An Empirical Examination of the Ad-Program "Congruence" Effect on Ad-Viewing Behaviors: Evidence from TVision Data

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This study examines how ad-program "congruence"—the alignment between ad content and TV program themes—affects viewers' attention to TV ads. Using a large dataset from TVision, we find that ads placed within congruent programs receive greater visual attention, particularly in the entertainment and financial industries. Further analysis shows that this positive congruence effect persists across different ad positions within a program, whether in the first, second, or third segment. These findings offer practical insights for advertisers seeking to optimize ad placement and maximize engagement.

INTRODUCTION

In the dynamic landscape of advertising, understanding the factors that may impact ad engagement is a pivotal concern for marketers and researchers alike. For decades, television (hereafter TV) has served as a conventional advertising media channel. The inaugural paid TV advertisement, featuring Bulova watches, aired in 1941. Since then, TV advertising has evolved to adapt to technological advances, reshaping not only consumer behavior, but also the media landscape as a whole. As an industry with substantial market size, TV advertising is projected to have a spending budget of $69 billion in North America in 2024 alone (Zenith 2022). In the new digital era, TV advertising must continually embrace innovation and new industry trends in order to remain as a powerful and attractive medium for mass audiences.

Moreover, the TV advertising industry is facing many challenges in today's digitally-saturated and multimedia society. The evidence implies that viewers' engagement on TV ads has deteriorated over the past few decades (Forrester Survey 2010; Shapiro et al. 2021). Nevertheless, it is still important and worthy to explore the underlying factors that affect TV ad engagement. The emergence of connected TV and other advanced technologies, such as artificial intelligence (AI), has provided the opportunity to create new strategies for effective advertising for targeted audiences.

Keywords: TV ads; ad engagement; ad-program congruence; TV advertising

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Management Slant

- Overall, viewers pay more attention to ads that have similar content or topics with the TV programs in which they are embedded (a concept referred to as "ad-program congruence" in this study) and less attention to the ads that have different content with the TV programs.
- The positive and significant "ad-program congruence" effect holds in particular for the entertainment and financial ads, but not for government or food ads.
- On average across all ad categories, the positive and significant "ad-program congruence" effect holds regardless of where the ads are inserted in TV programs (first, mid, or final third of a program). Further analysis indicates that this effect is driven by entertainment ads.

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This study is the first to employ largescale empirical data to examine the effects of ad-program congruence on viewers' attention.

Therefore, analyzing the factors that impact viewers' engagement on TV ads can assist advertisers and researchers in navigating the intricate media landscape, optimizing advertising strategies, and ensuring that TV advertising maintains its relevance and impact within the overall marketing mix.

A critical aspect requiring attention in the TV advertising industry is the "congruence" between ad content and the programs in which ads are embedded. Specifically, in this research, *ad-program congruence* refers to the similarity of the content or topic between the ad and the associated TV program. Furthermore, we define an ad-program as congruent when the contents or topics of both are similar, and as incongruent when the program's content significantly differs from those of the ad.

This study examines whether ad-program congruence impacts TV engagement, as measured by viewers' visual attention allocation to ads. According to a series of studies (*e.g.*, Liu-Thompkins 2019; Simmonds et al. 2020), visual attention plays a critical role in affecting ad engagement. In order to reliably categorize ads and TV programs, we first employ ChatGPT (3.5v) to evaluate whether the selected ads were topically congruent with their associated TV programs. Second, we conduct an online experiment using human coders to make judgements about ad-program congruence to validate the results obtained from the first method. Next, we use two measures of viewers' attention as the proxy: *attention duration* and *attention duration ratio*. The *attention duration* is the absolute value of viewer's sight watching duration of an ad in seconds, while the *attention duration ratio* is the relative value calculated as the percentage of viewers' attention duration divided by the total time duration of the ad in seconds.

Using a large comprehensive sample of 4,830,649 observations from TVision Insights Inc.[1] (hereafter referred to as "TVision"), which records viewers' attention to an ad at second level, we find a significant and positive relation between ad-program congruence and viewer attention after controlling for other determinants of viewer attention and individual or program fixed effects. We further explore the heterogeneity of ad-program congruence's effects on viewers' ad engagement. The results indicate that the positive and significant congruence effects hold for both entertainment and financial ads, but not for those related to food or government. These findings indicate that the contents of ads and programs exert different effects on viewers' ad engagement. We also test the moderating effects of the positions that ads are inserted within TV programs (*ad position*), *e.g.*, the first, mid, or last segment of the program. Regardless of where ads are inserted, ad-program congruence positively and significantly affects viewers' ad attention.

Although this study follows previous research in adopting viewer attention as a primary indicator of viewers' engagement on TV ads, this research differs significantly from the existing literature in two ways: [1] This paper provides a perspective in uncovering new ways to improve audiences' engagement to TV ads through the lens of the "congruent" effect; [2] the analyses were based on large-scale field experiment that were generously provided by TVision, leading to empirical findings with excellent external validity and generalizability.

This study contributes to the literature in the following ways. First, we contribute to the growing body of literature on the determinants of ad engagement and TV watching behavior. To the best of our knowledge, this study is the first to employ large-scale empirical data to examine the effects of ad-program congruence on viewers' attention. Second, we uncovered the moderation effects of two crucial variables, ad category and ad position, on ad-program congruence from the perspective of maximizing viewers' ad engagement. Third, the findings offer practical implications for advertisers seeking to optimize their strategies (Graham and Kennedy 2022) by understanding how congruence between ad and TV program content can be leveraged to enhance ad engagement. Our study sheds light on the critical interplay between ad-program congruence and consumer viewing behaviors, offering valuable insights for scholars and practitioners in the fields of advertising and media studies.

The remainder of the paper is structured as follows. First, we provide the theoretical background and a conceptual framework, then we offer a literature review and develop our hypotheses. Third, we present our data, variables, models and results. Finally, we draw our conclusions and discuss future research directions.

THEORETICAL BACKGROUND AND CONCEPTUAL FRAMEWORK

Theoretical Foundation

The "Theory of Attention" served as the theoretical foundation of this research due to its applicability to this study's focus on exploring viewers' visual attention behaviors when watching TV programs during the aired time frame. The Theory of Attention originated from the seminal work of James (1890), later written up in book form. In the book, the author examined several key aspects of human consciousness, including habit, willingness, attention,

and memory to help explain human activities relevant to the cognitive process (*e.g.*, TV watching behaviors). In the "Attention" chapter, the author examined the nature of attention, how it works, and its role in shaping perception and consciousness. Particularly, the author categorized attention control factors into two groups: [1] bottom-up factors, which depict the human visual attention selection process; and [2] top-down factors, which describe the attentional search process.

