How many times do customers need to be exposed to TV advertisements to take purchasing actions?

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Abstract

Customers are exposed to large quantities of advertisements daily and often struggle to process them. As a result, customers tend to avoid them entirely. The popularization of digital video recorders, which allow television advertisements to be skipped entirely, has made this even easier. Hence, some scholars argue that television advertisements are less influential than in the past. However, companies think that television advertisements may still be effective in expanding awareness of new products, so they have not been able to lower the cost of television advertising. In fact, the scale of television advertisements in Japan has remained almost constant over the last 10 years. This study examined the effective contact frequency of television advertisements for attracting customers to the website of Japanese automobile manufacturers, particularly whether the frequency was inferior to the “three-hit theory.” As it is difficult for respondents to accurately report contact frequency, television viewing and Web browsing data (smartphone, PC), which were linked via ID numbers, were used. The study findings showed that the three-hit theory held, although the effective frequency differed somewhat depending on the presence/absence of celebrities, the advertisement length, and the broadcasting time zone. With many companies concerned about the decline in business performance and lack of efficiency in television advertisements, this study offers companies the means to refine their marketing promotion plans.

Keywords: Three-hit Theory, Smart Television, Lifelog Data, Multinomial Logit Model

1. Introduction

The television (TV) advertising expenditure in Japan in 2017 totaled 1,947.8 billion yen—roughly 30% of the total advertising expenditure, making it the largest advertising medium [1]. Excluding economic-based changes, there has been no major shift in this proportion over the last 10 years (from around 1,990 billion yen in 2008).

Customers are exposed to large quantities of advertisements daily, which places a heavy burden on them. As a result, there is an increasing tendency to avoid advertisements. The popularization of digital video recorders (DVR) has made skipping TV advertisements easy [2, 3]. In addition, with the diversification and popularization of streaming video, customers are rapidly moving towards a point where they view only videos that they have voluntarily selected [4]. With this background, it is necessary to develop measurements of customers’ skepticism of advertisements [5] and improve advertisement strategies through analysis of how they are avoided [6].

Indeed, as the AISAS (Attention → Interest → Search → Action → Share) process indicates [7], it is important for companies that customers themselves develop a willingness to seek out information about that company’s products. However, unless companies acquire an understanding of customers’ cognitions or interest in their products, especially new products, it is impossible to attract these customers’ search behavior. Many companies still consider the effect of TV advertisements, a form of mass media, to be strong, which may be one of the reasons that it is difficult for companies to make decisions about reducing TV advertisements.

This study evaluated how much contact a customer must have with a given TV advertisement to engage in purchasing behavior (i.e., the effective contact frequency) in the Japanese automobile industry, as the adverse effect of TV advertisements is being examined. More specifically, it validated whether the effective frequency was inferior to the “three-hit theory” [8], which proposes that advertisements will affect purchasing behavior only at the third contact. Furthermore, it focused on visits to the manufacturer’s website as purchasing behavior. Ideally, the outcome would be purchasing. However, various factors such as discounts at the dealership and timing (because cars are durable consumer goods) are related to whether or not the purchase is actually made. In that case, it would be difficult to isolate the effect of TV advertisements. Because customers’ voluntary information seeking is important, this study defined the objective variable as visiting the website. Besides investigating the simple effective contact frequency, it examined how this effective frequency differed according to whether celebrities were cast in the advertisement, the broadcasting scale, and the broadcasting time zone. As there are few studies verifying the effect of advertisements by combining offline advertisement and...
The creative advertisements will provide consumers with the necessary to new products.

Another issue to address is how difficult it would be for customers to recall an accurate frequency of contact with specific TV advertisements. To work around this, the study employed data from TV viewing and web browsing logs (smartphone and PC), which were then matched using ID numbers. There are no studies that have used such behavior logs to evaluate the effective contact frequency of TV advertisements for attracting customers to company web sites, much less according to the frequency of TV advertisements for attracting customers to new products.

