Effects of Short-Form Digital Content on Memory Recall and Physiological Responses

A PRELIMINARY EXPLORATION INTO COGNITIVE AND PHYSIOLOGICAL IMPACTS

HUMAN TECHNOLOGY INTERACTION

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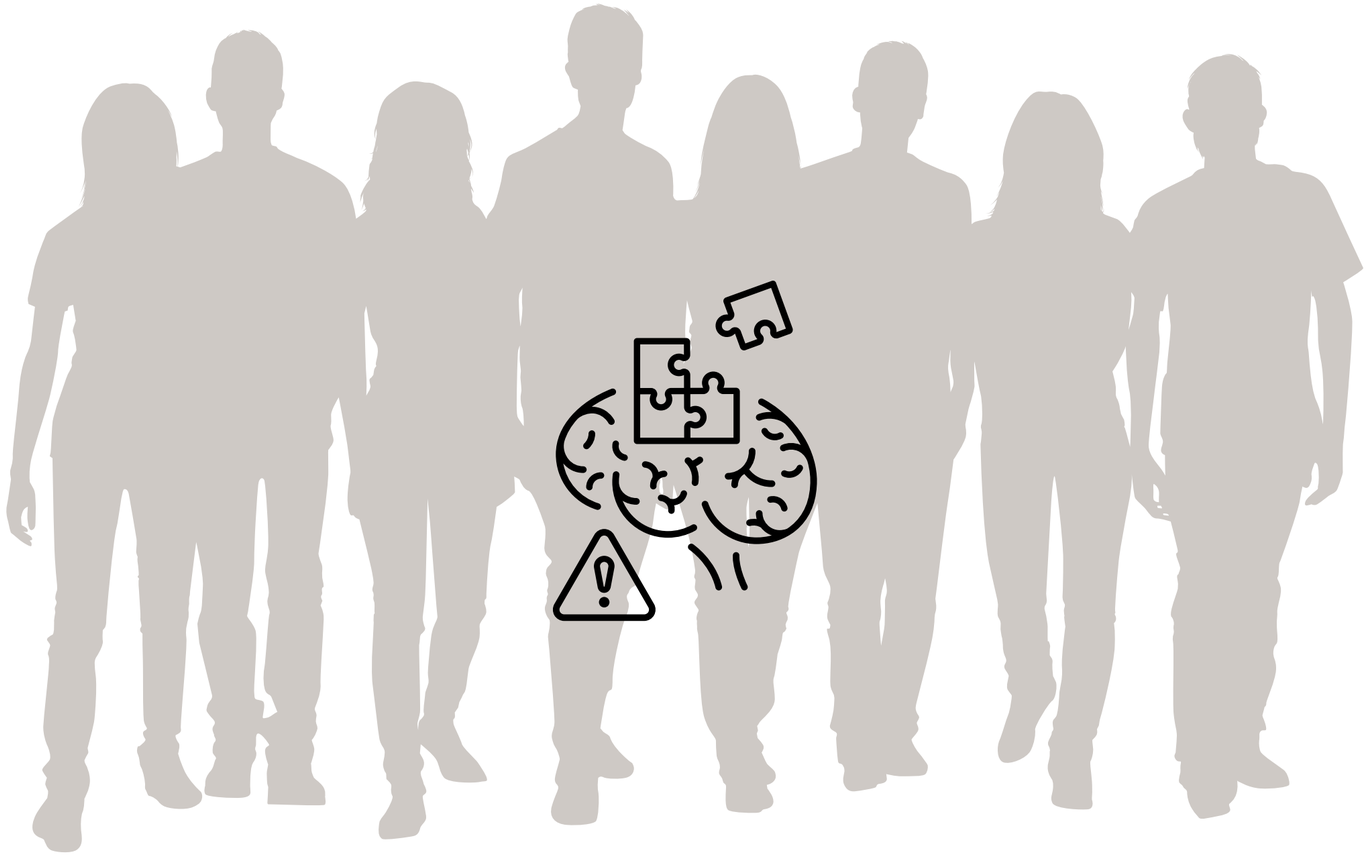
Problem Statement

- Rising popularity of short-form digital content SFC
- Unknown impact on cognitive functions (especially memory)
- Unclear physiological changes during SFC exposure (facial AUs, HRV)

Why This Matters



Big Picture Impact

Literature Survey

PAST FOCUS

Long-form media effects on cognition and mood

RECENT WORK

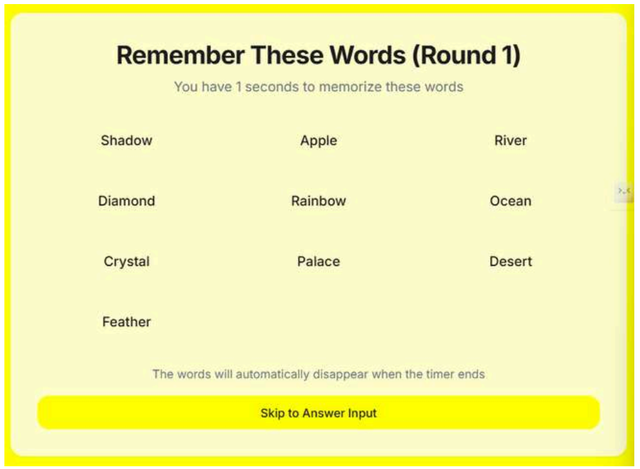
Physiological measures (e.g., HRV) in media studies.

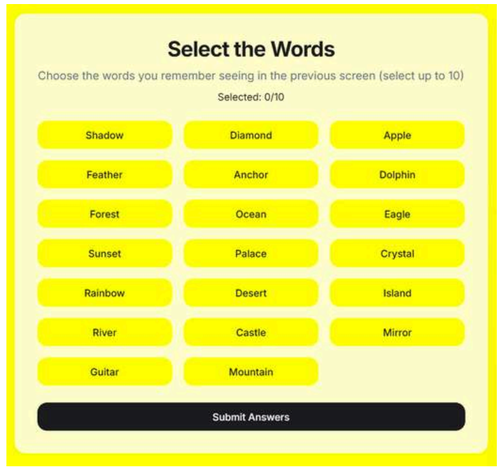
Bowman, L.L., Levine, L.E., Waite, B.M., & Gendron, M. (2010). Can students really multitask? An experimental study of instant messaging while reading. Computers & Education, 54(4), 927–931.

Bradley, M.M., & Lang, P.J. (2000). Measuring emotion: Behavior, feeling, and physiology. In R.D. Lane & L. Nadel (Eds.), Cognitive Neuroscience of Emotion (pp. 242–276). Oxford University Press.

Experiment Protocol

Pre-viewing memory test





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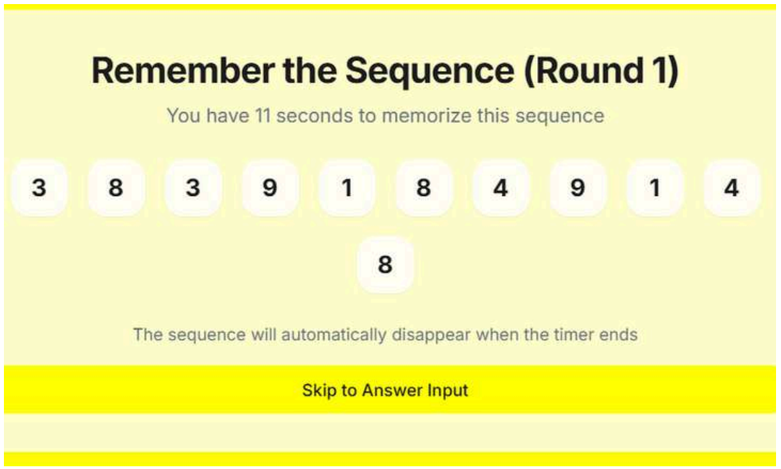

