Inhibitory Control Training as a potential behavioural intervention for overweight and obesity.

Andrew Jones
AIMS

• Background into Inhibitory Control and related cognitive processes, and how they might contribute to appetite regulation

• How can our environment influence our Inhibitory Control

• Can we train inhibitory control to improve healthy eating / reduce unhealthy eating

• Mechanisms, limitations and future research
**Inhibitory control**

- ‘the (in)ability to stop, change or delay a behaviour that is no longer appropriate, in the current environment (Logan et al 1988)’

- **Think of a traffic light**

- Fundamental behavioural component of ‘impulsivity’ and ‘executive functioning’

- Useful endophenotype for psychiatric disorders (Aron, 2011)
Real world ‘disinhibition’

- Substantial overlap with self-control.

- Estimates suggest 80 / 90% of self-regulation requires some form of stopping a response (Baumeister, 2015).

- Slaves to our ‘obesogenic’ environment (Jones et al, in press)
Measuring inhibition in the lab:
Obesity and cognitive biases

- Cognitive profile may confer vulnerability to overweight and obesity, but fortunately these processes may be modifiable (Jansen et al, 2014)

- Inability to inhibit behaviours

- Hyper-valuation of reward stimuli.
Hyper-valuation

• Attention
  • Individuals demonstrate attentional bias to food cues when hungry. This bias persists in obese individuals (Castellanos et al, 2009).

  • Food cues capture the attention more quickly in obese individuals (Werthmann et al 2013)
Hyper-valuation

• **Approach:**
  • Obese individuals are faster to pair food-related words with approach (Kemps et al 2015).

  • Approach biases for chocolate are correlated with chocolate craving (Kemps et al 2013)
**Fluctuations in disinhibition**

- There is an interaction between inhibitory control and hyper-valuation of reward stimuli.

- Attention and inhibition compete for resources.
  
  - Loeber et al (2012) – not specific to obese individuals
  - Jones and Field (2015) – unique disinhibition

- These fluctuations in inhibitory control may put individuals ‘at risk’ for substance use / overeating (c.f. Guerrieri et al 2009; Jones et al 2011a, b)
The effects of cues are strong

Main effect of cue – no interaction with reward (Jones et al, in preparation)
Potential pathways and moderators

Figure 4. Significant pathways in the moderated-mediation model for the food-based and neutral go/no-go tasks (controlling for baseline hunger, gender and alcohol consumption). Significant pathways are denoted by solid arrows ($P < 0.05$), and nonsignificant pathways are denoted by dotted arrows. The $+/-$ symbol denotes the direction (positive or negative) of the relationship.

Price et al (2016)
So far.....

• We know inhibitory control is not stable. It is responsive to the environment and internal signals.

• It can automatically engaged
  • Verbruggen et al (2008) – inhibition easier and more effective following STOP primes.

• Can it ‘train’ automatic inhibition?
Inhibitory control training

Premise: Appetitive stimuli cause transient impairments in the ability to control behavior. Can we train individuals to exert control to appetitive cues.
Cue specific inhibition training

The Effects of Cue-Specific Inhibition Training on Alcohol Consumption in Heavy Social Drinkers

Andrew Jones and Matt Field
University of Liverpool, Liverpool, United Kingdom

Associatively pair inhibition responses with alcohol related cues.
Typical ICT study

- Inhibition training condition: Mostly stop
- Control training condition: Mostly go
- No inhibition condition: Always go

Images of glasses of beer and pens.
Also demonstrated an **overall reduction in craving**.

No effect on alcohol consumption outside of the laboratory.
Similar results in food

Lawrence et al (2015)
Reduction in crisp and chocolate intake. *Stop Signal task*

Inhibitory control training reduces chocolate intake. *Go/No-Go task*

Werthmann et al (2013)
Reduction in chocolate intake. *Anti-saccade task.*
Are the effects of ICT robust?

Research review

Inhibitory control training for appetitive behaviour change: A meta-analytic investigation of mechanisms of action and moderators of effectiveness

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**Similar effects on both food and alcohol consumption**

\[ d = 0.36 \text{ – small to medium effect size.} \]
Other findings?

