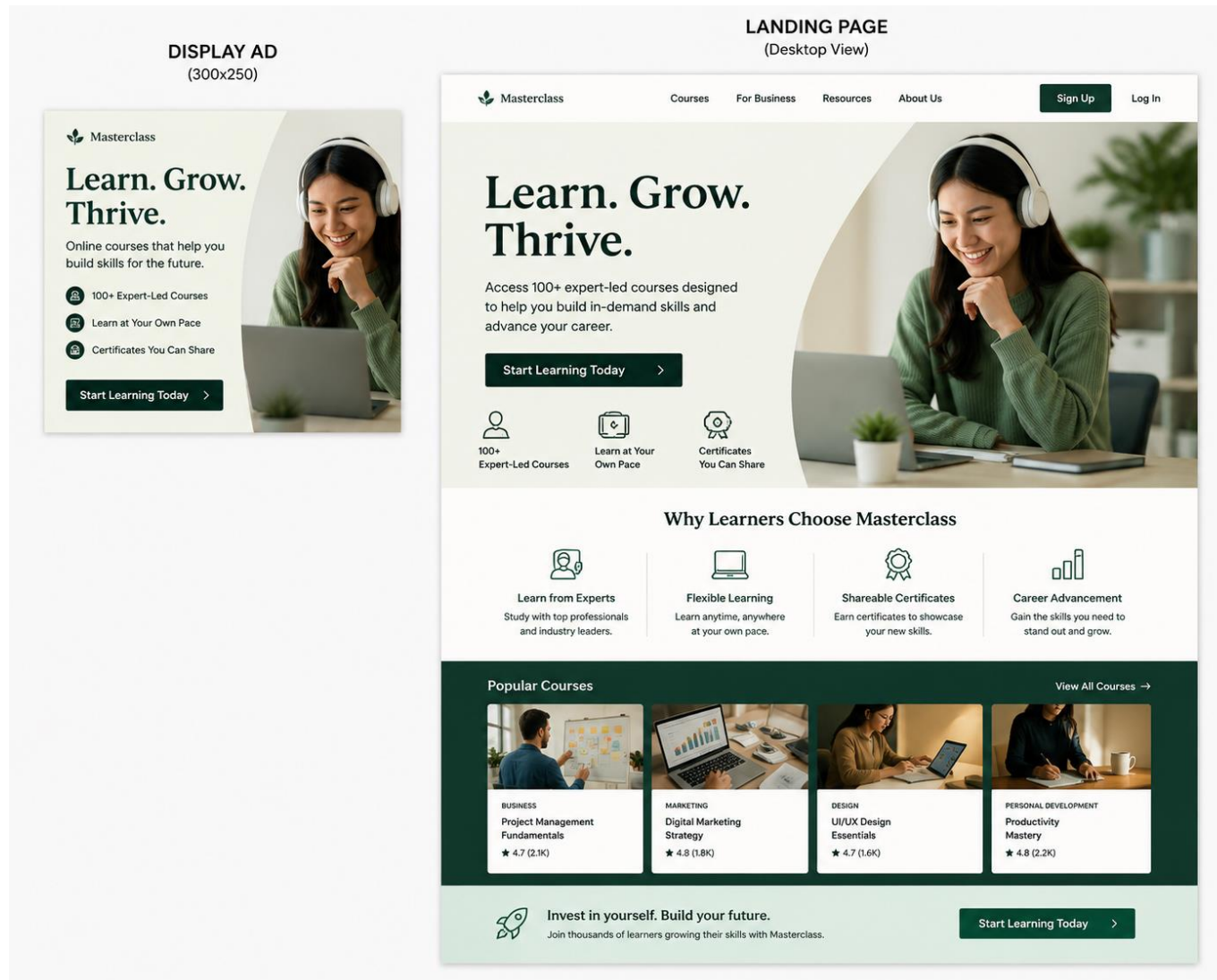


MSI Webinar:
When to Repeat Versus Rotate Ad
Content: Theory and Experimental
Evidence

Kirthi Kalyanam
Santa Clara University
Yewon Kim
Stanford GSB

ChatGPT Says Display Ad Content Should Match Landing Page Content—Message Match Principle



Kirthi: So in general Display ad content should match landing page content?

ChatGPT: Yes—almost always. In digital advertising, one of the most important principles is called **message match**: the landing page should feel like a natural continuation of the display ad the user clicked. Marketing practitioners often consider it one of the strongest drivers of conversion performance.

Our Finding: Not Always, and These Are Meaty Opportunities

DISPLAY AD
(300x250)



LANDING PAGE
(Desktop View)



Kirthi: So in general Display ad content should match landing page content?

ChatGPT: Yes—almost always. In digital advertising, one of the most important principles is called **message match**: the landing page should feel like a natural continuation of the display ad the user clicked. Marketing practitioners often consider it one of the strongest drivers of conversion performance.

