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Article

Demystifying the First-Time Experience of Mobile Games: The Presence of a Tutorial Has a Positive Impact on Non-Expert Players' Flow and Continuous-Use Intentions

Mario Passalacqua [1,*], **Raphaël Morin** [2], **Sylvain Sénécal** [2], **Lennart E. Nacke** [3] and **Pierre-Majorique Léger** [2]

[1] Polytechnique Montréal, Department of Mathematics and Industrial Engineering, Montréal, QC H3T 1J4, Canada

[2] Tech3lab, HEC Montréal, Montréal, QC H3T 2A7, Canada; raphel.morin@hec.ca (R.M.); sylvain.senecal@hec.ca (S.S.); pierre-majorique.leger@hec.ca (P.-M.L.)

[3] HCI Games Group, University of Waterloo, Waterloo, ON N2L 3G1, Canada; lennart.nacke@acm.org

[*] Correspondence: mario.passalacqua@polymtl.ca

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Abstract: The purpose of video game tutorials is to help players easily understand new game mechanics and thereby facilitate chances of early engagement with the main contents of one's game. The mobile game market (i.e., phones and tablets) faces important retention issues caused by a high number of players who abandon games permanently within 24 h of downloading them. A laboratory experiment with 40 players tested how tutorial presence and player expertise impact on users' psychophysiological states and continuous-use intentions (CUIs). The results suggest that in a simple game context, tutorials have a positive impact on non-expert players' perceived state of flow and have no effect on expert players' perceived flow. The results also suggest that flow has a positive impact on CUIs for both experts and non-experts. The theoretical contributions and managerial implications of these results are discussed.

Keywords: mobile gaming; tutorial; player expertise; flow; electrodermal activity; continuous-use intentions

1. Introduction

The mobile game industry is currently facing retention issues with 61% of customers deleting the game within 24 h of having downloaded it [1]. The reason for this high attrition rate is not well-known. The first significant interaction an individual will have with any system is to learn how to use it [2]. Learnability, meaning the capability of a system to enable the user to learn how to use it [3], is thus important to consider. In the games industry, learnability is often synonymous with tutorials during the first minutes of play, a period which is popularly referred to as the onboarding period. Tutorials have received little empirical attention from the games user research (GUR) community. To our knowledge, only Andersen et al. [4] have specifically explored the need for tutorials in the gaming context. Their main finding is that tutorials drive engagement in more complex games as compared to games characterized by "mechanics that can be discovered through experimentation (experiential learning)", i.e., simple games [4]. Specifically, playtime increased by 29% when a tutorial introduced the most complex game as compared to no tutorial. However, their results did not support any significant effect of tutorials for simple games. Though Andersen et al.'s [4] research is undeniably relevant, it does not address how a player's transferable expertise may affect their feelings and perceptions about tutorial

presence or absence. In the video game context, tutorials—designed to increase game learnability—are meant to offer knowledge to all users so they can overcome initial challenges. Tutorials, however, can play an important role in the first encounter of inexperienced players, because these players may suffer from a more substantial skill gap than other gamers who have accumulated expertise in other games. Without the help of a tutorial, a non-experienced gamer (i.e., a sporadic gamer who only plays a few games a year, with a low average time per session) might perceive the initial challenge of a system as more demanding than an expert gamer (i.e., a more devoted gamer who plays various franchises that he downloads for free or purchases frequently) [5].

As a frame of reference, the relationship between one's personal expertise and the perceived challenge at hand is embodied in Csikszentmihalyi's [6] flow construct, defined as a psychological state that a person undergoes when they are immersed in rich and engaging experience from a challenge they appraise as being in line with their faculties. With the world's highest yearly revenue among all platforms at 48% [7], mobile gaming attracts a wide audience composed of both expert and non-expert players that may benefit from a soft learning curve. Thus, developing a deeper understanding of the relation between expertise and tutorials on an engaging experience (flow) and the effect of the latter on continuous-use intention is relevant.

To investigate these issues, we performed a laboratory experiment. We investigated the effect of a tutorial (i.e., its presence or absence) and player expertise (i.e., expert or non-expert) on flow and on continuous-use intention. A multi-method approach was adopted to capture the rich conceptualization of the flow state as described by Peifer [8]. This approach captures the original psychological construct and its recent psychophysiological counterpart. Thus, we used both implicit (i.e., non-intrusive, continuous, and automatic reactions of players measured by electrodermal activity) and explicit (i.e., self-reported scale) measures to evaluate the participants' experience as they are playing a mobile game for the first time thus limiting biases resulting from using only explicit measures [9,10].