Thereafter, many researchers and scholars from different disciplines have conducted studies not only to extend the theory, but also to expand our overall understanding of the human vision process in different settings. For instance, through an optical lens, Merten (1956) was believed the first to systematically study the issue that the distribution of visual attention can be controlled by peoples' intentions. Much of the evidence for top-down control was considerably complemented by a series of work by psychologists Eriksen and Hoffman (*e.g.*, Eriksen and Hoffman 1972, 1973). Moreover, LaBerge (1995) offered a perspective from cognitive neuroscience by proposing a theoretical framework that integrates the interactions between bottom-up and top-down attentional factors. Similarly, marketing scholars have incorporated the theoretical model into the advertising research context. For example, Pieters and Wedel (2004) proposed a conceptual model to examine consumers' visual attention on distinct elements of print ads.

Conceptual Framework

Based on the Theory of Attention, this research delves into viewers' attention selection processes and explores how "bottom-up" factors exert influence during viewers' TV watching and TV ad engagement behaviors. According to Connor et al. (2004), TV viewing behaviors involve the subconscious shifting of visual attention to different objects displayed on TV screens. Moreover, Pieters and Wedel (2004) suggested that an advertisement's features determine ad perceptual salience (Janiszewski 1998), which "rapidly and almost automatically" draws viewers' attention to ad elements (Pieters and Wedel 2004, 38). Perceptual salience can additionally be affected by the size or shape of ad elements.

Therefore, our framework focuses on viewers' attention selection processes and the main analyses examine whether ad-program congruence impacts viewer attention. Specifically, we provide the following conceptual framework in Figure 1.

In addition to the main analysis, we also conduct two moderation effect analyses. The first moderator, "ad category", was added into the model due to our interest in examining whether the congruence effect was moderated by different categories of ad content (Moorman et al. 2002). Furthermore, the second moderator included was "ad position," as it was deemed helpful to explore at which stage of the program to insert the ad would be the most effective for attracting viewers' attention.

RELEVANT LITERATURE AND HYPOTHESIS DEVELOPMENT

Are TV Ads Still Attractive to Audiences?

TV has served as a conventional advertising method for decades, leading a vast number of marketing and advertising experts to examine the subject. Earlier studies, such as Rubinson (2009), have provided evidence that TV ads are more effective than online and print ads in terms of boosting sales and enhancing consumer recognition. This study adds to the body of research supporting the effectiveness of TV ads. However, another research stream offers prima facie arguments against TV ad effectiveness. For instance, according to a survey, 62% of TV advertisers believe that TV ads have become less effective (Forrester Survey 2010). Using data from 288 large brands from 2010 to 2014, Shapiro et al. (2021) found that TV ad effectiveness was negative for 80% of the brands in their sample, consistent with the trend of the general decline of TV ad effectiveness. Therefore, whether or not TV ads remain effective, and the extent to which they still are attracting to audiences in the digital era, are open questions to practitioners and scholars alike.

Studies have explored the effects of TV ads from the perspective of consumer behaviors' (Ansari and Joloudar 2011; Rubinson 2009; Siddiqui 2014). Ansari and Joloudar (2011), for instance, investigated the impact of TV ads on consumers' interest in purchasing and their actual purchase behaviors. The authors

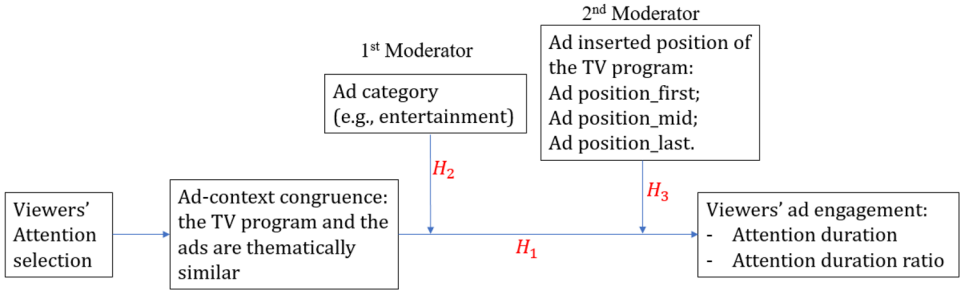
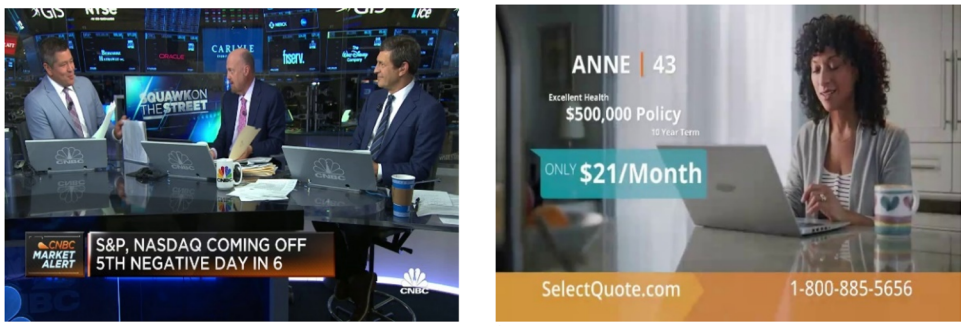


Figure 1 Conceptual Framework

(Panel A)



(Panel B)

Figure 2 (A) The Thematic Congruence of the TV Program and Ads in the Food Industry. (B) The Thematic Congruence of the TV Program and Ads in the Financial Industry.

(Panel A)

(Panel B)

Figure 3 (A) An Example of the Thematic Incongruence between TV Programs and Ads in the Government and Entertainment Industries, Respectively. (B) An Example of the Thematic Incongruence between TV Programs and Ads in the Entertainment and Government Industries, Respectively.

documented that TV ads are effective in terms of attracting consumers' visual attention and generating actual purchase behavior. This finding is consistent with prior studies examining how TV ads affect consumers' awareness (Rubinson 2009).

Viewers' engagement to TV ad is influenced by the context in which ads are placed at different time slots. With technological advancements, numerous media companies have adopted various approaches to buying and selling ad time slots. This phenomenon has been extensively discussed in relevant research and trade journal articles (Bellman et al. 2013; Malthouse et al. 2018). These studies have provided valuable insights into the underlying mechanisms of ad evaluation and selection processes, offering guidance to practitioners (*e.g.*, advertisers) on strategic audience targeting. For instance, Malthouse et al. (2018) studied how practitioners could be more effectively and strategically reaching potential audiences using programmatic TV ads. The "programmatic" approach, outlined in the article, uses search and display ads, as well as real-time auctions, to automatically generate transactions between media buyers and sellers. Compared to the traditional "mass" approach, where media companies sell audiences in bulk to advertisers, the new programmatic approach requires an additional computational burden, but is more effective in reaching specific audiences by analyzing and using results from customer- or household-level databases. We seek to contribute to this research stream by analyzing real-world, large-scale TV ads' impression data and providing insights on optimizing the programmatic system for increased ad engagement.