Theoretical Model

Utility

$$u_{i(g,r)j} = u(q_{ij}, d_{ij})$$

$$= \underbrace{\delta(d_{ijs})}_{=\delta(d_{ij}) \in [0,1]} \cdot q_{ij} - p_j + \epsilon_{ij} = \left(\frac{1}{1 + \delta_0} \right)^{d_{ij}} \cdot \underbrace{(v_{ij} + h_{ij})}_{=q_{ij}} - p_j + \epsilon_{ij}$$

Stage 0: Priors

$$q_{ij0} \sim N(\tilde{q}_{ij0}, \sigma_{iq0}^2)$$

$$d_{ij0} \sim \text{Exponential}(\lambda_{d0}), \quad \tilde{d}_{ij0} = E[d_{ij0}] = \frac{1}{\lambda_{d0}}$$

$$\lambda_{d0} \sim \Gamma(\alpha_{d0}, \beta_{d0}).$$

Stage 1: Web Ad
Click Decision

$$\tau_q \sim N(\tilde{\tau}_q, \sigma_\tau^2) \text{ and } \tau_d \sim \text{Exponential}(\lambda_\tau).$$

Stage 2: Landing
Page Ad
Engagement
Decision

$$\tilde{q}_{ijs} = E[q_{ijs} | \tau_{qs}] = \frac{1/\sigma_{iqs-1}^2}{1/\sigma_{iqs-1}^2 + 1/\sigma_\tau^2} \tilde{q}_{ijs-1} + \frac{1/\sigma_\tau^2}{1/\sigma_{iqs-1}^2 + 1/\sigma_\tau^2} \tau_q$$

$$\sigma_{iqs}^2 = \text{Var}(q_{ijs} | \tau_{qs}) = \frac{1}{1/\sigma_{iqs-1}^2 + 1/\sigma_\tau^2}$$

$$\tilde{d}_{ijs} = E[d_{ijs} | \tau_{ds}] = \frac{1}{\tilde{\lambda}_{ds}}, \quad \tilde{\lambda}_{ds} = E[\lambda_{ds} | \tau_{ds}] = \frac{\alpha_{ds-1} + 1}{\beta_{ds-1} + \tau_d}$$

- Customer Awareness Can be high or Low
- Customer can be navigating, matching or learning
- Content Types: Vertical Quality, Horizontal Quality or Availability

Mechanisms: Navigation, Selection, Learning

- **Navigation:** Ads are used as a navigation shortcut to the company. If this is the primary mechanism, content effect appears only in the ad click decision, ad content types do not matter, as long as they do no violence to navigation, and content effects (any) do not appear in the engagement decision.
- **Selection:** If advertising is *selecting* like minded customers, then matching (**repeating**) the landing page ad content type to the web ad content type will be more effective.
- **Learning:** The *learning* mechanism would suggest that not matching (**rotating**) the content will be more effective
 - Customers are learning in low awareness situations

The B2B Setting: Clicking on Web Ads Lead to Landing Pages (which also have Ads)

Product:	Inventory Available - 32 kHz Low Power TCXO	
Solution:	• ± 5 ppm, 1 μA supply current, 1.2 mm package • Samples ship in 24 hours • Most volume orders ship within 48 hours • Never stop your line – available now at sitime.com/buy	
	Download Datasheet	

(a) Display Ad (Transactional)

Product:	World's Broadest Line of Timing Solutions 32 kHz Low Power TCXO	
Solution:	• ± 5 ppm, 1 μA supply current, 1.2 mm package • Samples ship in 24 hours • Most volume orders ship within 48 hours • Never stop your line – available now at sitime.com/buy	
	Download Datasheet	

(b) Display Ad (Horizontal)

We only
manipulate
headlines!

Company name

SOLUTIONS PRODUCTS SUPPORT COMPANY INVESTORS

Q SEARCH

Product name

[Request Samples](#) [Contact Sales](#)

Datasheet

[Buy Now on
Company name](#)

Part Number Generator

  PCB Symbols, Footprint & 3D Model

1 to 110 MHz, Low Power Oscillator

Product name

 is a programmable oscillator, featuring wide frequency range, low power consumption, small size, excellent stability and short lead times for consumer, networking, industrial and other applications. Continuous 1.8 V to 3.3 V supply voltage enables inventory consolidation and qualification of a single device configuration.
Program oscillators to get instant samples, optimized performance, and fast prototyping | [Learn More](#)
View related products: 115 to 137 MHz | SOT23-5 package | -40 to +125°C | <1 ps phase jitter | XO lineup

Specs

Features

Applications

Freq. Test Reports

Quality Docs

IBIS Models

Tools

Resources

Landing
Page Ad

(a) Landing page ad (Transaction)

Company name

SOLUTIONS PRODUCTS SUPPORT COMPANY INVESTORS

Q SEARCH

Product name

[Request Samples](#) [Contact Sales](#)

Datasheet

[Buy Now on
Company name](#)

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Specs

Features

Applications

Freq. Test Reports

Quality Docs

IBIS Models

Tools

Resources

Landing
Page Ad

(b) Landing page ad (Quality: Vertical)

Three Types of Content: Transactional, Horizontal Quality, Vertical Quality

Transactional Headline

Product:	Inventory Available - 32 kHz Low Power TCXO	Company logo
Solution:	• ± 5 ppm, 1 μA supply current, 1.2 mm package • Samples ship in 24 hours • Most volume orders ship within 48 hours • Never stop your line – available now at sitime.com/buy	
	Download Datasheet	

(a) Display Ad (Transactional)

Horizontal Quality Headline

Product:	World's Broadest Line of Timing Solutions 32 kHz Low Power TCXO	Company logo
Solution:	• ± 5 ppm, 1 μA supply current, 1.2 mm package • Samples ship in 24 hours • Most volume orders ship within 48 hours • Never stop your line – available now at sitime.com/buy	
	Download Datasheet	

(b) Display Ad (Horizontal)

Company name

SOLUTIONS PRODUCTS SUPPORT COMPANY INVESTORS

Q SEARCH

Product name

Request Samples Contact Sales

Datasheet

Buy Now on Company name

Part Number Generator

  PCB Symbols, Footprint & 3D Model

1 to 110 MHz, Low Power Oscillator

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Landing Page Ad

Specs

Features

Applications

Freq. Test Reports

Quality Docs

IBIS Models

Tools

Resources

(a) Landing page ad (Transaction)

