



**HAL**  
open science

# How Awe Affects Players' Entertainment Experiences Over Six Weeks of Playing

Daniel Possler, Christoph Klimmt, Nicholas D. Bowman

► **To cite this version:**

Daniel Possler, Christoph Klimmt, Nicholas D. Bowman. How Awe Affects Players' Entertainment Experiences Over Six Weeks of Playing. 20th International Conference on Entertainment Computing (ICEC), Nov 2021, Coimbra, Portugal. pp.223-235, 10.1007/978-3-030-89394-1\_17 . hal-04144407

**HAL Id: hal-04144407**

**<https://inria.hal.science/hal-04144407>**

Submitted on 28 Jun 2023

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution 4.0 International License



This document is the original author manuscript of a paper submitted to an IFIP conference proceedings or other IFIP publication by Springer Nature. As such, there may be some differences in the official published version of the paper. Such differences, if any, are usually due to reformatting during preparation for publication or minor corrections made by the author(s) during final proofreading of the publication manuscript.

# How Awe Affects Players' Entertainment Experiences Over Six Weeks of Playing

Daniel Possler<sup>1</sup>[0000-0002-1644-6838], Christoph Klimmt<sup>1</sup>[0000-0002-2725-6378], and  
Nicholas D. Bowman<sup>2</sup>[0000-0001-5594-9713]

<sup>1</sup> Department of Journalism and Communication Research, University of Music, Drama and  
Media Hanover, Expo Plaza 12, 30539 Hannover, Germany

<sup>2</sup> College of Media and Communication, Texas Tech University, Lubbock, TX 79409, USA  
Daniel.Possler@ijk.hmtm-hannover.de

**Abstract.** Anecdotal evidence suggests that video games regularly inspire awe in players—an emotional response involving feelings of being ‘blown away’ or ‘amazed’. While game research has mostly overlooked awe, initial theoretical and empirical work just recently suggested that awe experiences substantially fuel players’ entertainment experiences. The present contribution aims to add to the deficient body of research. Specifically, it is examined whether awe is indeed a unique and reliable facilitator of both players’ enjoyment (i.e., hedonic entertainment experience) and their perception of deeper meaning and a sense of being moved (i.e., eudaimonic entertainment experience). We secondary analyzed a longitudinal study examining players’ experiences with the game *Fallout 76* over a six-week period (N = 556). Results indicate that *Fallout 76* reliably inspired awe in players and that the intensity of the emotion did not erode over the six-week period of the study. Furthermore, awe was found to exert a unique effect on players’ eudaimonic entertainment experience beyond well-studied gaming gratifications. However, no unique effect of awe on players’ enjoyment was found. Overall, the results suggest that awe does indeed make a unique and reliable contribution to players’ sense of entertainment.

**Keywords:** Video games, entertainment, awe, appreciation, enjoyment

## 1 Introduction

The rich potential of video games to entertain players has often been attributed to their capacity to satisfy gamers’ needs and trigger intense affective responses [1]. Consequently, in the last decades, research has studied a variety of emotions that may arise during gameplay ranging from joy, pride, or fear to more complex affects such as being moved [1–3]. However, one affective response to video games that has largely been overlooked until just recently is *awe* [4, 5]—an emotion that often involves the feeling to be ‘blown away’ or ‘amazed’ [6] by a game, and was, thus, metaphorically called the ‘Wow-effect’ of gaming [7]. The neglect of this ‘Wow-effect’ in gaming research seems notable for multiple reasons [4, 5]: First, anecdotal evidence suggests that games

regularly feature vast objects that may inspire awe in players, such as wide natural landscapes (e.g., *Fallout 76*), powerful orchestral music (e.g., *Halo*), or giant antagonists (e.g., *Shadow of the Colossus*) [4, 8]. Second, game developers seem to regularly aim to create this ‘Wow-effect’ [7, 8]. For example, many studios invest a high level of resources in improving the aesthetic qualities of games (e.g., the graphics [9]) to create ever new spectacular aesthetic experiences. New gaming technologies such as the *PlayStation 5*© are even actively promoted with regards to their capacity to inspire awe in players due to their “incredible graphics” or “breathtaking immersion” [10]. In addition, Keren points out that evoking awe is also an important mean for developers when designing video game highlights such as boss battles [11]. Third, theoretical analyses [4–6] and first studies [7, 12] suggest that feeling awe while playing video games contributes substantially to players’ entertainment experiences.

