The Effects of Context-Sensitive Tutorials in Virtual Reality Games

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ABSTRACT
Virtual reality (VR) devices have become popular in recent time due to the release of several consumer grade VR devices. Currently games are considered one of the primary use cases for VR. Game mechanics in VR games frequently work differently compared to non-VR games. However, there is no prevalent way how to teach game mechanics and game interaction to players in VR games. In this work we implemented a VR wave shooter game with two variants of a tutorial. We conducted a user study (n = 39) examining the effects of a context-sensitive tutorial on players' experience compared to a traditional instruction screen tutorial. The results show that the context-sensitive tutorial elicited higher positive emotions, lower negative emotions, and higher motivation while immersion and performance were comparable. These findings highlight that tutorials should not be seen as a separate introduction to a game but part of the overall experience as they can directly influence the players' experience.

Author Keywords
virtual reality; VR; game; tutorial; context-sensitive; player experience

ACM Classification Keywords
K.8.0. General: Games; H.5.2. User Interfaces: Evaluation/methodology

INTRODUCTION
Virtual reality (VR) has found its way into consumers' homes. Frequently, gaming is seen as one of most prevalent use cases for VR. Compared to non-VR games, there are few best practices on how to design VR games and their interaction. While there are guidelines that provide useful advice (e.g. [19]), there is little published evidence that practitioners and researchers can use to inform their design decisions. Games for VR frequently necessitate very different interaction schemes compared to traditional non-VR games. It is essential that players learn how to interact with a game and how game mechanics work. There are several ways to teach players game mechanics and game interaction. For games in general a common practice is to let players engage in tutorial levels before they start regular game play [1]. Using tutorials in VR games seems obvious as they provide a safe space for learning and exploring what might be especially important for VR games since recent research has shown that players need to get accustomed with VR devices and the input style required [24].
Some commercial games in recent years moved towards tutorials that are more context-sensitive in a way that they let players explore the game world and mechanics on their own and provide explanation just-in-time when required without interrupting the player. Andersen et al. [3] found that context-sensitive tutorials that introduce concepts close to where they are used can in some games improve engagement compared to more context-insensitive tutorials that provide all instructions upfront. In the light of the challenge of teaching game mechanics and interaction for VR games, employing context-sensitive tutorials could provide benefits. However, to our knowledge there has been no research yet examining the effects of context-sensitivity for tutorials in VR games. Studying these effects seems especially important as the domain of VR games is rather novel and there is little advice guiding researchers and practitioners developing VR games in general.

The main research question of this paper is to investigate the effects of context-sensitive design on player experience in VR game tutorials. For that purpose, in this work we compare a context-sensitive tutorial to a more traditional instruction screen tutorial regarding their effects on players' emotion, immersion, performance, and motivation. We implemented a VR wave shooter game for the HTC Vive with two different

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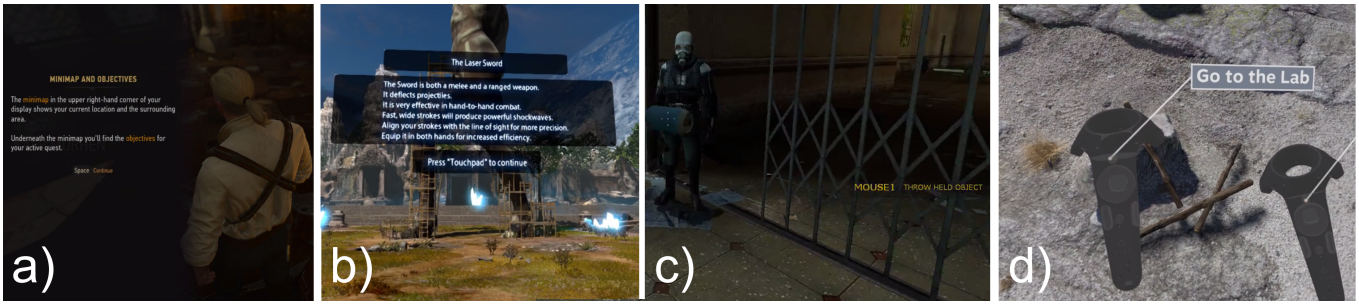

