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EYE-TRACKING STUDY ON PRODUCT PLACEMENT FAMILIARITY IN ONLINE GAMES IN STREAMING PLATFORMS: VISUAL ATTENTION, RECOGNITION AND RECALL

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Abstract:

The growing popularity of streams and video games is creating new marketing opportunities. Therefore, this paper examines the relationship of product placement (PP) familiarity to visual attention, recognition and recall in streaming video. The experiment has three sources of data gathering – eye-tracking (AOI), questionnaires with Likert scales and semi-structured interviews. The participants were chosen according to the largest group – males aged between 20-25 years old. The results indicated better-unaided recall of familiar placement although the aided recall was found to be similar, as visual attention. The visual attention for other factors differs for PP size and the respondents' experiences. The order of PP did not affect the visual metrics. Interviews complemented a picture of how and why respondents consume video games and streams and how mediums differ. Marketing opportunities could be seen in the growing video games industry and streaming platforms. However, some product placement might be more suitable to be implemented than others.

Keywords:

Advergaming, digital marketing, in-game marketing, memory, eye-tracking

JEL: M31

1 Introduction

The marketing industry created an alliance with the entertainment industry to reach a wider audience. PP is a marketing technique that is less intrusive than traditional advertising (Lee & Faber, 2007). The first well-known successful PP was in the film "E.T." in 1982 when in response, the sales of Reese's Pieces increased by 66% (Glass, 2007). Since then, PP has spread to all possible media such as video clips (song Ma Chérie - Skyy vodka), books (The Bulgari Connection) and video games (Super Monkey Ball- Dole) (Karisik, 2014). The marketing and entertainment industry have a win-win deal when companies sponsor marketing to compete when their advertisement is included (Zhu & Chang, 2015). PP is a common part of movies and shows; however, it is more usually seen in video games. Video games have an advantage over films because the user is actively interested in what is happening (Karisik, 2014). Moreover, the number of players and stream watchers has increased due to the corona crisis (Gought, 2020) with 40% of players in an active age (18-35 years). Statistics from the USA report lower differences between genders (54% M; 46% F) (ESA, 2019) than the rest of the world, with a higher male share (62% M; 38% F) (Statista, 2020). Consequently, video games are a suitable medium to reach the difficult to access younger generation (Yoon, 2019). The marketing is constantly evolving by the search for new platforms and move to media where the targeted groups spend their time (Glass, 2007).

PP has appeared in video games in recent decades. The researchers examined various factors and their impact on PP recall, recognition and the moderating effect on attitude towards a brand. The

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most frequently appearing factors in literature were PP familiarity (Zhu & Chang, 2015; Parreño et al., 2017), congruity (Lee & Faber, 2007; Gross, 2010; Peters & Leshner, 2013), game fluency (Siemens et al., 2015), game speed (Vashisht & Pillai, 2016; Vashisht & Pillai, 2017; Vashisht & Mohan, 2018) and PP prominence (Lee & Faber, 2007; Vashisht, 2017). Some researchers went further and developed theoretical models demonstrating the relationships between the factors and their impact on PP efficiency (Zhu & Chang, 2015; Lee & Cho, 2017). All these studies were short-time oriented, and some used specially designed games (Peters & Leshner, 2013; Vashisht, 2017), which could produce lower accuracy results due to simplification. The most frequently used methods were questionnaires with Likert scales (Paštiková, 2020). The marketing is missing the crucial information on the longer-term effect of PP and its influence on implicit memory, which is connected to unconscious mental processes (Dragolea & Cotîrlea, 2011; Pop & Iorga, 2012). This paper aims to examine how selected PP factors and players' characteristics influence the efficiency of PP in video games. The observation chose familiarity as the main research factor due to its frequency of appearing in previous research, the possible different impact on memory and particularly due to the question of PP efficiency for lesser-known brands. This paper also examines other factors such as the order and size of PP and the respondents' experiences. The research also sheds some light on the topic of PP in video games and video games in general by coding semi-structured interviews.

Previous studies frequently observed aspects linked to PP efficiency as attitude towards a brand, recall, recognition, brand trust and persuasive mechanism (Paštiková, 2020). The main goal of PP should be the purchase of the product. However, it could sometimes take years until the purchase is made. That reality and other contributing factors complicate the straight measurement of PP efficiency towards the purchase of a product or service. Consequently, the researchers measure PP efficiency by side step indicators (recognition, recall and attitude towards a brand), which are believed to contribute to the purchase of a product. This paper contributes by stating if familiarity or other factors have a significant impact on visual attention, recall and recognition. This research combines three types of data input to build a more complex picture of the factors that impact PP. Eye-tracking investigates eye movements and is useful for determining visual attention (Wedel & Pieters, 2006). Eye-tracking data provides much more comprehensive information than conscious questioning. Nevertheless, it only provides links to interpret how the respondents access the scene (Duchowski, 2017). To test the hypotheses, the study used these eye-tracking metrics: modified TTFF (Time to first fixation), TFD (Total fixation duration), TFC (Total fixation count), and the sum of revisits. The recognition was measured by two different types of data inputs, the implicit – eye-tracking and the explicit – the questionnaire. First, the eye-tracking metric delay measured the gap between dynamic PP appearance and TTFF on PP (implicit). Second, the recognition was measured in the questionnaire when the respondents answered if they had recognised one or more brands in the video sample (explicit). Another aspect, recall, was tested as unaided and aided where the unaided recall was to name the brand without the stimulus and aided was to identify the PP brands from the video among redundant brands viz Figure 3. Finally, the semi-structured interview created an overall picture of present-day attitudes and expectations of PP in video games. The further potential of PP for marketing purposes in video game interfaces, with the importance increasing with onward digitization, will be argued in the paper.

