Product Bundling as a Behavioral Nudge: Investigating Consumer Fruit & Vegetable Selection Using Dual-Self Theory

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Motivation

Obesity

- 68% of U.S. adults with BMIs of 25+ (CDC, 2013)

Fruit and Vegetable (F&V) Consumption:

- Linked to prevention of detrimental health issues
- 22% of adults self-report consuming vegetables less than once/day (CDC, 2013)
Mental Strain

- Restricts ability to self-regulate decision making
  - More likely to select an unhealthier food option (Shiv & Fedorikhin, 1999)

- Leads to a ‘dual-self’ different decisions made when under mental strain vs its absence (Fudenberg & Levine, 2006; Mukherjee, 2010)
  - Mental strain (cognitive load) directly impacts behavior (Kahneman, 2002; 2011)

- Park et al. (1989) grocery store shoppers in particular can find shopping mentally stressful
Possible Solution

Product Bundling

- Consumers may prefer bundled products over individually priced options (Harris & Blair, 2006)
  - Reduces in-store search efforts
  - Requires less information processing
  - May be perceived value from the bundle itself, regardless of a price discount
Objectives

• Explore whether shopping under mental strain influences one’s decision to purchase unhealthy foods

• Test whether product bundling can serve as an in-store behavioral intervention to both increase selection of healthful fruit and vegetable (F&V) items and lessen shoppers’ mental effort, as well as whether bundles need offer a price discount

We use a richer product set than previous studies (canned, fresh and frozen F&V items), as well as bundled products
Hypotheses

- H1: Product bundles will nudge consumers to select a greater proportion of F&V items, compared to selections made in the absence of bundles.

- H2: If product bundling reduces shoppers’ mental strain (due to less information processing), then a greater # of bundles will be selected when shopping under mental strain compared to shopping without.

- H3: If H1 holds, product bundling can serve as a behavioral intervention to increase F&V choice (provided the bundle(s) contain primarily F&V items).
Field Studies: Framed Field Experiments

287 shoppers in Dane County, WI (Study 1)

66 shoppers in Chicago, IL (Study 2)
Food Items: Study 1

- Grocery display with 30 different items displayed
  - Each appropriately sized for $1 retail pricing

- Items evenly split into 3 groups:
  1) F&V items (canned, frozen and fresh)
  2) Non F&V meal items
  3) Junk food snack items

Each group featured same proportion of perishable/frozen items
Design: Study 1

- Participants randomly assigned to a treatment upon arrival
  - Given set $10 budget to use

<table>
<thead>
<tr>
<th>TABLE 1. Selection Treatments</th>
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</thead>
<tbody>
<tr>
<td>Treatment</td>
</tr>
<tr>
<td>-----------</td>
</tr>
<tr>
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<td>3</td>
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<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
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<tr>
<td>6</td>
</tr>
</tbody>
</table>
Premade Product Bundles

- 5 for $5.00 Bundle
- 5 for $5.00 Bundle
- 5 for $5.00 Bundle
- 5 for $5.00 Bundle
- 5 for $5.00 Bundle
- 5 for $5.00 Bundle
- 5 for $5.00 Bundle
- 5 for $5.00 Bundle
Presence of bundles mattered as a framing effect, although price (discount) effects also influenced choice.
Raises questions concerning the usefulness of in-store price discounts when mentally taxed consumers must shop on a fixed budget.

NOTE: Differences between * and * (p=0.127); + and * not statistically significant.
Differences between Mental Strain Conditions

- Bundles-No Discount:
  - 78.7% of mentally strained consumers selected at least 1 bundle, compared to 47.1% in the without mental strain condition (1.5% more F&V items)

- Bundles-Discounted:
  - mentally strained consumers selected 8.2% more junk food snack items ($p=0.09$)
Results: Study 1

- The most frequently selected product bundles consisted of 2 fresh produce and 1 frozen vegetable item each.

- Clear preference ranking for F&V ‘form’
  - Fresh, frozen and canned items were preferred, respectively
Conclusions

- Results suggest preassembled product bundles (consisting primarily of F&V items) could potentially increase retail F&V sales
  - More research needed on practical implication of premade bundles in a large-scale retail setting

- Bundles need not necessarily offer a price discount
  - May perceive greater value from just the effort-saving convenience that accompanies bundle selection

- In-store price discounts may not effectively reach mentally strained consumers shopping on a fixed budget
Thank you

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MANIPULATING THE SENSORY VARIETY OF FRUITS AND VEGETABLES TO INCREASE THEIR INTAKE

Maya Vadiveloo, PhD RD
Food Choice Matters!