Company name

SOLUTIONS PRODUCTS SUPPORT COMPANY INVESTORS

Q SEARCH

Product name

Request Samples Contact Sales

Datasheet

Buy Now on Company name

Part Number Generator

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Landing Page Ad

Specs

Features

Applications

Freq. Test Reports

Quality Docs

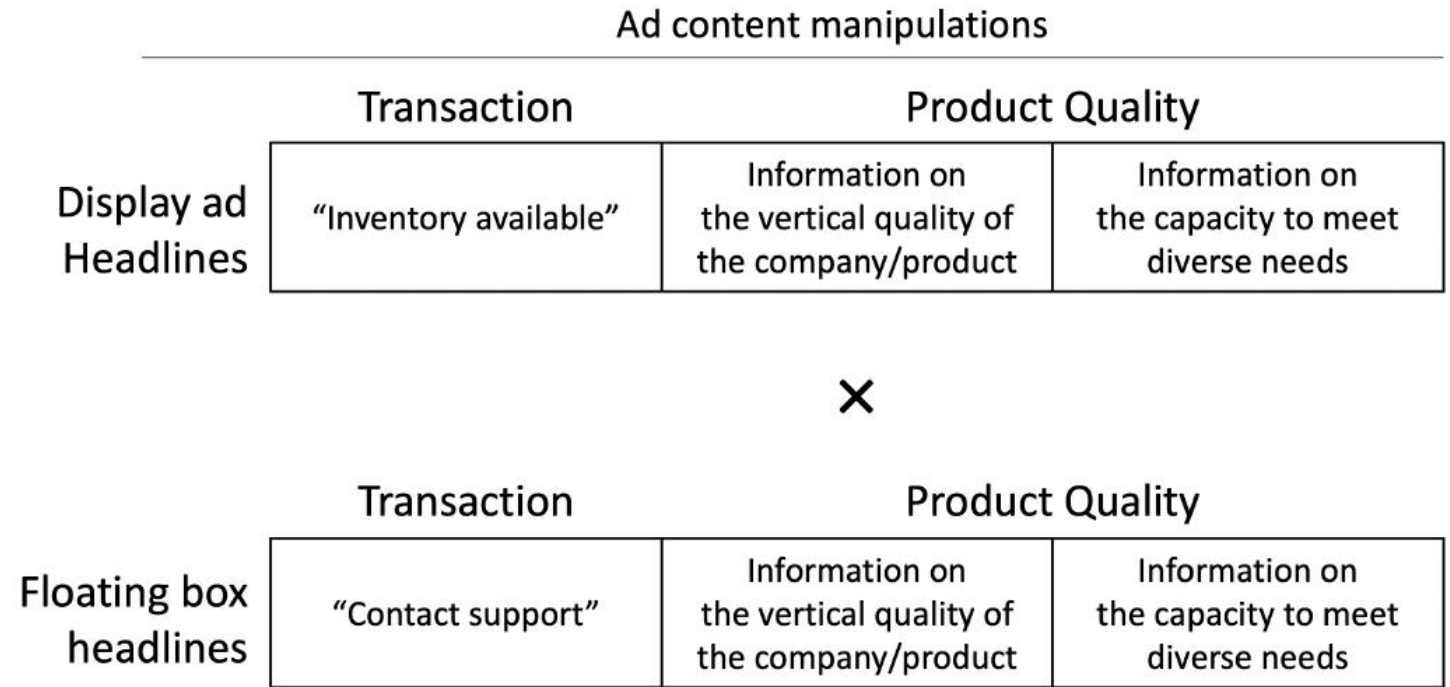
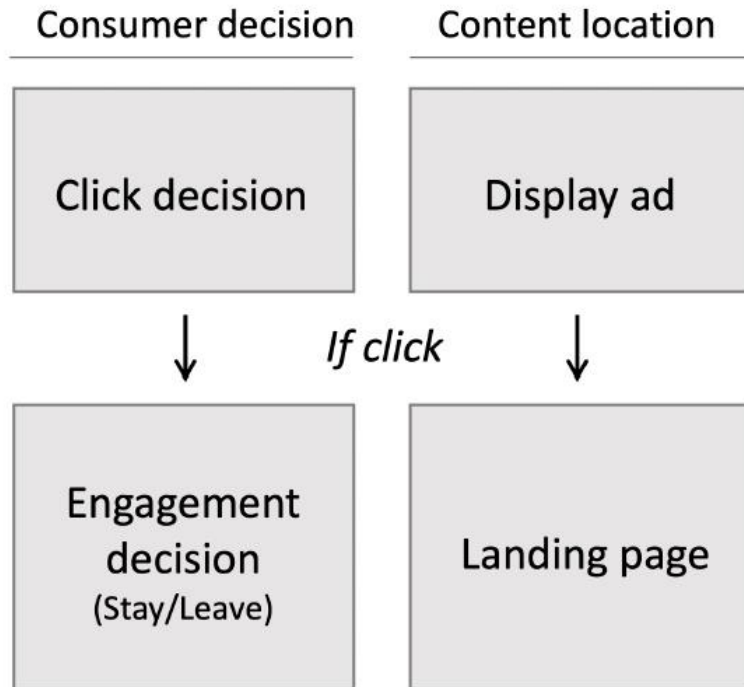
IBIS Models

Tools

Resources

(b) Landing page ad (Quality: Vertical)