In summary, awe seems to be an emotion that has rarely been studied in video game research but one that game developers aim for, that users experience regularly, and that potentially entertains them. Against this background, the present paper aims to add to the deficient body of research by examining whether awe is indeed a unique and reliable facilitator of players’ entertainment responses. In the following, we first define players’ entertainment experiences as well as the emotion awe and discuss how it may contribute to players’ entertainment responses. We then present a secondary analysis of a longitudinal study on players’ experience of the game *Fallout 76* (N = 556) [13] to examine the utility of awe for understanding the formation of players’ entertainment responses over the course of six weeks of playtime.

## 2 Awe and Video Game Entertainment

### 2.1 Defining Video Game Entertainment Experiences

Video game research has traditionally equated players’ entertainment responses with hedonic (i.e., pleasurable) cognitive or affective reactions to games, often referred to as “enjoyment” [14, 15]. However, a fast-growing body of research has shown that gaming may also result in more serious, complex experiences such as personal meaning, self-reflection or being emotionally moved or challenged [3]. Following the distinction between “hedonia” and “eudaimonia” in general media entertainment research [16], these more serious responses to games are often labeled “eudaimonic experiences” [3] and conceptualized as “appreciation” [3]—“an experiential state that is characterized by the perception of deeper meaning, the feeling of being moved, and the motivation to elaborate on thoughts and feelings inspired by the experience” [17].

Despite this differentiation, enjoyment and appreciation may also co-occur when playing a given game. However, the formation of enjoyment and of appreciation seem to rest on different processes [18]. For example, by drawing on the self-determination theory [19], various studies have shown that the gratification of players’ basic needs contributes to their entertainment responses [20]. While the satisfaction of players’ needs to act autonomously and to be competent fuels enjoyment, the gratification of their need to be related with significant others contributes to appreciation [21].

## 2.2 The ‘Wow-Effect’ of Gaming: The Emotion Awe

While the ‘Wow-effect’ has only recently attracted the attention of game scholars, other disciplines have mused about similar affects for centuries [22]. For example, philosophers such as Kant [23] discussed awe-related aesthetic experiences under the concept *the sublime* [24]. However, the psychological conceptualization of these and similar states as emotion *awe* [22] seems most promising to understand the ‘Wow-effect’ of gaming [4–6]. In a foundational paper Keltner and Haidt [22] defined awe as an emotional reaction evoked by stimuli that share two characteristics: First, awe-eliciting stimuli are perceptually ‘vast’—they exceed an individual’s typical frame of reference in some domain [22]. Second, the stimuli do not fit into established mental concepts, but rather require individuals to update these concepts (a process often called “accommodation” [22]). Thus, typical elicitors of awe are monumental natural phenomena [25] like the Grand Canyon, which are often considered to be vast and to not fit into peoples’ mental models (e.g., ideas of ‘how a canyon looks like’ [4] are unlikely to account for the sheer size of the Grand Canyon).