2. Literature Review and Hypotheses

2.1. Expertise, Learnability, and Flow

Learnability is considered an integral component of technology adoption in the technology acceptance model (TAM) [2,11,12]. The TAM defines factors, notably usefulness and usability, that influence user acceptance on both early and long-term use intentions of a system or technology [11]. Under the TAM frame of reference, but more specifically in a mobile commerce context, Lin and Wang [13] propose that efficient learning influences early usage proficiency and habit development, thereby impacting long-term continuous-use intentions (CUIs). Early usage proficiency may also derive from past experiences, since not all players possess equal capacity and expertise.

The existing expertise discrepancy among users has been studied in various contexts with regard to problem-solving [14], information search strategies [15], and cognitive processing [16]. Novelty implies uncertainty and stress for the user which leads to a more conscious and alert processing of the stimulus [17]. It is only when an individual is faced with a similar stimulus anew that they may process their environment more automatically. Moreover, this automation requires lower cognitive effort and is believed to yield a better performance as the user is capable of filtering more information cues [17]. Thus, we suggest that during their first exposure to a video game, non-expert players are likely to be overwhelmed by the displayed information unless it is concise and designed to facilitate their learning. Given their past experiences, expert users are more inclined to feel in control in a new environment and tend to extract information available within a new system by themselves to form their decision [16]. In the context of a video game, a lengthy tutorial may postpone the experts' gratification, thereby undermining their experience to an eventual state of boredom that is explained by an unbalanced skill–difficulty ratio, according to the theory of flow [6].

Flow is a multidimensional construct that involves a sense of being in control, a distortion of time, a positive attitude, more effective information assimilation, and greater concentration [6].

The four-channel view of the theory of flow suggests that an individual may fall into one of three states when skills and challenge are unbalanced: apathy, boredom, or anxiety [18]. Hence, the following hypotheses were posited.

Hypothesis 1a (H1a). *Non-experts are more likely to experience flow when exposed to a tutorial than when not exposed to a tutorial.*

Hypothesis 1b (H1b). *Inversely, experts are more likely to experience flow when not exposed to a tutorial than when exposed to a tutorial.*

2.2. Psychophysiological Conceptualization of Flow

From a theoretical standpoint, Hanin [19] states that to accurately understand both affective and cognitive conditions underlying the flow state, both psychological and physiological dimensions should be used. To this end, Peifer [8] (p. 148) proposes an integrative conceptualization of the optimal experience which states that flow is "a positive valence state (affective component) resulting from an activity that has been appraised as an optimal challenge (cognitive component) characterized by optimized physiological arousal (physiological component) for full concentration on coping with environmental/task demands (behavioral)". Taking Peifer's [8] psychophysiological definition of flow forward, Léger et al. [14] suggest that most of the flow components, if captured strictly by explicit, self-reported measures, tend to suffer from mono-method biases and from their retrospective nature. Specifically, Léger et al.'s and De Guinea's [20,21] results establish that self-reported measures correlate only moderately with their respective psychophysiological state conducive to perceived flow (engagement $r^2 = 0.37$, $p < 0.01$ and cognitive load $r^2 = 0.58$, $p < 0.01$). In both studies, participants had to make business decisions while running a simulated company. Thus, it is important to measure both perceived (psychological) and psychophysiological states to fully assert flow. Electrodermal activity (EDA) is one of the most common psychophysiological measures used to study flow in the context of game experience [22–24]. It corresponds to the production of sweat in the eccrine sweat glands which is entirely controlled by the human sympathetic nervous system [25]. Electrodermal activity is an index of autonomic nervous system activity measured by the potential difference between two areas of the skin and it correlates linearly with arousal [25].