2 Theoretical background

Marketing proved itself as a useful tool which greatly contribute on brand value (Liu et al., 2017). Companies are constantly trying to find new ways to get closer to a potential customer and communicate their marketing message as best as they can, often through the consumers' subconsciousness. However, this area is still underexamined (Dragolea & Cotîrlea, 2011; Pop & Iorga, 2012). Building a relationship with the brand has become a means of differentiating present-day commoditised products (Jha, 2014; McQuiston, 2004). Therefore, it would be appropriate to determine if

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the unfamiliar brands are earning the same visual attention, recall and recognition as the familiar brands. Nowadays, more aspects of everyday life are also moving to the online environment and, therefore, marketing. At the same time, current statistics show the shift by the millennial generation from television to online platforms (McKay, 2018). The popularity of online platforms is also enhanced by the fact that books, music, videos and video games are accessible from most devices anywhere in the world (Lindlahr, 2020). As a result, advertising content targets potential customers through digital media and platforms, wherever they are located. Despite the strong interest of marketers in implementing advertising on digital platforms, research in this area is falling behind (Duhaime et al., 2020). More attention should be focussed on the advertising implemented in the entertainment content of online games in the form of product placement (PP) and the subsequent streaming of these games, which carries an undiscovered potential for marketing. Unfortunately, the risk of manipulation and hidden advertisements is a secondary topic, which should also be explored (Soba & Aydin, 2013).

2.1 Visual attention

Video games are acquired with emotions and interactive experiences. It is almost impossible for people to verbally express what they feel while playing or watching a video game. Therefore, neuroscience measuring instruments are particularly useful for investigating the impact of video games on the human mind (Genco et al., 2013). Data collected using these tools are considered more accurate than data collected verbally or with questionnaires (Pop & Iorga, 2012). Neurosciences and neuromarketing are rapidly evolving sciences that find application in many industries (Esomar, 2012). People do not make rational purchasing decisions but instead base them on feelings and habits (Genco et al., 2013). Therefore, knowledge of neuromarketing can be used to make the product more attractive to the human subconscious. Eye-tracking measures visual attention and is the most accurate method to determine where the direction of a respondent's cognitive capacity, which is particularly suitable for examining PP (O'Connel & Chun, 2018). Nevertheless, the results should be carefully interpreted within the context (Almeida et al., 2016).

The currently best-known tool for measuring visual attention is eye-tracking (Genco et al., 2013). Eye-tracking measures the respondent's visual attention and where their eyes are subconsciously drawn to. It investigates eye movements and is useful for determining visual attention (Wedel & Pieters, 2006). However, eye movements are not an indicator for processing and consciously detecting stimuli (e.g. Gelderblom & Menge, 2018). One of the tasks of PP is to be registered by the consumer and to acquire part of their cognitive capacities (Duhaime et al., 2020). Therefore, eye-tracking is a suitable tool for assessing the visual attraction of PP. Human attention has a limited capacity, so to find where attention is directed is important information. In the video game environment, visual and interactive attention is controlled by other elements (sound, task, experience), so it is important to interpret the results in context (Almeida et al., 2016). Dynamic PP will be more visually attractive than static PP, and more colourful PP will attract more attention (Genco et al., 2013). At the same time, if PP is mentioned verbally, there is a greater chance that the respondent will be interested.

Eye-tracking aims to record eye jumps (saccades) and eye stops (fixations), or their smooth transitions. Data analysis occurs by identifying the region where the eyes stop for a long time, followed by a jump and further fixation (Duchowski, 2017). The eye jumps last only a very short time, and the brain is not able to process information during this time. Therefore, eye fixations are important when the brain processes the information viewed or retention in fixation. Long fixation may also be associated with new stimuli that the brain has difficulty processing or with stimuli that disrupt the overall consistency of the image (Genco et al., 2013).

The summarisation of eye-tracking metrics automatically generates clusters that depend on the concentration of visual attention. However, the clusters could also be entered manually for analysis purposes, in which case they are called AOIs (Areas of Interest) (Almeida et al., 2016). AOIs are defined as points of interest whose research is to obtain information, e.g. PP. It is possible to examine the TFD

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(Total fixation duration), TFC (Total fixation count), TTFF (Time to first fixation) and revisits only in the defined AIO (Pernice & Nielsen, 2009). The use of AOI is growing, especially for social and marketing purposes, where differences in the perceptions of different groups can be examined (Horsley, 2014).

2.2 Product Placement efficiency measures

The measurement of PP efficiency is complicated. Previous experiments mostly researched the short-term impact on explicit memory. The researched methodology mainly included questionnaires with the Likert scale (Paštiková, 2020), Zaichkow scales (Vashisht, 2018) or semantic differential (Roettl & Terlutter, 2018). Chen and Deterding (2013) used a more comprehensive method of essays and in-depth interviews. Possible future comprehensive methods to decode underlying relations could be netnography, autoethnography or methods directly measuring body reactions, which are linked to implicit memory. All these methods have the same aim to uncover the factors and conditions that lead to the greater efficiency of PP for consumers. The final goal of PP should be the purchase of advertised products and preferably the repeated purchase. However, the efficiency of product placement is difficult to measure. Hence, the researchers measure efficiency by side steps as recognition, recall and attitude towards a brand.

This paper proposes three hypotheses for the brand familiarity factor, which includes recognition, recall and visual attention. Although these indicators may contribute, they do not always lead to the purchase of a product. The first step of effective PP is the *recognition* of the product. It can only be implicit where the subconsciousness registers the stimulus or explicit when the person is aware of noticing the stimulus. The *recall* is a further step where the user can find and distinguish a particular product that had been viewed earlier (Keller, 1993). This is divided into unaided recall, which occurs without the stimulus, and aided recall where the stimulus usually viewing the brand is available. *Visual attention* is derived from eye-tracking metrics, which should indicate the response of the unconscious part of the brain. The chosen metrics compare the differences in duration, count fixation and revisits for familiar and unfamiliar brands.

- Recognition

$H1a_1$: Recognition differs significantly for familiar and unfamiliar brands.
$H1b_1$: Respondents' responses differ significantly for noticing familiar and unfamiliar brands.

- Recall

$H2a_1$: Unaided recall differs significantly for familiar and unfamiliar brands.
$H2b_1$: Aided recall differs significantly for familiar and unfamiliar brands.

- Visual attention

$H3a_1$: TFD metrics differ significantly for familiar and unfamiliar brands.
$H3b_1$: TFC metrics differ significantly between familiar and unfamiliar brands.
$H3c_1$: Revisit metrics differ significantly between familiar and unfamiliar brands.