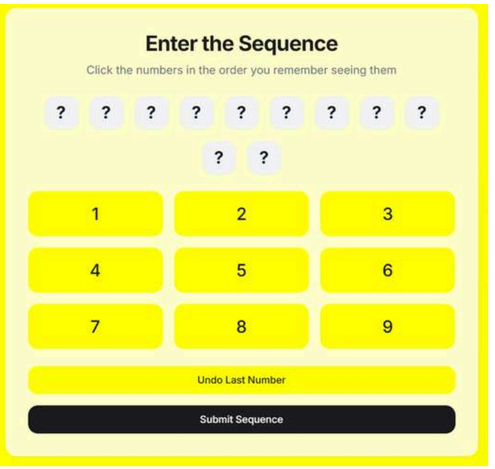

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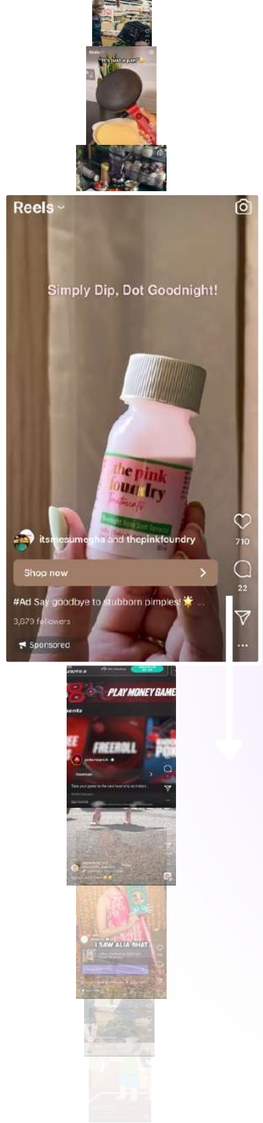
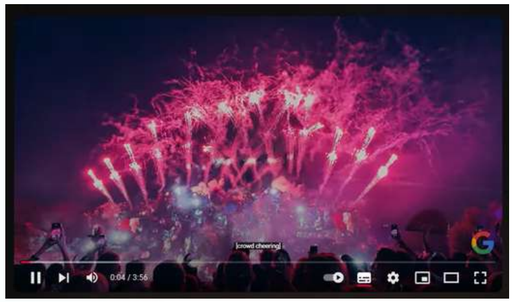
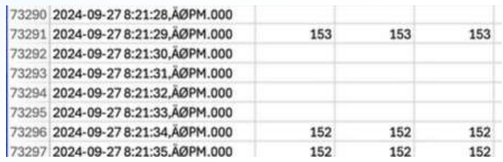




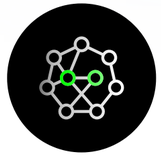


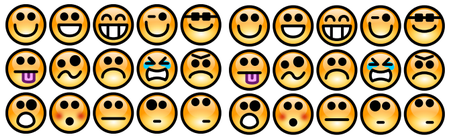
73290	2024-09-27 8:21:28,ÂØPM.000			
73291	2024-09-27 8:21:29,ÂØPM.000	153	153	153
73292	2024-09-27 8:21:30,ÂØPM.000			
73293	2024-09-27 8:21:31,ÂØPM.000			
73294	2024-09-27 8:21:32,ÂØPM.000			
73295	2024-09-27 8:21:33,ÂØPM.000			
73296	2024-09-27 8:21:34,ÂØPM.000	152	152	152
73297	2024-09-27 8:21:35,ÂØPM.000	152	152	152

Apple Watch

HR data Exporter

Data exported as CSV





Camera Rec

AU Calc

Emotion Prediction

Experimental Details

Participants: 60

Encoded as:

0: Short-form content - 32 participants.

1: Long-form content - 28 participants.

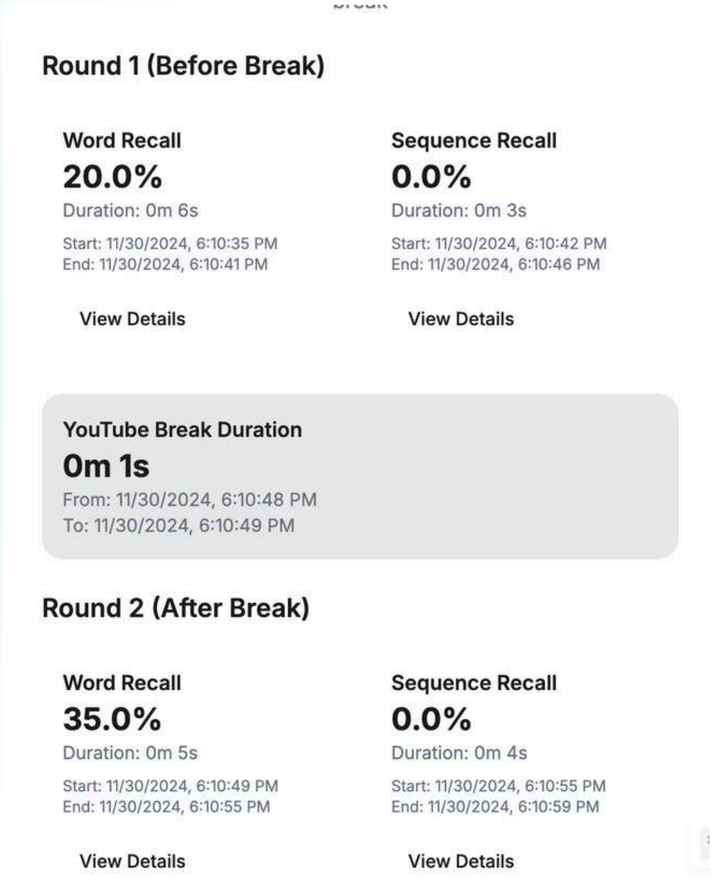
DATA COLLECTED :

WORD RECALL

DIGIT RECALL

FACIAL AU

HR



Score Change Formula: (post - pre) / pre

EDA

Digit scores mean after content exposure +0.016

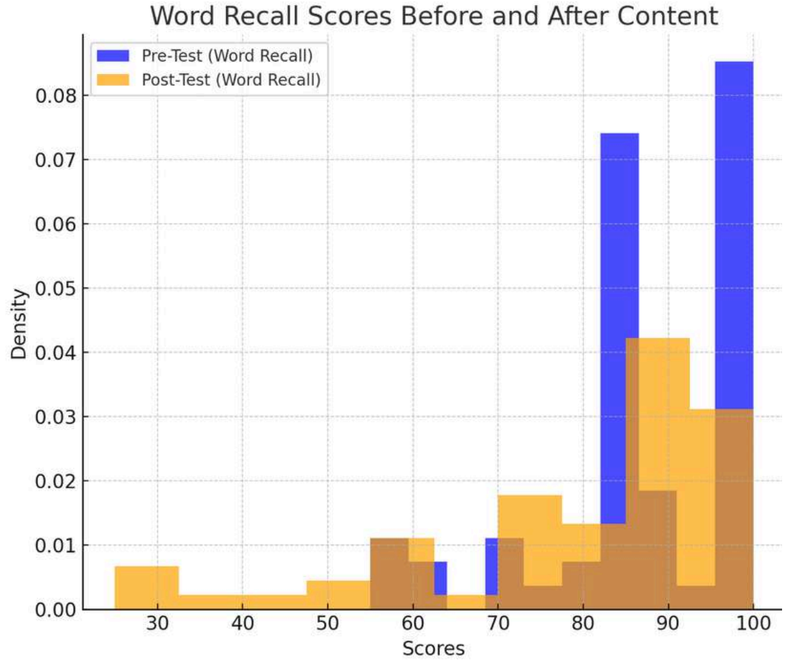
Word scores mean after content exposure -0.11

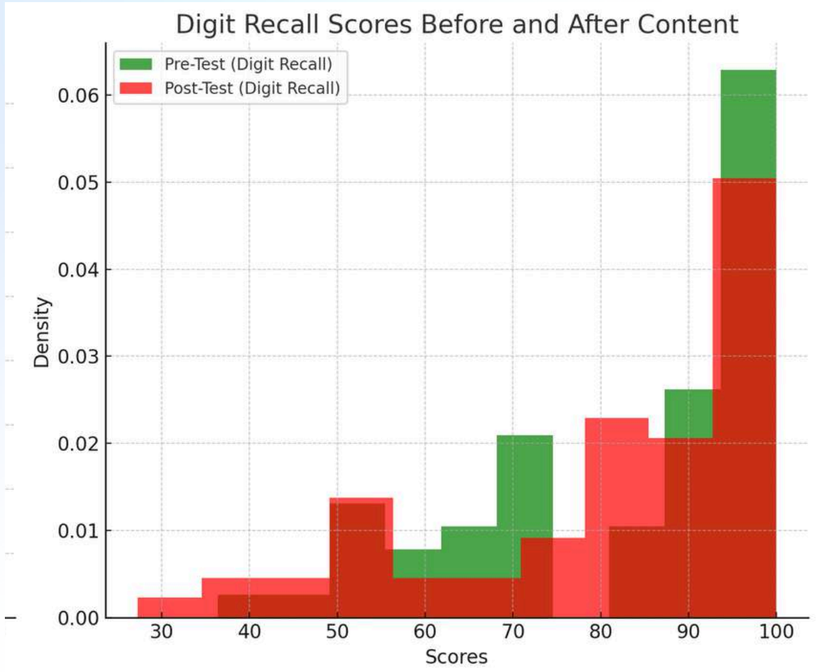
Word recall scores

Pre-test: Mean = 87.9, Post-test: Mean = 77.8.