One Accurate Proxy for Ad Engagement: Viewer Attention

Studies have employed various measures of TV ad engagement, with self-reported methods and questionnaires or interviews being prevalent among traditional methods (Bellman et al. 2017; Micu and Plummer 2010; Pozharliev et al. 2017). Compared with these, the data and methods used in this research have the following advantages. First, prior studies have relied on audiences' ability to accurately recall the ads to which they were exposed. However, if consumers do not truthfully disclose their attitudes, emotions, or preferences toward featured brands or products, the results may be biased. Compared to traditional measures, Pozharliev et al. (2017) suggested that biometric measures, such as consumers' visual attention, can provide a more accurate depiction because they directly record whether consumers are paying attention to the ad exposure and for how long they stay tuned. This type of measurement provides reliable information on where consumer interest may lie throughout the ad exposure experience; further, it can potentially predict consumer purchase intention (Krugman et al. 1995; Pieters et al. 1999).

Moreover, advertising research has suggested that "attention" serves as one of the four primary indicators which could be used to reveal ad engagement (Frade et al. 2023; Pieters et al. 1999; Venkatraman et al. 2015). Pieters et al. (1999) examined consumers' visual attention when they were exposed to repeated print ads using eye-tracking technology. By adopting this technology, the authors could decompose eye movement data into two elements: attentional scan path and attention duration. They argued that these two measures are crucial to understanding "the impact of repetition on advertising effectiveness" (Pieters et al. 1999, 424).

Among the research that has applied different methods to assess TV ad engagement, Venkatraman et al. (2015) conducted a representative study. The authors compared six commonly used measures (traditional self-reports, implicit measures, eye tracking, biometrics, electroencephalography (EEG), and functional magnetic resonance imaging (fMRI)) regarding their predictability of TV ad success. Specifically, the authors developed a novel experimental design to examine consumers' response to 30-second TV ads. They found that neurophysiological methods, including biometric measures (*e.g.*, attention), significantly outperform traditional self-reported measures.

Frade et al. (2023) examined the relationship between visual attention and ad effectiveness in in-stream ads. The authors discovered a positive correlation between viewers' visual attention to ads and their brand recall, a more favorable attitude toward the brand, and a smaller perceived sense of intrusiveness, suggesting that viewers' visual attention can serve as a proxy for ad engagement.

The Positive Effect of Congruence on Ad Engagement

Research regarding the impact of congruence on ad engagement has yielded conflicting results.

Ad-program congruence refers to the alignment or matching between the content of an advertisement and the TV program in which it is placed. One stream of literature has found a positive effect of congruence on ad engagement. Notably, the strategic placement of advertisements within media environments of thematic congruence has been posited to enhance the precision of consumer targeting. This assertion stems from individuals' cognitive tendency to preferentially process information that corroborates their existing beliefs and attitudes, thereby rendering thematically-consistent advertisements more likely to be deemed relevant by viewers. The perceived relevance fostered by thematic congruence can thus augment viewer engagement and interest, facilitated by the alignment with the viewer's current interests or the content with which they engage. It has been posited that congruent advertising messages are more readily assimilated, whereas those that are discordant may encounter cognitive

resistance (Janssens et al. 2012; Yoon et al. 2023; Zanjani et al. 2011) (See Figure 2).

Furthermore, within the domain of media and communication studies, priming theory elucidates how exposure to certain media content can predispose viewers toward particular modes of thought or reactions to subsequent stimuli, contingent upon the thematic content encountered. Given the limited cognitive resources available for information processing, individuals exhibit a propensity for easier assimilation of information that resonates with the thematic context in which they are presently engaged (Lang 2000; Srull et al. 1985). Therefore, priming effects predict that congruence increases viewers' memory of ads (Yi 1990). Moreover, thematic congruence has been argued to enhance the cognitive processing of ads, thereby exerting a positive influence on ad engagement (Belanche et al. 2017; Gunter et al. 2002; Kamins et al. 1991; Moorman et al. 2002; Yoon et al. 2023; Xie et al. 2023).

The Positive Effect of Incongruence on Ad Engagement

Ad-program incongruence, on the other hand, is characterized by the misalignment between the content of the ad and the TV program in which it is placed, thus presenting a paradox in advertising engagement literature. While conventional wisdom and a substantial body of research has tended to underscore the importance of congruence for maximizing advertising impact, another research stream has found a positive effect of incongruence on ad engagement. Saliency theory argues that an individual's attention is more likely to be captured by a stimulus that stands out from its surroundings (Fiske and Taylor 2013; Germelmann et al. 2020; Halkias and Kokkinaki 2017; Lee and Faber 2007; Santangelo 2015; Van Der Lans et al. 2008) (See Figure 3). Advertisements that are incongruent with their surrounding content may thus achieve heightened visibility amidst the informational clutter, rendering them more memorable to viewers. Therefore, unexpected or incongruent ads may become more salient and memorable, thus challenging the assumption that congruence leads to increased ad engagement. Empirical investigations lend credence to this hypothesis. For example, Dahlén et al. (2008) found that thematic incongruence can capture consumers' attention because it deviates from their expectations, making the ad stand out from its surroundings. Similarly, Ausín et al. (2021) found that incongruent music can lead to higher levels of attention and ad recall. The element of surprise inherent in thematically-incongruent advertisements can also potentially spark viewer curiosity and foster deeper engagement, as evidenced by Kononova et al. (2020) through a set of simulated online scenario experiments, which indicated superior recognition rates for incongruent ads.

Hypothesis Development

In light of the above, it remains unclear whether ad-program congruence enhances ad engagement, leaving a research gap that requires attention from both advertisers and academics. The current study aims to bridge this gap through an empirical investigation using a large, real-world dataset. The following research questions are explored:

> RQ1: During the course in which consumers watch a typical TV program, how (and to what extent) does ad-content congruence impact viewers' ad engagement behaviors?
>
> RQ2: What are the possible moderators that intervene the ad-program congruence effect?

The existing literature detailed in the previous section provided conflicting results regarding the impact of congruence on ad engagement. Therefore, it is an empirical question whether ad-program congruence increases viewers' ad engagement or not. In order to uncover the answers to the abovementioned questions, we propose our first hypothesis:

> H1: Ad-program congruence will increase viewers' ad engagement in terms of increased attention to the focal ad.

As audiences display different levels of interests toward different programs by category, therefore, we included a control variable to examine whether different ad category has a moderation effect on viewers' ad attention. Hence, we propose the second hypothesis:

> H2: The ad-program congruence effect is moderated by different ad category: Specifically, the effect is more pronounced for certain categories, but less so for the other categories.

Previous studies have suggested that viewers tend to allocate more attention to a program as it progresses (Frade et al. 2023; Li and Lo 2015). Consequently, ads that are inserted in the later part of a TV program are expected to receive more attention from viewers, compared with the same ads inserted at the beginning. Accordingly, we propose the third hypothesis:

> H3: The ad-program congruence effect is more pronounced during the later part of a TV program than the earlier part.

