Impact of altering proximity on snack food intake in individuals from high and low socio-economic status

Jennifer Hunter
PhD candidate
Funded by MRC/Sackler
The problem

Information-based interventions to improve diets widen the gap in healthy diets between those in high vs low socio-economic positions (SEP) (McGill et al 2015). This may reflect weaker executive function (EF) associated with lower SEP.

Do interventions that do not rely on EF avoid widening this gap?
Executive function (EF)

- Cognitive processes involved in planning, monitoring, and revising goal-directed behaviour
- 3 key processes:
  1. Response inhibition
  2. Working memory
  3. Set shifting
- We assessed response inhibition since it relates to eating unhealthy food

Evidence that response inhibition modifies the effect of interventions to change unhealthy consumption behaviours (Stautz, Zupan, Field, & Marteau, in prep.)
Executive function (EF)

Diamond A. 2013.
Annu. Rev. Psychol. 64:135–68
Executive function (EF)

- Years spent living in poverty in childhood impacts negatively on EF
- Weaker EF is associated with consumption of fatty foods
- May explain inequalities in diet by SEP
- Need an intervention that benefits populations with lower EF…
Choice architecture

• “Interventions that involve altering the properties or placement of objects or stimuli within micro-environments with the intention of changing health-related behaviour.”

• Environmental cues are thought to non-consciously affect eating
The Proximity Effect

• The closer the food, the more likely it is eaten and the more that is consumed
• Assessed and replicated consistently by 14 studies
• Occurs regardless of context, food preference and craving

Limitations of existing literature:

• Few studies recruit low SEP participants
• Experimental studies often have small samples
• No studies assess EF as a moderator of the proximity effect
Study 1

Objective: To assess whether the proximity effect is found in a general population sample including those from low SEP

Hypotheses:

1. Consumption of a snack food is more likely when it is placed nearer to participants in a general population sample

2. This effect is not moderated by EF
Study 1 Methods

- N=159 participants from high/low SEP (defined using education level)
- “Relaxation and Personality”
- 2 between-subjects conditions:
  1. Bowl near (20cm)
  2. Bowl far (70cm)
- EF assessed with the Stroop task
# Study 1: Table of participant characteristics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Proximal n=79</th>
<th>Distal n=80</th>
<th>All participants N=159</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Mean(SD))</td>
<td>38.8(15.6)</td>
<td>38.0(14.8)</td>
<td>38.4(15.2)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male (%(n))</td>
<td>35.4(28)</td>
<td>37.5(30)</td>
<td>36.5(58)</td>
</tr>
<tr>
<td>Female (%(n))</td>
<td>64.6(51)</td>
<td>62.5(50)</td>
<td>63.5(101)</td>
</tr>
<tr>
<td>BMI (Mean(SD))</td>
<td>24.8(4.8)</td>
<td>24.7(3.8)</td>
<td>24.8(4.3)</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;4 GCSEs (%(n))</td>
<td>17.7(14)</td>
<td>30.0(24)</td>
<td>23.9(38)</td>
</tr>
<tr>
<td>&gt;5 GCSEs/1 A-level (%(n))</td>
<td>15.2(12)</td>
<td>18.8(15)</td>
<td>17.0(27)</td>
</tr>
<tr>
<td>Degree/Diploma (%(n))</td>
<td>48.1(38)</td>
<td>35.0(28)</td>
<td>41.5(66)</td>
</tr>
<tr>
<td>Postgraduate degree (%(n))</td>
<td>19.0(15)</td>
<td>16.3(13)</td>
<td>17.6(28)</td>
</tr>
<tr>
<td>Stroop M(SD)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline reaction time</td>
<td>1844.6(797.9)</td>
<td>1831.1(898.5)</td>
<td>1837.8(847.9)</td>
</tr>
<tr>
<td>Baseline interference score</td>
<td>308.6(310.8)</td>
<td>268.9(291.2)</td>
<td>288.6(300.8)</td>
</tr>
</tbody>
</table>
Study 1 Results

• H1: A higher proportion of participants took proximal snacks ($b=-1.12$, Wald $X^2(1)=7.64$, $p=.006$)