The mentioned indicators sometimes work contraindicative to each other, e.g. incongruent PP attract more attention, which results in higher recognition and recall. However, it also disturbs the game flow, so negative feelings could deteriorate the attitude towards a brand. Therefore, it is crucial to access the indicators as a complex system to eventually decide which indicator would lead to the highest purchasing rate for the specific product.

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2.3 Product Placement Factors

Many of the further mentioned studies are interested in factors that influence the efficiency of PP in video games. The video game environment is complex due to multiple dimensions (difficulty, speed, categories). Consequently, it is impossible to make a universal manual of which factors work optimally for PP. The efficiency of product placement is conditioned by many factors, not only by the dimensions of the game itself but also by the personal characteristics of the player. However, previous researchers were able to craft some general rules, which can help to access the complexity of this area.

The *age* factor plays a role in the ability to recognise and recall when the younger generation had better results. However, no difference was found between *genders* (Toh & Leng; 2014). Choi and others (2015) have proved that *culture* also has an impact on the perception of PP. This was even more evident when increasing the difficulty of a game (Vashisht, 2017). The *experienced players* had a higher chance of spotting the peripheral PPs (Vashisht & Pillai, 2016).

This role is played by the *speed* factor, which lowers the chances of spotting PP; hence, PP is more suitable for the slower parts of a game (Vashisht & Pillai, 2016; Vashisht & Pillai, 2017) or parts where the player is not preoccupied with other tasks (Dardis et al., 2015). The *size* of PP plays a significant role when the bigger and more prominently situated PP is better recognised and recalled (Tan et al., 2006; Chaney et al., 2018). Interestingly, the size of the mediated equipment plays no role in PP size (Duhaime et al., 2020). The *prominence* of PP is a tricky factor that increases recognition and recall when it is centralised (Lee & Faber, 2007; Cauberghe & De Pelsmacker, 2010). Cauberghe and De Pelsmacker (2010) proved that when the game is played frequently, the attitude towards centrally allocated PP deteriorates faster than for its peripheral equivalent. The *interactivity* of PP is another investigated factor that contributes to better recall and attitude (Vashisht, 2017).

The previous experiments on video games created a robust groundwork for the following studies by exhaustive literature reviews (Terlutter & Capella, 2013; Guo et al., 2019; Yoon, 2019, Paštiková, 2020). The list of examined factors is not absolute but those most frequently examined are listed. The *familiarity* of PP has a crucial role in recall, but if unfamiliar PP appears repetitively, it can result in the same recall as a familiar brand (Parreño et al., 2017). The familiarity of PP should indicate the type of implementation in a video game. An unfamiliar brand should be introduced and provide more detailed information to allow players to build a relationship with it (Zhu & Chang, 2015). The *congruity* of PP was confirmed as a significant factor, which contributes positively to memory when the PP is in accordance with a game (Lee & Faber, 2007; Gross, 2010; Peters & Leshner, 2013). On the other hand, incongruent PP attracts attention (which increases recall and recognition) (Vermeir et al., 2014), but it could worsen players' attitudes. The *fluency* of a game probably plays its role by providing undisturbed enjoyment (Siemens et al., 2015), which is crucial for greater entertainment and the subsequent forming of a positive PP attitude (Wang et al., 2015).

According to the previous findings, the hypotheses were formulated to test other factors than familiarity:

- Order of PP

H4: There is a difference in visual attention to the same PP between the first and second images.

- Size of PP

H5: There is a difference in visual attention between larger and smaller PP.

- Respondents' experiences

H6: There is a difference in visual attention to PP in respondents who have more experience playing video games/watching a stream.

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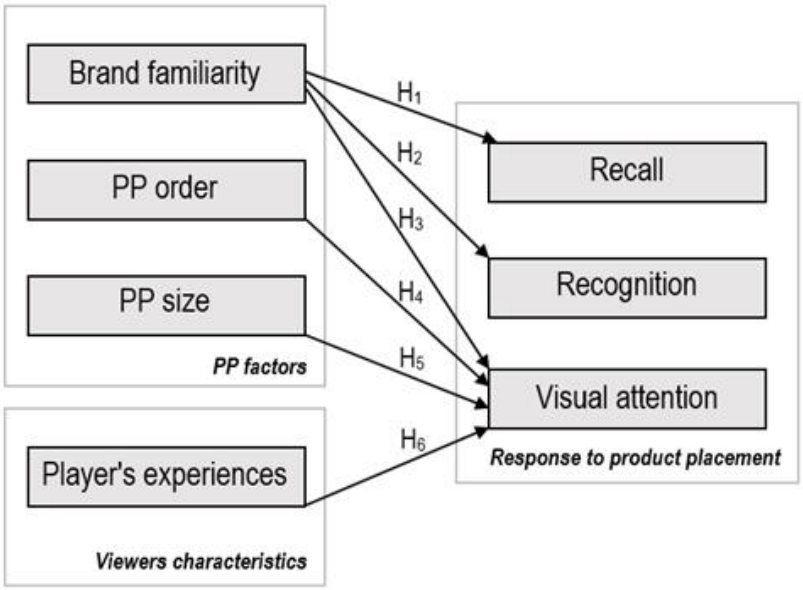
3 Methods

The research uses three methods of data gathering to build a comprehensive picture of the role of familiarity for PP and to build the premises for answering the hypotheses. The first step was a video of a stream with familiar and unfamiliar PP. This was followed by a questionnaire and pictures to test aided recall. A semi-structured interview to gather important details for later analysis closed the research design. The participants were not informed about the research purpose in advance because it could increase their attention towards PP. The observation was held under laboratory conditions to minimise the impact of external factors (Creswell, 2013). To test the research hypotheses, the data for both familiar/unfamiliar brand conditions were collected from all respondents. The research design allowed to test the hypotheses for additional factors (Figure 1).

The schema of research hypotheses (Figure 1) visualises the independent variables; brand familiarity, PP order, PP size, and player's experiences. Each variable has two categories. The relationship to dependent variables recall, recognition, visual attention are examined. The brand familiarity is categorized to familiar – the Monster brand, and unfamiliar - Porter's beer. The PP order is for the factor for the first and second display of the same brand in the video sample. The PP size probes the different types of PP display in the video sample when the second PP is larger. The player's experience factor was defined as time spent watching or playing video games. The respondents with complete view in all AOIs were then categorised into two same size groups: inexperienced players 0-6 hours/week and experienced players 7-9 hours/week. The aforementioned categorization of players was defined within the research sample. The categories of experienced and inexperienced players were determined based on the median values of the gaming experience of the respondents included in the research.