2. Effect of TV advertisements

2.1 Measurement Methods

Evaluating the effectiveness of TV advertisements is a well-covered topic in the marketing literature. Current evaluation methods can be roughly classified into three categories.

The first category is evaluation of the direct effects of an advertisement, such as sales and financial indicators. Little [12] proposed an advertising budget determination model that uses market share as the outcome variable. Mehta et al. [13] proposed a model of estimating the effect of advertisements based on advertisement quantity and product purchase quantity. Other studies have estimated the effect of TV advertisements by focusing on market share or return on investment [14,15]. However, the outcomes of these methods are subject to various influences other than advertising, leading to high noise.

The second category is evaluation of the creative aspects of the TV advertisement. Alden et al. [16] reported that the playfulness of the ad, ease of resolution of the incongruity in it, and the warmth created by the ad all moderate the effects of surprise on humor. Studies have also examined cultural differences in the creative qualities of advertising. For example, despite cultural similarities between the United States and the United Kingdom, there are substantial differences between American and British TV advertising—British advertisements tend to contain less information, employ a soft sell rather than a hard sell approach, and strive to entertain the viewer [17]. The American Association of Advertising Agencies (AAAA) announced, “Comparative advertisements will provide consumers with the necessary and useful information” [18]. Thus, the creative characteristics of advertisements are being studied from a variety of perspectives. However, there are reasons for each individual creative choice, which was not the subject of this research.

The third category involves evaluation of the factors influencing purchasing behavior. For instance, Borzekowski and Robinson [19] studied preschool children’s food preferences and found that children exposed to a videotape with embedded commercials were significantly more likely to choose the advertised items compared to the children who saw the same videotape without commercials. However, studies focusing on purchasing behavior have typically used customer surveys; few studies have examined the effective contact frequency of advertisements for promoting purchasing actions, which was the focus of this study. Advertisement evaluation based on behavior has primarily been limited to online shopping [20]. Although there has been a study integrating online and offline data, which showed an increase in the number of searches after the broadcasting of TV advertisements, it did not consider the effective number of advertisement exposures [9].

2.2 Effective Contact Frequency

Advertisements are generally repeatedly presented to customers, which over time exerts a simple contact or mere exposure effect. More specifically, research shows that even when a neutral stimulus is presented, repeated exposure to the stimulus increases its perceived favorability; however, by the tenth contact, the favorability level ceases to increase [21]. In the context of advertising, Krugman [8] proposed the “three-hit theory,” according to which an advertisement has the greatest impact on the third contact. On the first contact, the customer becomes aware of the product; on the second contact, the customer gains an understanding of the benefits of the product; and by the third time, the customer begins to understand whether the product meets his or her needs. This theory therefore suggests that merely increasing the frequency of contact with an advertisement is unproductive.

In research examining contact frequency, one study attempted to verify the effect of web banner advertisements [22]. However, it is more difficult to obtain real-life data on TV advertisement contact, as they are situated in the offline environment, which in turn makes it difficult to validate their effects.

3. Evaluation Method

3.1 Datasets

This study employed two datasets from a panel company owned by a survey company, with permission. One dataset consisted of linked data from the action logs of smartphone and PC Web browsers, while the other dataset focused on the viewing logs of smart TV commercial companies. It then matched these datasets for each user using ID numbers and extracted data on TV advertisement viewing and Web action logs. Note that while
smartphones were considered to contain the personal data of panel registrants, the TV and PC data reflected household habits. In addition, the Web action logs continuously accumulated data throughout the home, both indoors and outdoors.

Data accumulated between January 1, 2017 and April 3, 2018 were utilized. The target cars were the top 30 best-selling cars, which covered 9 manufacturers and 5 car body types (Kei, Compact, Minivan, SUV, and Sedan). The vehicles were identified using the advertisement ID obtained from the viewing log. Visiting the manufacturer’s website (hereinafter referred to as WebTop) was defined as the purchasing behavior in this study and was identified by whether participants visited the URL of the top page of each car.