Building on this conceptualization, emotion psychologists explored the experiential qualities of awe and found that the emotion is associated with, *inter alia*, the vocal outburst “Wow!” and goosebumps [26] (hence, the ‘Wow-effect’ referenced in this manuscript). Moreover, it was found that *linear* media content such as nature or space documentaries [e.g., 25, 27, 28] or short stories [29] can induce awe [5, 6]. Whether this also applies to *interactive* media, particularly video games, is questionable [4–6]: On the one hand, linear and interactive media place different demands on users [30], which in turn could affect the elicitation of awe: Linear media grant users the role of passive observers [31], allowing them to process a potentially awe-inspiring stimulus thoroughly. In contrast, players of video games need to invest a high level of their limited attentional resources to keep the game going and to make progress [30]. The cognitive demands of playing may, thus, conflict with the ‘mindfulness’ that is required to experience awe [4, 5]. On the other hand, video games regularly feature situations that do not require the expenditure of players’ total attentional resources (e.g., when players freely explore the game world). In such episodes, games may be able to evoke awe [4–6]. In line with this assumption a study found that virtual reality (VR)-simulations focusing on the exploration of a nature scenery or a space setting effectively induced awe [32]. Moreover, first experimental studies have shown that VR-games (i.e., *Eve: Valkyrie*, *The Elder Scrolls V: Skyrim*) can trigger awe [7, 33]. Finally, respondents of a survey study were able to recall prior awe experiences resulting from playing non-VR games [12]. To advance this body of research, the present study further explores the potential for (and relevant levels of) awe elicited through video game play:

- RQ1: How much awe do players of video games experience?

Moreover, it has not yet been studied how reliably video games trigger awe over the often many hours of playtime. Because awe is elicited when a stimulus cannot be assimilated into preexisting mental models (see above), habituation effects to the elicitor are likely [27]: The potential of a stimulus to elicit the emotion should be strongest when it is encountered for the first time, as internal schemata do not fit to the stimulus. With every subsequent encounter, the intensity of awe should decrease as the stimulus

better matches established mental models. As video games often involve from dozens to up to 100 or more hours of playtime, they necessarily involve some repetitions (e.g., visiting an already explored part of the game world again). Thus, it can be assumed that the ‘Wow-effect’ of a game is subject to some kind of hedonic adaptation [34]—it declines over time. The present contribution will test this assumption:

- H1: Players’ awe experience will decline over time.

### 2.3 Awe as Facilitator of Players’ Entertainment Response

The relevance of awe for players, however, does presumably not result from how reliable the emotion occurs in gaming, but from how it affects their entertainment responses. Drawing on empirical findings on the experiential qualities of awe, earlier theorizing has pointed out that the emotion may contribute to both players’ enjoyment and appreciation, for multiple reasons [4–6]. Regarding the former, studies suggested that although awe can either show great similarities with joy or fear [27, 28], it is most often a positive feeling [28] that boosts momentary life satisfaction [35]. Hence, experiencing awe during gaming most likely represents a pleasurable affective reaction and, thus, contribute to players’ enjoyment [4–6]. Furthermore, various studies reported that awe can lead to self-transcendent experiences [25, 27, 28, 36]—a momentary change in an individual’s self-perception [37]. This involves (a) a reduced attention to the self and its concerns [25, 27, 28], often described as feeling “small and insignificant” [36]. Moreover, (b) individuals perceive an increased connection with others or more abstract entities such as ‘the universe’ [25, 27, 36]. Hence, feeling awe while playing may reduce gamers’ attention to concerns and problems of their daily life, and these escapist qualities of awe is another reason why it may contribute to players’ enjoyment [4–6].

The self-transcendent qualities of awe may also explain why the emotion likely fuels players’ appreciation [4–6]: Particularly the perception of being connected with other people and to something greater than the self was found to be related to experiencing meaning [38]—a key dimension of appreciation [17]. Moreover, the perception of a community with others has been described as evoking the positive feeling of being moved [39]—another dimension of appreciation [17]. Finally, awe is elicited by stimuli that do not fit into established mental models [22] but rather challenge individuals’ world views [28] and require them to make sense out of the experience [29]. Thus, awe also seems to be related to the third dimension of appreciation [5]: the motivation to elaborate on a meaningful experience [17]. Finally, this reflection process may also result in “enlightenment” [40] and, thus, intensify the perception of meaning [5, 6].

