Effects of advertisements and questionnaire interruptions on the player experience

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Abstract — **New online stores and digital distribution methods have led to the development of alternative monetization models for video-games, such as free-to-play games with advertisements. Although there are many games using such models, until now the effect on the player experience from such interruptions has not been studied. In this controlled experiment, we requested that participants (N=236) play one of three different versions of a platformer game with: 1) no interruptions, 2) 30-second video advertisements, and 3) a multiple-choice questionnaire. We then evaluated the effects on the player experience. The study shows differences in their experiences, namely in: competence, immersion, annoyance, affects, and the reliability of the questionnaire answers. The contribution of this work is to identify which player experience variables are affected by interruptions, which can be valuable for selecting the business model and guiding the game design process.**

Keywords—video game, player experience, game user research, interruptions, advertisement, questionnaires

I. INTRODUCTION

Games are a thriving industry, with 2.3 billion gamers across the globe. The industry is projected to grow a further 13.3% by the end of 2018, reaching revenues of $137.9 billion [1]. With most game companies adopting the practice of producing downloadable games only and moving away from traditional means of distribution, games have become more accessible than ever. Present-day consumers have access to hundreds of thousands of games for free; therefore, they are less willing to spend money on games than they were before [2]. Hence, companies have had to adopt free-to-play business models in order to maintain revenue streams.

As a result, the "freemium" or "free-to-play", as it is known in the game industry, has become an increasingly relevant business model. Out of a 2017 confirmed revenue of $108.4 billion, $82 billion ($\approx$76%) came from free-to-play titles for both PC and mobile platforms [3]. The freemium business model provides users access to services or goods without requiring them to pay, although additional features within the service can be monetized. Within this model, companies may use multiple strategies to earn revenue. The two main sources of revenue are: 1) eliciting players to pay for extras in the games, e.g. cosmetic elements, time or content; 2) allowing third-party entities to embed external content, such as ads or questionnaires, for a flat rate per click or view of such third-party content.

This paper focuses on games that utilize interruptions to display third-party content, i.e., the game is suspended completely, and the player is "forced" to consume incongruent external content. Most of the time, the interruptions are displayed intermittently between levels, but there are several games which use a much more visceral approach and interrupt the gameplay actively to display all sorts of content, including short videos (from 10 up to 45 seconds long, see Fig. 1), questionnaires (e.g., PollFish[1] or Survata[2]), or even other interactive mini-games.

Although there are less intrusive advertisement strategies, such as in-game advertisements, i.e., placing brands and products directly in the game level or scene like: props, billboards, or street advertisements [24]. Those normally require more involvement from the game company, and not all games are able to accommodate such advertisement strategies, due to incompatibility of genres, violence driven games, lack of proper placement opportunities, or too much an alternative story/world to associate with real world brands. Lastly, creating such an intertwined relationship between the advertised brand and the game may not be desirable; hence, such methods are rarely used, and the study we report on in this paper will not address those advertisement strategies.
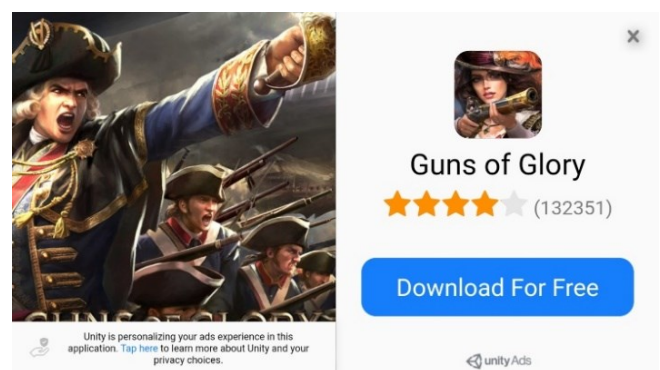

Fig. 1. Final frames of a typical commercial interruption that showcases a 30-second video and requests that the player download the game (big blue button) or dismiss the advertisement (grey cross on the top right corner).

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[1] https://www.pollfish.com/

[2] https://www.survata.com

Even with such a strong market presence in the industry, interruption-based free-to-play games are still a bit of a black art in the sense that there are still a lot of assumptions being made. The few research studies covering this topic seem to contradict widely held beliefs. For example, meta-critic scores seem maladjusted to free-to-play games [4], or developers' attitudes towards free-to-play are not as negative as initially thought [5].

Interruptions are also used for Games User Research [10] focusing on the measurement of any aspect of influence the experience and perception of video games, which may influence the intended measurement.

It is our goal with this paper to address an existing gap; support game companies, designers, researchers; and study the relationship between the game experience and non-congruent interruptions. By comparing the same game under three different conditions, we take a deeper look into how interruptions might affect the gaming experience.

II. BACKGROUND

It is fundamental that game designers consider deeply the experience that they are providing; hence, the player experience is a well-explored topic. There are multiple models and frameworks which focus on player enjoyment or satisfaction, but considerably less focused on the affects and effects of interrupting an experience.