• Effects were larger in individuals who were motivated to reduce food intake (Current dieters, those high in dietary restraint).
  • *Important*

• Effect sizes were similar to other brief interventions (implementation intentions, BAI).
  • Not driven by control conditions approaching appetitive cues

• Number of trials / Length of training didn’t influence the effect size.
  • Suggests high compliance, and feasibility outside of the lab
Moving past proof-of-concept stage

• Small but robust effects of one session of ICT in the lab.

• Repeated sessions?
  • Veling et al (2014): four sessions over one month lead to reductions in body weight.
  • Lawrence et al (2015): up to four sessions in one week led to reductions in weight, snacking frequency but also ‘liking’ of snack foods
  • Allom and Mullan (2015): mixed findings
Lose weight without dieting: simple 10-minute game retracts brain to avoid junk food

Can YOU train your brain to lose weight? Play the online game that claims to help you shed 0.7kg in ONE WEEK

- Researchers at Exeter and Cardiff University claim the game can help some people eat 220 fewer calories a day

This new app thinks it can train your brain to stop craving unhealthy foods

The app is called FoodT and is currently available only on Android and online
**Smartphone and web-based ‘apps’**

![Smartphone and web-based ‘apps’](image)

**Table 2**

Mean scores for each outcome; only statistically significant results are shown.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Training Baseline</th>
<th>Training Time 2</th>
<th>Waitlist Baseline</th>
<th>Waitlist Time 2</th>
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<tr>
<td>Healthy Eating Quiz</td>
<td>36.56</td>
<td>42.42</td>
<td>39.58</td>
<td>35.88</td>
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<tr>
<td>FCT(^a): healthy food</td>
<td>63.17</td>
<td>31.59</td>
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<td>-</td>
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<tr>
<td>FCT(^a): unhealthy food</td>
<td>234.68</td>
<td>76.50</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>TFEQ(^b): hunger</td>
<td>-</td>
<td>-</td>
<td>5.58</td>
<td>6.88</td>
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<tr>
<td>TFEQ: cognitive restraint</td>
<td>9.27</td>
<td>11.50</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

\(^a\) FCT: food consumption test.

\(^b\) TFEQ: Three-Factor Eating Questionnaire.

Blackburne et al (2016)
What do people think of ICT

• Sample responses to questions about whether participants’ felt the training influenced their snacking or was “helpful”

• “I feel less inclined to reach for biscuits – they are less appealing.” (participant 1)
• “The task influenced my snacking – I replaced sweets with strawberries. It is hard to explain why” (participant 6)
• “The task made me 'not bothered' about snacking on food – I haven't felt like it. This felt partially conscious but not entirely. I was not eating/seeking snacks.” (participant 16)
• “I think it influenced me. Someone gave me chocolate yesterday but I didn't get the same taste I normally would.” (participant 33)
• “It made healthy foods more attractive (salad, carrots) than non-healthy. It made me think more about foods I ate.” (participant 38)
What are the underlying mechanisms of inhibitory control training.

Stimulus devaluation?

Learning an abstract rule? ‘If chocolate, then don’t go’

Attentional bias?

Alternatives to inhibitory control training

Cue-approach training?
Results of cue approach training

**Results of cue approach training**

- **Experiment 1**: fast (n=25), slow (n=23), slow+ (n=25)
- **Experiment 2**: fast (n=24), slow (n=25)

Legend:
- Gray: low value
- Light gray: high value
- Dashed line: no preference

Statistical significance:
- ***: p < 0.001
Approach avoidance training
Results of approach avoidance training

Schumaker et al (2016)
Problems with the current evidence base.

Poorly designed control groups and sampling

Power

Absence of evidence

Future research.

Move away from one-size fits all.

Training in high risk situations.

Jones et al (in press)
Summary

• Obesity has a distinct psychological profile.

• Targeting these mechanisms using ICT (and similar) leads to a reduction in health-risk behaviours in the lab.

• Repeated ICT may be a useful treatment (or adjunct) – however we await results of RCTs.

• If successful ICT may be a cost-effective treatment, delivered over the internet, minimal face-time required.
Thanks
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