Digit recall scores

Pre-test: Mean = 83.3, Post-test: Mean = 81.5.





Hypothesis Testing 1 and 2

WORD SCORE

NOT NORMAL

WILCOXON TEST

A significant reduction in word recall scores after watching content

DIGIT SCORE

NORMAL

T-TEST

No significant change in digit recall scores after watching content

SFC VS LFC

Short-form content (0):

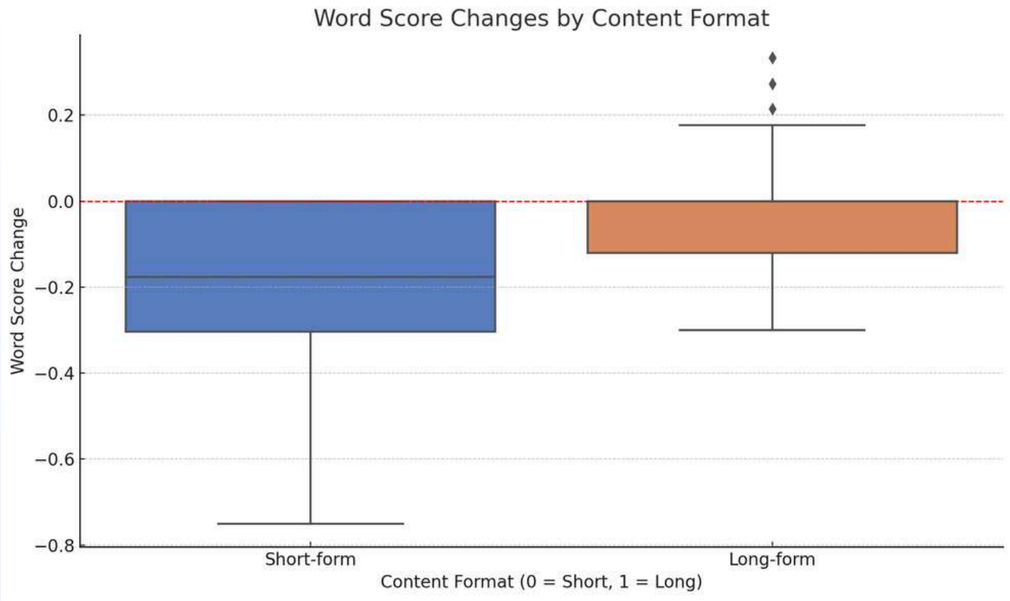
Word Score Change: -0.214 ↓

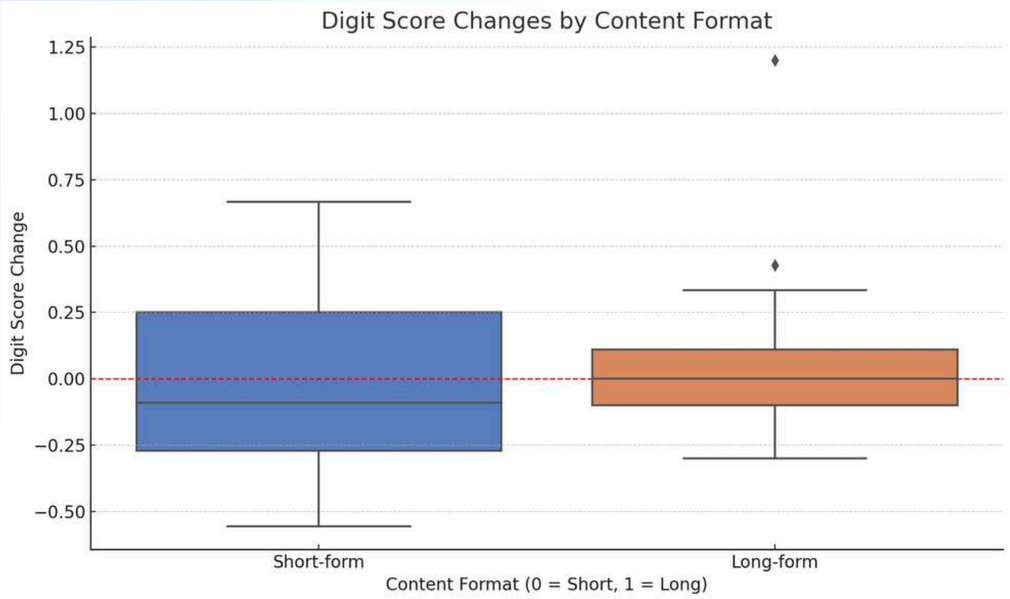
Digit Score Change: -0.007 ⟷

Long-form content (1):

Word Score Change: +0.001 ⟷

Digit Score Change: +0.043 ↑





Hypothesis Testing 3 and 4

WORD SCORE

MANN-WHITNEY U TEST

P-VALUE: 0.00011

Significant difference in word score changes between participants who watched short-form and long-form content.

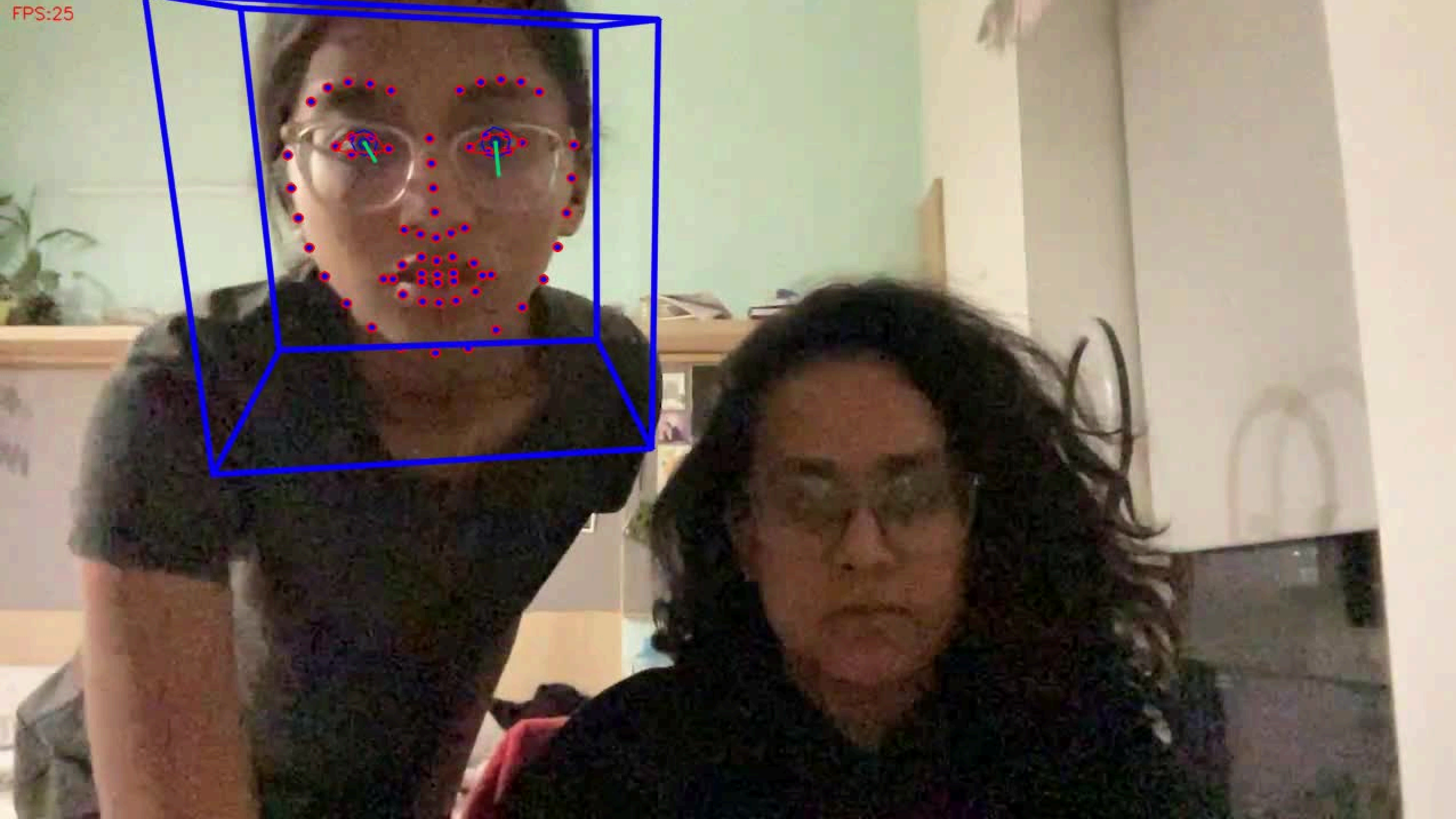
Short-form content is associated with greater variability and declines.