A. Interrupting an Experience

Although a scarce amount of research has been done on interruptions within a game context, the disruptive effects of interruptions have been researched in a task-oriented context. Despite the contextual differences, a structural similarity can be found between the interruptions in the two environments (shown in Fig. 2 [16]). In both cases, interruptions require the user to switch focus between multiple tasks, thereby affecting the execution of the primary task.

Early work showed that interruptions affect behaviour and memory performance [17]. Specifically within a gaming context, Gillie and Broadbent showed there are negative performance effects from interruptions [18], they found that nature (similarity) and the complexity of the interruption are determinant in making the interruption disruptive, while control over when a player is interrupted and length are less important factors. Other research [19] suggests that the interruption timing (e.g., immediate or scheduled) has a distinct effect on task performance in and of itself (e.g., task accuracy, promptness, and completeness).

Although the game and advertisement tasks are clearly disjoint, in the sense that the context, cognitive mental model, and required actions (playing vs. consuming) are unrelated, there is clear evidence they influence each other.
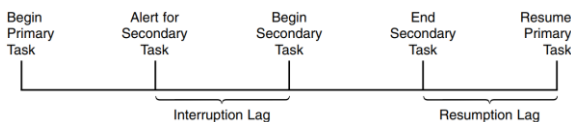

Fig. 2. The interruption and resumption process involving tasks [16].

Several studies show this crossover: for example, video game difficulty influences the effectiveness of the in-game advertising, i.e., increasing game difficulty affects the processing and evaluation of the brands [20]. Another study showed that levels of video game violence may influence the effectiveness of brand recognition, recall, and positive attitude [21]. And yet another quasi-experimental survey [22] looked into schema incongruity to understand if advertisements in a massively multiplayer, online role-playing game (MMORPG) would change brand awareness rates, concluding that moderately incongruent advertising in an MMORPG leads to higher awareness rates, although extremely incongruent in-game advertising can reduce the perceived sense of realism of a game and annoy players.

B. Ad Intrusiveness

A commonly used indicator for advertisement disruption and averting is perceived intrusiveness [23–25]. The main focus of perceived intrusiveness is to understand whether the advertisement evokes personal attitude changes in the consumer after exposure [26]. Although intrusiveness is related to traditional media, the concept can be applied to advertisements in games. Some research has been done on perceived advertisement intrusiveness in games [27]; yet, the causes of perceived intrusiveness remains rather unexplored.

There is a defined research tool which enables the measurement of the perceived intrusiveness of an advertisement (see Fig. 3) [26]. The combination of measured intrusiveness and player experience may provide a deeper look at, and support validation on, the effects of game interruptions. Although this is a known and frequently used tool specifically designed for advertisements, there is no similar or comparable measurement tool which focuses on research questionnaires, which we are also focusing on in this study.

Fig. 3. Example of an Ad Intrusiveness questionnaire [26].

III. METHOD

To investigate more closely how interruptions influence the game experience, we defined a between-subjects experiment in which the independent variable was the interruption setting of a video game, which was then followed by the 2013 Game Experience Questionnaire [7] to measure and evaluate the player experience under different conditions.

The Game Experience Questionnaire (GEQ) [7] is a tool for measuring subjective game experiences, which uses a modular approach that covers: core gameplay, social presence, and post-gameplay experiences. The authors provide extensive documentation, including internal correlations between game experience constructs and demographic factors that influence the measurements, making the GEQ a frequently used measurement tool for game experiences [14].

A very recent work from Law, Brühlmann and Mekle re-evaluated the reliability of GEQ and found some reliability problems, mainly to the Challenge and Negative Affect components [13] and it is advised to perform Cronbach's α, which we also included in our results.

Fig. 4. Runner game footage portraying the player's character (red square) and providing two possible paths to reach the end of the level.

We altered an existing game – Runner (see Fig. 4) – that we developed for another study [31]. Runner is a skill-based platformer game in which the player is represented by a simple red square and the goal is simply to reach the end of the level (denoted by a green area) as fast as possible by jumping onto and grabbing available objects.

The game was intentionally designed to be a barren, 2D platform with a negligible narrative. Such a set-up exposes players to the core game mechanics only and avoids strong influences, such as a plot, character self-representation, or empathy. For the same reason, we kept the graphics simple and purposely did not add any (cartoonish) avatar to the game.

For this study, the players had to play the first three levels of the game. The first level introduces visual clues that teach the game to the novice players, and subsequent levels increase the level of difficulty. All three levels took our participating players between 5 to 6 minutes to complete. Nevertheless, we recorded high variability (M=330.7 seconds, SD=333.2 seconds), which we deemed natural for a skilled-based game.

Specific performance metrics were tracked for all participants, namely: *i)* the score of the level, i.e., time taken on the first successful attempt to reach the end of the level; *ii)* total time, i.e., the total time a player spent in a level, including all failed attempts, and *iii)* number of attempts, i.e., the number of attempts required to complete the level.