METHODS AND ANALYSES

Data and Sample Selection

We obtained a large dataset from TVision, which uses computer vision and AI to develop in-home technology that measures TV viewing behavior. Central to this technology's capabilities is its precision in capturing data pertaining to TV program and ad viewing behaviors on a second-by-second basis across a sample of

households that is representative of national demographics. The dataset includes viewership metrics of both linear TV (LTV) and connected TV (CTV) ads. In this study, we focused on LTV ads, which are conventional TV commercials shown to viewers in a scheduled, linear time frame.

To examine the impact of the ad-program congruency effect on viewer engagement, we first screen for valid observations that require viewers to watch programs before encountering ads. Thus, we exclude observations where ads were inserted before the start of programs and focus solely on those inserted within programs. We also exclude the ads that the recorded start viewing time was before the airing start time due to potential data log errors. Lastly, we dismiss samples containing a discordance between the airing and ad durations. Such disparity precludes viewers from watching the ads in their entirety, thus potentially affecting the interpretation of our results.

Our final dataset consists of 4,830,649 observations between August 2022 and August 2023. Each observation represents an individual's program viewing followed by an LTV ad viewing. In the dataset, TVision categorized ads and programs. There were four categories of ads in our study: Entertainment, Financial, Food & Beverage & Restaurant, and Government. These four were the most common in TVision data. Moreover, 14 mostly watched genres of programs were considered: Comedy, Entertainment, Game Show, Talk, Business, Finance, Legal, Cooking, Food, Current Affairs, Documentary, Government, Politics, and Public Affairs. The final sample consists of 12,997 unique individuals and 39,434 different programs.

Variable Construction

This section details the dependent, independent, and control variables used to test our hypotheses. A summary of the variables can be found in Appendix B.

TVision uses technology to track whether viewers are watching which program or ads and the watching duration at second level. Our measures of viewers' engagement were attention duration in seconds (*attention duration*), which has been used in extant research (*e.g.*, McGranaghan et al. 2022), and attention duration relative to the total time duration of the ad (*attention duration ratio*). We incorporated the second measure (*attention duration ratio*) into the analyses because viewers' interest and attention may be influenced by the time length of ads.

Our variable of interest is the congruence between the content of ads and programs (*Congruence*), which equals 1 for observations with a congruent ad category and program genre, and 0 otherwise. To assess the congruence, we employ ChatGPT[2] (3.5v) to evaluate whether the genres of the TV programs align with the ad categories.[3] Table 1 shows the matched ads categories and program genres by ChatGPT. Additionally, to validate these findings, we conduct an ancillary online study using the platform Prolific.[4] In this online study, 106 human subjects participated and provided their independent evaluations on whether specific ad categories (*e.g.*, Financial) were thematically similar (or congruent) to the TV program genres (*e.g.*, Business). The responses from this online experiment revealed minor inconsistencies with the ChatGPT results (details of which can be found in Appendix A). Our main results of analyses were unaffected by the discrepancies between the ChatGPT and online study results.

We control three sets of factors that may have impacted individuals' ad viewing behaviors. First, we control for the viewers' demographic characteristics, such as gender (*Male*), age (*Age*), household income level, and the size of the household (*Family size*). To measure household income, we use indicator such variables[5] as *Income high* (equals to 1 for households whose income was categorized as "high," and 0 otherwise) and *Income low* (equals to 1 for households whose income was categorized as "low," and 0 otherwise). We control for ad characteristics, such as the total ad time length in seconds (*Ad duration*) and the categories of ads (*Ad entertainment*, *Ad financial*, and *Ad politics*[6]). Lastly, we take into account various situational and contextual elements that may have affected ad viewing, such as whether the program being watched was a new episode (*New episode*) or not, the type of channel being viewed (*Channel*), the presence of guest viewers (*Guest*), and the specific time of day in which the ads were viewed (*Morning*, *Early fringe*, *Prime*, *Late night*, and *Overnight*[7]).

Table 2 summarizes all of the variables and statistics. Across our sample, viewer's average attention duration for an ad was 7.61 seconds (*attention duration*), or 35% of the total ad time length (*attention duration ratio*), with an average ad time length of 22.15 seconds. Across all observations, males constitute 45% of the viewership, suggesting that females are the primary consumers of TV media content. The average age of a viewer in the sample is 58.14 years, and the average family size is approximately 2. Moreover, households with lower incomes are over three times more likely to engage with TV content than relatively higher-income households.

Table 1 The Congruent Matched Ad Category with the Program Genres

Ad category	Program genre
Entertainment	Comedy, entertainment, game show, talk
Financial	Business, finance, legal
Food & beverage & restaurant	Cooking, food
Government	Current affairs, documentary, government, politics, public affairs

The ad–program content congruence is paired by ChatGPT (3.5v).

Table 2 Variable List and Descriptive Statistics

Panel A: summary statistics	**N**	**Mean**	**SD**	**Min**	**Max**	**Q1**	**Median**	**Q3**
Attention duration	4,830,649	7.609	11.150	0	120	0	3	13
Attention duration ratio	4,830,649	0.35	0.398	0	1	0	.133	.767
Congruence	4,830,649	0.317	0.465	0	1	0	0	1
Income high	4,830,649	0.078	0.269	0	1	0	0	0
Income low	4,830,649	0.264	0.441	0	1	0	0	1
Family size	4,830,649	2.34	1.240	1	8	1	2	3
Male	4,830,649	0.444	0.497	0	1	0	0	1
Age	4,830,649	58.138	15.126	1	100	50	60	69
Ad entertainment	4,830,649	0.423	0.494	0	1	0	0	1
Ad financial	4,830,649	0.249	0.432	0	1	0	0	0
Ad politics	4,830,649	0.072	0.258	0	1	0	0	0
Ad duration	4,830,649	22.155	15.263	5	240	15	15	30
New episode	4,830,649	0.577	0.494	0	1	0	1	1
Channel	4,830,649	0.529	0.499	0	1	0	1	1
Morning	4,830,649	0.056	0.230	0	1	0	0	0
Early fringe	4,830,649	0.262	0.440	0	1	0	0	1
Prime	4,830,649	0.26	0.439	0	1	0	0	1
Late night	4,830,649	0.114	0.318	0	1	0	0	0
Overnight	4,830,649	0.034	0.180	0	1	0	0	0
Guest	4,830,649	0.185	0.388	0	1	0	0	0
Ad position first	4,830,649	0.221	0.415	0	1	0	0	0
Ad position mid	4,830,649	0.379	0.485	0	1	0	0	1
Ad position last	4,830,649	0.4	0.490	0	1	0	0	1