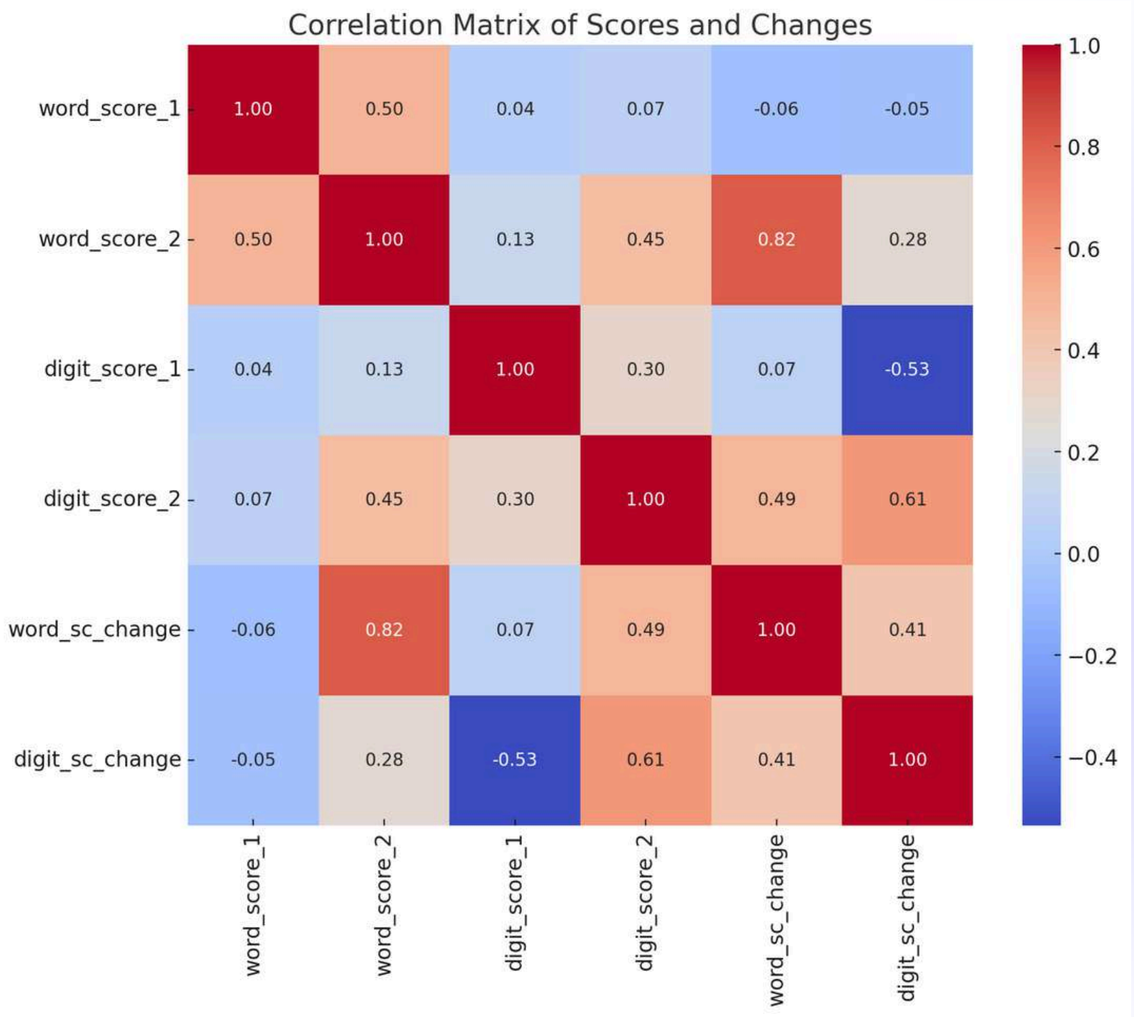
DIGIT SCORE

MANN-WHITNEY U TEST

P-VALUE: 0.56

No significant difference in digit score changes between short-form and long-form content participants.


FPS:25



Pearsonr Correlation between Digit and Word Recall

- Correlation Coefficient: 0.41
- P-value: 0.0012
- Participants who improve or decline in one test tend to show similar trends in the other. Only some overlap in the cognitive abilities measured.

Physiological Heuristics

1. Positive Engagement

$$\text{Positive Engagement} = (\text{AU06}_{\text{mean}} + \text{AU12}_{\text{mean}} + \text{AU14}_{\text{mean}}) - (\text{AU04}_{\text{mean}} + \text{AU07}_{\text{mean}})$$

Measures positive engagement by balancing joyful AUs against tension-related AUs.

2. Stress Score

$$\text{Stress Score} = (\text{AU04}_{\text{mean}} + \text{AU07}_{\text{mean}} + \text{AU23}_{\text{mean}}) - (\text{AU06}_{\text{mean}} + \text{AU12}_{\text{mean}})$$

Estimates stress by weighing stress-related AUs against positive AUs.

3. Happiness-to-Stress Ratio

$$\text{Happiness-to-Stress Ratio} = \frac{\text{AU06}_{\text{mean}} + \text{AU12}_{\text{mean}}}{\text{AU04}_{\text{mean}} + \text{AU07}_{\text{mean}} + \text{AU23}_{\text{mean}} + 10^{-5}}$$

Measures normalized happiness relative to stress. A constant avoids division by zero.

4. Engagement Score

$$\text{Engagement Score} = \text{HR Variability} \times \text{AU12}_{\text{mean}}$$

Combines HR variability and AU12 (joy) to gauge overall engagement.

5. Head Movement Intensity

$$\text{Head Movement Intensity} = \sqrt{\text{pose\_R}_{x\text{std}}^2 + \text{pose\_R}_{y\text{std}}^2 + \text{pose\_R}_{z\text{std}}^2}$$

Quantifies head movement using the Euclidean norm of rotation angles.

6. Gaze Consistency

$$\text{Gaze Consistency} = \text{Var}(\text{gaze\_angle}_x, \text{gaze\_angle}_y)$$

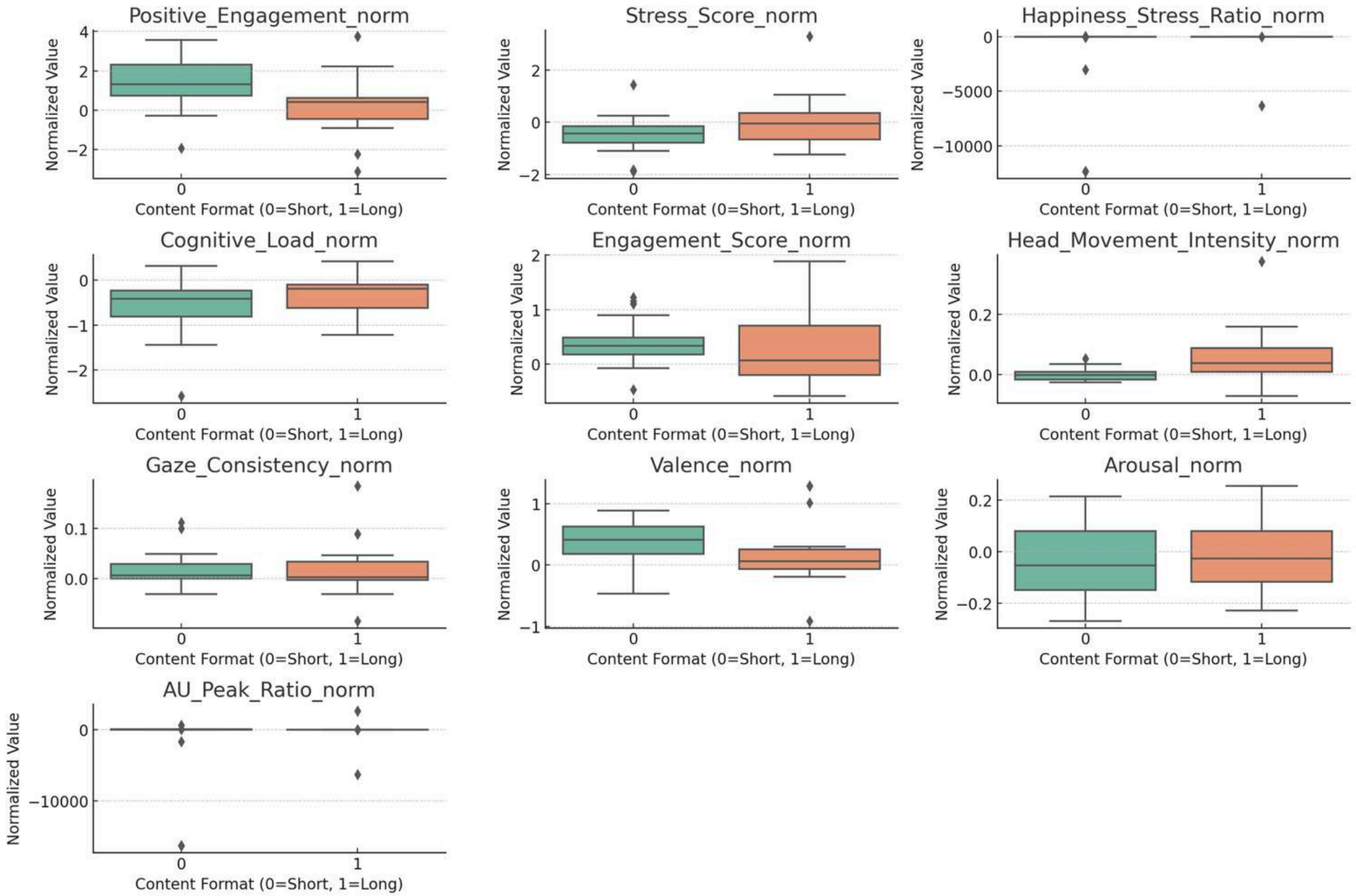
Calculates gaze variance to measure consistency in attention direction.