A. Experimental Conditions

The participants were split across three groups in which they played exactly the same game, with the sole difference among the groups being the nature of the interruption. In this section, we present the different experiment group conditions in more detail.
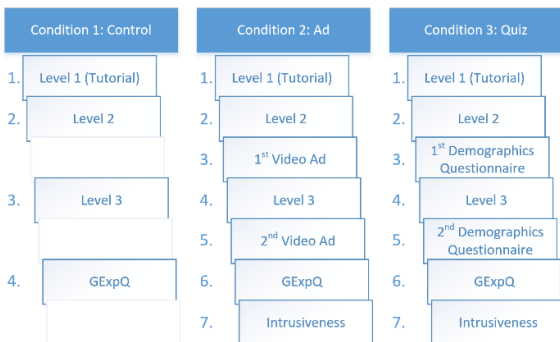

Fig. 5. Visual representation of the different activities that the participants in each group performed.

Fig. 6. Level-completion screen presented to the players with their level time score (in seconds).

1) Condition 1: Control Group

In the first condition (see Fig. 5), the players go through all three levels, and, at the end of each level, a level-completion screen with the score (traversing time) is displayed (see Fig. 6). If a player is not able to transverse a level successfully, they will restart from the beginning of the level. In this condition, there are no interruptions, and, after participants have successfully completed all levels, they are forwarded to an online, self-reported GEQ [14] in order for the study to establish a comparison baseline.

2) Condition 2: Advertisement Group

In the second condition (see Fig. 5), immediately after a player finishes the second and third levels, a distinct video ad is played. These two distinct video ads mimic patterns found in existing games by not allowing the player to dismiss or interact with the game until the ad ends. At the moment the ad does end, a cross appears on the upper left corner, requiring the player to dismiss it manually. Only after the ad is dismissed by the player will the level-completion screen (see Fig. 6) display, similar to Condition 1.

In order to mimic real-life conditions, both videos were real ads for other games that were exactly 30 seconds long. Although there are many advertisement formats, ranging from small banners to fully interactive mini-games, we selected a common advertisement format present in games at the time of this study.

Similar to Condition 1, after players complete all levels successfully and view the ads, they are forwarded to an online, self-reported GEQ [14], followed by the ad intrusiveness questionnaire [26], which requests that they evaluate the second (i.e., last) video advertisement that they saw.

3) Condition 3: Questionnaire Group

In the third condition (see Fig. 5), as in the previous condition, immediately after a player completes the second and third levels, a research-like questionnaire is presented to the player. To improve readability, we will refer to it as the Demographics Questionnaire in order to avoid confusing it with the other research questionnaires we are using.

The Demographics Questionnaire questions were directly copied from the statistical bulletin from the UK Office of National Statistics on Internet access – households and individuals from 2017, licensed under the Open Government License v3.0 [32]. To improve the questions reliability of the Demographics Questionnaire, the UK Office of National Statistics kindly supplied us with the original questionnaire.

Fig. 7. Questionnaire presented to players after the 3rd level under Condition 3 (Demographics Questionnaire group). Questions are courtesy of the UK Office of National Statistics.

Hence, we used the original questions exactly as they are formulated and presented them to our player-participants during the game interruptions. By using a known and validated questionnaire, we can measure the reliability of an in-game research tool by comparing the two sets of questionnaire results.

The questions retrieved from the national survey were related to what online sources were used to arrange accommodations or transportation and what types of products were bought or ordered online (see Fig. 7, which showcases one of the questionnaires that was given to our participants). We made sure to include a reasonable number of questions that participants could respond to in a short amount of time in order for this condition to be comparable, at least in terms of the time span, to the 30-second ad condition.

B. Participants

For the experiment, we tried to reach a diverse and large number of participants by using a crowdsourcing service (Prolific.ac), which has been proven to be more representative than a traditional university participant pool [33]. We rewarded each participant matching the UK minimum hourly wage (€9/hour), for completing the experiment. We used the same payment for all three conditions.

Participation in the study was voluntary and done with consent. In addition, participants were informed that their in-game behaviour was going to be monitored, data would be collected, and that all collected information would be used purely for research purposes. In addition, they were told that all published information would keep the participants anonymous and that they could refuse to participate or withdraw at any time.

We recruited 236 participants from the United Kingdom in line with the target demographics of our third condition, and these participants self-reported that they play games actively an average of 8.5 (SD=3.9) hours a week. Through the detailed demographic profiles were provided by the crowdsourcing service, we found that the average age of our participants was 30.4 (SD=8.6), with 30.1% being female, and almost all were Caucasian.

The average experiment duration was slightly above 8 minutes (M=495.5 seconds; SD=414.9 seconds). In total, we keep 212 participants that completed all steps and weren't

excluded because they took too long or did not fit within the outlier bounds.

IV. RESULTS

In this section, we present and compare the results of each condition. After applying the aforementioned exclusion criteria, we had 70, 72, and 70 participants per condition, respectively. Base on the recommendations of [13], we analysed the internal consistency using Cronbach's α for each condition and the obtained values are considered acceptable. The Control condition got 0.7071, the Advertisement condition 0.7348 and Demographic Questionnaire 0.7705.