Figure 1: The Schema of Research Hypotheses



The first method applied to the gathered data for observation was *eye-tracking*. Data about eye fixations were observed by the desktop eye tracker GP3 and the sampling rate was 60 Hz with a stated accuracy of about 0.5 – 1 degree. The study used a four-minute stream, which included the familiar and unfamiliar brands. The video sample was compiled from YouTube videos about the Death Stranding video game. The streamer did not highlight any brand in their speech. The brands used in the research were also included within the original video. The video sample included only one type of brand, which was repeated two times in the same time frame and within the similar situation. Each interaction with PP defined AOI, which lasted for 14 seconds. Four AOIs were defined in the video sample: two for the

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familiar Monster brand and two for Porter's beer – the unfamiliar brand where the defined AOIs were dynamics. Research numbers with dynamic AOIs are scarce because it was only first accessible for commercial goals in 2008 (Holmqvist & Andersson, 2017). The abbreviations represent: the type of metric – delay (D), TFD (Total fixation duration), TFC (Total fixation count) revisits (R) while the following letter represents the familiar (F) or unfamiliar (U) brand and the last symbol the sequence number 1- first, 2-second displays of the brand in the video. One of AOIs U2 (unfamiliar brand, second display) differed from the others by size, otherwise, the AOIs were similar in time, size and position in the video samples. All the metrics represent visual attention towards PP in the video. The metric delay was designed for observation purposes to measure the lag between the start of AOI and the TTFF. The delay measures implicit recognition. The explicit recognition was measured by the questionnaire and the respondents' conscious realization of PP in the video. Other metrics are commonly used eye-tracking measured values (Pernice & Nielsen, 2009).

Figure 2: Preview of product placement in video sample involving a familiar and unfamiliar brand

Source figure: Own compilation

After the participants finished the video sample, they filled in the *questionnaire*. The questionnaire included basic demographic questions and Likert scales. The Likert scale was 5-point and gathers information about recognition, recall and experience with video games or streams. The participants were then asked to recall both brands and write the name into columns – unaided recall. The next step was aided recall. Each participant was shown ten pictures of a brand and should have identified the brands that appeared in the video (Figure 3). The chosen questions were mostly inspired by the questions used in recent eye-tracking research (Duhaime et al., 2020). The questions focussed repetitively on the same aspect to uncover random answers. The last question was to check the suitability of chosen video samples: The selected video samples looked like those that can be viewed on YouTube or Twitch.

Figure 3: Aided recall pallet

Source figure: Own compilation

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The last step was a *semi-structured interview* that was recorded for later coding. First, the research assumption was confirmed that the respondents view Monster as a familiar brand. Then the respondents were asked about their experience with the Death Stranding videogame. The following questions aimed to investigate the relationship between video games and streaming platforms. The participants also described the reasons why they spend their time on these entertainment platforms. The participants were asked to describe and distinguish a typical video game player and a follower of a stream. Other questions examined more deeply the relationship to PP in video games and streams. The last questions focused on the participants' opinions on the future of PP in video games. The respondents were informed about the observation purpose and were asked for their consent to use their data at the end of the data collection.

Pilot research proceeded to test the suitability of the research design and the appropriateness of the chosen video sample. Two participants were asked to undergo whole designed research to confirm its adequacy. Both participants found the video suitable and adequate to real streams. Nielsen (2000) claims that saturation should be achieved even with a smaller number of respondents in eye-tracking studies. The sample size was expected to the size of at least 10 participants, where is believed that 97% of information is recorded especially in interviews. Another added participant brings fewer findings than the previous one (Francis et al., 2010).

4 Results

The data were collected from 12 participants in February and March 2021. All the participants were males and students with an average age of 22.58 years. None of them had played the Death Stranding videogame before. However, two respondents claimed that they had already seen the game in 2020 and another two stated that they might have seen it. All the respondents labelled the Monster brand as a familiar brand. The selected video samples were marked by the respondents as analogous to those that can be found on YouTube or Twitch. In two cases, the respondents were not able to decide on the suitability of the samples because they did not have enough previous experience in this area.

The GP3 eye tracker was used to record the visual attention, and later the software *Gazepoint analysis UX Edition* analysed the data due to set AOI. Then the data was subjected to Dixon's Q test to reject the outliers, of which eight were identified and rejected. Also, within two measures, the respondent did not set the visual attention in the AOI field. Consequently, the metrics for those areas were empty. The final adjusted data are aggregated in Table 1- Characteristic of variability. The table shows that the U2 differs from other records, which is probably caused by the larger PP in the video. The revisits metric reports the biggest differences between the records.

In the next step, adjusted data were tested to normality by the Kolmogorov–Smirnov test. The results did not exceed the testing criteria so it could not be excluded that the data follows the normal distribution. The following test was the F-test of equality of variances, which divided the records into those which would be suitable for the T-test with similar/unequal variances. All further tests used to null hypotheses were applied to the p-value of 0.05.

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Table 1: Characteristic of variability

Delay (seconds)				
	DF1	DF2	DU1	DU2
n	11	12	11	11
$\bar{x}$	5.72	2.42	2.61	0.48
s^2	4.34	1.27	13.63	0.15
s	2.08	1.13	3.69	0.38
CV	36.43	46.49	141.53	80.88

Total fixation duration (seconds)			
TFDF1	TFDF2	TFDU1	TFDU2
11	11	11	12
0.29	0.42	0.41	2.31
0.09	0.12	0.09	0.69
0.3	0.35	0.3	0.83
101.29	84.7	71.42	35.9

Total fixation count (number)			
TFCF1	TFCF2	TFCU1	TFCU2
11	11	10	11
1.45	2.91	2.1	10.36
0.67	4.89	1.21	13.05
0.82	2.21	1.1	3.61
56.39	76.02	52.4	34.86

Revisits (number)			
RF1	RF2	RU1	RU2
11	11	10	11
0.55	1.64	1.1	5.64
1.07	4.65	1.21	3.45
1.04	2.16	1.1	1.86
189.88	131.84	100.05	32.98

4.1 Brand familiarity and recognition

The brand familiarity factor and its effect on recognition were measured through eye-tracking metric delay and the questionnaire.