Aside from Kivikangas [26], whose experiment did not uncover any specific relationship between arousal and flow, many studies have successfully reported this relationship. For instance, Nacke and Lindley [22] designed three iterations of a first-person shooter game to ignite one of three different affective states: boredom, immersion (i.e., sensory absorption into atmospherics game elements), and flow. They observed the highest arousal values, as measured with EDA, in the flow condition. In addition, Keller et al. [23] explored the cognitive workload and arousal relationship in different skill-demand-compatibility conditions while measuring cortisol hormone levels. Keller et al. [23] observed higher cortisol levels in skills-matching-demand (flow) conditions, which they associate to a high arousal level, coherent with previous studies. Building upon previous work, we posit that electrodermal activity is a psychophysiological indicator of a mental state conducive of flow and that it should positively influence players' flow perceptions.

Hypothesis 2 (H2). *Psychophysiological correlates of flow positively influences psychological (perceived) flow.*

Numerous studies have investigated flow's behavioral effects related to various information systems. Extending the TAM, Agarwal and Karahanna [27] suggested that cognitive absorption (i.e., a deep involvement similar to the flow construct) positively influences CUI. These results have been corroborated by human–computer interaction (HCI) research which has modelled flow as either an antecedent or consequence of usefulness and ease-of-use, but always as positively impacting behavioral outcomes [28]. Hence, the following hypothesis was proposed.

Hypothesis 3 (H3). *Psychological (perceived) flow is positively associated with continuous-use intentions.*

Figure 1 summarizes the research model and displays our research hypotheses. We examined whether the interaction between tutorial and player expertise had an effect on both psychophysiological and psychological flow (H1). We also examined whether psychophysiological and psychological flow were correlated. Finally, we examined whether psychological flow and continuous-use intentions were correlated (H3).
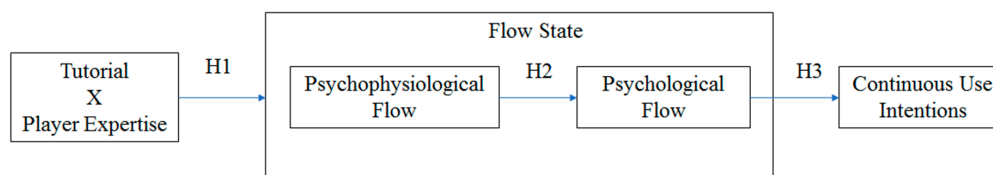
**Figure 1.** Conceptual model and hypotheses.

3. Materials and Methods

3.1. Participants

To test our hypotheses, an experimental approach reproducing players' onboarding was used. A total of 40 individuals (excluding 3 pretests) were recruited via our institution's research panel to take part in our laboratory experiment, approved by the Ethics Board of our institution (ethics approval number: 20162029). Participants were randomly assigned to either complete a tutorial (TUT) before playing, which is essentially a step-by-step presentation of the gameplay, or to play the game without a tutorial (N-TUT). Prior to their test day, players were invited to answer a short online questionnaire where they had to self-report their gaming expertise (expert (E) or non-expert (N-E)). Since we were not aware of any valid measures that could be used to evaluate gaming expertise, we developed a series of questions to assess the participants' perceived expertise (PE). The questions (average number of sessions played weekly, average session length, number and types of games played, amount spent on videogames per year, and preferred gaming platforms) were developed based on work by Kapalo et al. [29] and Phan et al. [30]. Approximately 250 participants were originally recruited to fill out the questionnaire assessing their self-report gaming expertise. The 40 most extreme participants in terms of gaming expertise were recruited for the study. In other words, the 20 participants who had the lowest weekly playing time and the 20 participants who had the highest weekly playing time were recruited for the study. Weekly playing time was calculated by multiplying number of sessions played weekly by average session length. The 20 lowest-scoring participants were classified as non-experts, while the 20 highest-scoring participants were classified as experts.

Participant distribution among conditions and expertise levels was as follows: non-expert with tutorial = 9, non-expert without tutorial = 9, expert with tutorial = 11, and expert without tutorial = 11. Age ranged from 18 to 40 years old, with a mean of 23 (SD = 4.01). There were 26 males and 14 females. Eighteen of the 22 experts played games a minimum of 2–3 times weekly. Average expert weekly play time was 14 h and 5 min, while average weekly non-expert play time was 8 min. According to Kunst [31], 37% of Canadians play less than 1 h per week, while 9% play over 16 h per week. On average, Canadians play approximately 3 h per week [31]. The distribution of the categories of games played was as follows: strategy (16), role playing (RPG) (14) and/or first-person shooter (14) games. Most non-experts reported never playing. When they did play, non-experts played action-adventure (12) and/or puzzle (9) games. Non-experts' main platform was mobile (versus. PC for expert players), but expert players reported playing on mobile more often on average than non-experts. Non-expert players reported playing on average 31 min (SD = 39 min) per game session compared to 117 min (SD = 91 min) for experts. Through micro-transactions in mobile games, expert players reported spending CAD$57 in-game in the last year, whereas non-experts' spending was less than CAD$1 on average.

