Cognitive Load and Neuro-Economics: Implications for Food Consumption and Health

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SNEB 2016

Introductions

- No Alisha
- George
- Elena
- You
  - Practitioners
  - EFNEP
  - SNAP-Ed
  - Researchers

Objectives

- The goal of this session is to provide you with:
  - foundational knowledge in cognitive load and neuroeconomics to help you develop more effective programming (and evaluation methods); and
  - skills to help you apply them to your nutrition education programs and research agenda

Outline:

I. Setting the Stage (Elena)

II. Cognitive Load (George)
  - Cognitive Resources and The Dual Systems/Dual Objectives
  - Framework Implications for Food Choices

III. Group Discussion of Your Program in This Context (Elena)

IV. Some Other Examples (Elena)

V. Neuroeconomics and Behavioral Economics (George)

VI. Applying Neuroeconomics and Behavioral Economics concepts to your Program and Research (Elena)

I. Introduction

- As nutrition education practitioners and researchers, our main goals are to:
  - improve food consumption of populations we work with
  - effectively evaluate the impact of our program and research activities
- This is clearly challenging given our national food landscape and lifestyle
  - America's culture of "busy"

Socio-Ecological Model

- We know there are various factors and layers that may influence or shape food consumption behaviors
- Policy, Systems, and Environmental (PSE) factors

Food Consumption Decisions

- Additionally, each day each person may be confronted with up to **200-related food and beverage-related decisions**, many unknowingly or 'mindless' (making a number of assumptions)
  - Decisions in this context considered conscious and sub-conscious
  - Purchase, prepare, serve, eat, give away, throw away, clean up, store
  - Eating behaviors, such as choice` of particular food or beverage, timing, location, distractions, start and end of eating, volume, number of chews/bites
  - Higher number of decisions for individuals with higher BMIs
- And yet, **food is not the only thing we make decisions about**

Ref: Wansink B, J Sobal, 2007

Decision Fatigue

- **Decision fatigue** has been shown to negatively impact food and health choices
- But … it is not always considered or addressed within nutrition education or evaluation

Cognitive Load and Neuroeconomics

- **Cognitive load** is determined by how much attention, focus, and concentration a decision requires.
- **Neuroeconomics** is a relatively new field of economics that combines methods and theories from neuroscience, psychology, economics, and computer science to better understand the process of decision-making and the resulting choices.
- *Cognitive load and neuroeconomics offer **new frameworks** for understanding food (and health) related decisions, as well as strategies to support positive changes, and potentially more robust evaluation.*

II. Cognitive Resources and Dual Systems

(Standard) Cognitive load – The total amount of mental effort being used in working memory in an instructional context (Sweller 1984).

(General) Cognitive load – The weight or demands on executive control systems in the brain associated with any activity. The muscle analogy (Muraven and Baumister 2000).
- Muscle memory
- Muscle strength requires repetitions, load, and success to become stronger

Key Concepts

• Cognitive resources at any given point in time are limited and can be depleted.

• Cognitive resources must be allocated to different tasks (*cognitive resource allocation model*) (Alonso, Brocas, Carillo 2014; Kool and Botvinick 2014)

• Dual Systems Processing (e.g., Evans 1984; Kahneman 2011)

(i) *System 1* - uses a fast, reflexive, automatic, and perhaps 'mindless' process that operates heuristically and expends little cognitive resources.

(ii) *System 2* - uses a slow, reflective, analytical, and deliberate process that expends many cognitive resources.

What types of food or evaluation decisions fall into each system?

- System 1
  - Ex: candy bowl on your desk
  - Others?

- System 2
  - Ex: comparing food labels for two different products
  - Others?

Dual Objectives for Food, Nutrition, and Health

Foods are consumed for **hedonic *and* health (utilitarian) reasons**. (Antonides and Cramer 2013; Shiv and Fedorikhin 1999; Sullivan et al. 2015)


Three Major Implications of the Cognitive Resource Allocation Model

1. Cognitive effort is minimized implying a preference for system 1 (e.g., Kool, et al. 2010, 2014).

2. Resource depletion contributes to system 1 use (e.g., Pocheptsova, et al. 2009).
  - As your cognitive budget goes down, you are more likely to choose system 1 types of decisions

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3. Hedonic decisions are associated with system 1, long-term and health-related decisions are associated with system 2 (e.g., Antonides and Cramer, 2013; Shiv and Fedorikhin, 1999).