The participants of this study were 1,000 people randomly sampled according to gender, age, and place of residence (using statistics from the Ministry of Internal Affairs and Communications) among the panel members who detected TV advertisements and WebTop. As shown in Table 1, the composition ratios generally agree between the true values and the sample values.

### Table 1: Distribution of gender and age

| Gender | Correct data (Thousand) | Sampling data |
|--------|-------------------------|---------------|
| Male   | Freq | Rate | Freq | Rate |
| 20s    | 6,426 | 16.0% | 73 | 14.5% |
| 30s    | 7,612 | 19.9% | 94 | 18.7% |
| 40s    | 9,561 | 23.8% | 119 | 23.7% |
| 50s    | 8,885 | 19.6% | 101 | 20.1% |
| 60s    | 8,645 | 21.5% | 115 | 22.9% |
| Total  | 49,129 | 100.0% | 502 | 100.0% |

### 3.2 Validation Procedure

In marketing, the act of choosing one product out of multiple alternatives is called “brand selection.” It is generally evaluated using a discrete selection model. Therefore, in this study, the degree of contribution of each TV advertisement by the number of contacts was evaluated via a multinomial logit model.

For this analysis, it is necessary to narrow down the number of vehicles (i.e., brands) selected by each subject to one. Therefore, assuming that a customer’s degree of interest was correlated with the frequency of visits to WebTop, this study defined each subject’s brand selection as the car they viewed most frequently on WebTop between January 1, 2017 and April 30, 2018. To calculate the effective contact frequency of TV advertisements, the frequency data for each participant was restricted to the point that they first visited WebTop for their selected brand (CV date). The reason for this was because once a customer begins studying a single brand, they will naturally acquire knowledge of competing products and visit WebTop sites for other cars; this will obscure the effect of subsequent TV advertisements. Figure 1 shows a schematic diagram of the definition of brand selection and the method of counting the TV advertisement contact frequency.

Table 2 shows the distribution of brands selected by subjects and the number of TV advertisement records before the CV date for the 30 target brands. In total, there were 344,062 TV advertisements, with the most being for the Suzuki WGNR at 33,181. As for brand selection, the maximum was 77 people for the Mazda DEMIO.

![Figure 1](image_url)

**Figure 1 Definition of brand selection and frequency**

### Table 2: Distribution of brands selected by subjects and the number of TV advertisement records

| No | Brand | Maker  | Body type | Number of brand selections | Number of CV records |
|----|-------|--------|-----------|---------------------------|---------------------|
| 1  | 3Series | BMW | Sedan | 9 | 3,415 |
| 2  | AQUA | Toyota | Compact | 34 | 3,924 |
| 3  | CClass | Mercedes | Sedan | 7 | 7,642 |
| 4  | CHR | Toyota | SUV | 69 | 7,765 |
| 5  | COROLLA | Toyota | Sedan | 28 | 2,577 |
| 6  | CX5 | Mazda | Sedan | 53 | 7,470 |
| 7  | DAYS | Nissan | Kei | 34 | 22,930 |
| 8  | DEMIO | Mazda | Compact | 77 | 7,602 |
| 9  | FIT | Honda | Compact | 33 | 21,753 |
| 10 | FREED | Honda | Minivan | 44 | 15,200 |
| 11 | HARRIOT | Toyota | SUV | 30 | 1,632 |
| 12 | IMPREZA | Subaru | Sedan | 46 | 14,055 |
| 13 | MOVE | Daihatsu | Kei | 11 | 15,397 |
| 14 | NOBOX | Honda | Kei | 57 | 14,017 |
| 15 | NOAH | Nissan | Minivan | 45 | 1,683 |
| 16 | NOTE | Nissan | Compact | 38 | 17,872 |
| 17 | PASSO | Toyota | Kei | 18 | 1,423 |
| 18 | PRUIS | Toyota | Kei | 23 | 16,094 |
| 19 | SERENA | Nissan | Minivan | 66 | 14,609 |
| 20 | SIENTA | Toyota | Minivan | 46 | 4,328 |
| 21 | SPACIA | Suzuki | Kei | 24 | 22,628 |
| 22 | STEPWGN | Honda | Minivan | 23 | 1,917 |
| 23 | SWIFT | Suzuki | Kei | 21 | 28,969 |
| 24 | TANT | Daihatsu | Kei | 21 | 11,740 |
| 25 | VELFIRE | Toyota | Minivan | 23 | 2,197 |
| 26 | YEZEL | Honda | SUV | 24 | 12,470 |
| 27 | VITZ | Toyota | Compact | 21 | 8,228 |
| 28 | VOXY | Toyota | Compact | 32 | 2,700 |
| 29 | WGNKR | Suzuki | Kei | 23 | 33,181 |
| 30 | XTRAIL | Nissan | SUV | 23 | 11,850 |