Figure 1. Different styles of tutorials are used in successful commercial games, e.g. traditional instruction screens in the *Witcher 3* [7] (a) and the VR game *Serious Sam VR: The Last Hope* [27] (b) and context-sensitive just-in-time instructions in *Half-Life 2* [25] (c) and the VR game *The Lab* [26] (d).

tutorial levels. A user study (n = 39) was conducted in that participants played one of the tutorials as well as a regular game play session and then reported subjective measures of their experience. The results show that the context-sensitive tutorial led to more positive emotion, less negative emotion, and higher motivation compared to an instruction screen tutorial.

RELATED WORK

Due to the increasing complexity of games, developers regularly include tutorial levels in games that are used to introduce players to the game [1]. Such tutorial levels usually contain explanations on the user interface and game mechanics [22]. Regarding user interfaces in games, Adams [1] mentions several types of interaction models. While these generally cover many types of user interfaces in non-VR games, interaction types and their effects in VR games are frequently very different [24]. Although, regular interaction such as keyboard, mouse, or gamepads can be used in VR games, other novel interaction methods might be more suitable. For example, developers are encouraged by the manufacturers of one VR head-mounted-display (HMD) to assess the usability of novel control schemes in order to avoid frustration and discomfort [19]. Similarly, the effects of interaction modes with VR games were examined in recent research [5, 10]. However, this research not only highlights the need to assess the quality and effects of interaction modes but also indicates that players are possibly unfamiliar with interaction and mechanics of VR games and need to get accustomed with them. With regard to game design in general Adams suggests that games which use interaction models that are not familiar to the player necessitate more detailed tutorials teaching the controls to the player [1]. Recently, Morin et al. [17] proposed that developers should provide tutorials if they are in doubt of the level of their users' expertise. As many players have little experience in the novel VR domain, using tutorials for games seems plausible but how they are best designed has yet to be studied.

Although the benefit of tutorials in general is largely accepted [22], there has been little research examining how differently designed tutorials affect player experience in VR games. Commercial games use very different techniques for teaching game mechanics and interaction. There are games in that instructions are provided by modal instruction screens. The regular game play is interrupted, an explanation of a game mechanic is provided as text, and players sometimes even have to explicitly confirm that they want to continue after they finished reading the instruction (see Figures 1a/1b). In some games information is provided just-in-time when players require it, e.g. through context-sensitive messages (see Figure 1c/1d). In this work we consider the latter variant as context-sensitive tutorials in a way that they provide explanations without interrupting the player and supplying necessary information by taking into account the players' behavior and current state in the game. On the other hand tutorials employing instruction screens are a more traditional approach to teaching game mechanics and interaction. Andersen et al. [3] compared context-sensitive tutorials that introduced concepts close to where they were used with context-insensitive tutorials that provide an instruction before regular game play. They found that the context-sensitive tutorials can improve engagement but this effect was only found for the most complex game. However, the authors studied regular non-VR games with regular interfaces. In this work we want to examine if the results also apply in the novel domain of VR games and if context-sensitive tutorials provide a better player experience compared to a more traditional tutorial, especially since what constitutes as a complex or simple game might be very different in comparison with regular non-VR games.

In summary, while there has been research on the effects of tutorials in games, there has been no such research in the domain of VR games, but there are still very different tutorials in commercial VR games. In this work we want to examine if the results of previous research can be replicated in this novel domain, especially as aspects such as expertise and complexity might actually be very different in VR games compared to non-VR games.