$H1a_0$: Visual attention metric delay is the same for F1 and U1.

$H1a'_0$: Visual attention metric delay is the same for F2 and U1.

The hypotheses were tested by a two-sample two-sided T-test with unequal variance. In the first case of H1a0, the hypothesis was rejected (n=11. $\bar{x}$DF1 = 5.72 second, sDF1 = 2. 08 and $\bar{x}$DU1 = 2.61 second, sDU1 = 3.69, p-value= 0.027). The unfamiliar brand gained the respondent's attention significantly faster in the observation. However, when comparing the delay of F2 and U1, the difference is much smaller. When testing the delay F2 and U1, the H1a'0 was not rejected (nDF2 = 12, $\bar{x}$DF2 = 2.42 second, sDF2 = 2.08 and nDU1 =11, $\bar{x}$DU1 = 2.61 second, sDU1 = 3.69, p-value= 0.876). It could be assumed that this metric is strongly influenced by the previous animation, which differed for F1 and F2. Based on the measured data, it is not possible to decide if brand familiarity has a significant effect on delay metrics or not.

$H1b_0$: Respondents' answers regarding noticing a familiar brand or both brands do not differ.

The Chi-square test of independence was used in the data set for $H1b_0$. The test verified the relationship between recognition and brand familiarity. The records were measured by questionnaire and scales (5-point Liker scale, where 5- means strongly agree, 1- strongly disagree). Based on the test, it was not possible to reject $H1b_0$ because the p-value was higher than 0.05 <0.053 (n = 12, $\bar{x}_{one}$ = 3.9 and $\bar{x}_{both}$ = 2.5; Test statistics = 0.81; Critical value = 0.45, p-value = 0.053). However, it approached the critical limit of the 95% confidence interval considerably. The hypothesis, in this case, was not rejected, but this may be due to the low number of input data. Therefore, it would be useful to have more data available if the p-value is so close to the rejection limit. In this case, error II might have occurred in which the invalid H_0 was not rejected. Based on the results of the eye-tracking and chi-square test, it was not possible to reject $H1b_0$ or $H1a'_0$, which support the same level of recall of familiar and unfamiliar brands. The opposite statement was made by comparing the delay metrics for F1 and U1 when $H1a_0$ was rejected.

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4.2 Brand familiarity and recall

$H2a_0$: Unaided recall is the same for the familiar and unfamiliar brands.

H2 is testing the unaided recall of brands from video without any incentive. The 12 respondents were able to recall the name of the familiar brand, and one respondent partly recalled the name of the unfamiliar brand. The results between brands showed significant differences. The p-value of the chi-square test was very low, hence the $H2a_0$ was rejected (n = 12, Sum_F = 12 and Sum_U = 0.5; Test statistics = 0.97; Critical value = 0.45, p-value = 0,001). The results show that brand familiarity has a very significant effect on unaided recall. The respondents had a significantly higher success rate of recalling the name of a well-known brand without external stimulus. Research by Parreño and others (2017) also confirmed the significant influence of familiarity on PP recall.

$H2b_0$: Aided recall is the same for familiar and unfamiliar brands.

The aided recall was tested through the logo identification on the pallet of images (Figure 3). The success of identifying familiar and unfamiliar brands was Sum_F = 12 and Sum_U = 11. In the case of an aided recall, the difference between familiar and unfamiliar brands was very low. The chi-square p-value was also high (Test statistics = 0.36; Critical value = 0.45, p-value = 0.835), therefore the null hypothesis $H2b_0$ cannot be rejected at the 5% confidence level. Thus, for aided recall, the respondents did not show any significant differences between known and unknown brands.

4.3 Brand familiarity and visual attention

The influence of PP familiarity on visual attention was evaluated based on eye-tracking data. The following hypotheses test the difference in the TFD, TFC and revisits (R). Null hypotheses were tested by a two-sample two-tailed T-test, which was either equal or unequal in the variances according to the previous F-test results.

$H3a_0$: The TFD metrics are the same for F1 and U1.

$H3a'_0$: The TFD metrics are the same for F2 and U1.

The p-value of the T-test was higher than 5% for F1 and U1 (n = 11, $\bar{x}_{TFCF1}$ = 0.29 seconds, s_{TFCF1} = 0.30 and $\bar{x}_{TFCU1}$ = 0.41 seconds, s_{TFCU1} = 0.30, p-value = 0.352). For the second pair of F2 and U1 data, the p-value was even higher than for the previous hypothesis (n = 11, $\bar{x}_{TFCF2}$ = 0.42 seconds, s_{TFCF2} = 0.35 and $\bar{x}_{TFCU1}$ = 0.41 seconds, s_{TFCU1} = 0.30, p -value = 0.991). In either case, the null hypothesis cannot be rejected. There is a high possibility that the data from the TFD metric belong in the same file. The standard deviations and the arithmetic means also correspond with this assumption. In this case, brand familiarity does not affect the TFD of PP visual attention. This is surprising because the new stimuli usually attract visual attention for a longer period because the brain needs to process new information.

$H3b_0$: The TFC metrics are the same for F1 and U1.

$H3b'_0$: The TFC metrics are the same for F2 and U1.

P-values were high for both null hypotheses out for $H3b_0$ (n_{TFCF1} = 11, $\bar{x}_{TFCF1}$ = 1.45, s_{TFCF1} = 0.82 and n_{TFCU1} = 10, $\bar{x}_{TFCU1}$ = 2.10, s_{TFCU1} = 1.10, p-value = 0.142) and for $H3b'_0$ (n_{TFCF2} = 11, $\bar{x}_{TFCF2}$ = 2.91, s_{TFCF2} = 2.21 and n_{TFCU1} = 10, $\bar{x}_{TFCU1}$ = 2.10, s_{TFCU1} = 1.10, p-value = 0.229). The null hypothesis cannot be rejected for any of the variants. Even in the case of TFC metrics, it was confirmed that brand familiarity did not significantly affect fixations.