Total: 1,000 | 344,062

### Table 3: Definition of time zones

| No | Time Zone | Description |
|----|-----------|-------------|
| 1  | A | 12:00 a.m. – 02:59 a.m. |
| 2  | B | 03:00 a.m. – 05:59 a.m. |
| 3  | C | 06:00 a.m. – 08:59 a.m. |
| 4  | D | 09:00 a.m. – 11:59 p.m. |

| No | Time Zone | Description |
|----|-----------|-------------|
| 5  | E | 12:00 p.m. – 02:59 p.m. |
| 6  | F | 03:00 p.m. – 05:59 p.m. |
| 7  | G | 06:00 p.m. – 08:59 p.m. |
| 8  | H | 09:00 p.m. – 11:59 a.m. |

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The following four validations were conducted. In Validation 1, the effective contact frequency was evaluated. For this analysis, contact frequency was divided into seven categories: 0 times, 1 time, 2–3 times, 4–5 times, 6–10 times, 11–20 times, and 21 times or more. In Validation 2, the effective contact frequency was evaluated according to whether celebrities were present in the advertisement or not. In Validation 3, the effective contact frequency was evaluated by advertisement length (15 seconds and 30 seconds; when an advertisement was more than 30 seconds, it was included in the 30-second category). Finally, in Validation 4, the effective contact frequency was evaluated by broadcast time slot. As shown in Table 3, Time zone was divided into 8 categories.

The above validations employed the 79 variables shown in Table 4. Explanatory variables of No. 2–79 were observed for each of the 30 brands. In the model, the probability that individual \( i \) selects brand \( j \) can be expressed by equation (1), while the utility function is expressed by equation (2). All analyses were conducted with R software; the multinomial logit model was constructed using the mlogit package.

\[
P_{ij} = \frac{\exp V_{ij}}{\sum_{k=1}^{30} \exp V_{ik}}
\]

\[
V_{ij} = \sum_{k=1}^{K} \beta_k X_{ijk}
\]

\( i: \) Respondent, \( j: \) Brand, \( K: \) Number of variables, \( X_{ijk}: \) Explanatory variable vector of Respondent, and Brand.

### 4. Results and Discussion

Table 5 shows the results of Validation 1. Notably, three contacts had the strongest effect, being significant at the 1% level and sporting an odds ratio of 1.441. Surprisingly, 6–10 contacts were the second most effective (odds ratio=1.332). These results confirmed that the three-hit theory applies to attracting customers to WebTop in the highly involved automobile industry. In other words, merely exposing customers to an advertisement more frequently does not increase the odds of their visiting the manufacturer’s website.

Through the next three validations, this study confirmed whether the three-hit theory changed according to the conditions.

Table 6 shows the results of Validation 2. The results indicated that, when celebrities are not present in the advertisement, the effective contact frequency was 3 contacts (odds ratio=1.488, \( p<.01 \)), followed by 5, 10, and 21 contacts or more. Employing celebrities did not significantly impact the effective contact frequency, although it did cause a negative effect on visiting WebTop for contacts above five. This suggests that advertisements in the automobile industry should aim for three contacts to maximize promotion efficiency, regardless of whether they employ celebrities in their advertisements or not. This is probably because the attractiveness of the celebrities has no bearing on whether the benefits of the advertisement are conveyed.