3.2. Experimental Stimuli

The videogame used was Saber's Edge, a Match-3 RPG developed by Hibernum (Montreal), played on an iPad Air 2 tablet. This game was chosen because its puzzle aspect and initial linearity better allowed for a thorough standardization among participants compared to other games. In addition, the game had not yet been released at the time of data collection. Therefore, no participant could have played the game beforehand. The game was not revealed to the players until the experiment began. Therefore, they had no prior knowledge of it or of the Hibernum company name, which remained undisclosed. Hibernum did not collaborate in the research project, they simply provided the game. Under Andersen's [4] definition, Saber's Edge is a simple game with mechanics that can be discovered through experimentation. Saber's Edge is also a freemium, i.e., a free and fully functional source of entertainment, where players may purchase virtual goods to enhance their performance [32]. Recent industry reports suggest that the one-day attrition rate (i.e., the rate of players leaving a game within 24 h following their original download) is 61% [1] for freemium games and applications. Consequently, such a mobile freemium game is an especially appropriate stimulus for our study, since it is of the utmost importance for the freemium game business model to quickly onboard and retain players. In this game, the player has to take turns against the computer and has to connect different combinations of the same item (see Figure 2a) to enact various moves (i.e., long/close-range attack, defense or heal) in order to neutralize their opponent characters. The player and the computer have the same number of heroes on the battlefield, and they play in consecutive turns (e.g., three for each player in Figure 2). Typical of this RPG genre, the player receives in-game currencies at the beginning of the game and gains more after each victory. With the currencies, the player can enhance their heroes between each battle at the in-game store (Figure 2b). The tutorial consists of messages presented in overlay pop-ups to provide contextual help and instructions while players are playing the game. A floating glove is also used to indicate gameplay gestures, such as how to flip game tiles and how to interact with characters. See Figure 3 for a screenshot of the tutorial. For a complete video presentation of the tutorial and of Saber's EDGE gameplay, see: https://bit.ly/2KpfZ99.

(**a**)   (**b**)
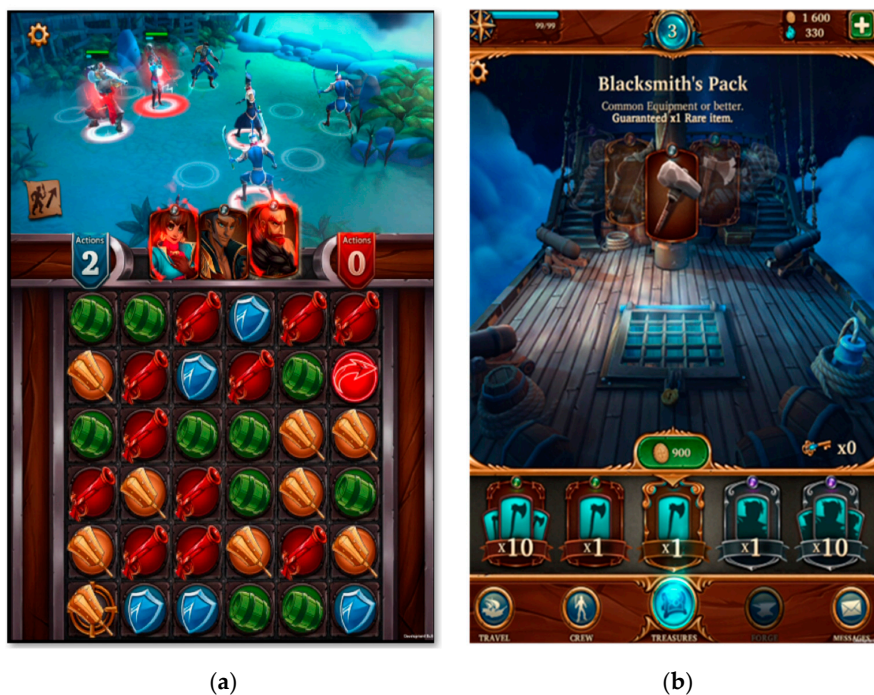
Figure 2. In-game screenshots of Saber's Edge (reproduced with permission from Hibernum): (**a**) Edge combat system; (**b**) Edge store.
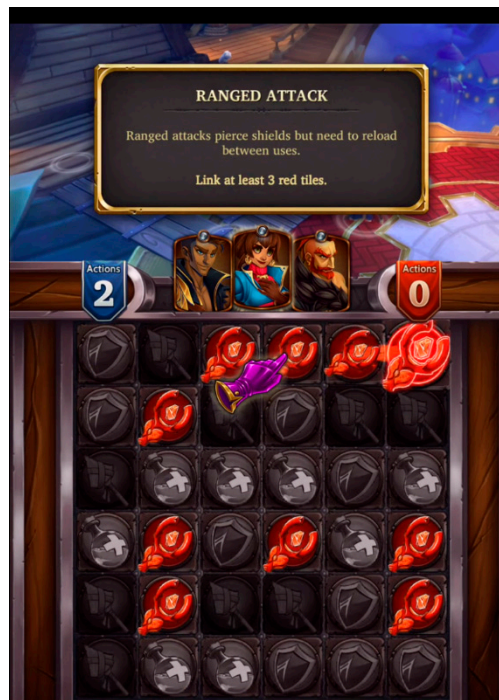
Figure 3. Example of a tutorial message with floating purple glove.