7. Valence

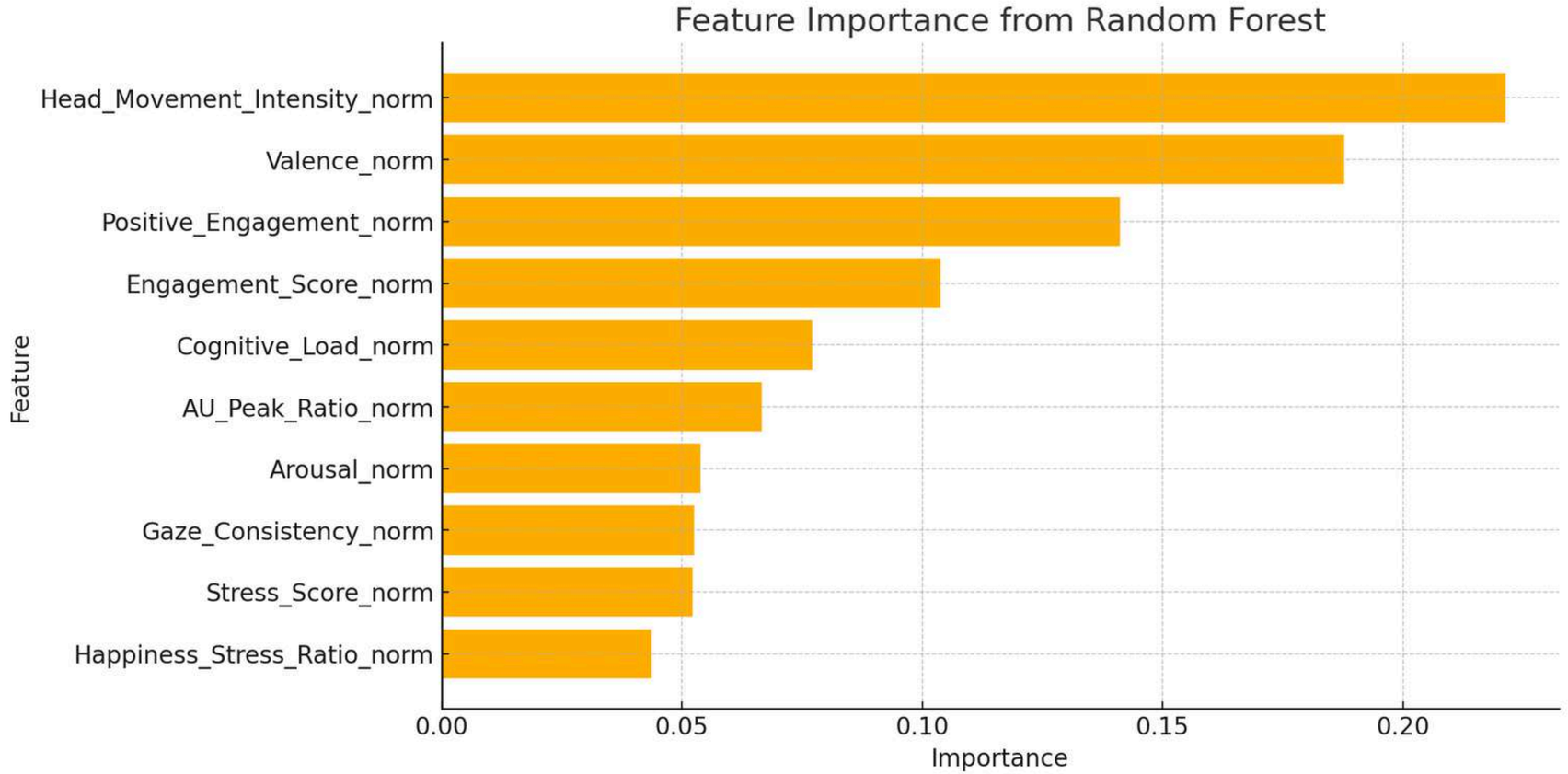
$$\text{Valence} = \frac{\text{AU06}_{\text{mean}} + \text{AU12}_{\text{mean}} + \text{AU14}_{\text{mean}}}{3}$$

Represents the average intensity of positive emotions like joy.