Figure 10.1 Dual Systems - Dual Objective Schematic of Food Choice
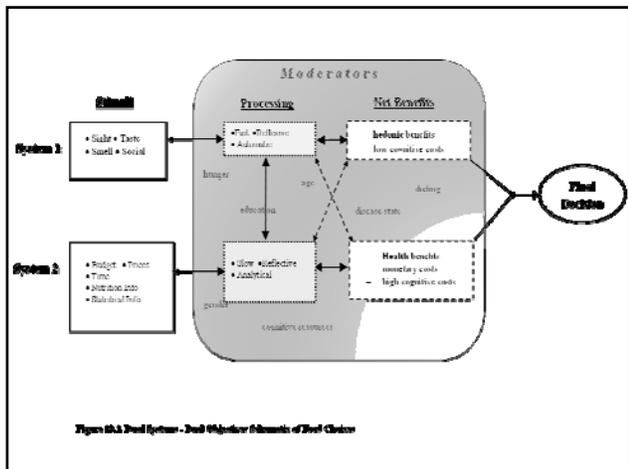
III. YOUR PROGRAM IN THIS CONTEXT

Introduce yourself, your position/job duties, and your target population, whether your focus is on program and/or research, to others at your table or group. Now consider one program or research study you work on. Using the worksheet as a guide, discuss with your other group members the following questions:

- What are the benefits you are aiming for? What benefits have you found to date? What are challenges your participants face in achieving the net benefits?
- What stimuli are you addressing?
- What type of processing is required as part of your program?
- Can you consider some tweaks or changes to your program that would help reduce cognitive load?

IV. SOME OTHER EXAMPLES

-You are attending a working meeting with your colleagues and are offered a box lunch with the signature salad selections to the left?
-Which one would you choose?

Slide 1

-You are super hungry.
-You have $20 cash.
-You can choose whatever you want, including side choice.
-What would you choose? Why?

Slide 2

-You are super hungry.
-But you only have $7.50 in cash and no credit card.
-What would you choose? Why?

Slide 3

-You are super hungry.
-But you only have $7.50 in cash and no credit card.
- You are also trying to manage your portion size and calories, so want to limit your main item and side choice to a total of 600 calories.
-What would you choose? Why?

Slide 4

-You are super hungry. Your childcare provider calls and asks you to pick something up for your child.
-But you only have $12.00 in cash and no credit card.
-What would you choose? Why?

Screaming Kid!!!!!!
Consider other atmospheric effects like people around you, loud annoying music, etc. and how they might influence your processing?

WORKING, LIMITED RESOURCE, SINGLE MOM

- You have three kids, two in elementary school and one in middle school
- Each are involved in different after school activities
- You don't own a super reliable car. You work with other parents to carpool your kids to different activities, which are all at different times
- You are the sole financial provider and caregiver for your kids
- Your parents live in the area, but are growing older, one has been diagnosed with heart disease
- You finished high school and then began working at a retailer near your apartment. You don't have much extra money, you do not earn a living wage
- You are often tired
- You did not learn to cook and given your schedule, you prefer to eat out.
- Using the concept of the cognitive resource allocation model, why would eating out be the preferred choice?

WEIGHT MANAGEMENT TECHNIQUES

- Evidence-based strategies for weight management highlight the following approaches:
  - Pre-plan/package portion sizes, meals, and snacks
  - Establish similar routines, such as the same breakfast every day
  - Eat at home
  - Reduce exposure to 'high-risk' situations, such as buffets
  - Self-monitoring/checklists

  How do these strategies relate to cognitive load?

- Depending on the weight loss approach utilized, long-term weight loss maintenance may range from $2 - 20\%$ among individuals. Why?

CURRICULUM TO LOWER SUGAR INTAKE

- TEACHER AS THE EXPERT
- GENERAL NUTRITION EDUCATION
  - Program objective: General nutrition education, in addition to lowering sugar intake
  - Uniform program

- LEARNER-CENTERED AS THE EXPERT
- FOCUSED INTERVENTION
  - Program objective: Lower added sugar intake
  - Educator guides the group in discussing foods and beverages that are high in sugars and participants do several hands-on experiences and activities over the course of the program
  - Personalized, repetitive, allows for success – building that muscle

Which would be more effective for participants, based on the cognitive resource allocation model? Which one requires cognitive load on the instructor?

EVALUATION

- Which family record requires more 'processing' for the participant?
- Which requires more 'processing' for the program administrator?

