Research Talk

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AI Nudging and Decision Quality: Evidence from Randomized Experiments in Online Recommendation Setting

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Motivation

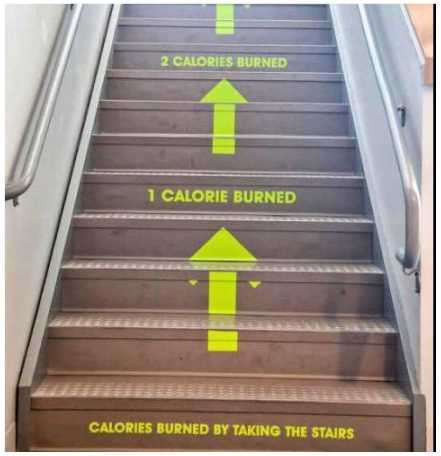
- Amazon's Choice is an AI nudge on E-commerce platform

- It has become controversial and drawn public concerns since 2019

- More than 10 social medias published articles questioning this:
  - *"Amazon's Choice" Does Not Necessarily Mean A Product Is Good* (BuzzFeed, Jun 2019)
  - *"Amazon's Choice" Isn't the Endorsement It Appears (*WSJ, Dec 2019)
  - *What Does "Amazon's Choice" Actually Mean?* (Reader's Digest, Apr 2021)
  - *Amazon Puts Its Own "Brands" First* (The Markup, Oct 2021)
  - *Amazon copied products and rigged search results to promote its own brands, documents show* (Reuters, Oct 2021)

Nudge

- Nudge: a choice architecture (Thaler and Sunstein 2009)
  - Alters individual's behavior in a predictable way
  - Preserves all the available options
  - Keep the same economic incentives



Nudge people to use stairs (anchoring and reminding)

The Decoy Effect:

Introduction of a third option into the choice set that helps to "nudge" customers toward selecting a particular product by making one option look better than the others.