A. Game Performance

The statistical analysis of all tracked performance metrics, namely: *i)* the score of the level, *ii)* total time, and *iii)* number of attempts did not reveal any significant differences between the conditions.

B. Game Core Experience

In Table I, we display the results of the statistical values for the game experience core variables, and, through the one-way ANOVA, it is possible to observe that there is statistical significance for multiple core variables, namely: competence, immersion (or, more accurately, sensory and imaginative immersion, according to the GEQ), tension/annoyance, negative affect, and positive affect.

We also present a graphic-based illustration (see Fig. 8) to show more clearly how this game experience was affected by the interruptions. Of all the variables, only challenge seems to be unaltered, which makes sense since the game was not altered per condition. Although the means show some difference in terms of how players experienced flow, according to the ANOVA result, the difference is not significant.

Further statistical exploration using post-hoc Tukey's HSD at the .05 level of significance tests showed that there is a different in perception of Competence, Immersion, Tension/Annoyance, Negative and Positive Affects components between the Control and Ads conditions. The pair comparison between the Control and Demographic questionnaire only show significant difference on the Competence. All other comparisons including all components between Ads and Demographic Questionnaires were not significant.

All of the other game experience variables registered significant or highly significant differences among the three conditions. Interestingly, and looking at the overall picture, it seems that the advertisement created stronger differences when compared to the Demographics Questionnaire. In theory, the Demographics Questionnaire requires more attention and effort from players by forcing them to answer a questionnaire; still, it seems less disruptive towards the player experience when compared with the control condition, particularly concerning the negative affect and immersion variables. It is clearly observed (see Fig. 8), that player's tension/annoyance was higher for both the demographic questionnaire and ad conditions when compared to the control group, while the positive affect is lower for both conditions. Another very interesting result is that the player's perception of his/her own competence was altered under both Conditions 2 and 3.

TABLE I.   STATISTICAL ANALYSES OF THE GAME CORE EXPERIENCE VARIABLES, INCLUDING MEANS, STANDARD DEVIATIONS, AND STANDARD ERRORS OF THE MEANS, FOR ALL THREE CONDITIONS AS WELL AS ONE-WAY ANOVA.

Variable Name	Control (N=70)			Ads (N=72)			Demographic Quest. (N=70)			ANOVA	
	mean	std dev	std error	mean	std dev	std error	mean	std dev	std error	F	Sig.
Competence *	0.724	0.223	0.027	0.607	0.224	0.027	0.617	0.252	0.030	5.396	0.005*
Immersion *	0.561	0.232	0.028	0.472	0.192	0.023	0.523	0.223	0.027	3.036	0.050*
Flow	0.756	0.223	0.027	0.681	0.244	0.029	0.742	0.250	0.030	1.954	0.144
Tension/Annoyance *	0.481	0.251	0.030	0.653	0.322	0.038	0.593	0.280	0.034	6.488	0.002*
Challenge	0.733	0.208	0.025	0.701	0.230	0.027	0.729	0.225	0.027	0.447	0.640
Negative Affect *	0.458	0.207	0.025	0.554	0.239	0.028	0.477	0.195	0.024	3.921	0.021*
Positive Affect *	0.798	0.249	0.030	0.673	0.260	0.031	0.724	0.265	0.032	4.131	0.017*

* Significant result

TABLE II.   STATISTICAL ANALYSES OF THE GAME POST-EXPERIENCE VARIABLES, INCLUDING MEANS, STANDARD DEVIATIONS, AND STANDARD ERRORS OF THE MEANS FOR ALL THREE CONDITIONS AS WELL AS ONE-WAY ANOVA.

Variable Name	Control (N=70)			Ads (N=72)			Demographic Quest. (N=70)			ANOVA	
	mean	std dev	std error	mean	std dev	std error	mean	std dev	std error	F	Sig.
Positive Experience *	0.620	0.187	0.023	0.515	0.226	0.027	0.584	0.244	0.029	4.085	0.018*
Negative Experience	0.358	0.130	0.016	0.402	0.163	0.019	0.392	0.157	0.019	1.668	0.191
Tiredness	0.379	0.174	0.021	0.405	0.233	0.028	0.411	0.206	0.025	0.474	0.623
Return to Reality	0.375	0.159	0.019	0.346	0.145	0.017	0.388	0.162	0.020	1.342	0.264

* Significant result

TABLE III.   STATISTICAL ANALYSIS OF THE PERCEIVED INTRUSIVENESS VARIABLE, INCLUDING MEAN, STANDARD DEVIATION, AND STANDARD ERROR OF THE MEAN FOR CONDITIONS 2 AND 3, PLUS A TWO-SAMPLE T-TEST.