### Table 4 List of variables

| No | Validation | Variable | Description |
|----|------------|----------|-------------|
| 1  | 1          | Selected Brand | Selected brand |
| 2  | 1          | Ad1       | 1 time Ad contact dummy |
| 3  | 1          | Ad3       | 3 times Ad contact dummy (pointing to 2–3 times) |
| 4  | 1          | Ad5       | 5 times Ad contact dummy (pointing to 4–5 times) |
| 5  | 1          | Ad10      | 10 times Ad contact dummy (refers to 6 to 10 times) |
| 6  | 1          | Ad20      | 20 times Ad contact dummy (pointing to 11–20 times) |
| 7  | 1          | Ad20over  | 21 or more Ad contact dummies |
| 8  | 2          | FamousCelebrity | 1 time Ad contact dummy with celebrities |
| 9  | 2          | FamousCelebrity | 3 times Ad contact dummy with celebrities |
| 10 | 2          | FamousCelebrity | 5 times Ad contact dummy with celebrities |
| 11 | 2          | FamousCelebrity | 10 times Ad contact dummy with celebrities |
| 12 | 2          | FamousCelebrity | 30 times Ad contact dummy with celebrities |
| 13 | 2          | FamousCelebrity | 50 times Ad contact dummy with celebrities |
| 14 | 2          | FamousCelebrity | 100 times Ad contact dummy with celebrities |
| 15 | 2          | NoneFamousCelebrity | 1 time Ad contact dummy without celebrities |
| 16 | 2          | NoneFamousCelebrity | 3 times Ad contact dummy without celebrities |
| 17 | 2          | NoneFamousCelebrity | 5 times Ad contact dummy without celebrities |
| 18 | 2          | NoneFamousCelebrity | 10 times Ad contact dummy without celebrities |
| 19 | 2          | NoneFamousCelebrity | 20 times Ad contact dummy without celebrities |
| 20 | 3          | 30sec1    | 1 time Ad contact dummy of 30 seconds |
| 21 | 3          | 30sec5    | 5 times Ad contact dummy of 30 seconds |
| 22 | 3          | 30sec10   | 10 times Ad contact dummy of 30 seconds |
| 23 | 3          | 30sec20   | 20 times Ad contact dummy of 30 seconds |
| 24 | 3          | 30sec20over| 21 or more Ad contact dummies of 30 seconds |
| 25 | 3          | 15sec1    | 1 time Ad contact dummy of 15 seconds |
| 26 | 3          | 15sec5    | 5 times Ad contact dummy of 15 seconds |
| 27 | 3          | 15sec10   | 10 times Ad contact dummy of 15 seconds |
| 28 | 3          | 15sec20   | 20 times Ad contact dummy of 15 seconds |
| 29 | 3          | 15sec20over| 21 or more Ad contact dummies of 15 seconds |
| 30 | 3          | 30sec20   | 20 times Ad contact dummy of 30 seconds |
| 31 | 3          | 30sec20over| 21 or more Ad contact dummies of 30 seconds |
| 32 | 3          | TimeZoneA1 | 1 time Ad contact dummy of time zone A |
| 33 | 3          | TimeZoneA3 | 3 times Ad contact dummy of time zone A |
| 34 | 3          | TimeZoneA5 | 5 times Ad contact dummy of time zone A |
| 35 | 3          | TimeZoneA20 | 20 times Ad contact dummy of time zone A |
| 36 | 3          | TimeZoneA20over| 21 or more Ad contact dummies of time zone A |
| 37 | 3          | TimeZoneB1 | 1 time Ad contact dummy of time zone B |
| 38 | 3          | TimeZoneB3 | 3 times Ad contact dummy of time zone B |
| 39 | 3          | TimeZoneB5 | 5 times Ad contact dummy of time zone B |
| 40 | 3          | TimeZoneB20 | 20 times Ad contact dummy of time zone B |
| 41 | 3          | TimeZoneB20over| 21 or more Ad contact dummies of time zone B |

