BeatClearWalker
Using degraded MP3 quality to encourage a health improving walking pace

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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 (exergaming)
  • Contemplation
  • Preparation
    • Action
    • Maintenance
  • The role of music in exercise (Karageorgis et al.)
  • MPTrain (Oliver & Flores-Mangas)

Guidelines (Consolvo et al.)
1. Give credit
2. Provide personal awareness
3. Support social influence
4. Consider practical constraints

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 interference

• 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

• 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.

• 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

Questions?