Field Experiment Overview



Pre Experimental Data on Products and Markets

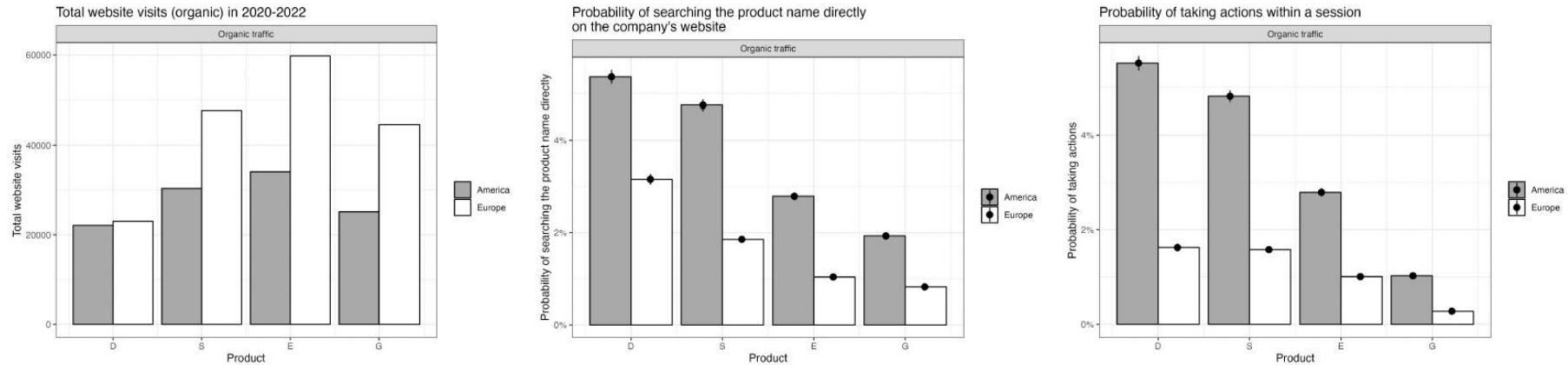
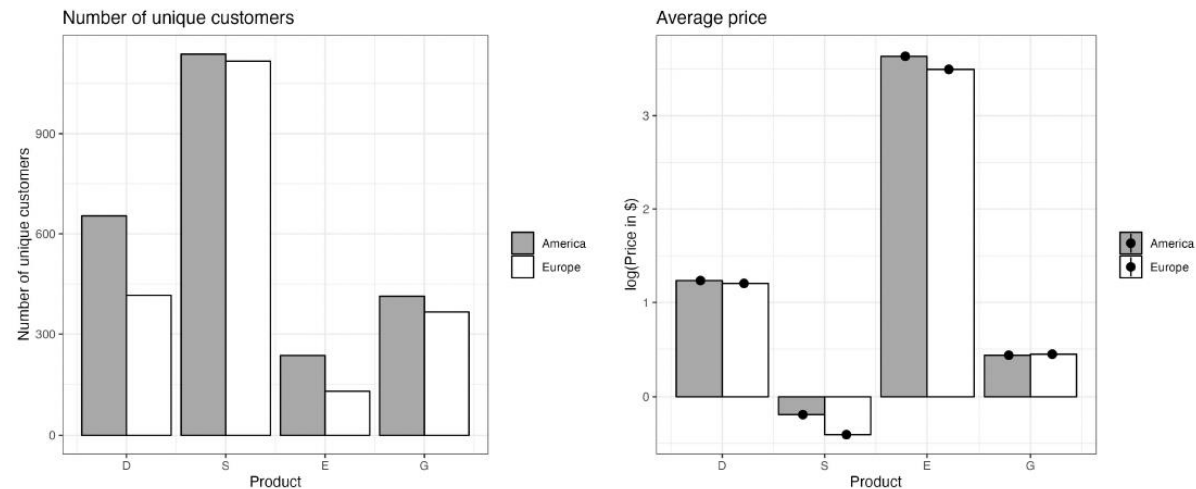


Figure 4: Pre-experiment organic traffic data across products and regions



The Impact of Ad Content on CTR: Aggregate Results (Not Significant!) but Market Type Effects Are!