CONCEPT AND IMPLEMENTATION

In order to examine the research question, we implemented a VR wave shooter game featuring different variants of tutorials. In games of this genre the player has to defend a position by shooting enemies approaching from multiple directions. Such games have been very popular amongst the early games for consumer grade virtual reality featuring 6DOF-tracked head and hands (e.g. [2], [4], [13], [27]). Players use weapons to defend themselves against the enemies. These weapons usually are directly mapped to the controllers and their corresponding real world position. Such input generally is unique to VR and players are often not very familiar with this form of input from

Figure 2. *MummyDefense* is a VR wave shooter game in which players use bow and arrow to defend themselves from approaching enemies (a). Players can dye arrows by touching colored spheres on pillars surrounding their platform as enemies require that they are hit by specifically colored arrows (b). Different items are included that help defeating specific enemies, e.g. a shield to let players defend themselves against enemies shooting projectiles (c).

regular non-VR games what makes this genre very well suited for our research question.

MummyDefense

We implemented *MummyDefense*, a VR wave shooter game for one player on the HTC Vive. In this game players stand on a platform on which they can move around freely. Enemies are approaching the platform from all directions and are constantly damaging the player when they arrive at the platform. Players can defend themselves by shooting the enemies with bow and arrow (see Figure 2a). When players have lost all their life points they lose. If they on the other hand, defeat all waves of enemies they beat a level. There are small enemies that are defeated by one arrow as well as big enemies that have to be hit multiple times. Enemies appear in different colors and can only be defeated when players have dyed their arrow in the corresponding color. For that purpose there are four pillars on the corners of the platform that allow dyeing the arrow by touching a color sphere with the arrow (see Figure 2b). Players have access to several items: a bomb, a shield (see Figure 2c), and a healing potion. From time to time groups of small enemies approach the platform that can be easily defeated using the bomb. The players can use the shield to defend themselves from projectiles that the big enemies shoot. The healing potion can be used to refill the players life points. Using items usually involves the player pressing a specific button and performing a specific gesture, e.g. activating and aiming the shield, throwing a bomb, or making a drinking motion to activate the healing potion. These gestures were chosen in order to introduce interaction that is not usually found in regular non-VR games.

Tutorials

Two variants of a tutorial were implemented to teach the game mechanics to players. We employed a more traditional instruction screen tutorial and a context-sensitive tutorial. Both tutorials feature similarly worded text-based explanations of game mechanics. Figures 3 and 4 show how the same instruction is presented in both variants.

Instruction Screen Tutorial

We implemented an instruction screen tutorial as a more traditional form of tutorial. In our implementation the game mechanics are described in text form. For that purpose instructions are displayed on parchment floating next to the platform players are standing on (see Figure 3). The instruction screen is implemented as a plane with a fixed position and orientation. The explanations of the game mechanics are distributed on multiple parchments and players proceed to the next instruction screen by shooting a target below the parchment. This is similar to a button that players use to continue to the next instruction in other games. However, players can already practice aiming and shooting with bow and arrow. This tutorial design features two phases. Players first are presented with the phase in that they encounter the instructions and then they enter a phase in that they can practice the different mechanics. They come across the different types of enemies and can use all of the game's items. With regard to Andersen et al.'s design variants [3] this tutorial can be regarded as context-insensitive.

Context-Sensitive Tutorial

In the context-sensitive tutorial the explanations of the game mechanics are also presented one by one. However, compared to the instruction screen tutorial, explanations are not presented to the user before they can try them in the second phase on the tutorial. In this version of the tutorial both phases (instruction and practice) are combined. Players directly start in a phase in that they can encounter mechanics of the game (trial phase) and explanations are provided in speech bubbles just-in-time when a new mechanic and interaction is introduced (see Figure 4). Speech bubbles are anchored at a suitable position, e.g. at the controller when the instruction explains a new interaction. Players encounter mechanics in the same order as in the instruction tutorial.