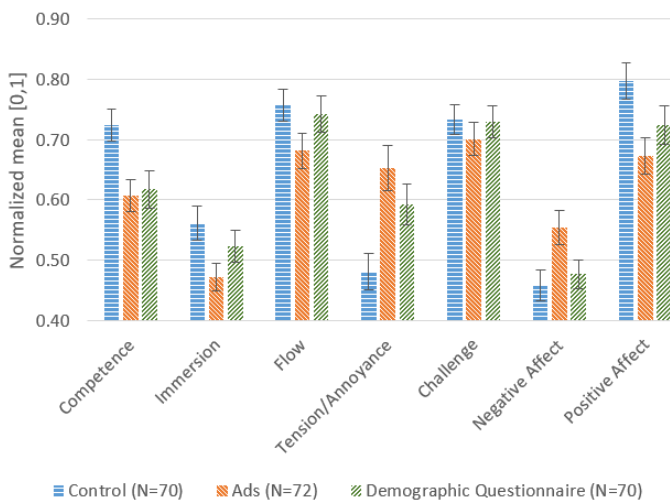| Variable Name	Ads (N=72)			Demographic Quest. (N=70)			t-Test	
	mean	std dev	std error	mean	std dev	std error	t	Sig.
Perceived Intrusiveness *	0.844	0.226	0.027	0.577	0.256	0.027	6.556	0.000000001*

* Significant result

Fig. 8. Plot of the mean value and the standard error for the core experience variables for the comparison between conditions.
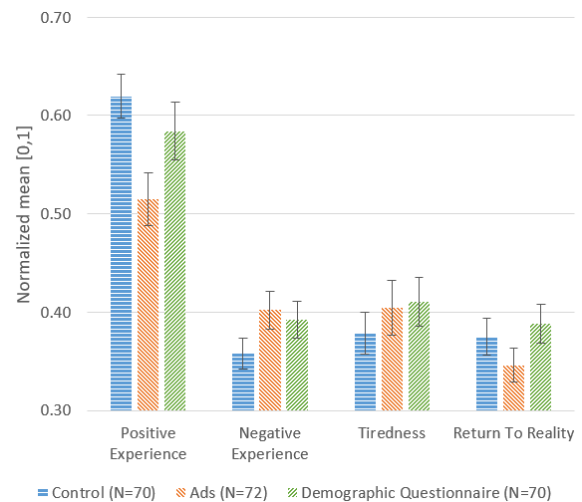

Fig. 9. Plot of the mean value and the standard error for the post experience variables for the comparison between conditions.
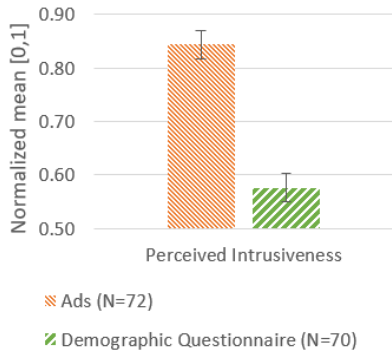
Fig. 10. Plot of the mean value and the standard error for the perceived intrusiveness comparison between the ads and demographic questionnaire conditions.

C. Game Post Experience

The statistical results of the Game Post Experience are presented in Table II and illustrated in Fig. 9. Overall, the interruptions with the questionnaire and the advert seemed to result in a less positive game experience than the control condition but ANOVA tests to compare the mean scores did not reveal statistically significant differences.

D. Perceived Intrusiveness

The perceived intrusiveness scores for ads and questionnaire revealed significant differences between conditions 2 and 3 as can be seen in Table II and in Fig. 10. Since the perceived intrusiveness questionnaire [26] only makes sense when interruptions are present, it was applied only for the Ad and Quiz conditions. The perceived intrusiveness questionnaire was adapted directly to Condition 3. To our knowledge perceived intrusiveness has not been used before to evaluate the experience of answering a research questionnaire.

E. Reliability of the Demographic Questionnaire

We purposely limited the participant pool to the United Kingdom and used an existing research study with a highly reliable statistical analysis to compare the results obtained in the demographics questionnaire. Below (see Fig. 11 and Fig. 12), a side-by-side comparison of the questionnaire outcomes is given.
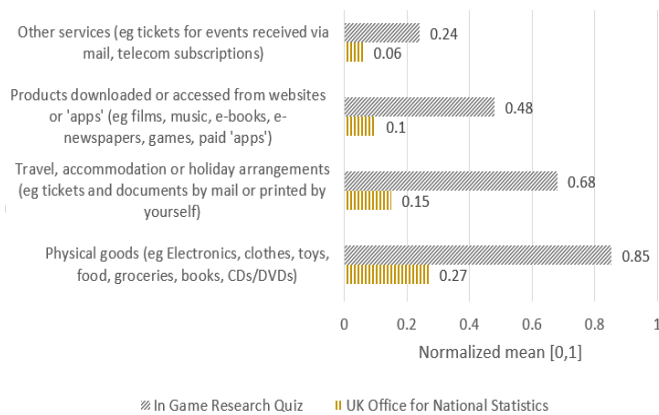