In line with these assumptions, awe positively predicted players’ appreciation experience in three initial experiments [7] and two survey studies [12]. Similar effects were found for players’ enjoyment although less strong and less consistently [7, 12]. The present contribution aims to complement these initial findings. More specifically, we investigate whether awe can make a *unique* contribution to players’ entertainment experiences beyond well-researched antecedents of enjoyment and appreciation. In particular, the satisfaction of players’ basic needs—defined in the self-determination theory (SDT) as relatedness, competence, and autonomy [19]—has been demonstrated to

be an important antecedent of both, enjoyment [20] and appreciation [21], and can therefore serve as a benchmark:

- H2: Players' awe experience will increase their enjoyment beyond and above the gratification of SDT-needs.
- H3: Players' awe experience will increase their appreciation beyond and above the gratification of SDT-needs.

Finally, it is debatable whether awe's presumed influence on players' entertainment experiences erodes over the course of playing a game. On the one hand, it is likely that the emotion is only rarely felt after various hours of playtime (see H1). However, because such awe experiences should be less likely to occur later in gameplay, those that do occur are likely to be valued all the more and as a result, exert a stronger effect on players' enjoyment and appreciation than awe experiences occurring early in the game. On the other hand, other game features such as the multiplayer mode may be more important for entertainment responses after several hours of playing time than rarely occurring awe episodes. The present contribution investigates these conflicting ideas:

- RQ2: Does the effect of players' awe experience on their entertainment responses change over time?

### 3 Method

A secondary analysis of a three-wave longitudinal study ( $N = 556$ ) on players' experiences with the video game *Fallout 76* was performed. The original study was conducted by Bowman and colleagues [13], and data were shared freely at OSF via <https://osf.io/n9dw5>. Permission to use the data for the present contribution was officially granted by the original authors. The secondary analysis had several advantages over primary data collection. At first, while all relevant variables for the present purpose were measured at two time points using established scales (see below), the study has not yet been analyzed with regards to awe or entertainment [13]. Hence, the data set allows to examine the present hypothesis and research questions in a resource efficient manner [41]. Moreover, the study focuses on players' experience with *Fallout 76*. Although this game was criticized for its poor technical stability and narrative style, it also received praises for depicting "beautiful" natural environments and offering rich possibilities for exploration [e.g., 42]. Given that awe is often elicited by objects from the natural world [25], *Fallout 76* seems to be a good case study.

The dataset combines three surveys conducted over a three-month period in late 2018/early 2019: Players of *Fallout 76* were surveyed two weeks before the game was released ( $t_0$ ), two weeks after release ( $t_1$ ) and two months after release ( $t_2$ ). The present contribution focusses on players' experiences reported after the game's release ( $t_1$  &  $t_2$ ) as we consider awe a reaction to playing *Fallout 76* rather than an anticipatory affect. Participants were recruited via social media (i.e., *Reddit* communities, original authors' social media pages and *Facebook* Ads: [13]). The final sample consists of  $N = 556$  respondents who completed all surveys (age:  $M = 30.7$ ,  $SD = 8.7$ ; 68% male).

The participants were highly involved in gaming, playing on average 2.9 hours on a weekday ( $SD = 2.1$ ) and 4.8 hours on a weekend day ( $SD = 2.7$ ) and using the medium for  $M = 20.3$  years ( $SD = 8.8$ ). They also showed a high level of fandom for the Fallout-Franchise ( $M = 9.1$ ,  $SD = 1.3$ , scale from 0 “not at all a fan” to 10 “a huge fan”).

**Table 1.** Descriptives and Reliabilities (Cronbach’s  $\alpha$ ) of all analyzed constructs in t1 (2 weeks after release) and t2 (2 months after release)

Construct	t1			t2		
	<i>M</i>	<i>SD</i>	$\alpha$	<i>M</i>	<i>SD</i>	$\alpha$
Enjoyment	5.74	1.28	.936	5.58	1.36	.938
Appreciation	4.29	1.54	.891	4.19	1.63	.909
Awe Experience: Need for accommodation	3.82	1.84	-/-	3.68	1.77	-/-
Awe Experience: Vastness vis-a-vis the self	3.64	1.57	.909	3.85	1.30	.717
Awe Experience: Self-diminishment	3.71	1.30	.834	3.60	1.44	.896
Awe Experience: Combined	3.73	1.27	-/-	3.71	1.33	-/-
Satisfaction of Relatedness Need	3.95	1.70	.904	3.93	1.76	.926
Satisfaction of Competence Need	5.42	1.17	.765	5.46	1.18	.794
Satisfaction of Autonomy Need	5.29	1.23	.743	5.24	1.32	.792