3.3. Procedure

Upon their arrival to our facility, all participants freely reconfirmed their desire to participate in our 45-min experiment, for which they were compensated with a CAD$15 gift certificate. To calibrate the apparatus, the experiment began with a 10 min recording of the participants' baseline (i.e., a period of time when the player was asked to sit and relax to record their EDA at rest). The data obtained were then used to normalize the measure for each of the participants. Participants were then randomly assigned to one of the two tutorial conditions. In the TUT condition, the participants started by completing the in-game tutorial of approximately 7 min and then played freely for the rest of the 15 min phase. In the N-TUT condition, the tutorial was skipped, and participants played the game for 15 min.

3.4. Self-Reported Measures

To assert participants' perceived flow (Per_Flow), they were invited to report their experience on a Flow Short Scale [33,34] immediately after the 15 min game sequence. This scale is a 7 point Likert scale composed of 10 items and divided in two dimensions, Fluency (6 questions: e.g., "I feel I have everything under control"), for which a Cronbach alpha of 0.82 was obtained, and Absorption (4 questions: e.g., "I don't notice time passing"), which obtained a Cronbach alpha of 0.78. Players were also invited to report their continuous-use intention on Hess, Ganesan, and Klein's [35] CUI scale (Cronbach alpha = 0.78). The CUI scale was also a 7 point Likert scale which included items such as "It is likely that I will play this game in the future" and negative statements such as "I do not expect to play this game in the future". All scale items were randomized.

3.5. Psychophysiological Measures: Electrodermal Activity

Electrodermal activity was used as a means to measure the flow physiological activation (arousal) component. A Biopac MP-150 amplifier was used to collect EDA data [36]. The baseline raw data (average and standard deviation) were measured in microsiemens (μS), and its normal range had to vary between 0.1 and 50 μS. The average of EDA values of the resting baseline was subtracted from each data point (except the baseline data), resulting in a change-from-baseline measure. The minimum and maximum EDA were also obtained for each participant across both conditions. These values

served to normalize the players' EDA (in percentage). Because of the tonic nature of our analysis, aberrant value spikes in small numbers were not considered critical, since they mostly represent the tool's sensitivity to physical movements. Following guidelines used for EDA analysis [25], participants' data were excluded if over 1% of their electrodermal data were judged as containing too many artefacts. This rigorous criterion led to the exclusion of 10 participants; a total of 30 participants were thus retained for the final analysis (non-expert with tutorial = 7, non-expert without tutorial = 6, expert with tutorial = 9, and expert without tutorial = 8). It has to be noted that the median sample size is 30 for human–computer interaction studies using neurophysiological measures [37]. Therefore, despite these exclusions, our sample size was within the acceptable range of studies using neuroscientific measures.