Fig. 11. Product bought or ordered over the internet from outside the UK, comparison between the results from the UK Office for National Statistics and the Research quiz placed within Runner.
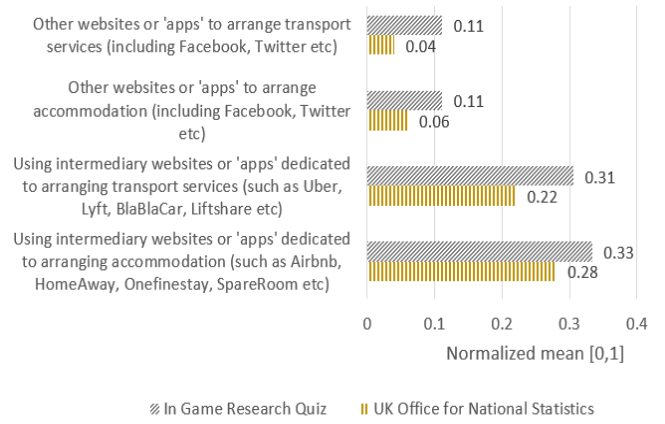

Fig. 12. Use of Internet to arrange accommodations or transport via another individual, comparison between the results from the UK Office for National Statistics and the Research quiz placed within Runner.

In both figures, there is a noticeable difference between the national results in comparison with the results obtained within the game. Although the results seem relative congruent in terms of order, i.e., the different options are equivalently ordered in relation to each other, there is a large disparity between the values obtained by the national survey and those obtained within the game.

V. DISCUSSION

The results show clearly that there are significant alterations to the game experience variables when interruptions are introduced. The games with interruptions show a decrease in perceived competence, immersion, and the positive affect, while there is an increase in the negative affect and tension/annoyance. In the game post-experience, it was also clear that the players had a better positive experience without interruptions; this is particularly important because it may lead to higher impressions of the game. From a product relationship and marketing point of view, better positive experiences may lead to improved product satisfaction, public ratings, and recommendations.

A. Detailed Evaluation of the Game Experience

When taking a detailed look at the experimental results and different conditions, there are some notable results, which we took a closer look at in this section.

1) Flow

Despite our interruptions being performed rather abruptly after the player had terminated a level, the statistical comparison of flow did not reveal significant differences suggesting that the questionnaire and the ad had a minimal impact on flow. We speculate that the timing of the interruption suggested a scheduled interruption [19], which may have reduced the disruption of player flow.

This result is extremely relevant for game developers in terms of understanding under which circumstances the game should be interrupted and minimize game flow interference.

2) Competence

There is a significant difference in competence; players felt less competent in the conditions with interruptions. At first glance, this seems a curious result since the players didn't notice a difference in the challenge while the self-perception of competence was lower.

A task interruption study conclusively found that performance decreases with the introduction of interruptions [18], which led us to extended our analysis and analyse the different times/scores of the groups, and we concluded that there wasn't any meaningful variation on the means.

We hypothesize that the interruptions may incite players to reflect on their own performance, which might lead to lower self-perceptions of competence. This insight will need to be further investigated with in-depth analysis of game experience by combining the in-game observations with in depth interviews.

3) Advertisement vs. Demographic Questionnaire

Although the in-game advertisement is a known and frequently used model and players have an acceptance attitude towards in-game advertisements [34], the study shows clearly that game experience variables for the advertisement condition diverged from the control variables more than the Demographics Questionnaire condition variables did. They showed higher impacts on immersion, tension, negative affect, positive affect, and positive experience. Similarly, the pair-wise analysis showed us the majority of significant differences being between the control and the advertisement conditions, indicating that players find the advertisement more intrusive (shown in Fig. 10).

If we consider both activities (watching an advertisement video vs. answering research questions), in theory, the research questions should be more challenging and disruptive, i.e., they require more cognition, an explicit action for answering (checking the correct box), and may have privacy issues to consider. Still, the advertisement, which is a passive experience and one that can be completely ignored by the player, was clearly more disruptive.

We can only speculate why without a proper and grounded follow-up study, but our theory is that the advertisement has an explicitly commercial focus and completely breaks with the player context with a different graphic style and soundtrack, perhaps causing a consumer backlash [35].

B. Reliability of In-Game Questionnaires

We purposefully used a known and reliable study in order to attempt to replicate similar conditions and evaluate the reliability of performing an in-game questionnaire.

The results were mixed; they show relative accuracy, i.e., the results' ordering and distribution are well-balanced (ratio between two results) for both questions (Fig. 11 and Fig. 12). In addition, for the second question, the results for the in-game questionnaire are rather close to the national office statistics; however, the results of the first question (types of products ordered online) are completely different (with a difference up to 58%). Note that if players had randomly select items on the list, we would see an even distribution of all results. In addition, it would be unlikely that they would follow the same distribution as the results of a national survey.

The second question (about arranging accommodations or transport) shows a clear connection to the national survey results. The big difference relative to the first question might have been due the selection of the target audience. Because we used online crowdsource workers and, by the nature of their work, they spend a lot of time online, and they may be more inclined to buy products online, independently of their country of origin.

We cannot recommend that these game-embedded research tools be used without further research into this topic, not only to confirm the above identified hypothesis, but also to address other issues such as ordering, carryover effects or psychological influences that the game may have on the research tool since such influences are clearly present in the case of advertisement [20–22].