Note: For a full list of all measured items, see the supplementary material published at OSF: <https://osf.io/4fxwp/>

The SPSS syntax file for all subsequent steps of data processing and analysis as well as supplementary material containing additional tables including a full list of all measured items can be found at OSF (<https://osf.io/4fxwp/>). All items were measured on a 7-point scale (1 = “strongly disagree” to 7 = “strongly agree”). Players’ *enjoyment* and *appreciation* were each assessed by three items [17] widely used in games research [3] and reliable mean indices were calculated (see table 1). Players’ *awe experience* was measured by three subscales based on prior research [7, 27], each capturing an important experiential quality of awe: need for accommodation (3 items), vastness vis-à-vis the self (4 items) and self-diminishment (6 items). Exploratory factor analyses (EFAs) revealed that all 13 awe items can form a unidimensional structure in both waves (t1 and t2): The one factor solution explained 44.4 (t1) and 49.0 (t2) percent of the variance with factor loadings from 0.46 to 0.84 (t1) and 0.53 to 0.84 (t2) and showed a high internal reliability (Cronbach’s  $\alpha_{t1} = .907$ ; Cronbach’s  $\alpha_{t2} = .922$ ). The full results of the EFAs can be found in the supplementary material (published at OSF: <https://osf.io/4fxwp/>). This indicates that the awe items can be compressed to an overall index. However, as the number of items measuring the three qualities differed substantially, the items were initially compressed per quality to ensure that each dimension equally contributes to the overall awe index. The items measuring vastness and self-diminishment showed sufficient reliability (see table 1), thus, mean indices were calculated. In contrast, the ‘need for accommodation’ subscale only showed weak reliability (Cronbach’s  $\alpha_{t1} = .550$ ; Cronbach’s  $\alpha_{t2} = .644$ ). Therefore, instead of the full subscale the one item that best represents this dimension was selected for further analysis

(i.e., “I rarely had gaming experiences like this before”). Finally, an overall awe mean index was calculated based on the two indices and the single item (see table 1). Finally, the satisfaction of SDT needs was measured with the widely used Player Experience of Need Satisfaction (PENS) scale [20]. Mean indices were calculated for the items measuring relatedness (2 items), autonomy and competence (each 3 items; see Table 1). Zero-order correlations among all indices can be found in the supplementary material (published at OSF: <https://osf.io/4fxwp/>).

## 4 Results

Regarding RQ1, the results suggest that players experienced a medium-level intensity of awe when playing *Fallout 76* (see Table 1). The mean agreement with statements forming the combined awe index was closely below the midpoint of the scale (4 = “neither agree nor disagree”) in t1 and t2. 95% confidence intervals of the means in t1 [3.62, 3.83] and t2 [3.60, 3.82] supported this observation. Compared to the satisfaction of SDT needs, the data shows that players experienced awe less frequently or intensely when using *Fallout 76* than competence and autonomy need gratification, but almost similarly intensely or frequently as relatedness need satisfaction (see Table 1).

Moreover, and in contrast to H1, the data does not suggest that the intensity of players’ awe experience declined between the first survey (two weeks after the game’s release) and the second survey (two months after release; see Table 1). A paired t-test supported this observation,  $t(548) = 0.330$ ,  $p = .742$ , Cohen’s  $d = .014$ . Hence, H1 was disconfirmed: The game inspired roughly the same intensity of awe in players participating in this study two months after release as it did two weeks after release.