3.6. Analysis Approach

Data analysis was conducted with SPSS 13. We tested H1a and H1b with two separate regressions, each one assessing the effect of the experimental conditions on a flow indicator included in this research, namely, EDA_Avg and EDA_SD. We then assessed the differences within groups with independent-sample *t*-tests. We tested H2 and H3 with the correlations. Parametric tests were used because the CUIs and perceived flow data were normally distributed for all groups.

4. Results

4.1. Descriptive Statistics

Table 1 presents descriptive statistics and correlations among the measured variables. continuous-use intentions had an average of 3.90 out of 7 (SD = 1.45). Perceived flow values were considerately high with an average of 4.8 out of 7 (SD = 0.84). These relatively high values were similar to those obtained by Kivikangas [26] who also conducted an experiment using a video game as a stimuli.

4.2. The Combined Effect of Tutorials and Expertise on Flow State (H1a and H1b)

First, we tested the effect of expertise and tutorial presence on psychological (perceived) flow. We observed a significant effect of tutorial presence (TUT) and perceived expertise (PE) interaction on perceived flow (Per_flow) ($F(3,36) = 2.41$, $p = 0.07$, $r = 0.36$). Assuming unequal variance, an independent sample one-tailed *t*-test supports a significant difference between the non-expert with tutorial group ($\mu = 4.94$, SD = 0.45) and without tutorial group ($\mu = 4.14$, SD = 0.96; $t(16) = -2.21$, $p = 0.024$, $r = 0.48$; see Figure 4). No significant effect was observed for experts among tutorial conditions ($t(18) = 0.44$, $p = 0.33$). Nonetheless, experts' averages without tutorial ($\mu = 5.02$, SD = 0.74; $t(18) = -2.09$, $p = 0.026$, $r = 0.44$) and with tutorial ($\mu = 4.86$, SD = 0.77; $t(18) = -1.79$, $p = 0.047$, $r = 0.39$) were both significantly higher than non-experts without tutorial ($\mu = 4.14$, SD = 0.97), supporting the theoretical premise on transferable expertise. To conclude, no statistical difference ($t(18) = -0.23$, $p = 0.81$) was observed between expert players without tutorial ($\mu = 5.01$, SD = 0.74) and non-expert players with tutorial ($\mu = 4.94$, SD = 0.45).

Second, we tested the effect of expertise and tutorial presence on psychophysiological flow. We observed neither a significant effect of PE and TUT's interaction nor a significant main effect from these variables on the two psychophysiological flow correlates, respectively, EDA_Avg ($F(3, 26) = 0.86$, $p = 0.47$) and EDA_SD ($F(3, 26) = 1.41$, $p = 0.26$). Together, these results suggest that neither tutorial presence nor expertise have an impact on psychophysiological correlates of flow. To summarize, because experimental conditions have an effect only on non-expert players' perceived flow, H1a is partially supported, but H1b is not supported.

Table 1. Experimental condition effect on flow.

	Psychophysiological Flow						Perceived Flow		
	EDA_Avg (%)			EDA_SD (%)			Per_Flow		
	Coef.	**SE**	**Sig.**	**Coef.**	**SE**	**Sig.**	**Coef.**	**SE**	**Sig.**
TUT	−6.60	9.38	0.48	−6.03	3.00	0.06	0.80	0.36	0.04
PE	6.41	9.38	0.50	−4.56	3.00	0.14	0.87	0.36	0.02
PE-TUT	−1.82	12.32	0.88	7.17	3.95	0.08	−0.96	0.51	0.07
Intercept	42.84	7.36	0.00	9.71	2.36	0.00	4.1	0.27	0.00
R^2	−0.09		0.47	0.14		0.26	0.17		0.08