- Obesity-related diseases are leading causes of preventable morbidity and mortality

- >25% of deaths from CVD could be prevented through lifestyle changes, public health efforts, and medical care

- Lifestyle factors, including increased consumption of fruits and vegetables can markedly improve metabolic health, weight control, and reduce chronic disease risk.

Rolls BJ. Nestle Nutrition Institute workshop series. 2012
Why don’t Americans eat Fruits and Vegetables?

- Fewer than 1 in 10 Americans consume the 2 cups of fruit and 2.5 cups of vegetables recommended per day

- Factors that affect F&V intake:
  - Cost
  - Availability
  - Preferences

Nicklas TA et al. J Acad Nutr Diet. 2013
Can food preferences be manipulated?

- Food preferences can be influenced by psychological mechanisms that can be manipulated:

  - Can dietary variety be used to manipulate food preferences as well?

  ![Diagram showing food preferences manipulation](image)

Food variety can increase consumption!

Sensory-Specific Satiety:
the decrease desire for a particular food due to its consumption while appetite for uneaten foods remains high

Epstein LH et al. Psychological review. 2009;
Variety in healthy foods is inversely associated with multiple markers of body fatness in US adults.
Variety in healthy foods is favorably associated with metabolic health parameters in US adults
Could more subtle forms of variety affect food intake?

- Children eat more mac & cheese w/2 vs. 1 shape
- Intake of M&Ms increases with more colors
- Does greater sensory variety in healthful foods increase intake of those foods?

Daily servings of beans was increased among urban adults who used more seasoning ingredients.

*\( p < 0.05 \); Adjusted for age, sex, area, case/control, rice (for bean intake), income, smoking, physical activity, energy, and BMI

*\( p < 0.05 \); Adjusted for age, sex, area, case/control, rice (for bean intake), income, smoking, physical activity, energy, and BMI

Manipulating perceptions of dietary variety may improve intake of healthful foods.

Vadiveloo M et al. 2016 Under Review Nutrition Research
Primary Research Question
Does variety in shape, color, or both affect intake, liking, and purchase intentions for fruits and vegetables?

Secondary Research Question
Does priming individuals to think about similarities and differences affect these measures?
Recruitment

- Participants recruited via:
  - Posted flyers
  - Listservs
  - Craigslist
  - Active RA recruitment

Researchers at the Harvard T.H. Chan School of Public Health are conducting consumer research on attitudes & preferences for locally grown produce. English-speaking adults ages 18-65 with no fruit and vegetable allergies are eligible to participate. Participation is voluntary. Participants will receive $10 & a snack of fresh fruits and vegetables for their time. If interested please email localproducestudy@gmail.com
# Experimental Design

<table>
<thead>
<tr>
<th></th>
<th>Positive Prime (Thought listing protocol: how foods differ)</th>
<th>Negative Prime (Thought listing protocol: how foods are similar)</th>
<th>Control (Sentence scramble)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Shape variety</strong></td>
<td><img src="image1.png" alt="Images" /></td>
<td><img src="image2.png" alt="Images" /></td>
<td><img src="image3.png" alt="Images" /></td>
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<tr>
<td>(2 shapes)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>Color variety</strong></td>
<td><img src="image4.png" alt="Images" /></td>
<td><img src="image5.png" alt="Images" /></td>
<td><img src="image6.png" alt="Images" /></td>
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<tr>
<td>(2 colors)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>Shape + color</strong></td>
<td><img src="image7.png" alt="Images" /></td>
<td><img src="image8.png" alt="Images" /></td>
<td><img src="image9.png" alt="Images" /></td>
</tr>
<tr>
<td>(2 colors + 2 shapes)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>No variety</strong></td>
<td><img src="image10.png" alt="Images" /></td>
<td><img src="image11.png" alt="Images" /></td>
<td><img src="image12.png" alt="Images" /></td>
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<tr>
<td>(1 color, 1 shape)</td>
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</table>
## Reduced Treatment Categories