STUDY

The aim of this study was to examine effects of different forms of tutorials on player experience in VR games. For that purpose two versions of *MummyDefense* were implemented featuring a traditional instruction screen (*InstructionScreen*

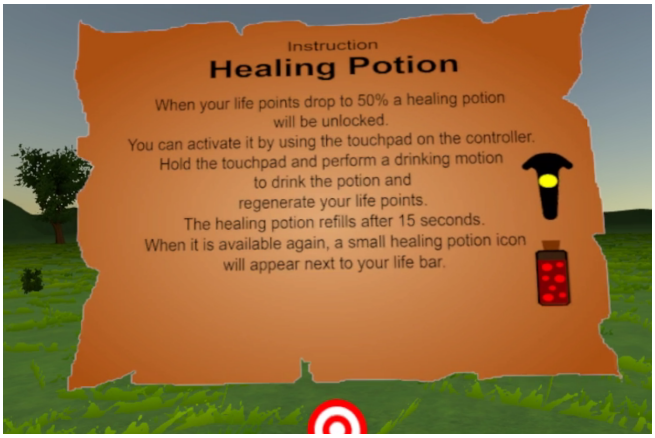

Figure 3. The traditional instruction screen was implemented for *MummyDefense* as a parchment floating on a fixed position and rotation. Instructions are presented in succession before players can practice the mechanics. After they finish an instruction, they have to confirm proceeding to the next instruction by shooting the target below the parchment.

Figure 4. The context-sensitive tutorial provides information in speech bubbles just-in-time. When the player requires new information or new features are unlocked this information is shown. The speech bubbles are anchored at appropriate locations, e.g. at the controller for new controller input.

condition) and a context-sensitive tutorial (*Context-Sensitive* condition).

Participants

Overall we recruited 40 participants (14 female, 25 male, 1 not reported). One male participant was excluded from the analysis as he experienced discomfort during the study. The final sample consisted of 39 participants (14 female, 24 male, 1 not reported) with an average age of 23.56 (SD = 3.754) years. On average they reported playing video games for 6.949 (SD = 12.890) hours per week. Only 4 participants reported playing VR games regularly, i.e. 0.5 hours (2 participants), 1 hour, and 5 hours per week.

Procedure

Participants were invited into a university lab where the study took place. The study was designed as a between-subjects experiment. The participants were randomly assigned to the *Context-Sensitive* or the *InstructionScreen* condition. In the study participants played one of the tutorial variants and regular game play session of *MummyDefense* afterwards. At first, the participants were introduced to the topic of the study, stated their consent, and completed a questionnaire about their demographic background. Subsequently, the participants were introduced to the HTC Vive and *MummyDefense*. The participants were instructed that they could replay the tutorial as often as they liked but only until they decided to start the regular game. On the other hand, the players could not skip the tutorial and had to complete it at least once in order to proceed to regular game play. The duration of the tutorial phase lasted for approximately 5-10 minutes and the regular game consisted of 5 minutes game play. The game featured a level system in that difficulty increased in higher levels. Participants would have to repeat a level if they lost and proceeded to the next one if they won. After the regular game play the participants completed a questionnaire about their experience and received their compensation. The duration of the study was approximately 30 minutes and participants were compensated with 5 euros.

Measures

Several metrics were measured in our study in order to determine the effects of the tutorial variants. We measured the participants emotional state by measuring valence, arousal, and dominance via SAM [6], and the self-reported emotions joy, frustration, anger, and boredom on 7-point Likert scales. These can play an important role during learning [20] and as a result might be crucial for tutorials. Further, we measured the participants' immersion and game experience using the IEQ [14] and their intrinsic motivation using the *interest/enjoyment* subscale of the IMI [16]. We assessed the performance of the tutorial objectively by recording how far the participants progressed in the game and how many tries they required. Participants also reported their subjective opinion on the performance of the tutorial by stating their agreement to four statements: *"The tutorial helped me understand the game mechanics"*, *"The tutorial prepared me well for the game"*, *"I thought the tutorial was good with respect to content"*, and *"The tutorial taught me everything I needed to know for the game"*. Participants stated their agreement on 7-point Likert scales (1 = *strongly disagree*, 7 = *strongly agree*). Finally, participants had the chance to give qualitative feedback by supplying open-ended comments.