Sig = significance probability, Coef. = coefficient, TUT = tutorial, PE = perceived expertise, PE-TUT = perceived expertise and tutorial interaction.
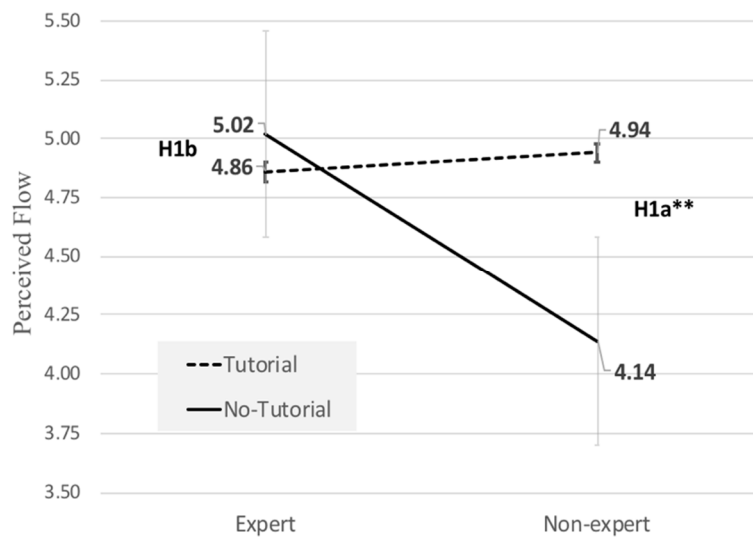
Figure 4. Perceived flow as a function of player expertise and tutorial.

4.3. The Influence of Psychophysiological Flow on Perceived Flow (H2)

Physiological flow correlates, EDA_Avg ($r = 0.23$, $n = 30$ $p = 0.11$) and EDA_SD ($r = 0.21$, $n = 30$ $p = 0.14$) were not related to perceived flow as illustrated in the correlation matrix (Table 2). Thus, we rejected H2.

Table 2. Correlation Matrix.

No#	Variable	Mean	SD	Correlation					
				1	**2**	**3**	**4**	**5**	**6**
1	CUI	3.90 (/7)	1.45	1	-	-	-	-	-
2	TUT	-	-	0.07	1	-	-	-	-
3	PE	-	-	0.03	0.5	1	-	-	-
4	PE-TUT	-	-	−0.07	−0.62 ***	0.59 ***	1	-	-
5	Per_Flow	4.76 (/7)	0.84	0.58 ***	−0.17	0.24 *	0.08	1	-
6	EDA_Avg	42.17%	16.34	−0.02	−0.25	0.19	−0.06	−0.15	1
7	EDA_SD	5.85%	5.38	0.25 *	−0.17	−0.023	−0.05	−0.02	0.39 **

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. CUI = continuous-use intention, Per_flow = perceived flow, EDA_Avg = average arousal, EDA_SD = arousal standard deviation.

4.4. The Relationship between Perceived Flow and Continuous-Usage Intention (H3)

Table 2 shows that continuous-use intention positively correlates with perceived flow ($r = 0.58$, $n = 40$, $p < 0.01$), supporting H3. We conducted a post-hoc analysis to test the mediation effect of

psychological flow in the relationship between psychophysiological flow and CUI and no relationship was found. Thus, our results suggest that only flow perception influences a player's CUI. Table 3 presents the results summary related to the hypotheses of the experiment.

Table 3. Results summary.

	Hypotheses	Results
H1a	Tutorial effect on non-experts' relation with flow.	Partially supported
H1b	Tutorial effect on experts' relation with flow.	Not supported
H2	Physiological flow is positively related to perceived flow.	Not supported
H3	Perceived flow positively influences continuous-use intentions.	Supported

5. Discussion

Results suggest that players' expertise and the presence of a tutorial interact to influence perceived flow (H1a) which, in turn, influences players' intentions to continue using the simple RPG game (H3). For non-expert players, the presence of the tutorial positively influenced their flow perception (H1b), but it made no difference for expert players. Thus, the presence of a tutorial did not adversely impact experts' flow perception in this simple game context. These findings replicate prior research on the positive relationship between flow and continuous game-use intention [28].