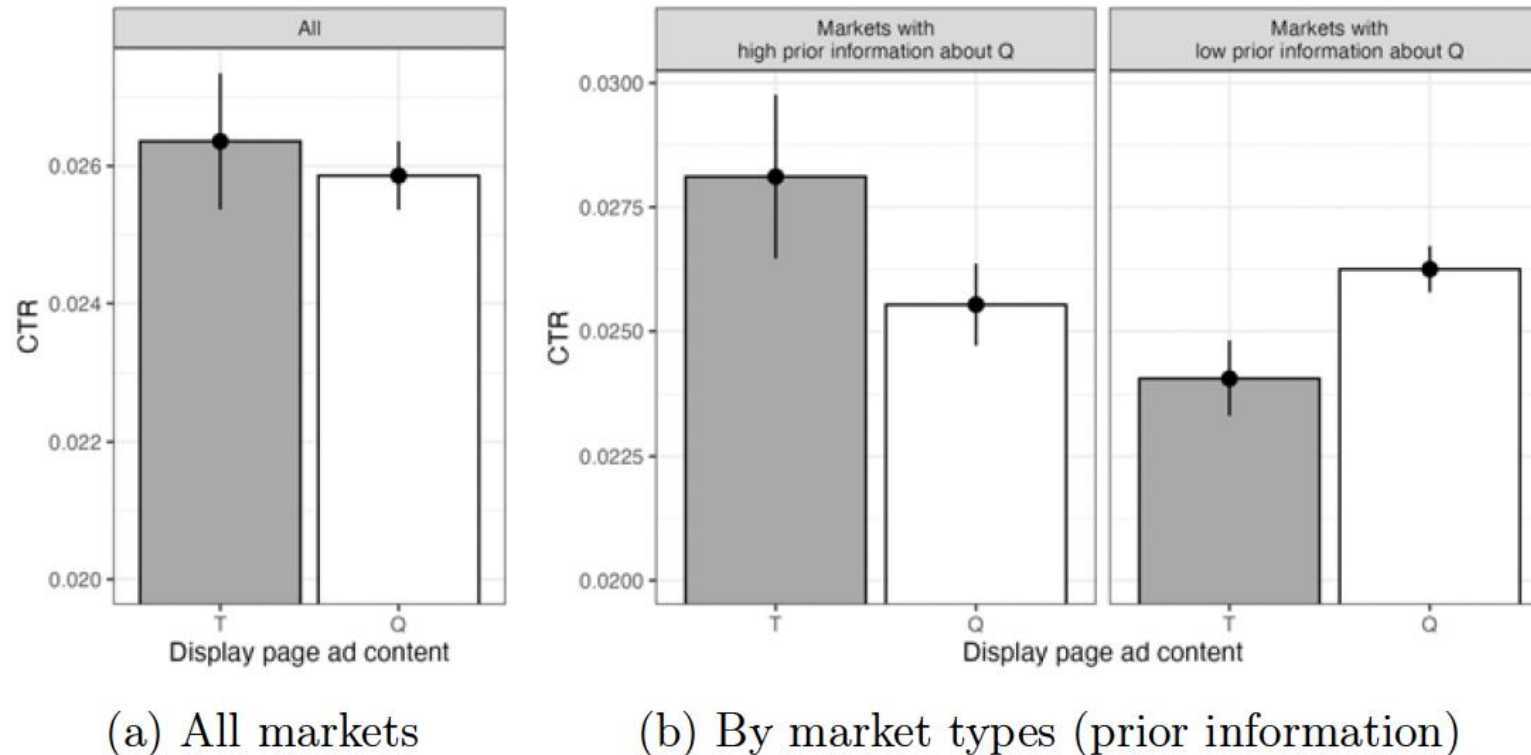
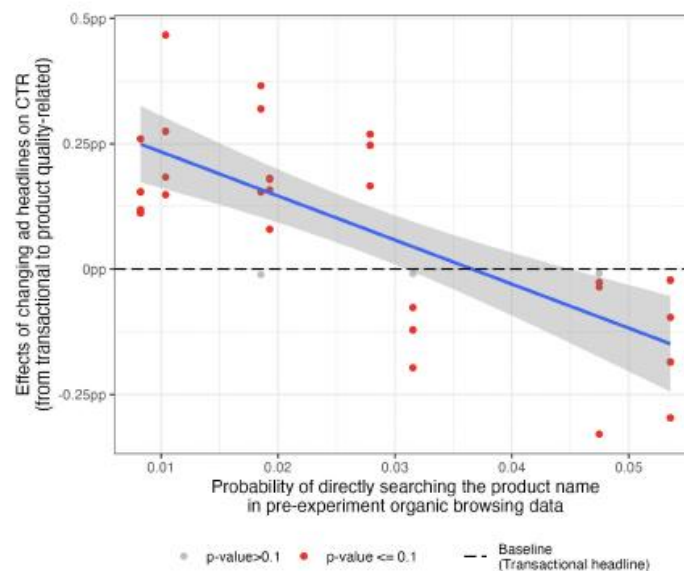
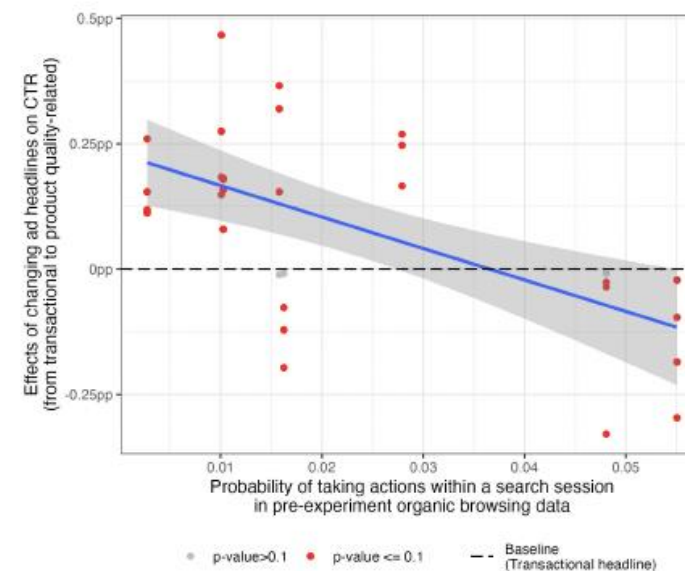