Results

Scores were calculated for IMI *interest/enjoyment* subscale, IEQ factors, and performance measure. Normally distributed data was analyzed using independent samples t-tests (2-tailed) while Mann-Whitney U tests were used for the analysis of data which was not distributed normally. Exact 2-tailed significances are reported for the Mann-Whitney U tests. Levene's test was used to assert that variances were equal in the groups before conducting the t-tests.

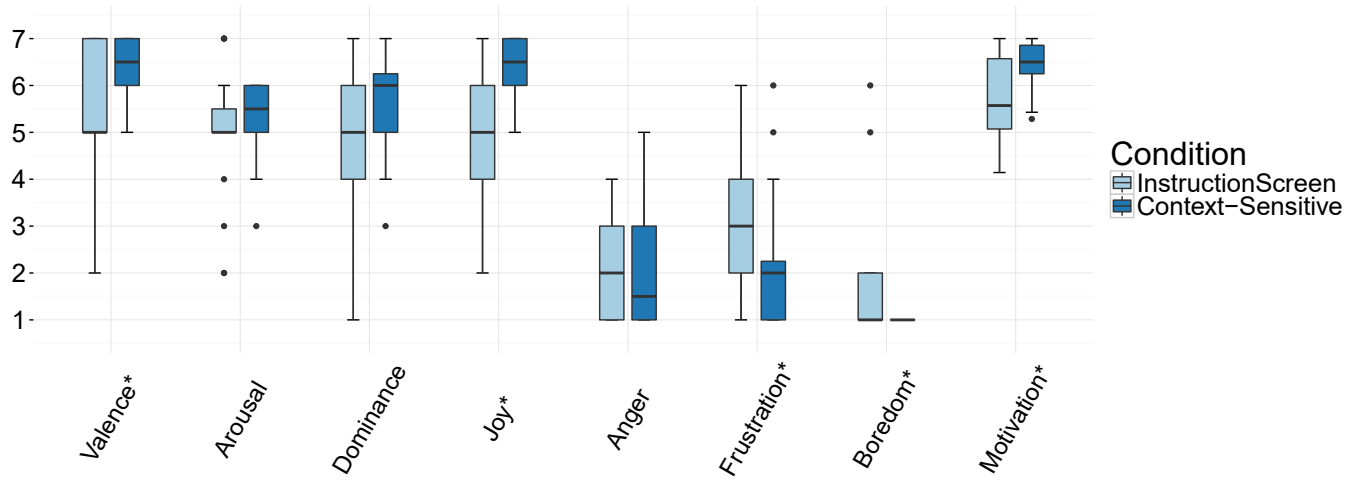

Figure 5. Boxplots for the emotion and motivation scores for both conditions. * indicates significant differences

Emotion

Results show that the *Context-Sensitive* condition elicited higher valence scores (*Mdn* = 6.50) compared to the *InstructionScreen* tutorial (*Mdn* = 5.00), (U = 110.00, z = -2.378, p = .017, r = -.38). The form of the tutorial did not affect arousal scores (U = 163.00, z = -.799, *ns*) or dominance scores (U = 131.00, z = -1.701, *ns*). Joy ratings in the *Context-Sensitive* condition (*Mdn* = 6.50) were significantly higher than in the *InstructionScreen* condition (*Mdn* = 5.00), (U = 84.50, z = -3.102, p = .002, r = -.50). The tutorial condition did not influence anger scores (U = 168.00, z = -.653, *ns*). Participants were significantly less frustrated in the *Context-Sensitive* variant of the tutorial (*Mdn* = 2.00) than in the *InstructionScreen* variant (*Mdn* = 3.50), (U = 118.00, z = -2.073, p = .038, r = -.33). Further, boredom scores were significantly lower in the *Context-Sensitive* condition (*Mdn* = 1.00) compared to the *InstructionScreen* condition (*Mdn* = 1.00), (U = 130.00, z = -2.688, p = .008). However, that variable was rated very low in both conditions as indicated by the medians, even constantly as 1 in the *Context-Sensitive* condition. For an overview of emotion scores see Figure 5.