$H3c_0$: The revisits metrics are the same for F1 and U1.

$H3c'_0$: The revisits metrics are the same for F2 and U1.

The revisits metric is partly related to the number of TFC, because the more times the respondent returns to the AOI area, the higher the number of fixations should be. The values of this metric also had a higher p-value than 0.05, for $H3c_0$ (n_{RF1} = 11, $\bar{x}_{RF1}$ = 0.55, s_{RF1} = 1.04 and n_{RU1} = 10, $\bar{x}_{RU1}$ = 1.10, s_{RU1} = 1.10, p-value = 0.249) and for $H3c'_0$ (n_{RF2} = 11, $\bar{x}_{RF2}$ = 1.64, s_{RF2} = 2.16 and n_{RU1} = 10, $\bar{x}_{RU1}$ = 1.10,

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s_{RU1} = 1.10, p-value = 0.478). Also in this case, the null hypotheses cannot be rejected. The brand familiarity factor did not prove to be significant for revisits either.

The results of the eye-tracking metrics for H3 reveal that the familiarity of PP did not have a significant effect on visual attention. This implies that the familiar and unfamiliar PP profits the same from visual attention. Based on the results, it can be assumed that even lesser-known brands will receive the same visual attention.

4.4 Product placement order and visual attention

$H4a_0$: The delay metric for the same PP of the first and second views is the same.
$H4b_0$: The TFD metric for the same PP of the first and second views is the same.
$H4c_0$: The TFC metric for the same PP of the first and second representations is the same.
$H4d_0$: The revisits metric for the same PP of the first and second views is the same.

The PP order factor was tested for F1 and F2, where both samples had identical animation. The hypothesis examined whether there was a statistically significant difference in different visual metrics for familiar and unfamiliar brands. The first null hypothesis was rejected due to very low p-value (n_{DF1} = 11, $\bar{x}_{DF1}$ = 5.72 seconds, s_{DF1} = 2.08 and n_{DF2} = 12, $\bar{x}_{DF2}$ = 2.42 seconds, s_{DF2} = 1.13, p-value = 0,0003). P-values of other metrics were higher than 0.05: $H4b_0$ (n = 11, $\bar{x}_{TFCF1}$ = 0.29 seconds, s_{TFCF1} = 0.30 and $\bar{x}_{TFCF2}$ = 0.42 seconds, s_{TFCF2} = 0.35, p-value = 0.391), $H4c_0$ (n = 11, $\bar{x}_{TFCF1}$ = 1.45, s_{TFCF1} = 0.82 and $\bar{x}_{TFCF2}$ = 2.91, s_{TFCF2} = 2.21, p-value = 0.062), $H4d_0$ (n = 11, $\bar{x}_{RF1}$ = 0.55, s_{RF1} = 1.04 and $\bar{x}_{RF2}$ = 1.64, s_{RF2} = 2.16, p-value = 0.153). Based on the results of the analysis, it can be concluded that the order of the same PP has an effect on visual attention. Only the time required for the first fixation of the PP showed a significant difference where respondents fixed attention to PP in F2 on average almost twice as fast as in F1 (D_{F1} – 5,72 seconds; D_{F2} – 2,42 seconds). However, this metric may be significantly affected by the previous scene, which was different for F1 and F2. Previous experiments have also found that the order is not a significant factor influencing PP effectiveness (Chaney et al., 2018).

4.5 Brand size and visual attention

$H5a_0$: The delay metric of the larger PP is not different from the metric of the smaller PP.
$H5b_0$: The larger TFD metric does not differ from the smaller PP metric.
$H5c_0$: The TFC metric of a larger PP is not different from the metric of a smaller PP.
$H5d_0$: The revisits metric of a larger PP is not different from the metric of a smaller PP.

The size factor was tested between U1 and U2, which had the same brand but in animation U2 the displayed PP in the video was larger. Based on the resulting p-values the $H5b_0$, Hc_0 and $H5d_0$ were rejected. The p-values here were less than 0.00001. Details of null hypotheses are: $H5b_0$ (n_{TFCU1} = 11, $\bar{x}_{TFCU1}$ = 0.41 seconds, s_{TFCU1} = 0.30 and n_{TFCU2} = 12, $\bar{x}_{TFCU2}$ = 2.31 seconds, s_{TFCU2} = 0.83, p-value <0,00001), $H5c_0$ (n_{TFCU1} = 10, $\bar{x}_{TFCU1}$ = 2.10, s_{TFCU1} = 1.10 and n_{TFCU2} = 11, $\bar{x}_{TFCU2}$ = 10.36, s_{TFCU2} = 3.61, p-value <0,00001), $H5d_0$ (n_{RU1} = 10, $\bar{x}_{RU1}$ = 1,10, s_{RU1} = 1,10 and n_{RU2} = 11, $\bar{x}_{RU2}$ = 5.64, s_{RU2} = 1.86, p-value <0,00001). For the delay metric, it was not possible to reject $H5a_0$ (n = 11, $\bar{x}_{DU1}$ = 2.61 seconds, s_{DU1} = 3.69 and $\bar{x}_{DU2}$ = 0.48 seconds, s_{DU2} = 0.38, p-value = 0.086). However, in the case of animation of samples for U1 and U2, the beginning of the interaction with PP was the same, so it would be appropriate to verify the findings for the delay in other samples, where the larger PP would be placed at the beginning of the animation. Other results of the null hypotheses support the statement about the difference between larger and smaller PP. The larger PP is likely to attract higher visual attention. The significance of the size factor has already been confirmed in previous research (Chaney et al., 2018). Although a larger PP attracts more visual attention, it may be less effective overall because it could elicit a negative response in the respondents' attitudes.