Figure 6: Effect of Display Ad Headlines on CTR

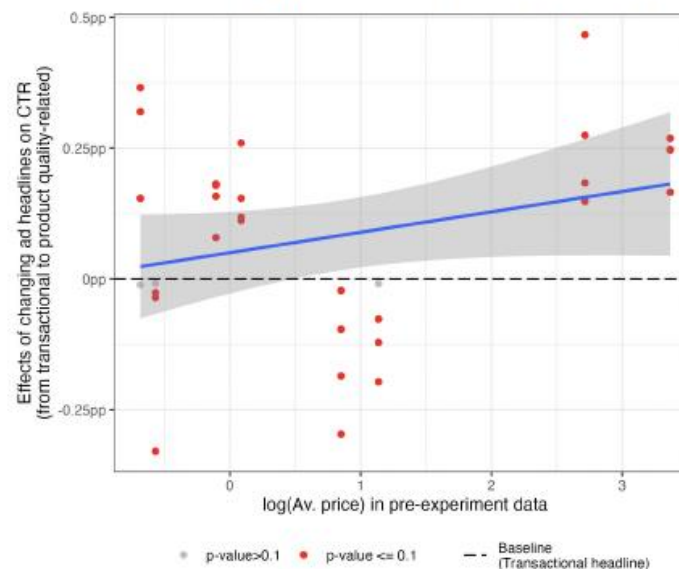
CTR Results for Display Ads: Discrete Heterogeneity



(a) Pre-experiment direct searches (I_1)



(b) Pre-experiment action rates (I_2)

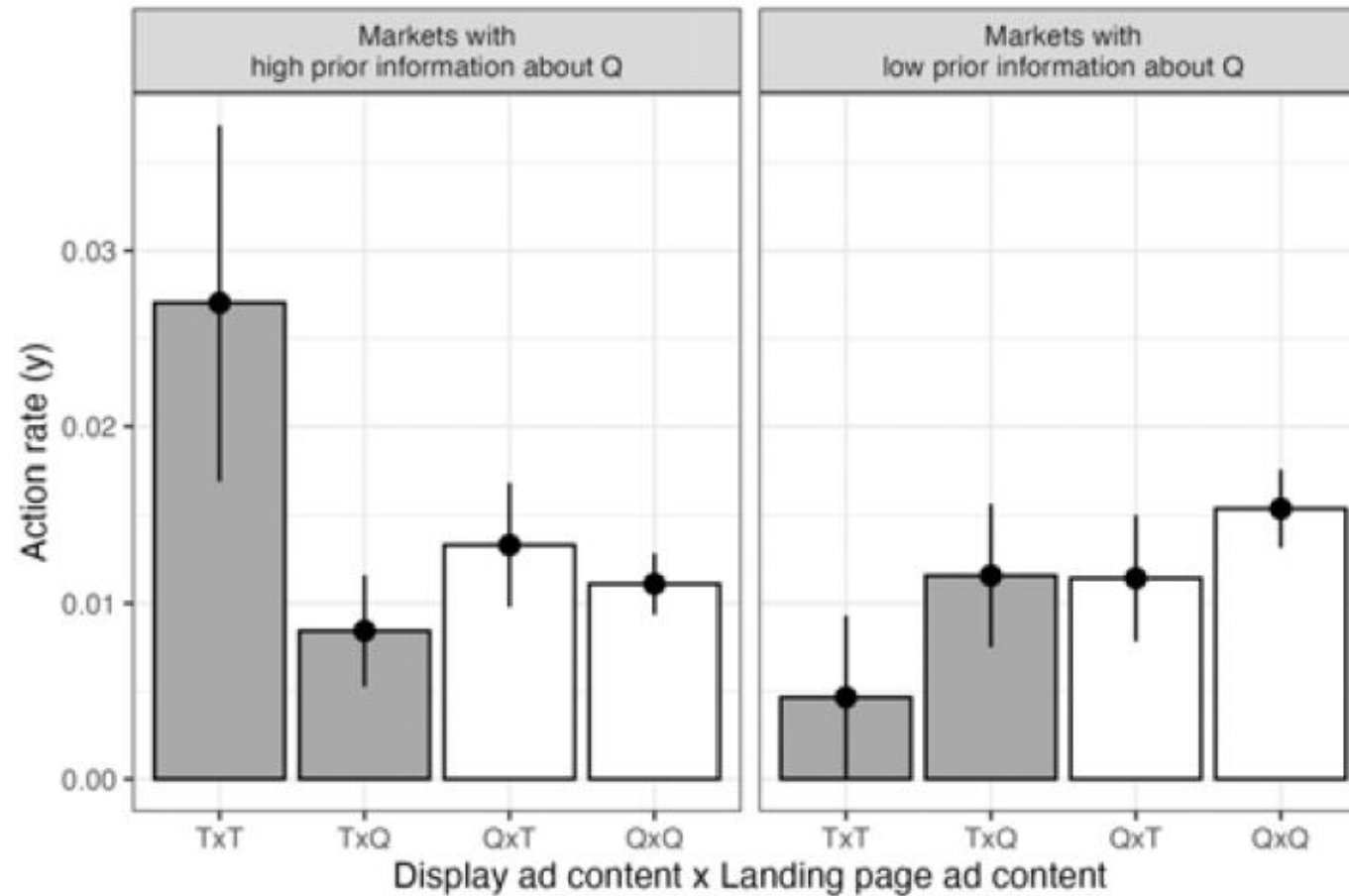


(c) Pre-experiment prices

Economic Significance of Click Thru Rates

- Lift in CTRs: -11.1% to 19.1%
- *\$4,000 increase to a \$10,600 reduction in the costs for the same level of ad-driven traffic over 3.5 months*
- *Annual Impact: From an increase of \$13,700 to a reduction of \$36,300 for a single product's display*

Repeat vs Rotation: Landing Page Ad Content Moderated by Display Ad Content



Economic Significance of Landing Page Ad Content

- Three Month Impact: 62 Additional Customers taking action (23 customers from markets with high differentiation and low awareness and 39 from markets with high differentiation and high awareness).
- Annual Impact: This translates to approximately 250 additional actions annually, representing 20% of all actions observed in display-ad-initiated traffic in the FY.