Panel B: frequency statistics	**Ad entertainment**		**Ad financial**		**Ad politics**		**Ad food**	
Congruence								
0	929,048	19%	1,109,204	23%	196,221	4%	1,064,818	22%
1	1,112,790	23%	93,539	2%	149,934	3%	175,095	4%
Attention duration								
0 s	842,855	17%	484,607	10%	127,496	3%	542,918	11%
0–15 s	944,745	20%	469,721	10%	118,779	2%	658,007	14%
15–30 s	243,144	5%	211,738	4%	82,333	2%	38,672	1%
> 30 s	11,094	0%	36,677	1%	17,547	0%	316	0%
Attention duration ratio								
0%	842,855	17%	484,607	10%	127,496	3%	542,918	11%
0–25%	273,304	6%	198,871	4%	63,690	1%	152,156	3%
25–50%	208,649	4%	125,707	3%	37,922	1%	127,016	3%
50–75%	179,823	4%	108,028	2%	32,113	1%	112,284	2%
>75%	537,207	11%	285,530	6%	84,934	2%	305,539	6%

(*Continued*)

Table 2 Continued

Panel B: frequency statistics	Ad entertainment		Ad financial		Ad politics		Ad food	
Male								
0	1,142,057	24%	655,002	14%	188,747	4%	698,646	14%
1	899,781	19%	547,741	11%	157,408	3%	541,267	11%
Ad duration								
0–15 s	1,278,404	26%	470,729	10%	1,216	0%	1,119,091	23%
15–30 s	731,229	15%	611,475	13%	72,423	1%	119,680	2%
> 30 s	32,205	1%	120,539	2%	272,516	6%	1,142	0%
Ad position first	453,736	9%	244,923	5%	62,829	1%	306,086	6%
Ad position mid	741,792	15%	465,104	10%	144,357	3%	478,100	10%
Ad position last	846,310	18%	492,716	10%	138,969	3%	455,727	9%

Note: This table represents descriptive statistics for variables used in the paper. The statistics include the number of observations, mean, standard deviation, minimum, maximum, first quartile, median, and third quartile. All variables are defined in Appendix B.

Model and Results

To examine the effects of ad-program congruence on TV ad engagement, we estimate the following regression that incorporates fixed effects (FE) for both individual viewers and specific TV programs:

$$Attention_{ijs} = \alpha + \beta \times Congruence_{js} + \gamma \times CONTROLS_{ijs} + Individual\,FE + Program\,FE + \varepsilon_{ijs}, \quad (1)$$

where the dependent variable $Attention_{ijs}$ represents the viewer's engagement measured by the time length of a viewer's attention on the ad in seconds (*Attention duration*) and the ratio of *attention duration* over total ad time duration (*Attention duration ratio*). The subscripts *i*, *j*, *s* represent viewer *i*, ad *s*, and TV program *j*, respectively. The key independent variable $Congruence_{js}$ takes a value of 1 when the content of ad *s* and program *j* are thematically congruent, and 0 otherwise. *CONTROLS* represents control variables.

Table 3 shows the results of the ad-program congruence effects on viewers' attention to TV ads. Consistent with our hypothesis H1, the coefficients of *Congruence* are positive and significant in both absolute and relative measures at the 0.1% significance level. On average, ad-program congruence extends viewers' attention by 0.196 seconds longer, or a 0.7% increase in the attention duration ratio. These outcomes indicate that advertisements are more engaging to viewers when they follow programs of matching thematic categories.

Equation (2) explores the moderation role that the ad category plays in influencing viewing behaviors:

$$Attention_{ijs} = \alpha + \sum_k \beta_k \times Congruence_{js} \times \text{Ad Category}_k + \gamma \times CONTROLS_{ijs} + Individual\,FE + Program\,FE + \varepsilon_{ijs}, \quad (2)$$

where the interaction terms $Congruence_{js} \times \text{Ad Category}_k$, β_k represents the moderation effects of different ad categories (k = *entertainment*, *financial*, or *food*) on viewer *i*'s attention to ad *s* in program *j*. The control variables included are identical to those specified in Equation (1).

Table 4 presents the results of the moderating effects of ad categories. Column (1), where the dependent variable is *Attention duration*, shows that the coefficients on *Congruence*Ad entertainment* and *Congruence*Ad finance* are positive and significant at the 0.1% level. However, the coefficient on *Congruence*Ad politics* is insignificant, while the coefficient on *Congruence*Ad food* is negative and significant at the 5% level. Column (2), with *Attention duration ratio* as the dependent variable, shows that the coefficient on *Congruence*Ad entertainment* is positive and significant at the 0.1% level. The results in Table 4 suggest that the congruence between different ad categories plays different roles in modifying viewer attention. Overall, the results suggest that the moderation effects of ad categories are positive for entertainment and financial ads, but negative for food ads.

Ads can be situated at various time slots during the broadcast of a TV program. To explore how the inserted positioning of ads influences viewing behavior, we partition a TV program into three equal-length segments, each constituting one-third of the total program length. Accordingly, we introduce two new control variables: *Ad position first* (equals 1 for observations where ads were placed in the first segment, and 0 otherwise) and *Ad position last* (equals 1 for ads placed in the third segment, and 0 otherwise), with ads in the second (or, middle) segment serving as the reference group[8]. To assess the moderating impact of ad position with a program on viewer attention, we employed Equation (3):

Table 3 Impact of Content Congruence on Viewers' Attention

	(1) Attention duration	(2) Attention duration ratio
Congruence	.196***	.007***
	(14.413)	(13.708)
	[.000]	[.000]
Ad entertainment	.087***	.003***
	(8.014)	(5.812)
	[.000]	[.000]
Ad financial	.032*	−.001
	(2.173)	(−1.415)
	[.030]	[.157]
Ad politics	.354***	−.003***
	(13.000)	(−3.915)
	[.000]	[.000]
Ad duration	.299***	−.001***
	(297.232)	(−50.605)
	[.000]	[.000]
New episode	.302***	.015***
	(16.175)	(19.188)
	[.000]	[.000]
Channel	.051	.003
	(.911)	(1.214)
	[.362]	[.225]
Income high	−.398***	−.013***
	(−21.442)	(−18.595)
	[.000]	[.000]
Income low	−.495***	−.021***
	(−41.76)	(−45.929)
	[.000]	[.000]
Family size	−.077***	−.003***
	(−18.237)	(−20.94)
	[.000]	[.000]
Male	.385***	.018***
	(39.250)	(47.765)
	[.000]	[.000]
Age	.058***	.003***
	(170.004)	(196.655)
	[.000]	[.000]
Morning	.014	.001
	(.392)	(.865)
	[.695]	[.387]
Early fringe	.566***	.026***
	(25.364)	(28.198)
	[.000]	[.000]
Prime	.639***	.029***
	(26.522)	(27.666)
	[.000]	[.000]
Late night	.033	.001
	(1.268)	(.875)
	[.205]	[.382]
Overnight	.164***	.015***
	(4.664)	(10.244)
	[.000]	[.000]
Guest	−1.405***	−.064***
	(−122.441)	(−141.287)
	[.000]	[.000]
Constant	−2.609***	.202***
	(−55.671)	(113.112)
	[.000]	[.000]
Observations	4,830,649	4,830,649
R-squared	.219	.076
Individual FE	Yes	Yes
Program FE	Yes	Yes

Note: *t*-values are in parentheses and *p* values are in square brackets. *, **, and *** denote significance at the 5%, 1%, and 0.1% level, respectively.

$$Attention_{ijs} = \alpha + \sum_{p} \beta_p \times Congruence_{js} \times \text{Ad position}_{\text{p}} + \gamma \times CONTROLS_{ijs} + Individual\,FE + Program\,FE + \varepsilon_{ijs}, \quad (3)$$

where p represents the three ad positions (first, mid, and last) and β_p are the corresponding coefficients. Positive β_p indicates that the congruence effect holds positive for ads inserted in ad position p, thus supporting H_3.