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4.6 Influence of experiences on visual attention

In this part, it was tested whether the respondents' experiences influence visual attention. The TFD metric is the most relevant to this topic because it expresses the time that the respondents needed to process the stimulus. It could be expected that experienced players would have faster reactions. Values from TFDF1, TFDF2, and TFDU1 were used to compare data due to their normal distribution and the same variance. As part of the analysis, the total fixation duration is denoted as A1, A2, A3. Respondents with empty or excluded values in those metrics were excluded. The verified factor is the experience which is tested as a mediator of the relationship. This experience factor was counted as the sum of the hours spent per week playing video games and hours watching the stream. One respondent was excluded from the sample due to his extreme value, which was 37 hours per week. Respondents were divided into two groups according to weekly played/viewed hours: B1 - inexperienced players {0; 0; 5; 6} and B2 - experienced players {7; 7; 8; 9}. It would have been more appropriate to divide the respondents into three groups, but the number of research participants was too low. The One-way ANOVA test was used to verify the relationship between the factors and the data.

It has already been confirmed above that the data possibly belong in the same file for a given pair of data selections, although the factors had no significant effect: $H4b_0$: TFDF1-TFDF2; $H3a_0$: TFDF1-TFDU1; $H3a'_0$: TFDF2-TFDU1. Therefore, the experience factor will be responsible for any relationship found, so it can be labelled as a complete mediator (Bhandari, 2021). H6 deals with the relationship between time spent playing video games/streaming and eye-tracking time tracking metrics. In this relationship, it is assumed that the respondents' experiences are a mediator, which means that the time spent playing/watching the stream affects the visual attention - TFD, through the influence of the respondent's experience.

$H6_0$: The TFD metric does not differ between respondents with varying degrees of experience.

Based on the results of ANOVA (Table 3), it is possible to reject $H6_0$ of the same variability between blocks B1 and B2 (experience). The respondents' experiences proved to have a statistically significant effect on the TFD concerning PP in the video (9.452> 4.41). The sum of TFD differs significantly between differently experienced groups B1(6,49 seconds), B2 (2,45 seconds). Less experienced players spent more than twice as much time watching PP compared to experienced players. This could be because of accelerated responses and processing of perceived stimuli, where players with PP experience process faster or have a faster decision-making ability to ignore the stimulus. These findings are consistent with an earlier experiment where the better players showed better memory capacity and faster responses (Dardis, et al., 2015). Within blocks A1, A2, A3, which represented different samples of PP of two familiar and one unfamiliar, no statistically significant difference was found, which corresponds with statements from $H3a_0$, $H3a'_0$ and $H4b_0$. The analysis also did not show a statistically significant difference between the groups of different examples and the experience of the respondents.

4.7 Semi-structured interview findings

Qualitative research could be viewed as a complementary method to quantitative, which could make more sense to causes, attitudes and motives. The results could not be generalised but could decode some key topics for the researched area (Tahal, 2015). The following paragraphs summarise the respondents' interviews on the relationship towards PP in videogames/streams and the factors that moderate their attitude and expectation for the future of PP in videogames. The participants were also asked to describe the reasons why they spend their time on these entertainment platforms and to define the typical videogame player and stream consumer.

The respondents generally regarded PP as positive and as a standard marketing technique. The positive aspects of PP that were mentioned were an increase in realism and more affordable video games. On the negative side, the aspects were fictitious brands, disturbance of game fluency and too

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much use of PP. These aspects agreed with previous findings except for the dislike of the fictitious brand, which was identified as a new finding. The future of PP in video games was viewed as promising. The main potential was identified in targeting the younger generation. It was uniformly believed that PP would be implemented more intensively in the videogame interface. Another opportunity is for tournaments that allow brand highlighting. The negative expectation that was mentioned was the abundant implementation of PP. There is expected the creation of laws that would restrict the PP at least in games for children.

Videogames and streaming have some common aspects but differ in others. The respondents started to play video games when they were an average of 11 years old; however, some started earlier from the age of five. The average time spent playing video games was 5 hours per week. This time varied greatly due to seasonal tournaments, the weather and part-time jobs. The weekly time spent on a stream watching someone else playing video games on average took up half the playing time (2.5 hours/week). Half of the respondents claimed to spend more time playing video games, a quarter watching streams and a quarter divided their time equally between both activities. The reasons to spend time on these activities were mainly relaxation, entertainment, social contact and leisure time. In addition, the reasons to watch streams were to see the new environment of the game, videogame tutorials or having insufficient equipment to play the game in the first person. One respondent said that for him a stream is another type of series instead of television. The typical consumer of videogames streams was defined as someone younger than a videogame player even though the most mentioned characteristic was the similarity with gamers. The typical videogame player was defined as more likely to be male aged between 16-28 years old. The most mentioned characteristic was to be immersed in the game with no interest in the world around. In some cases, the negative appearance characteristics were also mentioned. The videogames and streams were considered a common part of modern life although there still exists a tendency to stigmatize these activities.

5 Discussion and conclusion

The results of this study draw on several contributions to the field of PP in video games. The familiarity factor affects only some of the monitored aspects that are believed to contribute to PP efficiency. A summary table with the results of the null hypothesis can be found in the appendix of this paper in section 9 Tables (Table 3). The recognition was indifferent because the hypotheses were rejected only in half the cases. The results for recall differ for unaided and aided, where only unaided recall shows a significant difference between familiar and unfamiliar brands. These findings confirmed the previous research on this topic (Parreño et al., 2017). The visual attention metrics did not differ, which implies the opportunity that even less well-known brands profit similarly from visual attention. Another observed factor was the PP order and impact on visual attention, where the study did not find any difference. On the other side, the size of PP in the video sample plays a considerable role in visual attention. Both these findings correspond with previous research (Chaney et al., 2018). The last factor tested was the respondent's experience and their influence on TFD. Within ANOVA, the differences between experienced and inexperienced players were found statistically significant. Experienced players devoted less than half the time measured than inexperienced players did to PP, which may be related to faster stimulus processing (Dardis, et al., 2015).

The interview mostly confirmed the previous research and uncovered some additional information. The respondents perceived PP in the video game rather positively, with the proviso that a more affordable video game can be obtained. The most highlighted aspect was the increase in the realism of the entertainment content through the implementation of real products. On the contrary, the respondents had a negative attitude towards fictitious PP that resembled real brands. This finding is new and did not occur in previous research but could be related to the interruption of the flow of the game (the respondent wonders what the fictitious brand reminds him of and thus moves away from the story of the game in concentration). Interrupting the flow of the game also has a negative effect on attitude towards

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PP. Findings on realism and congruity were consistent with previous research (Vermeir et al., 2014; Vashisht & Chauhan, 2017) and with the requirement for game fluency (Siemens et al., 2015; Wang et al., 2015).