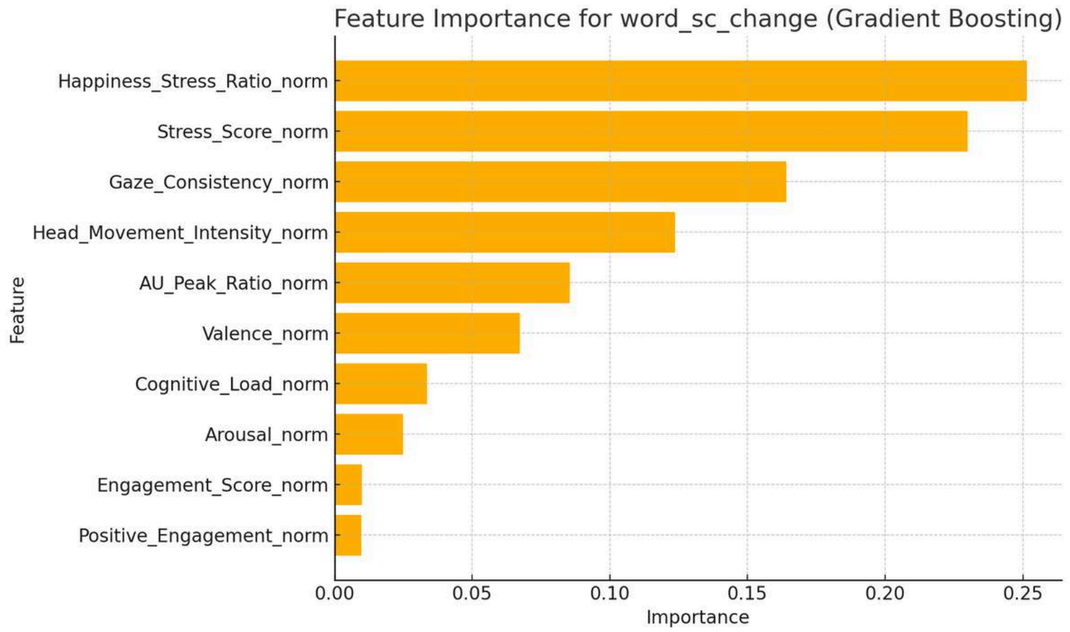
Physiological Heuristics

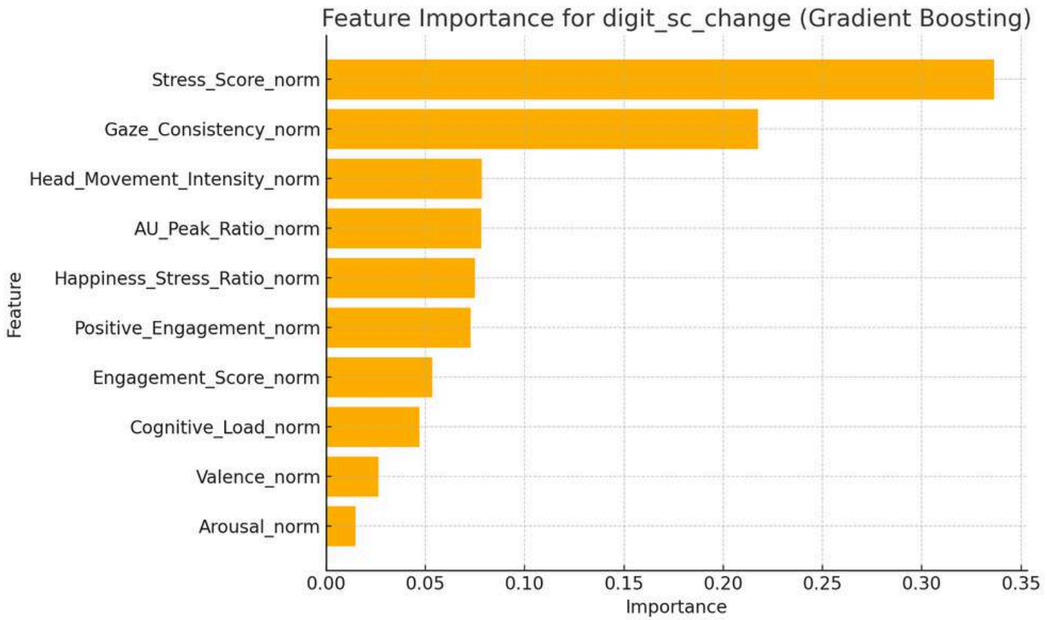


Fusing Cognition & Physiology

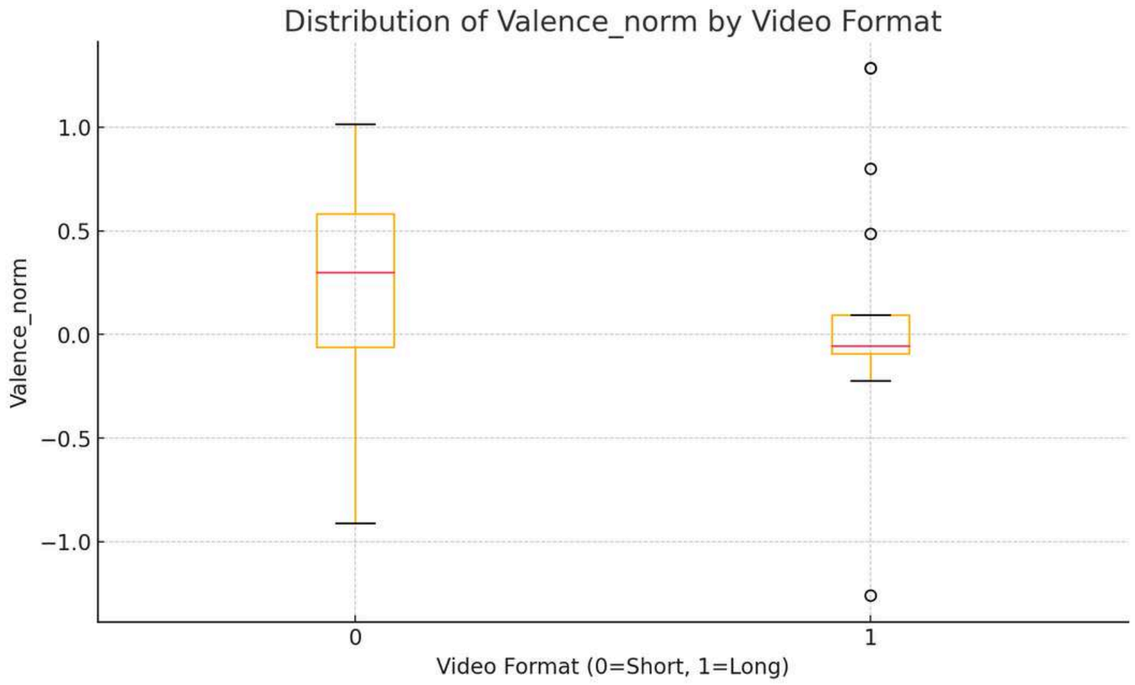


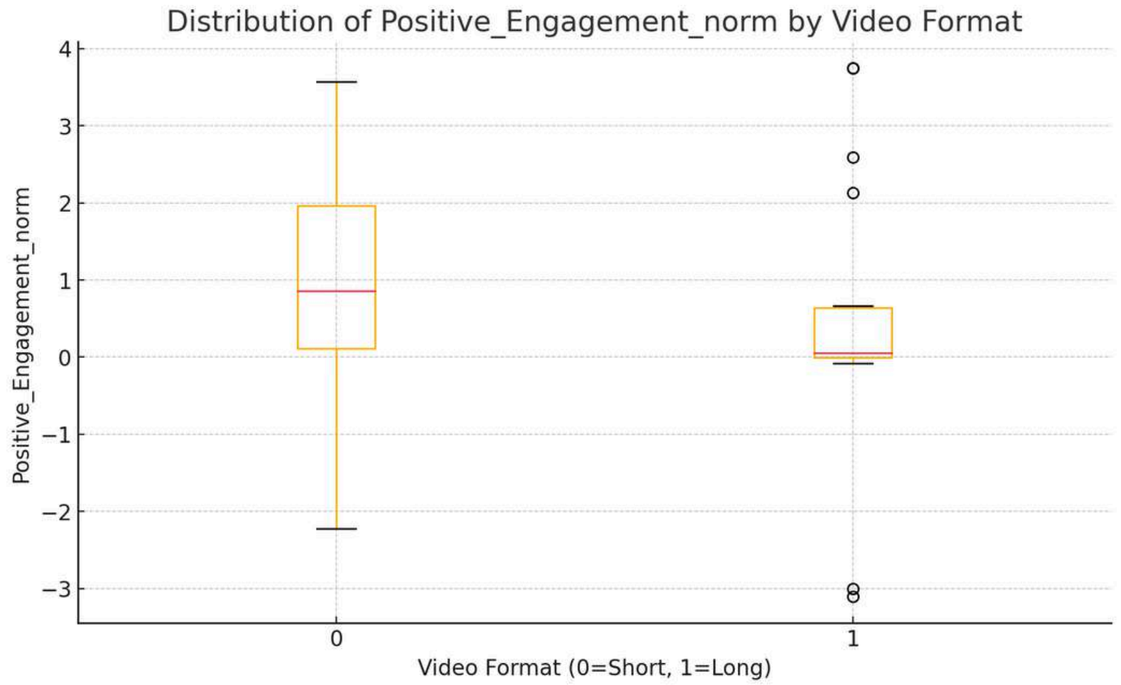
What made a difference?