Table 5 reports the estimation results of the moderation effects of ad position on viewers' attention. In Table 5, the estimated coefficients of the interaction terms *Congruence*Ad position first*, *Congruence*Ad position mid*, and *Congruence*Ad position last* are consistently positive and significant at the 0.1% level for both the absolute and relative attention measures. In line with H3, the results suggest that the ad position positively moderates the congruence effects regardless of where they are inserted within the program (*i.e.*, first, mid, and last segment). Notably, ads positioned in the last segment tend to garner more viewer attention on average.

Additional Analyses

To provide more practical insights for advertisers, we further explore the three-way interactions among content congruence, ad

Table 4 Moderation Effects of Ad Category on Viewers' Attention

	(1)	(2)
	Attention duration	**Attention duration ratio**
Congruence Ad entertainment*	.342***	.013***
	(17.377)	(16.3)
	[.000]	[.000]
Congruence Ad financial*	.212***	−.002
	(3.652)	(−1.025)
	[.000]	[.305]
Congruence Ad politics*	.015	−.001
	(.255)	(−.948)
	[.799]	[.343]
Congruence Ad food*	−.066*	−.001
	(−2.427)	(−.479)
	[.015]	[.632]
Constant	−2.569***	.203***
	(−54.642)	(113.184)
	[.000]	[.000]
Observations	4,830,649	4,830,649
R-squared	.219	.076
Control variables	Included	Included
Individual FE	Yes	Yes
Program FE	Yes	Yes

Note: *t*-values are in parentheses and *p*-values are in square brackets *, **, and *** denote significance at the 5%, 1%, and 0.1% level, respectively. Control variables include *Ad entertainment*, *Ad financial*, *Ad politics*, *Ad duration*, *New episode*, *Channel*, *Income high*, *Income low*, *Family size*, *Male*, *Age*, *Morning*, *Early fringe*, *Prime*, *Late night*, *Overnight*, and *Guest*, which are not shown for brevity.

Table 5 Moderation Effects of Ad Position on Viewers' Attention

	(1)	(2)
	Attention duration	**Attention duration ratio**
Congruence Ad position first*	.217***	.007***
	(9.903)	(7.734)
	[.000]	[.000]
Congruence Ad position mid*	.108***	.003***
	(5.715)	(4.429)
	[.000]	[.000]
Congruence Ad position last*	.264***	.010***
	(14.205)	(14.409)
	[.000]	[.000]
Ad position first	−.038*	−.001
	(−2.519)	(−1.118)
	[.012]	[.264]
Ad position last	.108***	.007***
	(8.437)	(13.874)
	[.000]	[.000]
Constant	−2.643***	.200***
	(−55.665)	(110.477)
	[.000]	[.000]
Observations	4,830,649	4,830,649
R-squared	.219	.076
Control variables	Included	Included
Individual FE	Yes	Yes
Program FE	Yes	Yes

Note: *t*-values are in parentheses and *p* values are in square brackets *, **, and *** denote significance at the 5%, 1%, and 0.1% level, respectively. Control variables include *Ad entertainment*, *Ad financial*, *Ad politics*, *Ad duration*, *New episode*, *Channel*, *Income high*, *Income low*, *Family size*, *Male*, *Age*, *Morning*, *Early fringe*, *Prime*, *Late night*, *Overnight*, and *Guest*, which are not shown for brevity.

category, and ad positions. To do so, we modify Equation (1) as follows: We replace the variable *Congruence* with the 12 interaction terms $\sum_{kp} Congruence * AdCategory_k * Adinsertion Position_p$, where each interaction term served as an indicator, with the value of 1 denoting that congruence occurs within the corresponding ad category and ad position, and 0 otherwise. The results are presented in Table 6. The results reveal a consistent positive and significant impact of content congruence on viewer attention for "entertainment" category ads, across all ad positions, and reflected in both attention duration and attention duration ratio metrics. For the "Financial" ads, a similar positive and significant influence was observed, but only for those positioned in the mid and last segments, affecting attention duration. Notably, "Politics" ads placed in the first segment of programs exhibit negative and significant coefficients, revealing a distinct pattern. Similarly, a negative moderation effect is observed for "Food" ads on content congruence, particularly for those positioned in the first and mid segments. In summary, the positive effects of content congruence on viewer attention are found to be most pronounced for "Entertainment" and "Financial" ads, especially when located in later segments.

DISCUSSION AND CONCLUSION

General Discussions

To the best of our knowledge, this study is among the first to empirically examine ad-program congruence on viewers' ad engagement behaviors. Specifically, based on the large-scale field data provided by TVision, we construct two measures of viewers' visual attention (both the absolute measure, *attention duration*, and the relative measure, *attention duration ratio*) from a comprehensive sample of 4,830,649 observations. The findings are summarized as follows.

Table 6 Three-Way Interaction Effects among Content Congruence, Ad Category, and Ad Position on Viewer's Attention

	(1)	(2)
	Attention duration	**Attention duration ratio**
Congruence Ad entertainment* Ad position first*	.436***	.015***
	(16.107)	(13.319)
	[.000]	[.000]
Congruence Ad entertainment* Ad position mid*	.211***	.007***
	(8.952)	(7.526)
	[.000]	[.000]
Congruence Ad entertainment* Ad position last*	.408***	.017***
	(17.575)	(17.765)
	[.000]	[.000]
Congruence Ad financial* Ad position first*	.13	−.004
	(1.397)	(−1.349)
	[.162]	[.177]
Congruence Ad financial* Ad position mid*	.189*	0.000
	(2.27)	(−.085)
	[.023]	[.932]
Congruence Ad financial* Ad position last*	.283***	−.002
	(3.493)	(−.979)
	[.000]	[.328]
Congruence Ad politics* Ad position first*	−.521***	−.011***
	(−4.547)	(−3.969)
	[.000]	[.000]
Congruence Ad politics* Ad position mid*	.11	.003
	(1.261)	(1.573)
	[.207]	[.116]
Congruence Ad politics* Ad position last*	.116	−.003
	(1.394)	(−1.359)
	[.163]	[.174]
Congruence Ad food* Ad position first*	−.15***	−.007**
	(−3.601)	(−3.111)
	[.000]	[.002]
Congruence Ad food* Ad position mid*	−.068*	−.001
	(−1.984)	(−.497)
	[.047]	[.619]
Congruence Ad food* Ad position last*	−.03	.003
	(−.851)	(1.414)
	[.395]	[.157]
Constant	−2.601***	.201***
	(−54.625)	(110.599)
	[.000]	[.000]
Observations	4,830,649	4,830,649
R-squared	.219	.076
Control variables	Included	Included
Individual FE	Yes	Yes
Program FE	Yes	Yes

Note: *t*-values are in parentheses and *p* values are in square brackets *, **, and *** denote significance at the 5%, 1%, and 0.1% level, respectively. Control variables include *Ad entertainment, Ad financial, Ad politics, Ad duration, New episode, Channel, Income high, Income low, Family size, Male, Age, Morning, Early fringe, Prime, Late night, Overnight, Guest*, *Ad position first,* and *Ad position last*, which are not shown for brevity.