Regarding the respondents' time spent playing or passively watching games, these activities can certainly be regarded as potentially significant platforms for the implementation of PP. Moreover, when this is considered statistically to increase the number of users. This should alert companies to act and implement their brands/products into the environment of video games or streams. At the same time, paid cooperation with streamers or game designers can be cheaper than PP in a series/film and with the possibility of higher granularity in targeting. In addition, it is possible to even target the younger generation through this channel. Marketers could thus consider whether the streaming/video game environment is suitable for implementing advertising for their product and whether there is a presumption of sufficient representation of their target group. Finally, building a positive attitude towards a brand has become a necessity in the commoditisation of products. The results of the research showed that even lesser-known brands are visually perceived in the same way as well-known brands. Therefore, it should be possible to create potential customer priming for a new brand. Familiar brands will always benefit more from better recall in explicit memory, but PP works more on the principle of implicit memory, where the unfamiliar brands could also profit.

6 Limitations and future research

One of the main limitations of the findings is the low number of respondents, where it would certainly be more appropriate to support the results with data from a larger set especially the quantitative part of research. A sufficient level of saturation was achieved in the qualitative part of the research, where the last three respondents did not bring any further substantial information. Considering the similar characteristics of the respondents, the formulated research objectives and research questions, as well as the recommendations of Nielsen (2000), the number of respondents was reasonable, although we are aware of the limitations of the sample size. The participants' group was small but homogenous: male, 20-25 years, students of the Faculty of Management, Prague University of Economics and Business. Homogeneity was beneficial for the completion of results and data saturation although it limits the results to a very small population. The categorization of respondents into two differently experienced groups was based on the research sample experience characteristics which could be inaccurate. It could be argued that these data are valid for a population that belongs to the same group as the participants. Possibly, these data would be analogous for other university students or even for men aged 20-25 although there is not enough information available for this statement in the research. At the same time, video games and streaming should not be related only to this age group or gender because there is a high number of players or stream watchers in other age categories as well as for women. Another limitation is that the observation was made on only one type of video; the use of another genre could bring different results, so the generalizability of the results is low. The limitation also can be seen in the explicitly presented PP; it is not always such an obvious implementation of advertising. The remaining limiting condition was the measurement of AOI only during the interaction with PP. This design of measuring only dynamic PP can be misleading because the respondents noticed PP even though it was static. Despite the low generalizability of the results, significant information was found within the research. The results could be compared to wider sample research to increase the findings reliability.

The question of generalisability to a wider population can only be answered after further research. That could be conducted with different groups of the population, different genres of videos and different implementation of PP into the content. This topic also deserves a longer study, which should uncover the effect that PP has in the long term. This area should attract more interest in the future as videogames will be played by a larger number of the population. Therefore, this area would be more attractive as a marketing channel.

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9 Tables

Table 2 – Input data ANOVA

Block A	A1	A2	A3	Sum of time played/watched	**Block B**
respondent	TFDF1	TFDF2	TFDU1		
1	0.153	0.504	0.129	0	B1
6	0.747	0.056	0.805	0	B1
3	0.542	0.747	0.64	5	B1
11	0.874	0.833	0.461	6	B1
5	0.147	0.265	0.192	7	B2
9	0.351	0.195	0.171	8	B2
10	0.011	0	0.279	9	B2
12	0.098	0.726	0.014	7	B2

Table 3 – ANOVA results

	Sum of squares	**df**	**Average square**	**F**	**F (0,05)**
Between A	0.026	2	0.013	0.179	3.55
Between B	0.681	1	0.681	9.452	4.41
Between A x B	0.036	2	0.018	0.249	3.55
Inside	1.296	18	0.072		
Total	2.039	23			

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Table 4 – Summary of results of null hypothesis

Metric	Null Hypotheses	Statistical test	Result
Recognition	*H1a$_0$: Visual attention metric delay is the same for F1 and U1.*	T-test	rejected
	H1a'$_0$: Visual attention metric delay is the same for F2 and U1.		**not** rejected
	H1b$_0$: Respondents' answers regarding noticing a familiar brand or both brands do not differ.	Chi-square test	**not** rejected
Recall	*H2a$_0$: Unaided recall is the same for the familiar and unfamiliar brands.*	Chi-square test	rejected
	H2b$_0$: Aided recall is the same for familiar and unfamiliar brands.		**not** rejected
Visual attention	*H3a$_0$: The TFD metrics are the same for F1 and U1.*	T-test	**not** rejected
	H3a'$_0$: The TFD metrics are the same for F2 and U1.		**not** rejected
	H3b$_0$: The TFC metrics are the same for F1 and U1.	T-test	**not** rejected
	H3b'$_0$: The TFC metrics are the same for F2 and U1.		**not** rejected
	H3c$_0$: The revisits metrics are the same for F1 and U1.	T-test	**not** rejected
	H3c'$_0$: The revisits metrics are the same for F2 and U1.		**not** rejected
Factor			
Order of PP	*H4a$_0$: The delay metric for the same PP of the first and second views is the same.*	T-test	rejected
	H4b$_0$: The TFD metric for the same PP of the first and second views is the same.		**not** rejected
	H4c$_0$: The TFC metric for the same PP of the first and second representations is the same.		**not** rejected
	H4d$_0$: The revisits metric for the same PP of the first and second views is the same.		**not** rejected
Size of PP	*H5a$_0$: The delay metric of the larger PP is not different from the metric of the smaller PP.*	T-test	**not** rejected
	H5b$_0$: The larger TFD metric does not differ from the smaller PP metric.		rejected
	H5c$_0$: The TFC metric of a larger PP is not different from the metric of a smaller PP.		rejected
	H5d$_0$: The revisits metric of a larger PP is not different from the metric of a smaller PP.		rejected
Respondents' experiences	*H6$_0$: The TFD metric does not differ between respondents with varying degrees of experience.* A square Familiarity B square Respondents' experiences AxB square	ANOVA	**not** rejected rejected **not** rejected