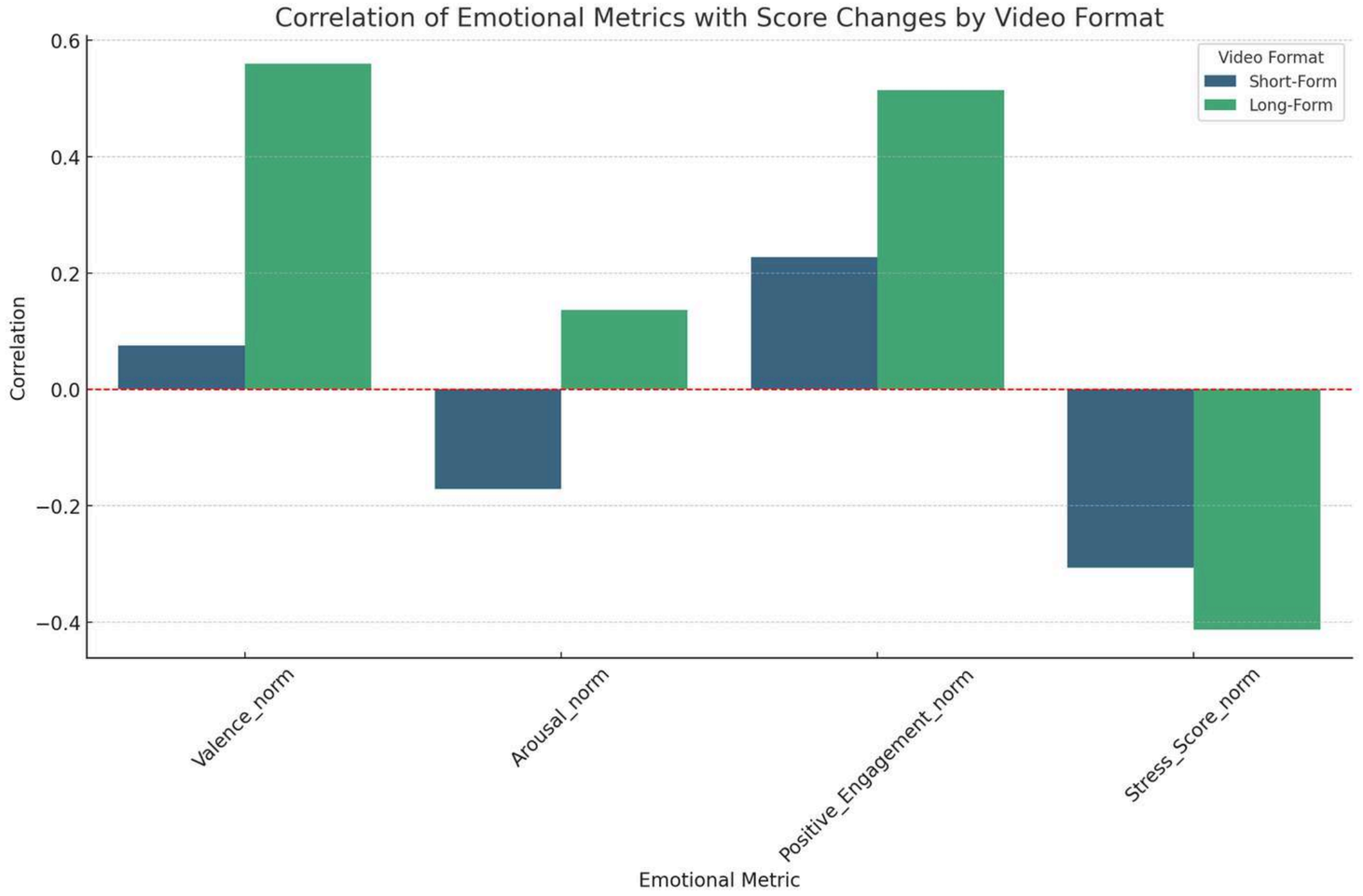


Emotional Response vs Content Type

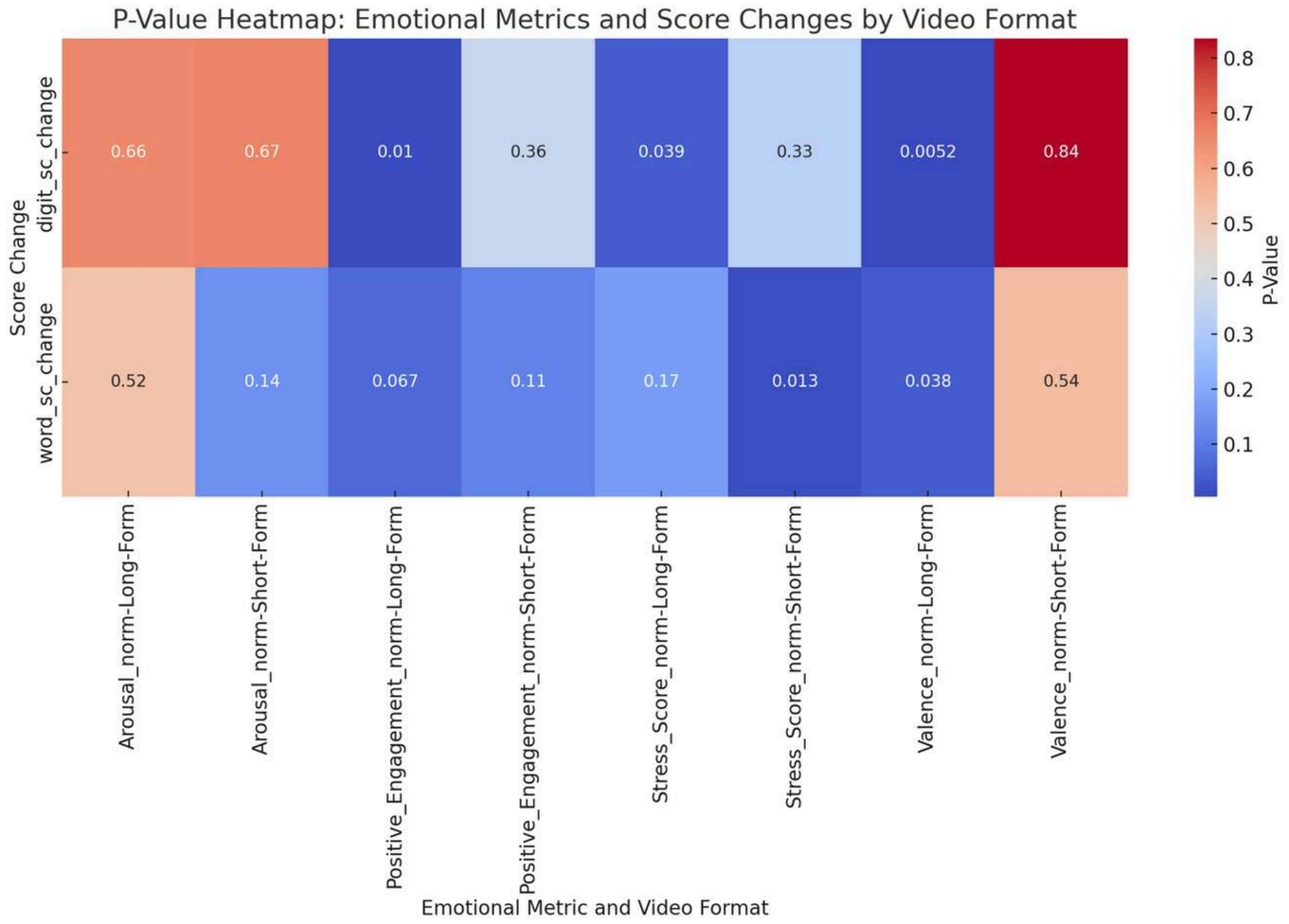




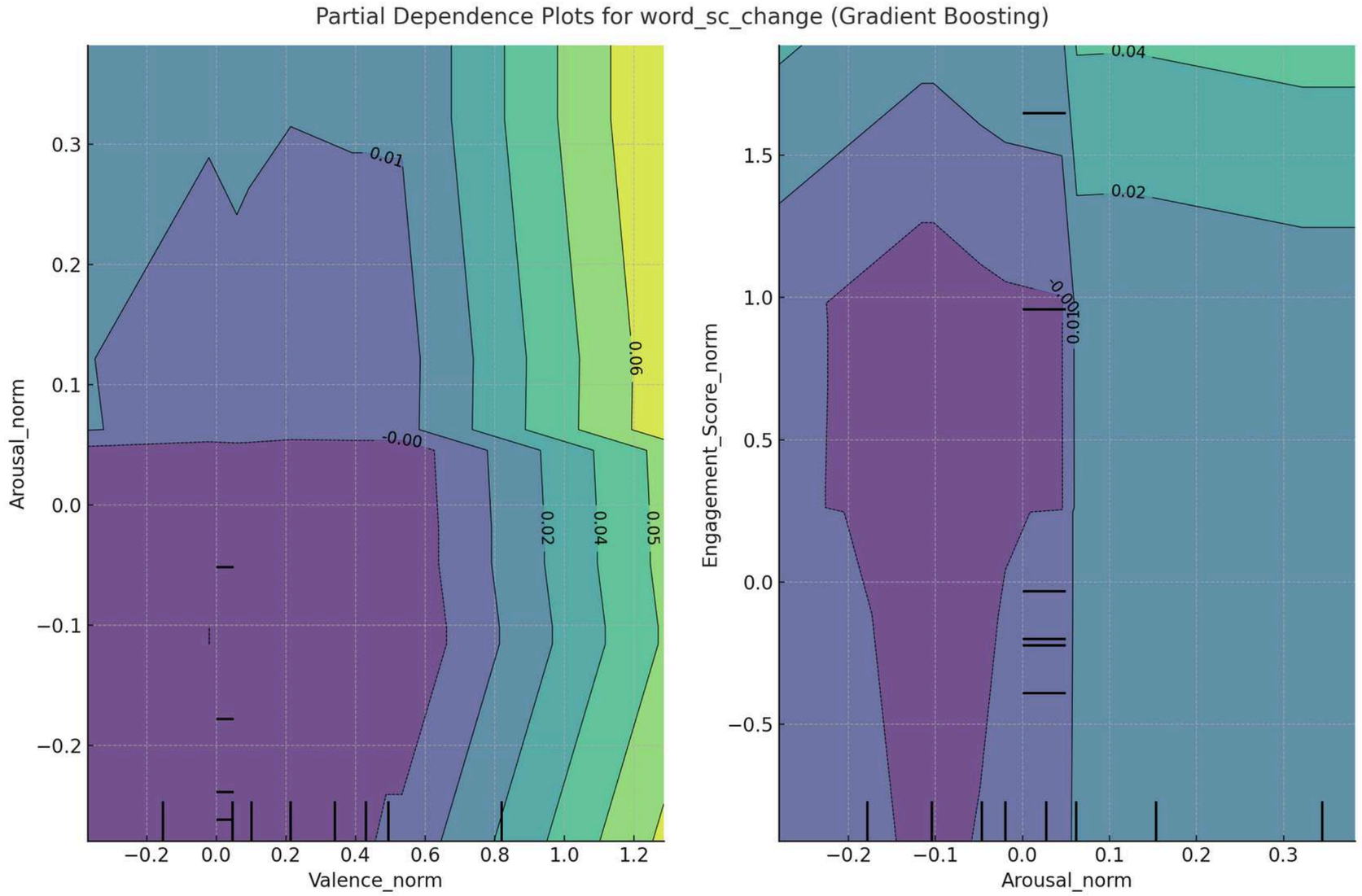
Emotional correlation with score change (Long vs Short)