Embracing AI technologies could allow for optimized ad targeting and content delivery based on individual user habitual behaviors, preferences, and engagement patterns.

Across over four million observations, we find a significant and positive relationship between ad-program congruence and viewers' visual attention after controlling for other determinants of viewers' attention and individual viewer or program fixed effects.

First, across over four million observations, we find a significant and positive relationship between ad-program congruence and viewers' visual attention after controlling for other determinants of viewers' attention and individual viewer or program fixed effects. These outcomes suggest that viewers are more engaged with ads that have matched thematic categories with TV programs. This finding also provides evidence regarding the phenomenon of the ad-program congruence effect, thus shedding new light on TV ad engagement from the lens of thematic content similarity. This significant finding suggests that airing the same ads in TV programs with similar content will increase viewer attention on ads.

Second, in order to verify whether the moderation role of different ad categories impact viewing behaviors, we conduct an analysis including the interaction term of content congruence and ad category. Our results indicate that a strong positive and significant congruence effect only holds for "Entertainment" and "Financial" ads at the 1% level, but insignificant for "Politics" ads. Additionally, we find the effect to be negative for "Food" ads, significant at the 5% level. These finding suggest that the mental processes of viewers while watching ads and TV programs may differ significantly due to their distinct content, thereby producing various effects on viewers' ad engagement. Consequently, this discovery presents crucial practical implications for advertisers seeking to strengthen the efficacy of TV ads through a comprehensive grasp of how content congruence can be exploited.

Third, we conducted an additional analysis by incorporating three-way interactions among content congruence, ad category, and ad positions. We find that the positive effects of ad-program congruence on viewer attention were most pronounced for "Entertainment" and "Financial" ads. Moreover, the positive effects are statistically significant when these were inserted in later segments of the program. In order to attract more attention from existing audiences, ads can be more strategically inserted at the later, rather than earlier, stages of TV programs if these are within the categories of entertainment or finance. Thus, our research reveals new insights on the optimal placement for ads with different categories to enhance viewer ad engagement.

Fourth, the emergence of new technologies is driving significant changes in the traditional TV advertising industry, necessitating new strategies to adapt and thrive in this evolving landscape. Addressable advertising, which allows advertisers to target specific households or individuals with personalized TV ads, is one promising strategy to consider. Advertisers can expand their reach beyond traditional broadcast channels by targeting audiences who consume content through streaming services and CTVs. Embracing AI technologies could allow for optimized ad targeting and content delivery based on individual user habitual behaviors, preferences, and engagement patterns. Our findings provide insights for enhancing ad engagement in the new digital era.

Managerial Implications and Practical Relevance

The findings from this study carry relevance for practitioners and offer several managerial implications.

Targeting Audience. Media buyers can strategically organize or restructure their advertising content or topics in order to align with the focal aired TV programs in which they are embedded. Our results suggest that viewers pay more attention to ads with similar content or topics, which advertisers could leverage to improve the outcomes of audience targeting. For example, research (*i.e.*, Nabi et al. 2003) shows that TV programs with entertainment content tend to be more attractive than other type of programs. Indeed, "regular viewers watch mainly because they are entertained" (*p.* 320, Nabi et al. 2003). Based on our findings, it is recommended to tailor the ads to align with viewers' preferences for entertainment

content. More specifically, practitioners could incorporate ads with humor, engaging storylines, or captivating visuals with the focal entertaining TV programs to effectively reach more audience and engage with existing audience.

Optimizing Ad Replacement for Entertainment and Financial Ads. One of our findings suggests that ads inserted in a later (vs. earlier) stage of a program receive more (vs. less) attention from viewers if the ads are either of an entertainment or financial nature. This finding provides insights on the optimization of ad placement for certain categories of ads. To maximize the likelihood of capturing viewer attention, practitioners could strategically choose exactly where to insert ads based on their content or topic. For example, if the ad is financial, it would be better to insert it in a later segment. Moreover, this insight aligns with the changing dynamics of consumer attention spans in the digital world. This observation contributes to the ongoing discussion about adapting advertising strategies to capture and maintain viewer attention, especially in the face of decreasing attention spans in the digital age.

Enhancing Ad Awareness and Ad Recall. Advertisers should consider the potential impact of ad content alignment on ad effectiveness in terms of ad awareness and ad recall. Ads that are thematically similar to the surrounding TV program may have a higher chance of being noticed and remembered by viewers, leading to higher ad awareness and ad recall. Media advertisers and marketers could strategically create ads to not only align with the content of the TV program, but also design them to be more salient. This could lead to improved ad recall as viewers are more likely to remember and associate the advertisement with the program content they enjoyed.

DIRECTIONS OF FUTURE RESEARCH

This section concludes the study by briefly listing several fruitful areas for future research and providing a possible agenda for future studies.

i. Generalizability could be improved by using longer time durations: the dataset provided by TVision is undeniably rich and novel, nevertheless it could be practically important to examine mass audience's TV program and ad watching behaviors using longer time durations. The dataset used in this study covers the period from August 2022 to August 2023. Consequently, the findings mainly relate to audiences' temporal viewing habits during this short time period. However, it would be intriguing to re-investigate the same issue using data covering a longer duration to observe consumers' dynamic viewing behaviors and how they evolve over time.

ii. Future researchers could also explore other contextual factors that may affect TV viewing behaviors. In this study, we mainly investigated the congruence between TV program and ads. Besides the thematic congruence, it is also important to look into more contextual variables between TV programs and the inserted ads such as emotional congruence and audio congruence. Furthermore, this study only focused on linear TV ads. It is still unclear whether these congruence effects hold in connected TV advertising, leaving a fruitful future research direction.

iii. The understanding of viewers' emotional reactions could be further improved: Future research could explore different types of viewer heterogeneity and examine whether ad-program congruence effects exist for various types of viewers. For instance, it would be valuable to investigate how viewers emotionally react to TV programs when they are integrated with ad-program congruence. Would the ad-program congruence effect persist if viewers were not fond of the TV program?

iv. The study could be extended by implementing a field experiment using eye-tracking technology: Future research could extend the current study by implementing a field experiment collaborating with a TV practitioner using eye-tracking technology. Existing research suggests that eye-tracking data provides much richer information (Chen et al. 2021) regarding consumers' visual activities. With the recent advancements in computer vision (Redmon and Farhadi 2018) and machine learning techniques (Hessels et al. 2018; Kurzhals et al. 2017; Liu et al. 2020), future research could adopt eye-tracking technology to record audiences' entire viewing journeys of both TV and ads. Moreover, the annotation process could be supported by automated annotation with AI and machine learning techniques, which would significantly reduce the labor burden of human annotation and improve the accuracy and efficiency of data analyses. JAR

NOTES

1. TVision Insights Inc. https://www.tvisioninsights.com/.
2. ChatGPT https://chat.openai.com/.
3. We used the following prompt for ChatGPT: "I have 4 ad categories and 14 program genres. For each ad category, please suggest the program genres representing a similar topic. Ad categories: "Entertainment," "Financial," "Food & Beverage & Restaurant," and "Government." Program genres: "Comedy," "Entertainment," "Game Show," and "Talk"; "Business," "Finance," and "Legal"; "Cooking" and "Food"; and "Current Affairs," "Documentary," "Government," "Politics," and "Public Affairs.".