Summarizing, more research is required but we believe that in-game questionnaires have the potential to provide good insights into players as a target audience but that they cannot be generalized to the general population. Without an appropriate study on the reliability, companies that are using in-game questionnaires services to conduct research should carefully consider the representability of such study, due to the natural segmentation created by the player base of that game.

C. Implications

This study looked directly into the effects on the game experience caused by advertisement and questionnaire interruptions and identified and quantified the influences of those interruptions on players' game experiences. For game developers and designers, this information might be critical in terms of making informed decisions on how a specific business model will influence the game experience. In addition, it may provide support for those same developers to attenuate those influences by counter-balancing the negative effects through product design, for example, by timing the interruptions or allowing the player to decide when they want to interrupt their game.

The new business model, in which advertisement interruptions are replaced by a questionnaire, is becoming increasingly common. Since the focus of this study was mainly on the game experience consequences, the reliability results are considered a by-product, and, although promising, they can only be considered preliminary work since there is still much more work required in this field.

D. Limitations and Opportunities

In addition to the follow-up study options mentioned above, we would like to list other possible research opportunities. The target audience was limited to UK players in order to be able to look into the reliability of the demographics questionnaire. Cultural differences might interfere with the results, therefore, a cross-cultural study could analyse this facet in more detail.

There is the opportunity to expand this study by considering other interruption formats. We selected two specific incongruent interruptions: a multiple choice research questionnaire and a 30-second video advertisement. Questions remain as to whether other interruptions would manifest in a similar manner and how the effects of these other interruptions could be minimized.

Although we purposely used a game without external artifices or any known intellectual property to minimize side effects and properly test the game experience, it is not possible to fully generalize this study to all mechanics and genres. We would like to promote the opportunity to redo the experiment with other types of games.

VI. Conclusions

In this work, we examined the effects that two types of interruptions have on the player experience. For that purpose, we designed a between-subjects experiment in which we altered game interruptions and measured the player experience through GEQ [14]. In our analyses, we found proof that the effects extend beyond tension and annoyance, affecting other variables such as immersion, competence, and positive experience. In addition, the analysis of the reliability of the in-game questionnaires showed strong scaling effects in terms of the answers.

This work contributes directly to the deep understanding of the effects of interruptions on the player experience in games, which, from a product point of view, may influence recommendations and overall product satisfaction.

References

[1] T. Wijman, "Mobile Revenues Account for More Than 50% of the Global Games Market as It Reaches $137.9 Billion in 2018," NewZoo.com, 2018. [Online] Available: https://newzoo.com/insights/articles/global-games-market-reaches-137-9-billion-in-2018-mobile-games-take-half/. [Accessed: 12-Sep-2018].

[2] T. Rayna and L. Striukova, "'Few to Many': Change of Business Model Paradigm in the Video Game Industry," Digiworld Econ. J., vol. 94, no. 2nd Q, pp. 61–82, 2014.

[3] J. Batchelor, "Games industry generated $108.4bn in revenues in 2017," gamesindustry.biz, 2018. [Online]. Available: https://www.gamesindustry.biz/articles/2018-01-31-games-industry-generated-usd108-4bn-in-revenues-in-2017. [Accessed: 12-Sep-2018].

[4] K. Alha, E. Koskinen, J. Paavilainen, and J. Hamari, "Critical Acclaim and Commercial Success in Mobile Free-to-Play Games," in Proceedings of 1st International Joint Conference of DiGRA, 2016.

[5] K. Alha, E. Koskinen, J. Paavilainen, and J. Hamari, "Free-to-Play Games : Professionals ' Perspectives," Proc. Nord. Digra 2014 Gotland,Sweden, 2014.

[6] J. Nakamura and M. Csikszentmihalyi, "The concept of flow," in Flow and the Foundations of Positive Psychology: The Collected Works of Mihaly Csikszentmihalyi, 2014.

[7] IJsselsteijn, W. A., de Kort, Y. A. W., & Poels, K. 2013. The Game Experience Questionnaire. Technische Universiteit Eindhoven

[8] J. Chen, "Flow in games (and everything else)," Commun. ACM, 2007.

[9] B. Cowley, D. Charles, M. Black, and R. Hickey, "Toward an understanding of flow in video games," Comput. Entertain., 2008.

[10] Anders Drachen, Pejman Mirza-Babaei, Lennart Nacke. 2018. Games User Research. Oxford University Press

[11] L. Ermi and F. Mäyrä, "Fundamental Components of the Gameplay Experience: Analysing Immersion," Chang Views Worlds Play, 2005.

[12] J. Nielsen, "10 Usability Heuristics for User Interface Design," Nielsen Norman Gr., 1995.

[13] Effie Law, Florian Brühlmann, and Elisa Mekler. 2018. Systematic Review and Validation of the Game Experience Questionnaire (GEQ) - Implications for Citation and Reporting Practice. In Proceedings of the 2018 Annual Symposium on Computer-Human Interaction in Play (CHI PLAY '18). ACM, NY, USA, 257-270. DOI: https://doi.org/10.1145/3242671.3242683.