Managerial Summary: When to Repeat Versus Rotate Ad Content

Yewon Kim and Kirthi Kalyanam

A. Market Classification and Advertising Mechanism	1. Awareness Proxies by Market	- Organic Traffic from Google - Specific Product Searches on Web Site - Conversion Actions		
	2. Target Market Classification	Extremely High Awareness	High Awareness	Low Awareness
	3. Implied Advertising Mechanism	Navigation	Selection	Learning
B. Recommended Content Strategy	4. Content Type (Click Thru)	Any Content That Can Help Navigation	Availability or other Matching	Vertical or Horizontal Quality
	5. Content Sequencing (Engagement)	Repeat	Repeat	Rotate

Conclusions

- Theory model provides framework for ad content on vertical quality, horizontal quality and availability
- Predicts where ad content matters, distinguishes between navigation, selection and learning.
 - Do not agree with ChatGPT!
- Ad content (Display and Landing page) matters, big impact on both CTRs and action rates
- Display ad content impacts downstream action rates
- Prior Market knowledge is a sharp predictor of what content performs well and whether to repeat or rotate.
 - High prior knowledge, repeat content, low prior knowledge rotate content

Extra Slides

Table 4: Effect of Quality-Focused (vs. Transaction-Focused) Display Ads on CTRs

Dependent Variable: Model:	CTR (in percentage points)			
	(1)	(2)	(3)	(4)
Constant	2.602*** (0.1092)	2.598*** (0.1128)		
Quality-focused display ad (Q_1)	0.0693 (0.0628)	0.0881** (0.0319)	0.0926** (0.0348)	
Prior information (I , normalized)		0.0227 (0.0574)		
$Q_1 \times I$		-0.1456*** (0.0181)	-0.1398*** (0.0174)	
$Q_1 \times$ High-differentiation products $\times$ America				0.1936*** (0.0276)
$Q_1 \times$ Low-differentiation products $\times$ America				-0.1131** (0.0333)
$Q_1 \times$ High-differentiation products $\times$ Europe				0.2109** (0.0613)
$Q_1 \times$ Low-differentiation products $\times$ Europe				0.0251 (0.1181)
Product $\times$ Continent FE			Yes	Yes
Date $\times$ Continent FE			Yes	Yes
Observations	3,495	3,495	3,495	3,495
Adjusted R ²	0.00055	0.01217	0.17558	0.17539
Within Adjusted R ²			0.00459	0.00436

Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

CTR Results
for Display
Ads

Display Ads and Landing Page Ads on Within Session Action Rate

Table 5: Effect of Quality-Focused (vs. Transaction-Focused) Display and Landing Page Ads on Within-Session Action Rates

Dependent Variable: Model:	$\mathbb{1}\{\text{Action within a session}\} \times 100\%$					
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Variables</i>						
Constant	1.202*** (0.2535)	1.160*** (0.2329)		0.7755*** (0.1389)		
Quality-focused landing page ad (Q_2)	0.3295 (0.2283)	0.3638 (0.2249)	0.0299 (0.1600)	0.4752*** (0.1128)	0.1377 (0.1364)	
Quality-focused display ad (Q_1)	0.1635 (0.2105)	0.1955 (0.2000)	0.3579 (0.2183)	0.4897* (0.2688)	0.6317*** (0.2242)	
Prior information (I , normalized)		0.4747** (0.2093)				
$Q_2 \times I$		-0.4092* (0.2424)	-0.4725*** (0.1333)			
$Q_1 \times I$		-0.3814** (0.1635)	-0.3592* (0.1568)			
Prior information, country level (I^c)				1.111*** (0.1076)	1.769* (0.9504)	
$Q_2 \times I^c$				-0.4971*** (0.1744)	-0.6080*** (0.2179)	
$Q_1 \times I^c$				-0.9203*** (0.2992)	-0.9814*** (0.1900)	
$Q_2 \times \text{High diff.} \times \text{America}$						-0.0251 (0.0884)
$Q_2 \times \text{Low diff.} \times \text{America}$						-0.4791* (0.2305)
$Q_2 \times \text{High diff.} \times \text{Europe}$						0.8307*** (0.1896)
$Q_2 \times \text{Low diff.} \times \text{Europe}$						-0.2359 (0.4983)
$Q_1 \times \text{High diff.} \times \text{America}$						1.016*** (0.1819)
$Q_1 \times \text{Low diff.} \times \text{America}$						-0.4185* (0.2105)
$Q_1 \times \text{High diff.} \times \text{Europe}$						0.5655 (0.3647)
$Q_1 \times \text{Low diff.} \times \text{Europe}$						0.1647 (0.4572)
Mobile access $\times$ Continent			Yes		Yes	Yes
Product $\times$ Continent			Yes		Yes	Yes
Date $\times$ Continent			Yes		Yes	Yes
Observations	13,576	13,576	13,576	13,483	13,483	13,576
Adjusted R^2	-0.00002	0.00020	0.00913	0.00005	0.00430	0.00903
Within Adjusted R^2			0.00010		0.00005	0.000001

Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

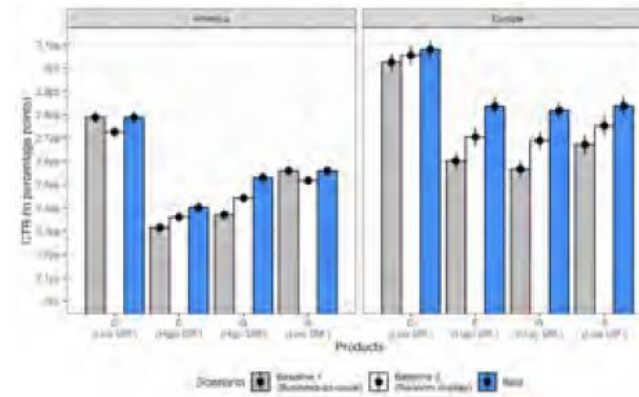
Landing Page Ad Content Moderated by Preceding Display Ad Content

Table 6: Landing Page Ad Effect Moderated by Preceding Display Ad Content

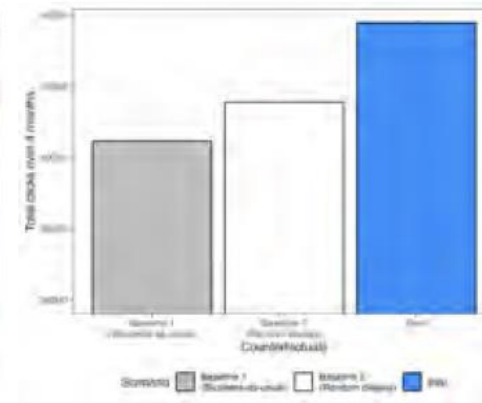
Dependent Variable: Model:	Within-session action rate (in percentage points)	
	(1) High prior ($I \geq 0$)	(2) Low prior ($I < 0$)
Quality-focused display ad (Q_1)	-0.9270*** (0.1164)	0.8710* (0.2793)
Quality-focused landing page ad (Q_2) Transaction-focused display ad (T_1)	-1.714** (0.4567)	1.004** (0.2901)
Quality-focused landing page ad (Q_2) Quality-focused display ad (Q_1)	-0.2294 (0.1464)	0.4366 (0.2305)
Mobile access $\times$ Continent FE	Yes	Yes
Product $\times$ Continent FE	Yes	Yes
Date $\times$ Continent FE	Yes	Yes
Observations	7,309	6,267
Adjusted R^2	0.02044	-0.00074
Within Adjusted R^2	0.00022	-0.00032

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

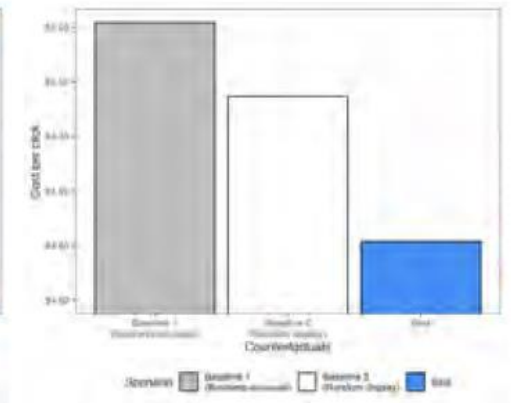
Counterfactuals



(a) CTRs (market-level)

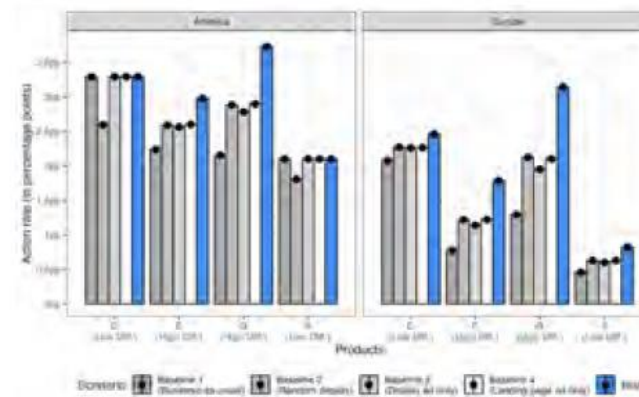


(b) Total clicks

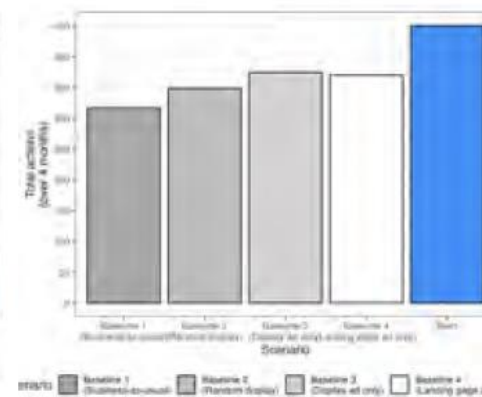


(c) Cost per click

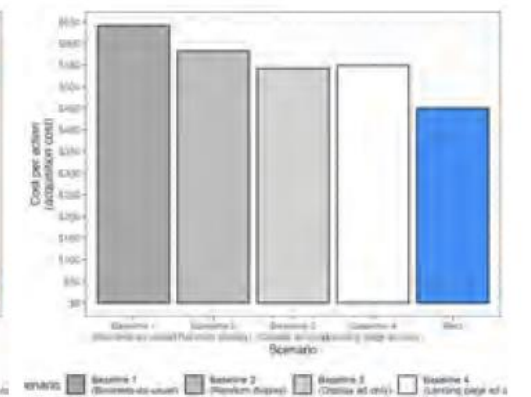
Figure 10: Counterfactuals: Predicted display ad clicks and cost per click



(a) Action rates (market-level)



(b) Total actions



(c) Acquisition cost

Figure 11: Counterfactuals: Predicted actions and cost