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Table 7 shows the results of Validation 3. Surprisingly, 21 contacts or more on the 30 second scale had the highest odds ratio (2.429), followed closely by 11–20 contacts (odds ratio=2.126), unlike Validations 2-3. As with Validations 2-3, for 15-second advertisements, 3 contacts were considered most effective (odds ratio=1.315). These findings indicate that, for 30-second advertisements, the effect increases linearly with the number of contacts, whereas for the 15-second advertisements, the effect decreases as the frequency increases. Taken together, promotion strategies should be changed depending on the length of the TV advertisements.

Table 8 shows the results of Validation 4. It was found that contact frequency was most effective at 1 and 5 contacts for Time Zone H (10 p.m. to 12 a.m.), with odds ratios over 1.4. This suggests that airing advertisements between 10 p.m. and 12 a.m. is the most efficient. On the other hand, Time Zone G—which corresponds to the so-called “golden time” of 7 p.m. to 10 p.m. (during which it is easy to take audience ratings), did not show any significant effective contact frequency. One possible reason for this is that this time zone is a prime time for viewers to be engaged in housework, so even if the advertisements are shown, they are not seen by the viewer; even when they are seen, it is possible that individuals are not in a situation where they can engage in search behavior immediately.

| No | Variable          | Estimate | Odds ratio | t   | p    |
|----|-------------------|----------|------------|-----|------|
| 1  | TimeZoneA1        | -0.22    | 0.978      | -0.178 | 0.839|
| 2  | TimeZoneA3        | 0.046    | 1.047      | 0.312 | 0.735|
| 3  | TimeZoneA5        | 0.164    | 1.178      | 0.768 | 0.443|
| 4  | TimeZoneA10       | -0.048   | 0.953      | -0.183 | 0.855|
| 5  | TimeZoneA20       | -0.542   | 0.582      | -1.145 | 0.252|
| 6  | TimeZoneA2over    | -0.847   | 0.429      | -0.774 | 0.439|
| 7  | TimeZoneB1        | 0.309    | 1.361      | 1.121 | 0.262|
| 8  | TimeZoneB3        | -0.042   | 0.959      | -0.090 | 0.928|
| 9  | TimeZoneB5        | -0.413   | 0.662      | -0.402 | 0.688|
| 10 | TimeZoneB10       | -1.639   | 0.000      | -0.006 | 0.956|
| 11 | TimeZoneB20       | -2.254   | 0.000      | -0.003 | 0.998|
| 12 | TimeZoneB2over    | 3.021    | 20.506     | 1.877 | 0.000 . |
| 13 | TimeZoneC1        | -0.120   | 0.847      | -0.973 | 0.330|
| 14 | TimeZoneC3        | -0.019   | 0.982      | -0.141 | 0.888|
| 15 | TimeZoneC5        | 0.029    | 1.029      | 0.160 | 0.873|
| 16 | TimeZoneC10       | -0.268   | 0.765      | -1.292 | 0.196|
| 17 | TimeZoneC20       | 0.327    | 1.387      | 1.404 | 0.160|
| 18 | TimeZoneC2over    | 0.389    | 1.476      | 1.145 | 0.252|
| 19 | TimeZoneD1        | -0.118   | 0.889      | -0.013 | 0.931|
| 20 | TimeZoneD3        | -0.216   | 0.805      | -1.555 | 0.120|
| 21 | TimeZoneD5        | -0.238   | 0.788      | -1.059 | 0.290|
| 22 | TimeZoneD10       | -0.258   | 0.773      | -0.960 | 0.337|
| 23 | TimeZoneD20       | 0.477    | 1.610      | 1.208 | 0.227|
| 24 | TimeZoneD2over    | 1.184    | 3.267      | 1.336 | 0.182|
| 25 | TimeZoneE1        | 0.248    | 1.281      | 2.254 | 0.022 . *
| 26 | TimeZoneE3        | -0.179   | 0.836      | -1.226 | 0.220|
| 27 | TimeZoneE5        | 0.199    | 1.220      | 0.972 | 0.331|
| 28 | TimeZoneE10       | 0.082    | 1.086      | 0.632 | 0.510|
| 29 | TimeZoneE20       | -0.908   | 0.380      | -1.747 | 0.081 . |
| 30 | TimeZoneE2over    | -0.293   | 0.746      | -0.364 | 0.716|
| 31 | TimeZoneF1        | 0.022    | 1.022      | 0.192 | 0.848|
| 32 | TimeZoneF3        | 0.038    | 1.039      | 0.278 | 0.781|
| 33 | TimeZoneF5        | -0.048   | 0.953      | -0.209 | 0.835|
| 34 | TimeZoneF10       | 0.164    | 1.179      | 0.621 | 0.534|
| 35 | TimeZoneF20       | -0.875   | 0.417      | -1.373 | 0.170|
| 36 | TimeZoneF2over    | -0.604   | 0.547      | -0.549 | 0.583|
| 37 | TimeZoneG1        | 0.066    | 1.068      | 0.595 | 0.522|
| 38 | TimeZoneG2        | 0.029    | 1.040      | 0.333 | 0.729|
| 39 | TimeZoneG5        | -0.180   | 0.836      | -1.115 | 0.265|
| 40 | TimeZoneG10       | -0.273   | 0.761      | -1.567 | 0.117|
| 41 | TimeZoneG20       | -0.209   | 0.812      | -0.919 | 0.358|
| 42 | TimeZoneG2over    | -0.191   | 0.826      | -0.541 | 0.588|
| 43 | TimeZoneH1        | 0.345    | 1.413      | 3.159 | 0.002 **
| 44 | TimeZoneH3        | 0.213    | 1.237      | 1.787 | 0.074 . |
| 45 | TimeZoneH5        | 0.356    | 1.428      | 2.369 | 0.018 . *
| 46 | TimeZoneH10       | 0.299    | 1.348      | 1.827 | 0.068 .
| 47 | TimeZoneH20       | 0.254    | 1.289      | 1.193 | 0.233|
| 48 | TimeZoneH2over    | 0.468    | 1.597      | 1.625 | 0.104|