(Townsend, et al, JNEB, 2014)

EVALUATION

Table 1. A Comparison of 2 Nutrition Education Evaluation Models (Current and Proposed): Guiding Principles, Content, Text, Message, and Perceptions

(Townsend, et al, JNEB, 2014)

OTHER

- Individuals must balance many conflicting messages that may cause tension to their cognitive load
  - Example 1: An overweight individual starts a new healthy eating regimen after attending a wonderful evidence-based nutrition education program without changes to his/her environmental settings, sectors of influence, and social and cultural norms and values. His/her socio-ecology may support unhealthy eating, but he/she is trying to eat better.
    - Exactly why PSEs are important

WHY IS COGNITIVE LOAD SO APPLICABLE TO LOW-INCOME AUDIENCES?

POVERTY IS A COGNITIVE TAX

(Mullainathan & Shafir, 2013)

V. NEURO ECONOMICS - BEHAVIORAL ECONOMICS AS ORGANIZATIONAL CATEGORIES IN DUAL SYSTEMS

Behavioral economics is the field of economics that studies the interaction of the choice environment attributes with individuals' psychological attributes or tendencies and the resulting choices.

A *behavioral effect* is a systematic and repeatable tendency toward a choice alternative resulting from the interaction of a choice environment attribute with a psychological attribute.

Four Behavioral Economic Effects Relevant for Food Choices

1. *Environmental cue effect* is a tendency to increase or decrease consumption in response to an environmental cue

- Most Wansink "mindless" type effects (System 1 processing)

- Examples: proximity of food, odor, serving size, noise, music, lighting, socialization

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Smarter Lunchrooms Movement

Cornell Center for Behavioral Economics in Child Nutrition Programs

Smarter Lunchroom Best Practice Evaluation & Implementation Guide

	Objective A Increasing the number of Students that select Fruit	Objective B Increasing the number of Students that select Vegetables	Objective C Increasing the number of Students that select White Milk	Objective D Increasing the number of Students that select Targeted Entrée	Objective E Increasing the number of Students that select Reimbursable Meals
A	Display Fruit on all lunch lines in 2 locations. 1 location should be near the register[1].	Give Vegetables creative/descriptive names and display names next to or with Vegetables on the line	Place White Milk first in the lunchroom coolers, in front of sugar added beverages.	Make the Entrée with the greatest nutrient density the first or most prominent in the lunch line.	Place components of RM at snack window[3]. Add an RM "grab and go"[4] bag to the window.
on Items B	Display whole Fruit in a bowl or basket instead of a	Display the age targeted creative/descriptive names on posters or	Place White Milk in every cooler in	Give the Entrée an age targeted creative/descriptive name and display it	Move all "competitive snack foods" (chips, cookies, etc) behind the serving counter in

2. Default effect - the tendency to accept the option made available, even when some apparently more preferable alternative is available

- Weak vs Strong Defaults (System 1 processing)

- Example: Combo meal with side of fries vs side of apple slices

3. Ambiguity effect is the tendency for individuals to choose options where the probability of a favorable outcome (e.g., taste) is known over an option where the probability of the favorable outcome is unknown

- System 2 processing required)

- Ex: future effects of an healthy unsavory meal; role of taste preference

4. Decision fatigue effect is the tendency for the quality or consistency of decisions to erode as more decisions have to be made (e.g., multiple decisions or temptations). In other words, there is a finite store of mental energy for exerting self-control or "willpower."

- System 2 processing result

- Ex: Eating when traveling with many unknowns; Being extremely tired; single, limited resource, mother example; weight management strategies

Think about the program you used earlier today.

Which of these choice architecture effects do you target within your program?

Which others could you consider adding?

What stimuli may be more effective than others?

BEHAVIORAL ECONOMICS

Contexts to Consider

- How do these frameworks apply and help provide insight into food and health-related decisions among the following populations?
- How should health education programs be developed and implemented to take these issues into consideration?
  - Low-Literacy
  - Children
  - Single-headed households
  - Aging audiences

Contexts to Consider

- How might emotions, personality style, etc. affect cognitive load and decision-making?
- How might mindfulness affect system 1 versus 2 processing?

Conclusions

- The neuro-economic model helps us understand food and health-related decisions with a new lens

Reference and Disclosure?

This presentation is based on Chapters 9 and 10 in our book.

(Oxford University Press, 2016)

FOOD &
NUTRITION
ECONOMICS