**Table 2.** Blockwise Regression of SDT Need Satisfaction and Awe on Enjoyment in t1 (2 Weeks After Release) and t2 (2 Months After Release)

Predictor	Enjoyment (t1)		Enjoyment (t2)	
	Model 1 $\beta$	Model 2 $\beta$	Model 1 $\beta$	Model 2 $\beta$
Step 1				
Relatedness	.159***	.181***	.152***	.135***
Competence	.221***	.215***	.309***	.315***
Autonomy	.532***	.546***	.512***	.499***
Step 2				
Awe		-.050		.041
$R^2_{adj}$	.609***	.610***	.695***	.695***
$\Delta R^2$		.001		<.001

Note:  $N_{t1} = 555$ ,  $N_{t2} = 549$ . \*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$ ; robust standard errors were calculated in all analysis (HC3 estimator); predictors showed only a weak level of multicollinearity ( $VIF_{t1}$  between 1.393 and 1.903;  $VIF_{t2}$  between 1.497 and 1.966)

To test H2 and H3, four blockwise regression analyses were calculated (see Table 2 & 3). Players’ self-reported enjoyment and appreciation in t1 and t2 served as dependent

variables in these models. The satisfaction of their relatedness, competence and autonomy needs were entered as independent variables in a first block, and the combined awe index was included as an additional independent variable in a second block. It was found that the satisfaction of SDT needs substantially predicted players enjoyment two weeks ( $R^2_{adj.} = .609$ ;  $p < .001$ ) and two months after the game's release ( $R^2_{adj.} = .695$ ;  $p < .001$ ; see Table 2). Including awe in the second step of the analysis did not significantly improve the model (t1:  $\Delta R^2 = .001$ ,  $p = .074$ ; t2:  $\Delta R^2 < .001$ ,  $p = .173$ ). Hence, H2 was disconfirmed: In the present study, players' awe experience did not increase their enjoyment beyond and above the gratification of SDT needs.

The satisfaction of SDT needs also substantially predicted players' experience of appreciation both two weeks ( $R^2_{adj.} = .591$ ;  $p < .001$ ) and two months after the game's release ( $R^2_{adj.} = .643$ ;  $p < .001$ ). Including awe in the model improved the predictive power substantially in t1 ( $\Delta R^2 = .044$ ,  $p < .001$ ) and t2 ( $\Delta R^2 = .031$ ,  $p < .001$ ). Awe was the second strongest predictor of Appreciation in t1, exerting a stronger effect than relatedness and competence need satisfaction; in t2, awe was the third strongest predictor (see Table 3). Overall, H3 was supported: Players' awe experience had a substantial and unique effect on players' appreciation experience.

**Table 3.** Blockwise Regression of SDT Need Satisfaction and Awe on Appreciation in t1 (2 Weeks After Release) and t2 (2 Months After Release)

Predictor	Appreciation (t1)		Appreciation (t2)	
	Model 1 $\beta$	Model 2 $\beta$	Model 1 $\beta$	Model 2 $\beta$
Step 1				
Relatedness	.317***	.204***	.412***	.325***
Competence	.065	.095*	.064*	.094**
Autonomy	.514***	.442***	.449***	.381***
Step 2				
Awe		.257***		.214***
$R^2_{adj.}$	.591***	.635***	.643***	.673***
$\Delta R^2$		.044***		.031***

Note:  $N_{t1} = 555$ ,  $N_{t2} = 550$ . \*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$ ; robust standard errors were calculated in all analysis (HC3 estimator); predictors showed only a weak level of multicollinearity ( $VIF_{t1}$  between 1.393 and 1.903;  $VIF_{t2}$  between 1.497 and 1.966)

With respect to our second research question (RQ2), the data suggests that the effects of players' awe experience on their entertainment responses remained rather stable. Awe did not fuel enjoyment, neither two weeks nor two months after release (see Table 2). In contrast, awe significantly increased players' appreciation experience, but the size of this effect remained also rather stable across t1 ( $\beta_{t1} = .257$ ) and t2 ( $\beta_{t2} = .214$ ). In line with this observation, the 95%-confidence intervals for the standardized regression coefficients of awe on appreciation in t1 [.197, .317] and t2 [.157, .270] overlapped, suggesting that the strength of these effects is not statistically different.