Immersion

IEQ overall ratings in the *Context-Sensitive* condition (*Mdn* = 5.69) were not significantly different from ratings in the *InstructionScreen* condition (*Mdn* = 5.23), U = 143.50, z = -1.307, *ns*. Similarly there was no effect of the condition on the IEQ challenge ($t(37)$ = .520, *ns*), IEQ control (U = 142.00, z = -1.357, *ns*), IEQ real world dissociation (U = 171.00, z = -.536, *ns*), IEQ emotional involvement (U = 166.00, z = -.677, *ns*), and IEQ cognitive involvement scores ($t(37)$ = .959, *ns*), as well as on single item immersion measure ($t(37)$ = .520, *ns*).

Motivation

Regarding the IMI *interest/enjoyment* subscale participants reported significantly higher motivation in the *Context-Sensitive* condition (*Mdn* = 6.50) than in the *InstructionScreen* condition (*Mdn* = 5.57), U = 100.50, z = -2.525, p = .011, r = -.40 (see Figure 5).

Measure	*Mdn (CS)*	*Mdn (IS)*	*U*	*z*	*p*
T1	7.00	7.00	139.50	-1.661	.101
T2	6.50	6.00	143.00	-1.416	.166
T3	6.50	6.00	149.00	-1.245	.212
T4	7.00	7.00	186,50	-.118	.993

Table 1. Medians and test statistics show that there are no significant differences between the subjective performance measures with regard to condition (CS: *Context-Sensitive*, IS: *InstructionScreen*, T1: "The tutorial helped me understand the game mechanics", T2: "The tutorial prepared me well for the game", T3: "I thought the tutorial was good with respect to content", T4: "The tutorial taught me everything I needed to know for the game").

Performance

As soon as participants completed a level they proceeded to the next level. If they lost they had to repeat the level. As participants only had 5 minutes to play the regular game of *MummyDefense* they could finish at most 2 levels while they could lose in a level multiple times before proceeding to the next one. We calculated the performance of the participants as the number of levels won divided by the number of tries. Results show that the performance scores for *Context-Sensitive* (M = .413, SD = .370) were not significantly different from scores of the *InstructionScreen* condition (M = .300, SD = .414), (U = 148.50, z = -1.229, *ns*). Participants had the chance to repeat the tutorial as many times as they wanted before they started the game. There was no significant difference in how often participants played the tutorial between the *Context-Sensitive* condition (M = 1.35, SD = .489) and the *InstructionScreen* condition (M = 1.53, SD = .697), (U = 169.50, z = -.674, *ns*). Participants stated their agreement to several statements regarding the subjective performance of the tutorial. Table 1 shows that there are no significant differences between the conditions.

	Overall		*CS*		*IS*	
	τ_b	p	τ_b	p	τ_b	p
Valence	.338**	.007	.336	.076	.262	.151
Arousal	.297*	.017	.104	.569	.441*	.016
Dominance	.192	.114	.107	.543	.172	.333
Joy	.348**	.005	.371	.050	.300	.092
Anger	-.282*	.024	-.088	.623	-.496**	.007
Frustration	-.294*	.015	-.111	.534	-.433*	.015
Boredom	-.407**	.002	— †	— †	-.586**	.002
Motivation	.541**	.000	.535**	.001	-.596**	.000

* significant at the .05 level (2-tailed)

** significant at the .01 level (2-tailed)

† boredom scores are constant in the *Context-Sensitive* condition

Table 2. Kendall's tau-b correlations of immersion with emotion and motivation (CS: *Context-Sensitive*, IS: *InstructionScreen*).

Experience with Games and VR

Although the data showed trends of differences regarding the weekly play time of video games (*Context-Sensitive*: M = 9.950, SD = 17.006, *InstructionScreen*: M = 3.789, SD = 4.995), this was mostly due to one outlier who reported an average play time of 80 hours per week (more than 6 times of the SD). An analysis after excluding this outlier mostly confirmed the reported results. The difference of boredom scores between the conditions became non-significant after excluding the outlier (U = 123.50, z = -2.625, *ns*). All other reported differences remained significant. As most of the participants (35 of 39) reported not regularly playing VR games we did not account for this variable in our analysis.