Large: $7.99

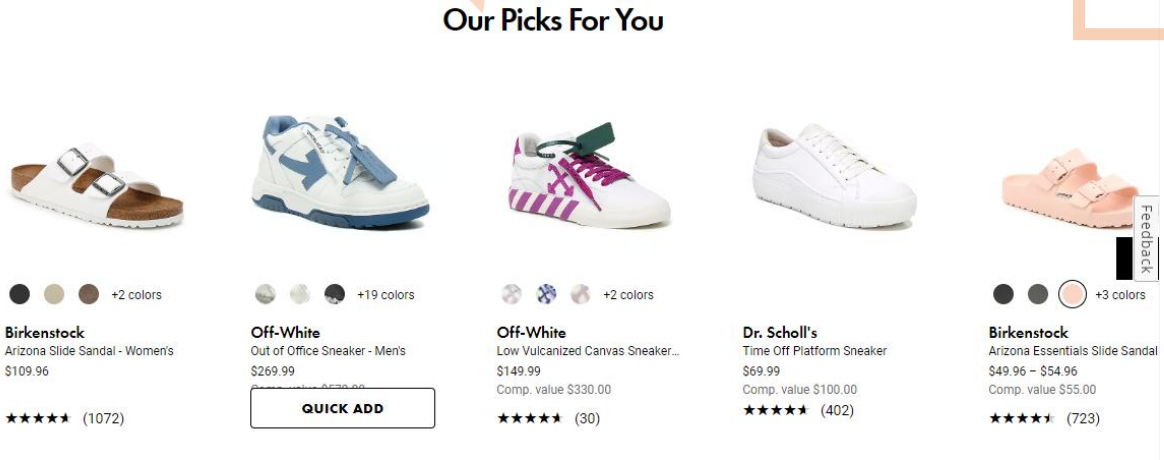
Medium: $6.99

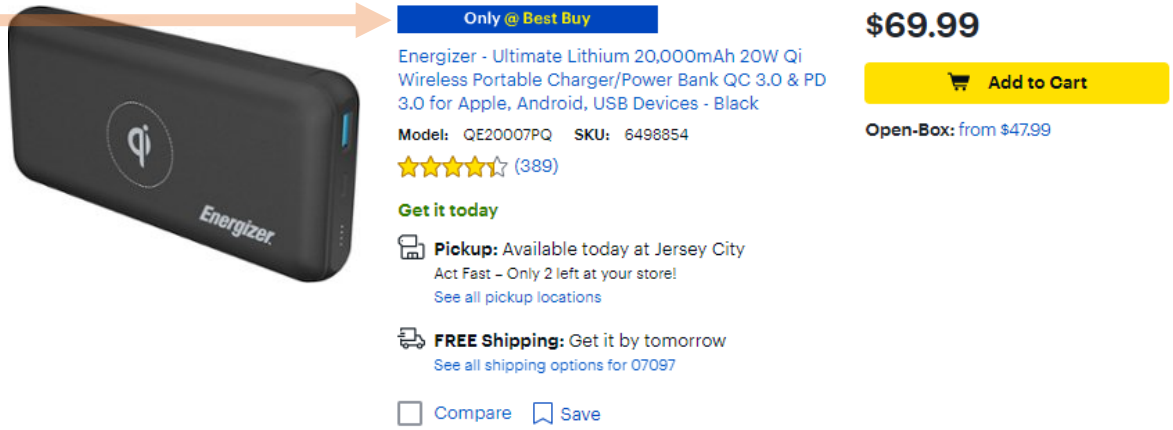
Small: $3.99

Nudging -> Digital Nudging -> AI Nudging

- *"Amazon's Choice"* is a **recommendation badge** relying on **nudging technique**.
- **Digital nudge**: UI elements used to guide user's behavior (Schneider et al. 2018; Weinmann et al. 2016).
- **Algorithmic nudge** (Möhlmann 2021)
- **AI-nudge**: human outsource the generation and placement of digital nudges to "black box" AI algorithms (Wagner 2021).

- “Best Seller” on Amazon.com
- “Amazon Choice” on Amazon.com
- “Our Picks For You” on Dsw.com
- “Best Delivery” on Yelp.com
- “Top pick” on Bestbuy.com
- “Only @Best Buy” on Bestbuy.com
- …





Two Types of Recommendation Badges

AI-nudge is generated and implemented by AI/ML algorithms. (e.g., *Amazon's Choice*)	*Non-AI nudge* is generated with specific rules and traceable attributes. (e.g., *Best Seller*)
• Inner workings are NOT fully transparent OR explainable; consumers don't know the features driving the placement of the badge. • can be adjusted in real-time • placement is unpredictable	• Inner workings are fully explainable; consumers can fully understand the generation process and trace the information source. • can be adjusted in real-time • the placement is predictable

Research Questions

- Transparency of recommendation badges (AI vs. Non-AI nudge) → Decision quality

- What is the impact of recommendation dissonance (preference match vs. preference mismatch) on the relationship between Badge Recommendation Transparency and Decision Quality?

Theoretical Background

- **Cognitive Theory**
  - Dual Process/System Theory (Kahneman 2011).
  - Heuristics (Kahneman 2011)
  - Cognitive Bias (Haselton et al. 2015).

- **Nudging** (Benartzi 2017)

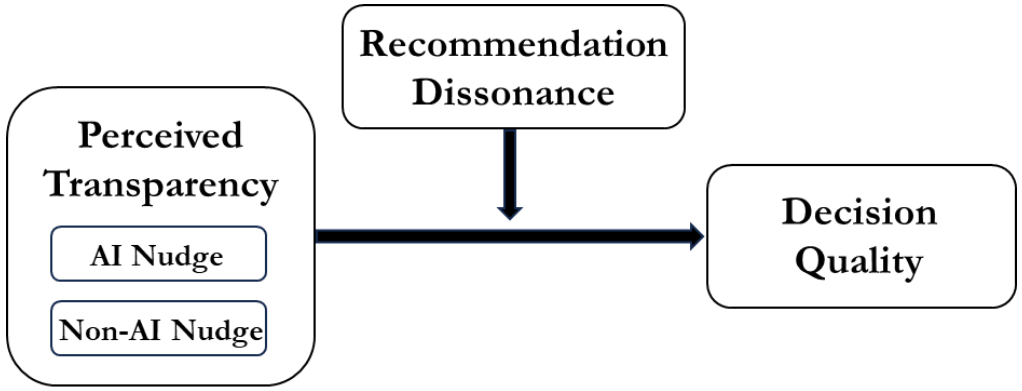
- **Recommendation Agent/Systems in IS literature** (Chau et al. 2013; Adomavicius et al. 2013, 2018, 2019; Xiao and Benbasat 2018; Wang and Wang 2019).

- **AI-nudging Characteristics**
  - Nudging Transparency (Hansen and Jespersen 2013)
  - Explainable AI (Bauer et al. 2023)

Research Model and Hypotheses

H1:
Perceived transparency of the nudging recommendation in the choice architecture is positively related to the choice confidence of user decision.