• H2: Did not find an effect of moderation by EF on the proximity effect
Limitation of Study 1

• Did not have adequate statistical power to test H2

Objective of Study 2

• To assess whether the proportion of participants taking snacks at each given food distance is equivalent regardless of high or low EF
• To provide adequate statistical power
Study 2

Methods:
• N=246 Participants from high and low SEP
• “Relaxation and Memory”
• 4 between-subjects conditions:
  1. Bowl near, load received later (20cm)
  2. Bowl near, load received earlier (20cm)
  3. Bowl far, load received later (70cm)
  4. Bowl far, load received earlier (70cm)

• Participants memorised a 7-digit number to induce cognitive load
Study 2 Cognitive load manipulation check

- Participants receiving load showed poorer Stroop performance:

<table>
<thead>
<tr>
<th>Stroop outcome (ms)</th>
<th>No Load (n=122)</th>
<th>Load (n=120)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reaction time (M, SD)</td>
<td>1108.89(387.04)</td>
<td>1252.09(466.00)</td>
<td>.015*</td>
</tr>
<tr>
<td>Interference (M, SD)</td>
<td>184.71(184.19)</td>
<td>233.82(212.97)</td>
<td>.056</td>
</tr>
</tbody>
</table>

- Only for participants receiving load earlier in the session
### Study 2: Table of participant characteristics

<table>
<thead>
<tr>
<th>Variables</th>
<th>Condition</th>
<th>Total (N=246)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Proximal (n=123)</td>
<td>Distal (n=123)</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male (%(n))</td>
<td>41.5 (51)</td>
<td>44.7 (55)</td>
</tr>
<tr>
<td>Female (%(n))</td>
<td>58.5 (72)</td>
<td>54.5 (67)</td>
</tr>
<tr>
<td>Other (%(n))</td>
<td>0.0 (0)</td>
<td>0.8 (1)</td>
</tr>
<tr>
<td><strong>Age M(SD)</strong></td>
<td>35.7 (12.7)</td>
<td>36.8 (13.2)</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;4 GCSEs (%(n))</td>
<td>17.1 (21)</td>
<td>18.7 (23)</td>
</tr>
<tr>
<td>&gt;5 GCSEs/1 A-level (%(n))</td>
<td>25.2 (31)</td>
<td>26.0 (32)</td>
</tr>
<tr>
<td>Degree/diploma (%(n))</td>
<td>31.7 (39)</td>
<td>32.5 (40)</td>
</tr>
<tr>
<td>Post-graduate degree (%(n))</td>
<td>26.0 (32)</td>
<td>22.8 (28)</td>
</tr>
<tr>
<td><strong>Stroop M (SD)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline reaction time</td>
<td>1659.8 (743.8)</td>
<td>1607.9 (651.0)</td>
</tr>
<tr>
<td>Baseline Interference score</td>
<td>288.4 (270.2)</td>
<td>266.9 (220.9)</td>
</tr>
</tbody>
</table>

*Note: The table presents the distribution of participant characteristics across different conditions.*
Study 2 results

- **H1**: A higher proportion of participants took proximal snacks ($R^2 = -.82$, $p = .004$)

- **H2**: Proportions of participants taking snacks were the same regardless of cognitive load status
Discussion

• Studies 1 & 2 replicated the proximity effect in a general population sample including low SEP participants
• Study 2 suggests that the proximity effect is unlikely to be moderated by EF

Limitations of Studies 1 & 2

• Provided only one food option
• This option was unhealthy (chocolate M&Ms)
Study 3

• Can the proximity effect be used to discourage intake of unhealthy food when a healthy food is either at the same distance or nearer to the participant?

Objective of Study 3

• To provide two snack-food options, one healthy and one unhealthy
• To place these options at different distances relative to each other and the participant
Study 3

- Will create a basis from which we can consider how a proximity intervention would impact intake of healthy and unhealthy foods at population-level and whether it avoids increasing diet inequalities.
Thank you

Acknowledgments:
Medical Research Council
Raymond and Beverly Sackler fund
Theresa Marteau
Gareth Hollands
Dominique Laurent-Couturier
BHRU team