This research makes three theoretical contributions. First, our findings suggest that research on the effect of tutorials needs to take into account players' expertise. Interestingly, Anderson et al. [4] showed an impact of tutorials on complex games but not for simple games. Our findings suggest that tutorials for simple games have an effect if players' expertise is taken into account. Second, our results suggest that in the context of simple games, tutorials do not necessarily have a negative impact on expert players' flow perception. In fact, our results suggest that there was no difference in flow perception between experts who interacted with a tutorial and those who had no tutorial. We attribute this to the possibility that the Saber's Edge tutorial length (approximately 7 min) matched the expert players' expectations and may have thus created a "momentary fuzzy safe zone where mood does not intrude" [38] (p. 34). In other words, Chen [38] theorizes that the failure of a game to instantly engage the player may not necessarily result in players abandoning it. Rather, he posits that players have a certain tolerance for a temporary lack of stimulation or challenge, as long as the game sustains their hope that more is to come [38]. Third, the lack of significant relationships between psychological flow (self-reported) and psychophysiological flow correlates contributes to the literature on flow. Even if we observed significant differences between experimental conditions in terms of flow perception, there were no differences in players' electrodermal activity across conditions. Thus, in the context of a simple game, the results suggest that flow correlates stay relatively stable, while flow perception may vary. The simple game context can be seen as a boundary condition in which players are not physically aroused by a game, but still perceive themselves as being in a state of flow. This may help explain why, in some conditions, the relationship between psychological and psychophysiological flow should not be expected.

This study's findings have the following practical implications. In the context of simple RPG games, the results suggest that tutorials do not have a negative effect on players' perceived flow, even for expert players. Since perceived flow has a positive impact on players' continuous-use intentions, the results suggest that for this type of game, tutorials are beneficial. The results go against the popular belief that experts have an aversion for tutorials. Indeed, there exists a belief among some gamers that tutorials explain game mechanics that are too obvious, which may lead to boredom and to negative impacts on onboarding for expert players. It is believed that certain characteristics of tutorials lead to a negative player experience for experts (e.g., walls of text, controller schemes, leaving steps out, force player to complete the whole tutorial, having no tutorial). An approach to tutorials that is often discussed in a positive light is learning through level design, where players are led through initial levels of the game without an explicit tutorial. Learning through level design coupled with the ability

to turn off the tutorial's aid is seen by some as being the best way to implement a tutorial and may avoid boredom among expert players when faced with problematic tutorials.

As with any study, some limitations need to be acknowledged. First, we relied on a self-report measure to categorize players into either experts or non-experts. To our knowledge, no valid scale or guidelines currently exist on this matter. Second, this research was based on an experiment with a single game which limits the generalizability of our results. Third, because continuous-use intentions are measured using self-reported measures, participants had to make projections of their future behaviors. Thus, some participants may have under-evaluated or over-evaluated their future behaviors based on other factors. To this end, collecting more data, such as learning preferences, general motivations to play video games [39] or more specific preferred gaming styles [40], would be one way to mitigate this limitation. Fourth, the generalizability of our results is constrained by the specific tutorial mechanisms used in this game and may not extend to other types of in-game training. Other research designs could mitigate this limitation by collecting data over a longer period of time or with in-game tracking systems to measure behaviors [4].

Future research should aim to incorporate additional physiological constructs to be even more representative of Peifer's [8] rich conceptualization of the flow construct. For instance, following Ekman, Friesen, and Hager's [41] Facial Action Coding System (FACS), some game user research measures electrical activity involved in the contractions of muscles and sets of muscles at the surface of specific facial regions to analyze a player's emotional state [22,26,42]. Notably, Mandryk and Atkins [42] show the possibility of categorizing the players' affective states according to a model that combines arousal and emotional valence. Moreover, recent technologies enable a less invasive recording of the players' emotional valence than with facial electrodes. Indeed, software solutions, like Facereader [43], make it possible to automatically differentiate basic facial expressions through video recorded with a HD webcam. For example, recent game user research has used the arousal–valence model in their assessment of physiological flow in a group context [20,44]. Other games user research has used automatic facial emotion detection to examine how to enhance the e-sport experience [45].

6. Conclusions

This research's findings contribute to the current need for players' insights on retention in the mobile context, and also point out the importance of transferable expertise as an influencing factor of flow emergence and game continuous-use intentions. This research also highlights the impact of inadequate tutorialization and argues for its attention. Given the high rate at which some players abandon games within a day of downloading them, the results have a direct practical application: tutorials for players with less experience in a simple-to-learn game increase perceived flow and continuous-use intentions. In addition, results also show that the impact of tutorials on expert players' experience is less important than expected. Indeed, tutorials have neither a positive nor negative effect of expert players' perceived flow and continuous-use intentions. More broadly, this research sets the ground for exploring a player's first experience with a game using both psychological and physiological measures, which could open up new frontiers in the development of adapted, effective, and enjoyable tutorials.

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