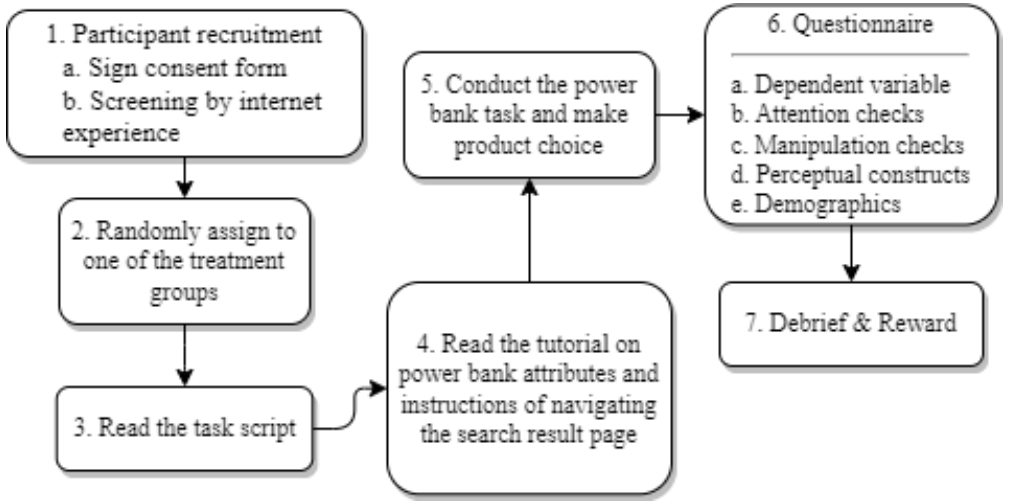
H2:
The effect of perceived transparency on the user's choice confidence in the decision will be contingent upon recommendation dissonance (preference match vs. preference mismatch). Such an effect will be stronger for the preference match condition.



Research Method

- 2x 2 between-subject randomized experiments with survey instrument (837 participants)
  - Type of badge: AI nudge and non-AI nudge
  - Recommendation dissonance: preference mismatch and preference match
- Two pretests to explore users' perceptions of badge transparency and difficulty of tasks.

Website	Scenario	Condition	1st Product	2nd Product	3rd Product	4th product	5th product	6th product
1	Scenario1	xxx's Choice + Mismatch	BSYYO	Baseus	QTshine	nrgGo	Ekrist	INIU
2	Scenario1	xxx's Choice + Mismatch	nrgGo	Baseus	INIU	Ekrist	QTshine	BSYYO
3	Scenario1	xxx's Choice + Mismatch	QTshine	BSYYO	Ekrist	Baseus	nrgGo	INIU
4	Scenario2	xxx's Choice + Match	nrgGo	Baseus	Ekrist	QTshine	INIU	BSYYO
5	Scenario2	xxx's Choice + Match	QTshine	BSYYO	nrgGo	Ekrist	INIU	Baseus
6	Scenario2	xxx's Choice + Match	BSYYO	QTshine	Ekrist	nrgGo	INIU	Baseus
7	Scenario3	Best Seller+ Mismatch	INIU	BSYYO	nrgGo	Baseus	Ekrist	QTshine
8	Scenario3	Best Seller+ Mismatch	Baseus	BSYYO	Ekrist	nrgGo	QTshine	INIU
9	Scenario3	Best Seller+ Mismatch	QTshine	Baseus	BSYYO	Ekrist	INIU	nrgGo
10	Scenario4	Best Seller+ Match	INIU	BSYYO	QTshine	Ekrist	Baseus	nrgGo
11	Scenario4	Best Seller+ Match	QTshine	INIU	Ekrist	Baseus	nrgGo	BSYYO
12	Scenario4	Best Seller+ Match	Baseus	nrgGo	QTshine	INIU	BSYYO	Ekrist



Instruments

- Survey constructs
  - Decision quality: product choice and choice confidence
  - Perception of badge transparency: perceived transparency
  - Perception of product homogeneity: brand familiarity
  - Controls: web experience, demographics