Emotional correlation with score change (Long vs Short)



Partial Dependance for Score Change



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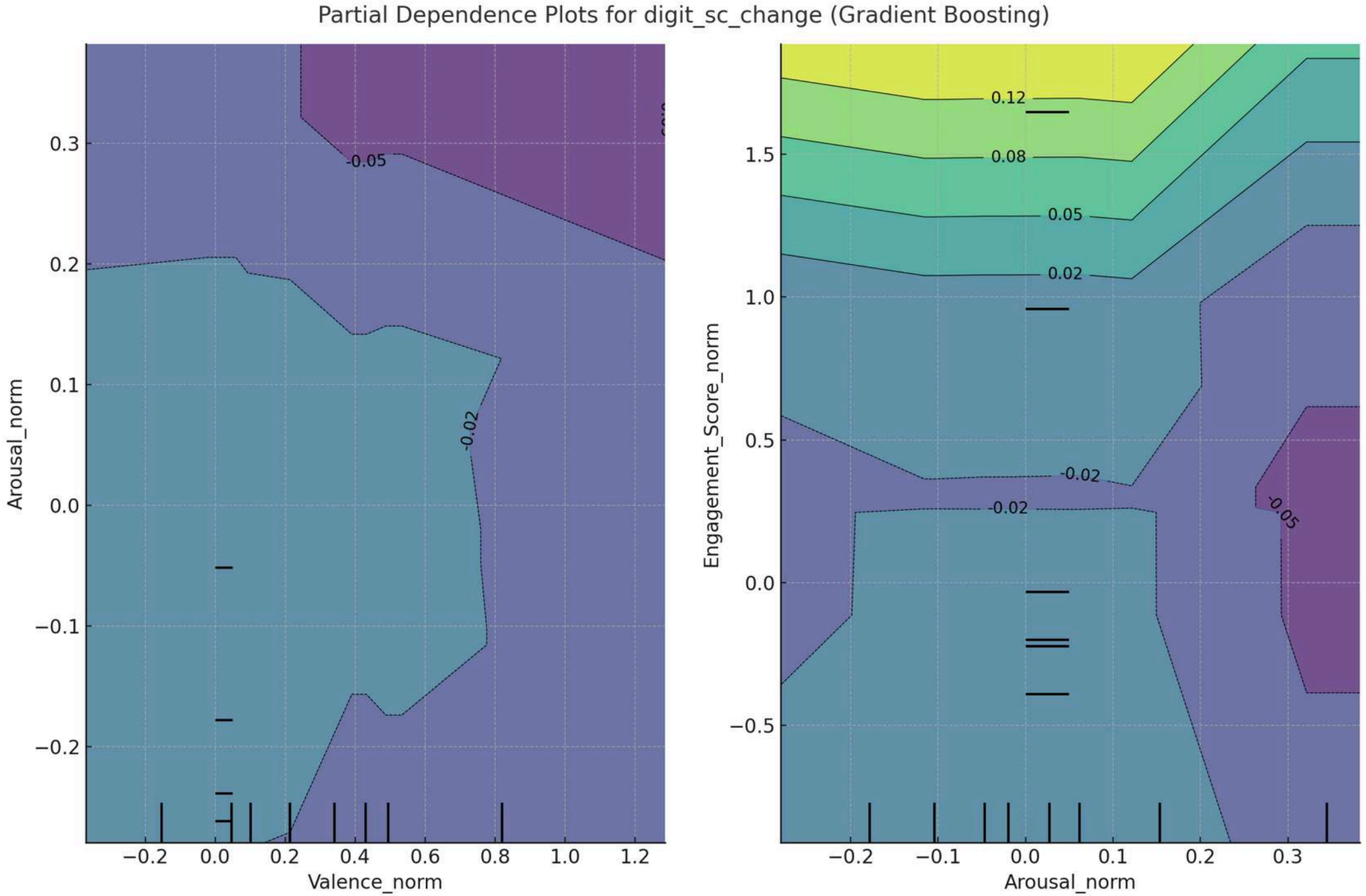


Impact & Implications

IN THE END, THIS WORK HELPS US UNDERSTAND A TINY PIECE OF THE PUZZLE IN OUR MASSIVE DIGITAL ECOSYSTEM. BY PINPOINTING WHETHER SHORT-FORM CONTENT TWEAKS OUR MEMORY AND PHYSIOLOGICAL RESPONSES, WE CAN INFORM HOW WE CONSUME, CREATE, AND REGULATE DIGITAL MEDIA. IT'S ABOUT FOSTERING A MORE INFORMED, MINDFUL RELATIONSHIP WITH OUR SCREENS. WHO KNEW A 15-SECOND REEL COULD HAVE SUCH A RIPPLE EFFECT?

What TikTok does to your mental health: 'It's embarrassing we know so little'

Nearly six in 10 teenagers count themselves as daily users of the app yet little is known about the impacts on the brain

Read the new Guardian series exploring the increasing power and reach of TikTok

By Kari Paul

In the few years since its launch, TikTok has already alter the social media landscape, attracting more than 1 billio leading competitors to replicate some of its most unique

The impact of that explosive growth and the 'TikTok-ific internet at large on social media users remains little understo warn, exacerbating concerns about the impact of social media and mental health.

THE WEEK

THE EXPLAINER

'TikTok brain' may be coming for your kid's attention span

What happens to kids' brains when they binge bite-sized videos?

The New York Times

How Teens Recovered From the 'TikTok Tics'

A wave of teenagers who developed tics during the pandemic has receded, illustrating the powerful influence of stress on the body and the resilience of adolescents.

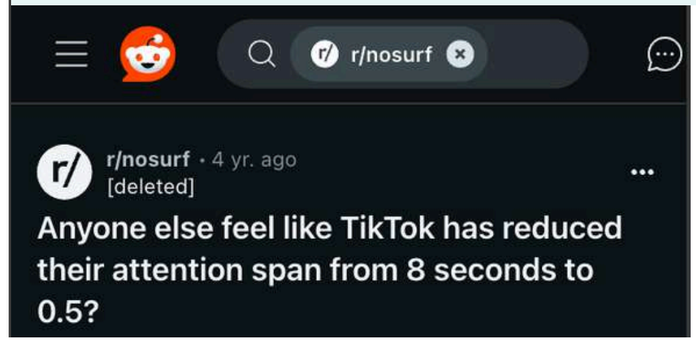
PIRG

I deleted TikTok as a college student. It saved my mental health.

TikTok can be destructive to teens' and young women's mental wellbeing. I know because I experienced it first hand.

PHILADELPHIA INTEGRATIVE PSYCHIATRY

TikTok Brain: The Declining Attention Spans of Our Kids



TIME

HEALTH • MENTAL HEALTH/PSYCHOLOGY

Why Instagram Is the Worst Social Media for Mental Health

4 MINUTE READ


SIT&GO
PLAY MONEY GAME
FREEROLL


I SAW ALIA BHAT