Relationship of Emotion and Motivation with Immersion

Since there was an effect of the experimental condition on emotion measures and motivation, but not on immersion we examined the relationship of these variables by calculating Kendall's tau-b correlation of these measures. There was a significant relationship of IEQ overall score with most measures (see Table 2). Immersion was positively correlated with positive emotions and motivation, but negatively correlated with anger, frustration, and boredom. Then, we divided our whole sample in two samples based on condition and calculated correlations in these subsamples. Motivation was highly correlated in both conditions. There were no significant correlations of immersion and emotional state in the *Context-Sensitive* condition, but correlation coefficients are comparably high to those in the overall sample for valence and joy scores. In the sample for the *InstructionScreen* condition immersion was positively correlated with arousal while immersion had a negative correlation with anger, frustration, and boredom.

DISCUSSION

In summary, the results show that in this study a context-sensitive tutorial in VR games elicited higher positive emotion, lower negative emotion, and higher intrinsic motivation compared to a traditional context-insensitive instruction screen tutorial. On the other hand the experimental condition did not lead to any significant differences with regard to immersion, other more specific IEQ measures such as challenge as well as subjective and objective performance of the tutorial. Overall the findings of this study confirm the previous results of Andersen et al. [3] that context-sensitive tutorials can lead to a better player experience. However, although Andersen et al. found these effects mainly for complex games, our study showed similar effects for a rather simple game in the VR games context. These findings might be evidence that in VR games well-designed tutorials might lead to an overall enjoyable player experience regardless of the complexity of the game. Thus, it seems that the relationship of the variables moderating the positive effects of well-designed tutorials on player experience require further study in the domain of VR games. However, this work provides evidence that context-sensitivity can be valuable when designing game tutorials. This is particularly important for tutorials in VR games, as VR is quite novel for games and players need to get accustomed to this new medium. When designing tutorials for VR games, it seems necessary that developers and researchers pay attention to how they design a tutorial as it not only teaches players how a game is played but also directly influences player experience.

Limitations

There are some limitations that should be considered with regard to generalizability of the results. Participants overall had very low experience with VR games. This might have resulted in a better player experience for the context-sensitive tutorial as its presentation was more novel compared to a traditional instruction screen. However, in this study we wanted to examine what tutorial is most suitable for teaching game mechanics in the new domain of VR games and, due to their novelty, VR games are new to a lot of players. Thus, a population with little experience with VR is currently close to the real population of VR game players. It seems reasonable to expect that tutorials should provide a good experience especially for novices that need a good introduction to a game and its mechanics.

The implementation of the sequencing of instruction and trial phase was different for the *Context-Sensitive* and *InstructionScreen* condition. While the *InstructionScreen* tutorial provided a complete block of instructions and a trial phase afterwards, in the *Context-Sensitive* tutorial these phases were mixed. The latter condition allowed players to explore a feature as soon as it was unlocked and explanations were provided. A similar implementation could have been chosen for the *InstructionScreen* tutorial as well, i.e. modal instruction screens are displayed when a new feature is provided. Such implementation would have provided a middle ground between the adaptivity of the *Context-Sensitive* condition and the traditional *InstructionScreen* condition. For this study we decided against such implementation as instruction screens would actually have interrupted practice phases what can negatively affect presence and emotion [9]. The effects of varying degrees of context-sensitivity should be examined in future work nonetheless.

This study compared two implementations of a player-game interaction interface and its effects on the players' experience. In our analysis we did not yet consider other player specific aspects that might have an influence on player experience such as player motivations or types [11], the theory of learning styles [8], or knowledge acquisition styles [21].