4. Please refer to Appendix A for more details of the online experiment.
5. TVision classifies income with the following criteria: "high" for income over $150k, "mid" for $35k–150k, and "low" for under $35k. We took *Income mid* as the reference group in our tests.
6. We take Food & Beverage & Restaurant ads as the reference group in our tests.
7. TVision defines dayparts as follows: Morning is from 6 am to 10 am, Daytime from 10 am to 4 pm, Early Fringe from 4 pm to 8 pm, Prime from 8 pm to 11 pm, Late Night from 11 pm to 2 pm, and Overnight from 2 am to 6 am. We used Daytime as the reference group in our tests.
8. Please note that we do not use the "position_in_pod" variable provided in the TVision dataset. "Position_in_pod" indicates where an ad was placed within the ad pod (either "First," "Mid," or "Last").

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APPENDIX A

ONLINE EXPERIMENT TITLE: "MATCHING TV SHOWS WITH ADS CATEGORIES"

To corroborate the findings obtained via ChatGPT regarding the thematic alignment between ad categories and TV program genres, we conducted an online experiment using online platform Prolific from February 15, 2024 to March 22, 2024. This study involved the recruitment of participants from Prolific.com. The sample comprised 51 males, 55 females, and 1 individual identifying as a trans woman—all of whom met our criteria of being over 18, fluent in English, and residing in the USA. The procedure for this experiment, conducted via a Qualtrics survey, included several steps: (1) Signing the electronic consent form; (2) answering two questions related to TV viewing behaviors (*i.e.*, Do you consider yourself a frequent TV viewer? If yes, how many hours do you typically spend watching TV in a week?); (3) evaluating the congruence between ad categories and TV program genres; and (4) answering demographics questions on age, gender, race, and education level. For the third step, the participants were instructed to match each of the 14 TV program genres with the most thematically similar ad categories (from a total of 4), following the prompt: "Below, you will find 14 program genres and 4 ad categories. For each ad category, please suggest the program genres representing the most similar topic."

The findings largely align with ChatGPT's analysis, showing high agreement rates among participants for matching TV program genres with ad categories: 98.1%, 75.7%, 100%, and 98.1% of participants categorized "Comedy," "Talk," "Entertainment," and "Game Show" programs under the "Entertainment" ad category, respectively. Additionally, 97.2% of participants placed "Business" programs and all participants placed "Finance" programs under the "Financial" category. In terms of the "Food & Beverage & Restaurant," 95.3% and 99.1% of participants, respectively, assigned "Cooking" and "Food" programs to this category. Moreover, "Politics," "Government," "Current Affairs," and "Public Affairs" programs were matched with the "Government" category by 94.4%, 86.0%, and 100% of participants, respectively.

However, there were two notable deviations from ChatGPT's categorizations: 75.7% of the participants associated the "Legal" TV program genre with the "Government" ad category, as opposed to "Financial." Moreover, 84.1% of the participants linked the "Documentary" genre with the "Entertainment," rather than Government," ad category.

Within our dataset, TV programs categorized as "Legal" and "Documentary" constituted 0.3% and 6.9% of the total sample, respectively. Given these two discrepancies, we proceeded to recode the congruence variable in line with the outcomes of human coding and recalculated all effects as per Equations (1), (2), and (3). This re-evaluation yielded results that were in agreement with those presented in Tables 3, 4, and 5.

APPENDIX B

Table B1 Variable Definitions

Variable	Definition
Attention duration	Number of seconds that the viewer paid attention to the TV screen.
Attention duration ratio	Ratio of the attention duration over the total ad duration.
Congruence	An indicator variable that takes the value of 1 if there is thematic congruence between TV programs and ads, and 0 otherwise.
Ad entertainment	An indicator variable that takes the value of 1 if the ad is classified as Entertainment by TVision, and 0 otherwise.
Ad financial	An indicator variable that takes the value of 1 if the ad is classified as Financial by TVision, and 0 otherwise.
Ad food	An indicator variable that takes the value of 1 if the ad is classified as Food & Beverage & Restaurant by TVision, and 0 otherwise.
Ad politics	An indicator variable that takes the value of 1 if the ad is classified as Government by TVision, and 0 otherwise.
Ad duration	Length of the ad in seconds.
New episode	An indicator variable that takes the value of 1 if the program is aired for the first time, and 0 otherwise.
Channel	An indicator variable that takes the value of 1 if channel type is cable, and 0 otherwise.
Income high	An indicator variable that takes the value of 1 if the household income is over $150,000 per year, and 0 otherwise.
Income low	An indicator variable that takes the value of 1 if the household income is between $35,000–$150,000 per year, and 0 otherwise.
Family size	Household size, measured by the number of persons in a household.
Male	An indicator variable that takes the value of 1 if the viewer is male, and 0 otherwise.
Age	Viewer's age.
Morning	An indicator variable that takes the value of 1 if the viewer watched the ad in the morning time (6 am–10 am), and 0 otherwise.
Early fringe	An indicator variable that takes the value of 1 if the viewer watched the ad in the early fringe time (5 pm–8 pm), and 0 otherwise.
Prime	An indicator variable that takes the value of 1 if the viewer watched the ad in the prime time (8 pm–11 pm), and 0 otherwise.
Late night	An indicator variable that takes the value of 1 if the viewer watched the ad in the late night time (11 pm–2 am), and 0 otherwise.
Overnight	An indicator variable that takes the value of 1 if the viewer watched the ad in the overnight time (2 am–6 am), and 0 otherwise.
Guest	An indicator variable that takes the value of 1 if the viewer is a guest of the household, and 0 otherwise.
Ad position first	An indicator variable that takes the value of 1 if the ad is aired in the first segment of the program, and 0 otherwise.
Ad position mid	An indicator variable that takes the value of 1 if the ad is aired in the second segment of the program, and 0 otherwise.
Ad position last	An indicator variable that takes the value of 1 if the ad is aired in the last segment of the program, and 0 otherwise.