<table>
<thead>
<tr>
<th></th>
<th>Positive Prime (Thought listing protocol: how foods differ)</th>
<th>Negative Prime (Thought listing protocol: how foods are similar)</th>
<th>Control (Sentence scramble)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Shape variety</strong></td>
<td><img src="image1" alt="Red bell pepper" /></td>
<td><img src="image2" alt="Red bell pepper" /></td>
<td><img src="image3" alt="Red bell pepper" /></td>
</tr>
<tr>
<td>(2 shapes)</td>
<td><img src="image4" alt="Cut red bell pepper" /></td>
<td><img src="image5" alt="Cut red bell pepper" /></td>
<td><img src="image6" alt="Cut red bell pepper" /></td>
</tr>
<tr>
<td><strong>Shape + color</strong></td>
<td><img src="image7" alt="Red and yellow bell pepper" /></td>
<td><img src="image8" alt="Red and yellow bell pepper" /></td>
<td><img src="image9" alt="Red and yellow bell pepper" /></td>
</tr>
<tr>
<td>(2 colors+ 2 shapes)</td>
<td><img src="image10" alt="Cut red and yellow bell pepper" /></td>
<td><img src="image11" alt="Cut red and yellow bell pepper" /></td>
<td><img src="image12" alt="Cut red and yellow bell pepper" /></td>
</tr>
<tr>
<td><strong>Color variety</strong></td>
<td><img src="image13" alt="Red and yellow bell pepper" /></td>
<td><img src="image14" alt="Red and yellow bell pepper" /></td>
<td><img src="image15" alt="Red and yellow bell pepper" /></td>
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<tr>
<td>(2 colors)</td>
<td><img src="image16" alt="Cut red and yellow bell pepper" /></td>
<td><img src="image17" alt="Cut red and yellow bell pepper" /></td>
<td><img src="image18" alt="Cut red and yellow bell pepper" /></td>
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<tr>
<td><strong>No variety</strong></td>
<td><img src="image19" alt="Red bell pepper" /></td>
<td><img src="image20" alt="Red bell pepper" /></td>
<td><img src="image21" alt="Red bell pepper" /></td>
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<tr>
<td>(1 color, 1 shape)</td>
<td><img src="image22" alt="Cut red bell pepper" /></td>
<td><img src="image23" alt="Cut red bell pepper" /></td>
<td><img src="image24" alt="Cut red bell pepper" /></td>
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</tbody>
</table>
# Study Procedure

| Before       | • Participants randomized to 1 of 12 possible conditions (3 x 4 design)  
|             | • RAs cut and weigh a standardized portion of pears and peppers ahead of time |
| Phase 1     | • Participant is brought to an individual table and completes a priming exercise  
|             | • Participants complete demographic questionnaire on iPads using Qualtrics |
| Phase 2     | • RA brings first food (peppers or pears) and instructs participant to continue Qualtrics survey. Participant is instructed to raise hand when finished.  
|             | • Participant receives second food and completes remainder of survey |
| After       | • Participant is debriefed about study purpose  
|             | • RAs weigh remainder |
Survey Content

- Demographic Characteristics
- Usual fruit and vegetable intake
- Multiple measures of liking (7-point Likert Scales):
  - Quality, taste, flavor
- Multiple measures of willingness to purchase
- Fruit and vegetable budget
- Hunger and fullness
Statistical Analysis

- **MANOVA/MANCOVA**
  - 2 intake variables (pear and pepper)
  - 2 liking variables (pear and pepper)
  - 2 willingness to purchase variables (pear and pepper)

- Tested for differences in effect by:
  - Age and Sex
  - Prime
  - Fruit and vegetable budget

- Conducted “Floodlight” analysis for significant interactions

- Adjusted for multiple comparisons
# Descriptive Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Control N=40</th>
<th>Shape + Combo N=84</th>
<th>Color N=40</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td>34.2 (12.7)</td>
<td>35.2 (14.7)</td>
<td>34.7 (12.2)</td>
</tr>
<tr>
<td><strong>Female (%)</strong></td>
<td>35.0</td>
<td>27.4</td>
<td>37.5</td>
</tr>
<tr>
<td><strong>Body Mass Index</strong></td>
<td>24.0 (5.35)</td>
<td>24.8 (5.33)</td>
<td>24.0 (4.79)</td>
</tr>
<tr>
<td>≥ College Grad (%)</td>
<td>70.0</td>
<td>70.2</td>
<td>77.5</td>
</tr>
<tr>
<td><strong>Fruit and Vegetable Intake</strong></td>
<td>4.21 (4.33)</td>
<td>4.23 (3.29)</td>
<td>3.16 (2.99)</td>
</tr>
</tbody>
</table>