- Treatments
  - Recommendation dissonance
  - Badge type

Manipulation Checks

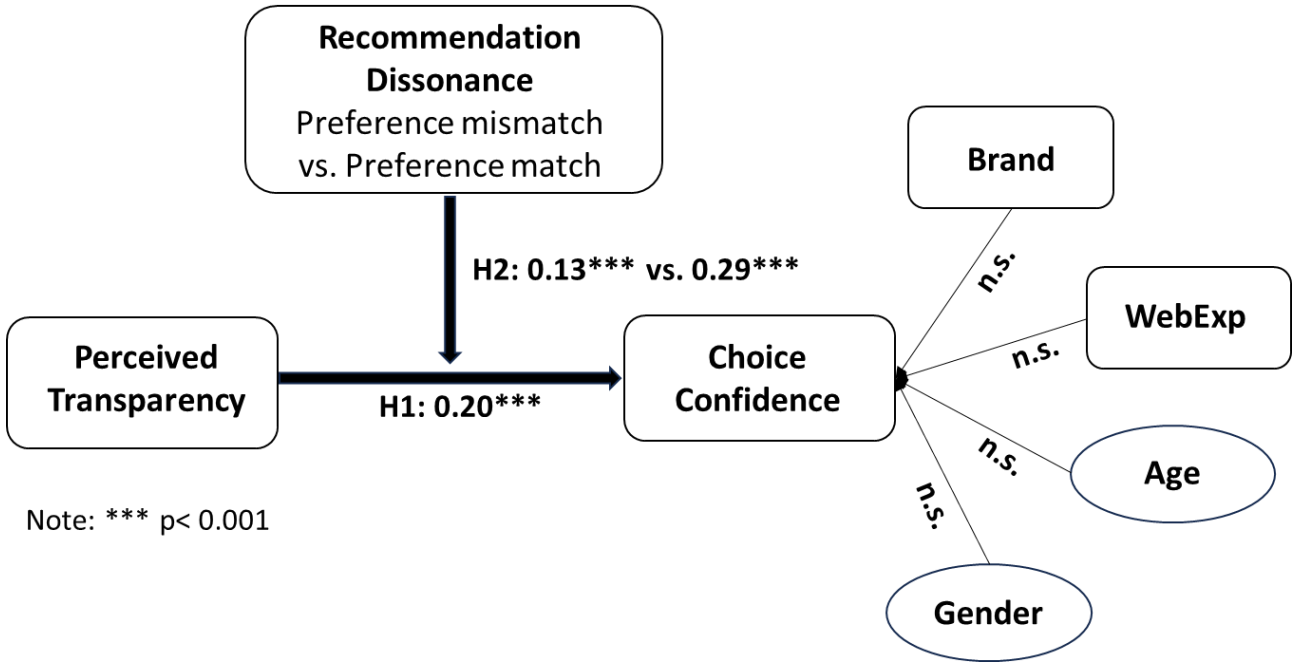
- *Perceived Transparency*
  - in the *non-AI nudge* condition is higher than in the *AI nudge* condition (M = 5.078 vs. 4.738, F (1, 835) = 13.647, p < 0.01)
  - participants perceived higher transparency with non-AI nudge (Best Seller) than that with the AI nudge (xxx's Choice).

- *Brand Familiarity*
  - shows NO significant difference between *AI nudge* and *non-AI nudge* (M = 2.176 vs. 2.046, F (1, 835) = 1.710, p = 0.191)
  - Shows NO significant difference between *preference match* and *preference mismatch* (M = 2.114 vs. 2.105, F (1, 835) = 0.008, p = 0.927)

- Self-reported awareness of *preference mismatch* between recommendation and task description (mean = 4.81, S.D. = 1.55).

Results

- *Main effect: Perceived Transparency → Choice Confidence*
  - Significantly positive effect (β = 0.2, p < .001)
  - Improve transparency in digital nudging helps improve user choice confidence



Results

- *Moderation effect* of *recommendation dissonance*
  - Multi-group SEM Analysis (Evanschitzky and Wunderlich 2006)
  - The effect of *perceived transparency* is significantly stronger in *preference match* group than in *preference mismatch* group (β_match = 0.29 and $\beta\_mismatch$ = 0.13, p < .05)
  - For users facing recommendations not matching their preferences, the direct impact is weaker.

Recommendation dissonance	Recommendation dissonance		$\chi 2$	$\Delta\chi 2(df = 1)$
	Preference mismatch	Preference match		
Perceived transparency --> Choice confidence	0.13***	0.29***	155.842	5.4**

Significance: ** p < 0.05, *** p < 0.01.

Table 1 Results of Multi-group Analysis

Discussions

- The main effect confirms our hypothesis developed based on the Explainable AI literature and Cognitive Theory
  - It partially aligns with the findings in Wang and Wang (2019):

    Sponsorship Disclosure -> RA Transparency -> Perceived RA Integrity

- The moderation effect shows an interesting finding that Recommendation Dissonance (i.e., deficient recommendation) can weaken the positive impact of transparency on decision quality in the digital nudging context (AI nudge vs. Non-AI nudge).

Wang, W., & Wang, M. (2019). Effects of sponsorship disclosure on perceived integrity of biased recommendation agents: Psychological contract violation and knowledge-based trust perspectives. *Information Systems Research*, *30*(2), 507-522.

Theoretical Implication

- Theoretically, the findings contribute to these literature
  - Nudging literature: the risks and side effects of “black-box” AI nudging
  - Recommendation agent/systems research in IS: the negative impact of deficient recommendations (i.e., preference mismatch)
  - Explainable AI literature: emphasizes on the necessity of making AI nudges algorithmically transparent and explainable; while also points out that transparency is not a universal key to solving all problems (e.g., moderation effect of deficient recommendation).

Practical Implications

- Practically, this study shows
  - Ethical implications to the use of AI nudging
  - Importance of educating users the mechanism behind AI/ML recommendation
  - Call for large-scale tech companies to follow Federal Trade Commission (FTC) guidelines on disclosure and endorsement
  - Developers should focus on minimizing recommendation deficiency (i.e., preference mismatch)

Q&A

Thank you!