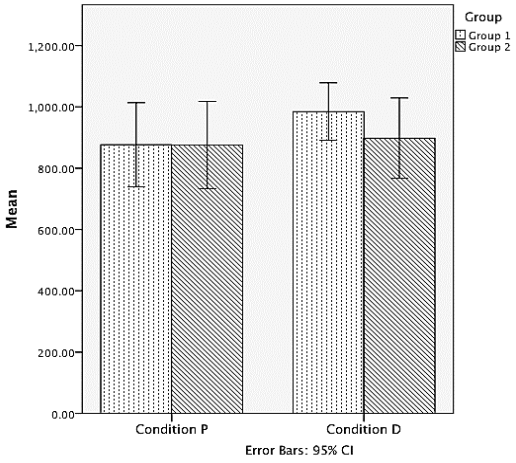
Evaluation

- 20 participants (8f), 18 in the 18-30 group and 2 in the 50-59 group
- Stage 1 – Judge typical pace
  - Walk 5 minutes at a steady and comfortable pace (practice route)
  - Log steps and convert to METs, according to participant height
- Stage 2 – Learn the target pace
  - Walk 5 minutes on practice route at >=4 METs (5 MET cap)
  - Use the metronome, without music
- Stage 3 – Using BeatClearWalker
  - Walk the 10 minute route twice
  - Walks start off with metronome, which stops automatically after 15 seconds.
  - Walks are taken under one of two conditions:
    - Condition P: use the plain music player (no effects)
    - Condition D: use the degrading music player (with effects)
  - Participants were counterbalanced
    - Group 1 started with Condition P, Group 2 started with Condition D
  - After each walk, complete a NASA TLX + own questionnaire



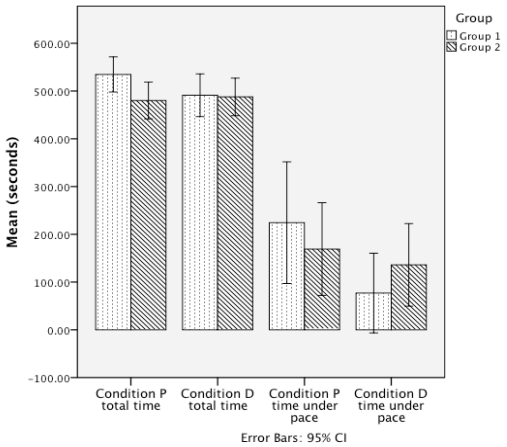
Quantitative data

- Number of steps
  - Statistical significance for both Groups, but only Group 1 (starting with Condition P) actually displayed significantly more steps



Quantitative data

- Time taken to walk
  - Statistical significance for Group 1 (starting with Condition P), who walked faster with the degrading player
  - Group 2 did not show statistically significant differences and times were very close to those of Group 1 Condition D, showing a possible learning effect in place.
- Time under pace
  - Statistical significance for Group 1, who spent less time under pace while using the degrading player
  - Group 2 did not show statistically significant differences.

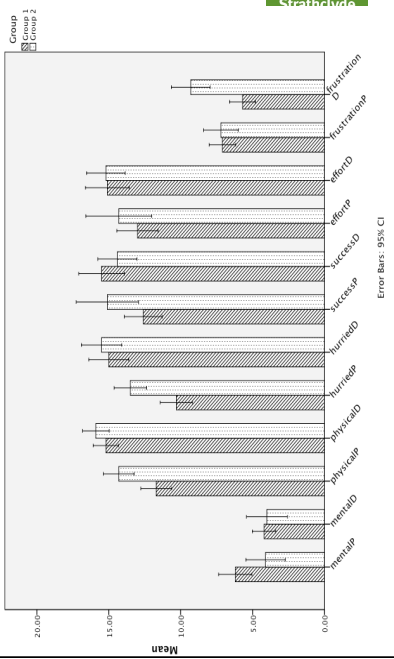


Quantitative data

- Group 1
  - Started off with the plain player
  - On average, they spent 41.87% of their time under pace when using the plain music player
  - When using the degraded player, time under pace was reduced to just 14.81%
- Group 2
  - Started off with the degrading player
  - On average, they spent 28.54% of their time under pace with the degraded player
  - When switching to the plain player, performance suffered (34.97% of their time under pace) but not by much.

Qualitative results – NASA TLX

- Mental Demand
  - Group 1: Less challenging with degrading player
  - Group 2: Same
- Physical Demand
  - Group 1: More challenging with degrading player
  - Group 2: More challenging with degrading player (but not much)
- Temporal Demand
  - Group 1: More hurried with degrading player
  - Group 2: More hurried with degrading player (but not much)
- Performance
  - Group 1: Better with degrading player
  - Group 2: Same
- Effort
  - Group 1: More with degrading player
  - Group 2: Same
- Frustration
  - Group 1: Less with degrading player
  - Group 2: Less with plain player

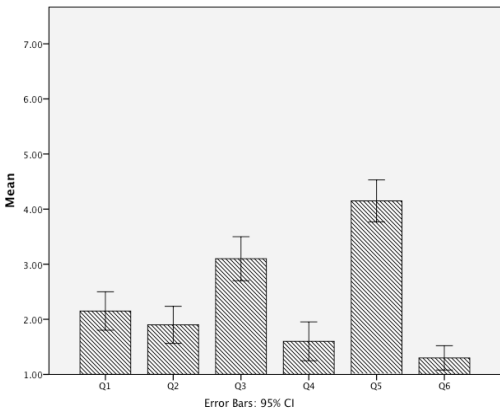


Qualitative results - feedback

1. Did you find it easier to walk at the right pace with or without sound effects? (1=much easier with, 7=much easier without)
2. Did you feel the sound effects helped you learn the faster pace we asked you to walk at? (1=considerably, 7=not at all)
3. For casual walks (e.g. to the shops) do you see yourself using these sound effects to increase your walking pace and exercise level? (1=regularly, 7=never)
4. For exercise walks (e.g. a dedicated weekend walk for leisure/ exercise) do you see yourself using these sound effects to increase your walking pace and exercise level? (1=regularly, 7=never)
5. If your normal MP3 player could do these sound effects while you are walking, would you use them? (1=use it always, 7=never)
6. If a dedicated app was available, would you recommend this to friends / family? (1=highly, 7=not at all).

Qualitative results - feedback

- Easier to walk with the degrading player
- Sound effects helped them to learn the required pace
- System could be used for casual walks, but is probably better for dedicated exercise sessions
- They would not want the SFX present in their default music app
- If a separate app like ours existed, they would highly recommend it to family and friends.



Summary

- BeatClearWalker was successful in helping participants maintain the desired pace for achieving health benefits during walks
- Strong indication of potential learning effects

- In the future:
  - Better pedometer
  - Full integration with music library
  - Integration with GPS to improve pedometer accuracy
  - Stop detection to remove annoyance (e.g. traffic lights)
  - Longitudinal trial to monitor long-term effects

University of Strathclyde Science

Questions?