In this study we examined one game in a domain (VR games)

and specific genre (VR wave shooter). If similar effects can be expected in other VR games or even games in general has to be examined in further studies. However, it seems plausible to expect that a context-sensitive tutorial leads to an overall better player experience in VR games that feature similar interaction circumstances: 6DOF-tracking of the players' head and hands. Such setup would allow a similarly context-sensitive tutorial since information can be anchored to objects in the players' hands or the players' looking direction. In our opinion the effects should be independent of the content of the explanations that is presented as well as how the information is presented (e.g. with speech bubbles as in our study). These aspects should rather be designed to fit the style of the game.

Interplay of Emotion and Immersion

Although the experimental conditions affected several emotion measures, there was no significant effect of the experimental condition on immersion. This is surprising as one might expect that immersion is interconnected with positive emotions and experiences in games and especially in VR games. Similar to previous research [12, 18] we found positive correlations of positive emotion and immersion. When examining the relationship of immersion and emotion separately for each condition the negative correlation of immersion and the negative emotions frustration, boredom, and anger was only found for the *InstructionScreen* condition but not for the *Context-Sensitive* condition. This might be indicative that negative emotions which happen during tutorials might not influence immersion if the tutorial is designed context-sensitive. However, these assumptions currently are speculation and thus these findings highlight that the interplay of emotion and immersion requires further examination in the context of VR game tutorials.

Relationship of Performance and Player Experience

One might expect that the performance of the context-sensitive tutorial would be better as players directly had the chance to practice interaction of specific mechanics as soon as they were explained in comparison to the instruction screen which featured two more distinct phases (instruction and practice). However, contrary to our expectations there was no difference of the form of tutorial on subjective or objective performance measures. Thus, both variants of the tutorial might be equally useful with regard to how well they are actually able to teach game mechanics. However, players reported more positive emotions, less negative emotions, and higher motivation in the *Context-Sensitive* condition. This mismatch of higher positive emotions but no increased performance lies in contrast to previous research. Previous work showed a connection of learning and presence [28] while presence has been shown to be connected to positive emotions [9]. This suggests that the tutorial eliciting a better player experience should also have a better performance. This mismatch might be due to the fact that the measure of performance that we used was not ideal for measuring if players learned game mechanics. How well a tutorial prepares players for a game might not even be assessable in a rather short lab study and might have to be examined in a longer study. In a realistic game context, however, a context-sensitive tutorial might lead to a better performance in any case. Games should feature tutorials that can be skipped [1] and this study showed a better player experience for the context-sensitive tutorial. In a real game players might rather skip tutorials they experience as low fun what could lead to players missing important information and as a result could negatively affect the tutorial's performance.

Adaptivity for Tutorials

In this study the context-sensitive tutorial was implemented in a way that instruction and practice phases were interwoven. Instructions were provided just-in-time when players needed them. Such an approach could be implemented in an adaptive fashion. In previous research adaptivity is sometimes defined as an approach that is not only based on player behavior but rather reacts accordingly to the players' current emotional state or experience [15, 23, 29]. In our work we only examined the effects of providing context-sensitive tutorials in VR games based on players behavior and current state in the tutorial. However, the positive effects of a well-designed tutorial might even be greater when it reacts adaptive to the players' current emotional and motivational state. For example, the tutorial could be adapted in pace if players are frustrated or bored. For that purpose any form of recognizing the players' emotional or motivational state is necessary. We plan to explore the direction of a more player-centered adaptive approach in future work.

CONCLUSION

In this work we examined the effects of two tutorials variants on player experience in VR games. We designed and implemented *MummyDefense*, a VR wave shooter game that features several game mechanics that are unique for VR games in comparison to non-VR games. Two variants of a tutorial level were implemented: a context-sensitive tutorial that provides information about game mechanics just-in-time and a more traditional instruction screen tutorial. We conducted a user study examining the effects of these tutorials on emotion, motivation, immersion, and performance. Results show that the context-sensitive tutorial elicited higher positive emotions, lower negative emotions, and higher motivation while there was no effect on performance or immersion. While there is more work required to further examine these effects and how to incorporate the players' current emotional state, these findings indicate that developers should not regard tutorials as separate introduction levels to a game but rather as part of the overall game experience.

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