Can attentional focus and physical exertion affect interoception?

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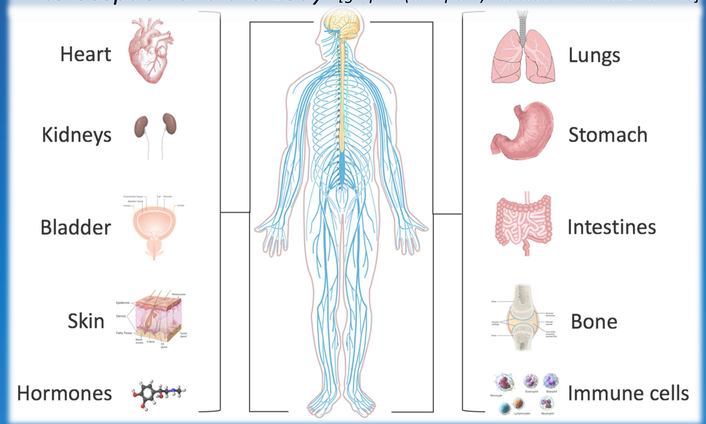
Background: 'Interoception' involves the sense of internal bodily processes, including respiratory and cardiac activity, as well as emotional sensations [1]. Maladaptive interoception can develop after traumatic life experiences, [2] sometimes contributing to poor mental health. [3] Physical exercise [4] and mindful body-based activities [5] are thought to improve interoception. Trauma-informed ways to notice bodily sensations have been incorporated into Outdoor Education sessions at Afon Goch Children's Homes Ltd., with instructors successfully engaging children in numerous Interoceptive Awareness Opportunities (IAOs). [6] One IAO guided children to notice their pulse in different parts of their body after cycling. The present study aimed to assess the effects of this exemplary cardiac IAO on interoception using well-operationalised variables.

Figure 1

'Interoception and the Body' *[graphic (Schapelle) licensed under CC BY-SA 4.0]*



Baseline procedures

Start of Session 1: preparation

- Random assignment to between groups variable: attentional focus
  - **Interoceptive Awareness Opportunity (IAO) group**
  - **Exteroceptive Awareness Opportunity (EAO) group**
- Measure and calculate:
  - Resting heart rate (HR)
  - Heart rate reserve (HRR) maximum
  - Target Heart Rate (THR) X 2
    - Very light: 20% HRR max
    - Vigorous: 60% HRR max

Session 1 & 2: baseline measures

- EEG electrodes fitted
- Heartbeat Evoked Potentials (HEP) during attention to heart
- Heartbeat Discrimination Task (HBDT)

Experimental procedures ~ 1 week within-groups

Session 1 | **Session 2**

Cycle ergometer set to 60RPM. Increase load by 25 watts/minute to reach THR; reached after approximately 2 minutes (HR1) and 6 minutes (HR2)

Target HR1 — Briefing for next task ~1min — **Target HR2**

IAO: Focus on the sense of your pulse in different parts of your body for 20 seconds (1. chest; 2. hands; 3. feet; 4. head; 5. abdomen; 6. legs; 7. multiple).
EAO: On the computer screen, find and click on the pulsing patch, then count the pulses.

IAO | EAO | IAO | EAO

- 1 – 3 psychometrics: Difficulties in Emotion Regulation Scale, Adverse Childhood Experiences scale, International Physical Activity Questionnaire (short), Perceived Stress Scale.
- Post 'intervention' measures at baseline HR
  - HEP during internal attention to the heart
  - HBDT

Book session 2

Borg Rating of Perceived Effort & Multi-dimensional Assessment of Interoceptive Awareness-2 **(MAIA-2)**

Hypotheses: Vigorous physical exercise and interoceptive attentional focus were expected to influence post-exercise interoception.

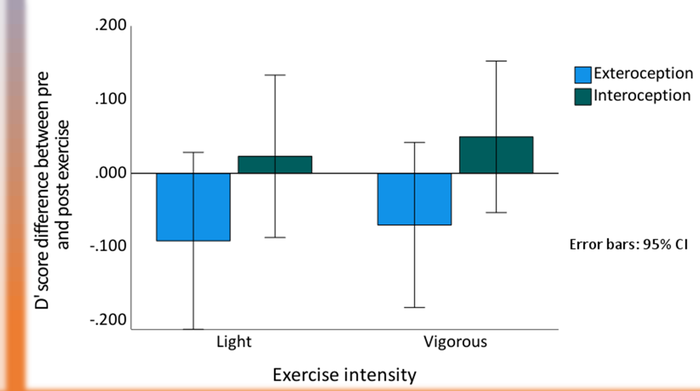
Analysis: Interoceptive accuracy was defined by d' [7] from HBDT data. Interoceptive Awareness was quantified by Area Under the ROC curve [8] values calculated from confidence ratings.

Results: Data was analysed for N = 70 participants. A 2 X 2 mixed ANOVA revealed that attentional focus after exercise (interoceptive or exteroceptive task) had a statistically significant effect on interoceptive accuracy from baseline d' to post-exercise d', $F(1, 68) = 4.50$, $p = .038$, $\eta p^2 = .062$. The mean d' change after exercise reflects a decrease in accuracy from baseline for the exteroceptive group, $t(33) = -2.166$, $p = .038$ ($M = -.074$), compared to the interoceptive group where there was no significant improvement, $t(38) = 1.027$, $p < .05$ ($M = .042$). There were no differences in baseline d' scores between attentional focus groups for light or vigorous exercise.

Adding psychometric scores as a covariate showed a significant interaction relating to exercise intensity level (Adverse Childhood Experience: $F(1, 67) = 5.13$, $p = .027$; light intensity $\beta = -0.034$, $t = -1.854$, $p = .068$; vigorous intensity $\beta = .023$, $t = 1.312$, $p = .194$.), Multidimensional Assessment of Interoceptive Awareness (v.2) 'Not Distracting' $F(1, 67) = 9.80$, $p = .003$ and 'Trusting' $F(1, 67) = 4.77$, $p = .032$), but not attentional focus condition. Directionality has not yet been evaluated for MAIA-2.

Figure 2

Significant Effect of Attentional Focus on Interoceptive Accuracy Between Baseline and Post Exercise Heartbeat Discrimination Task Scores



A 2 X 2 mixed ANOVA demonstrated no significant effects for Interoceptive Awareness.

Discussion: The decrease in performance post-exercise in the exteroception group may be a fatigue effect of a 2nd HBDT. It is possible that this effect was mitigated by the interoceptive focus.

The addition of psychometrics as covariates suggests that factors pertaining to childhood trauma and interoceptive sensibility interact with d' change scores, regardless of attentional focus condition. The higher the ACE score the greater the decrease in HBDT accuracy post-exercise.

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