No significant differences by treatment groups
No general effect of variety or prime for intake, liking or purchase intentions

<table>
<thead>
<tr>
<th></th>
<th>Treatment Category</th>
<th>Priming Condition</th>
<th>Treatment and Priming Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pepper Intake</td>
<td>P=0.09</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Pear Intake</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Overall Significance</td>
<td>P=0.27</td>
<td>P=0.49</td>
<td>P=0.75</td>
</tr>
<tr>
<td>Pepper Liking</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Pear Liking</td>
<td>P=0.08</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Overall Significance</td>
<td>P=0.11</td>
<td>p=0.47</td>
<td>P=0.19</td>
</tr>
<tr>
<td>Pepper Purchase Intentions</td>
<td>P=0.07</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Pear Purchase Intentions</td>
<td>NS</td>
<td>NS</td>
<td>P=0.02</td>
</tr>
<tr>
<td>Overall Significance</td>
<td>P=0.11</td>
<td>P=0.44</td>
<td>P=0.10</td>
</tr>
</tbody>
</table>
Adults 41+ ate more peppers with a variety of colors

- Variety influenced intake for some ages (p=0.04)
  - Floodlight analysis showed adults ≥41 y responded to the variety manipulation for pepper intake; no effect for pear intake

Pepper Intake by Variety Conditions & Age Groups

- Control
- Shape/Combo Variety
- Color Variety

- <41 y
- ≥41 y

<table>
<thead>
<tr>
<th>Condition</th>
<th>&lt;41 y</th>
<th>≥41 y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>2.22</td>
<td>3.87</td>
</tr>
<tr>
<td>Shape/Combo Variety</td>
<td>2.04</td>
<td>2.23</td>
</tr>
<tr>
<td>Color Variety</td>
<td>1.93</td>
<td>b</td>
</tr>
</tbody>
</table>
Variety Increased Pear Liking

- Controlling for intake, variety assoc. with ↑pear liking (p=0.03)

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<thead>
<tr>
<th>Treatment</th>
<th>Liking</th>
<th>a</th>
<th>b</th>
<th>ab</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>4.96</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shape/Combo Variety</td>
<td>5.58</td>
<td>b</td>
<td></td>
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<tr>
<td>Color Variety</td>
<td>5.45</td>
<td></td>
<td></td>
<td>ab</td>
</tr>
</tbody>
</table>
People with larger FV budgets are less likely to buy varied vegetables

- Purchase intentions across variety conditions differed by FV budget (p=0.0008)
  - Liking variables also related to purchase intentions

- Post-hoc analysis showed effect for peppers only:
## Strengths and Limitations

<table>
<thead>
<tr>
<th>Limitations</th>
<th>Strengths</th>
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<tbody>
<tr>
<td>Challenges with recruitment/study power</td>
<td>Protocol was piloted</td>
</tr>
<tr>
<td>Subtleness of manipulations</td>
<td>Convenience sample of community adults</td>
</tr>
<tr>
<td>Fruit and vegetable selected</td>
<td>Measurement of multiple variables related to FV intake</td>
</tr>
</tbody>
</table>
Conclusions

- Sensory variety may have *limited* influence on the intake, liking and purchase of F&V
- Color variety may promote vegetable intake in adults 40+
- Shape/color variety may promote liking of fruits
- Variety may be more likely to influence purchase among those spending less on FV
Research Implications

- Benefits of using more or less variety may vary across:
  - Different types and preparations of fruits or vegetables
  - Age
  - FV budgets

- Offering a variety of F&V may be more effective than manipulating sensory variety to increase intake, liking, and purchase intentions
Thank You!

Questions?

Co-Investigators:
Josiemer Mattei (postdoctoral mentor)
Christina Roberto
Vicki Morwitz

Research Assistants:
Ludovica Principato (RA supervisor and collaborator)
Alvin Chan
Leo Brown
Ngoan Tran Le
Layonne De Sousa Carvalho
Cameron Speyer
Martha Tamez

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References