[14] W. a. IJsselsteijn, Y. a. W. de Kort, and K. Poels, "Game Experience Questionnaire," FUGA - Fun Gaming, 2013.

[15] E. Calvillo-Gámez, P. Cairns, and A. Cox, "Assessing the Core Elements of the Gaming Experience," in Game User Experience Evaluation, Human–Comp., R. Bernhaupt, Ed. Springer, Cham, 2015, pp. 37–62.

[16] J. G. Trafton, E. M. Altmann, D. P. Brock, and F. E. Mintz, "Preparing to resume an interrupted task: Effects of prospective goal encoding and retrospective rehearsal," Int. J. Hum. Comput. Stud., 2003.

[17] M. B. Edwards and S. D. Gronlund, "Task Interruption and its Effects on Memory," Memory, no. 6, 1998, pp. 665-687.

[18] T. Gillie and D. Broadbent, "What makes interruptions disruptive? A study of length, similarity, and complexity" Psychol. Res., 1989.

[19] A. Sasse, C. Johnson, and others, "Coordinating the interruption of people in human-computer interaction," Human-computer Interact. INTERACT, 1999.

[20] L. Herrewijn and K. Poels, "Putting brands into play: How game difficulty and player experiences influence the effectiveness of in-game advertising," Int. J. Advert., 2013.

[21] S.-C. Yoo and J. Peña, "Do Violent Video Games Impair The Effectiveness of In-Game Advertisements? The Impact of Gaming Environment on Brand Recall, Brand Attitude, and Purchase Intention," Cyberpsychology, Behav. Soc. Netw., 2011.

[22] B. Lewis and L. Porter, "In-game advertising effects: Examining player perceptions of advertising schema congruity in a massively multiplayer online role-playing game.," J. Interact. Advert., 2010.

[23] L. Ha, "Observations: Advertising clutter in consumer magazines: Dimensions and effects," J. Advert. Res., 1996.

[24] C. Schneider, "Ad Intrusiveness , Loss of Control , and Stress : A Psychophysiological Study," Proc. 36th Int. Conf. Inf. Syst., 2015.

[25] S. McCoy, A. Everard, P. Polak, and D. F. Galletta, "An experimental study of antecedents and consequences of online ad intrusiveness," Int. J. Hum. Comput. Interact., 2008.

[26] H. Li, S. M. Edwards, and J. H. Lee, "Measuring the intrusiveness of advertisements: Scale development and validation," J. Advert., vol. 31, no. 2, pp. 37–47, 2002.

[27] S. Verberckmoes, K. Poels, N. Dens, L. Herrewijn, and P. De Pelsmacker, "When and why is perceived congruity important for in-game advertising in fantasy games?," Comput. Human Behav., 2016.

[28] B. J. Gajadhar, H. H. Nap, Y. A. W. de Kort, and W. A. IJsselsteijn, "Out of sight, out of mind: co-player effects on seniors' player experience," in Proceedings of the 3rd International Conference on Fun and Games, 2010, pp. 74–83.

[29] B. Zaman, V. Vanden Abeele, P. Markopoulos, and P. Marshall, "the evolving field of tangible interaction for children: the challenge of empirical validation," Pers. Ubiquitous Comput., vol. 16, no. 4, pp. 367–378, 2012.

[30] S. Gualeni, D. Janssen, and L. Calvi, "How psychophysiology can aid the design process of casual games: A tale of stress, facial muscles, and paper beasts," in Proceedings of the international conference on the foundations of digital games, 2012, pp. 149–155.

[31] C. Pereira Santos, K. Hutchinson, V.-J. Khan, and P. Markopoulos, "Measuring Self-Esteem with Games," in ACM Intelligent User Interfaces, 2017.

[32] O. for N. S. (UK) and C. Prescott, "Internet access – households and individuals: 2017," 2017.

[33] T. S. Behrend, D. J. Sharek, A. W. Meade, and E. N. Wiebe, "The viability of crowdsourcing for survey research.," Behav. Res. Methods, vol. 43, no. October 2015, pp. 800–813, 2011.

[34] K. Poels, W. Janssens, and L. Herrewijn, "Play buddies or space invaders? players attitudes toward in-game advertising," J. Advert., 2013.

[35] S. Peterson, "Games With Advertising: The Way Forward," Business Insider, 2011. [Online]. Available: https://www.businessinsider.com/games-with-advertising-the-way-forward-2011-9. [Accessed: 10-Oct-2018].

[36] Georgios N. Yannakakis, Roddy Cowie, and Carlos Busso. "The ordinal nature of emotions." In 2017 Seventh International Conference on Affective Computing and Intelligent Interaction (ACII), pp. 248-255. IEEE, 2017.

[37] ESA. 2018. Essential Facts about the Computer and Video Game Industry 2018. Entertainment Software Association 1. Retrieved 01/19/2019 from http://www.theesa.com/wp-content/uploads/2018/05/EF2018_FINAL.pdf