However, there are three limitations in this study. First, the TV viewing log does not contain data for a single smart TV subscriber but for an entire household. Accordingly, it is possible that children or others who do not accumulate Web browsing logs are included among

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the viewers. Second, it is not possible to evaluate effects such as word of mouth and train advertisements, which are not included in the data. Finally, this was not a controlled evaluation of TV advertisements. A randomized controlled trial should be performed to evaluate the causal effect; however, this would be difficult to realize. The suggestions in this study are therefore only based on the tendencies of TV advertisements currently being broadcast.

5. Conclusion

In recent years, customers are increasingly avoiding advertisements, which has become much easier with the popularization of DVR and streaming video. For that reason, it has been pointed out that the influence of the TV advertisement is declining; even so, to promote recognition of new products, companies continue to invest heavily in TV advertisements. Therefore, improving the efficiency is an urgent issue.

This study examined the effective contact frequency of TV advertisements for attracting customers to manufacturer websites for the Japanese automobile industry using TV advertisement viewing logs and smart phones/PC web browsing logs. The findings generally confirmed the three-hit theory, although the effective frequency differed somewhat depending on the presence/absence of celebrities, the advertisement length, and the broadcasting time zone. As noted above, this study has three limitations. First, viewers included not only survey subjects but also family members. Second, I could not evaluate other influencing factors of search behavior. Finally, due to the nature of television advertisements, the causality of the effects is questionable.

Nevertheless, as there are currently few studies showing the effective contact frequency by integrating offline and online action logs, this study could provide several important suggestions for future studies.

It was once said that, although half the money that companies spend on advertising is wasted, they can never find it. Nevertheless, due to advances in IT, a lifelog can be accumulated even when offline, enabling us to make smarter decisions.

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