## 5 Discussion

Harvesting the potential of a two-wave longitudinal data set, the present study investigated whether the experience of awe—the ‘Wow-effect’ of gaming—functions as a unique contributor to video game players’ sense of entertainment. The game under investigation—*Fallout 76*—should be considered a useful case, because it depicts a vast natural world but also, because it was not overly successful and, hence, does obviously not combine many well-developed entertainment factors. Hence, if awe functions as driver of gamers’ entertainment experience, such an effect should be observed among *Fallout 76* players. Moreover, while case studies are always limited in their generalizability, *Fallout 76* is an open-world multiplayer game and therefore resembles the mechanics and aesthetics of other recently popular titles (e.g., *GTA V*, *Red Dead Online*).

Descriptive findings (RQ1) suggest that awe is an experiential quality that respondents did recognize. While mean scores were not strong, the results still suggest that most gamers felt ‘some’ or ‘occasionally’ awe when playing *Fallout 76*. If awe would not play a role, much lower descriptive scores would have been expectable. We thus conclude that awe is empirically verified as a mode of experience that occurs during playing *Fallout 76*, which converges with previous theory [4, 5] and research [7, 12, 33]. The moderate mean values are also consistent with previous assumptions that awe is a rare gaming experience that occurs only in certain constellations [4, 5] and that is selectively evoked by developers to create game highlights such as boss battles [11].

Further analysis revealed that within the current study’s six-week time frame, intensity of awe experiences remained stable on average. During the first two month of exposure, gamers did thus not find the ‘Wow-effect’ eroding, which had been the rationale behind the disconfirmed H1. The observed temporal stability seems surprising, given that awe is triggered by stimuli that do not fit into established mental schemata [22]. Repeated contact with a stimulus should, thus, diminish its ability to trigger intense awe. At least three explanations can be found for this result: First, the observed stability of players’ awe reactions could simply be a result of the operationalization chosen in the original study [13]. In both, t1 and t2, players were asked to indicate their “feelings while playing *Fallout 76*” (see original questionnaires: <https://osf.io/n9dw5>). It can be argued that players based their responses not only on their feelings at the time of measurement (i.e., how it felt to play *Fallout 76* at that moment), but also on recalled, prior experiences (e.g., how it felt to play the game in the first few hours). In particular, players’ responses at t2 might reflect their cumulative experience and might, thus, not be sensitive to changes in the intensity of awe between t1 and t2. This might also explain why the satisfaction of the SDT needs remained relatively stable over time as well (see Table 1, for pairwise *t*-tests see supplementary material: <https://osf.io/4fxwp/>). However, the observed changes in the intensity of players’ entertainment responses between t1 and t2 are not consistent with this explanation. Second, the findings may also imply that players’ continuing exploration of the game world in *Fallout 76* brought about ever-fresh vast and unusual stimuli. The game was praised for its huge and beautiful game world [e.g., 42] and six weeks of playtime may just not be enough for habituation effects to occur. Third, the findings may also indicate that players are not always able to sufficiently update their mental models upon contact with an awe stimulus.

Studies indicate that accommodation is a cognitively demanding process [29]. Thus, the rather high demands of games [30] may at times interfere with players' accommodation processes, so that the same game stimuli may impress them multiple times. This assumption should be tested by systematically varying games' demands.

Multiple regressions returned the finding that awe did not explain additional variance in players' enjoyment (H2) beyond the general entertainment factors derived from self-determination theory [19–21]. But awe was isolated as unique and temporally stable factor of gamers' appreciation (H3 and RQ2). Converging with prior theoretical [4–6] and empirical work [7, 12], the study revealed that the 'Wow-effect' adds to the entertainment appeal of video games by increasing states of meaningfulness and the feeling of being moved in players. However, because SDT-based factors of entertainment are rather generic and abstract, it is possible that awe's actual contribution to players' entertainment experience is partly covered by these factors; the conceptual relationship between awe and SDT factors thus deserves further reflection. This particularly applies to the observed non-effect of awe on players' enjoyment, which diverges from most prior studies [7, 12] and theorizing [4–6]. It could be assumed that this effect does exist but was overshadowed in the data by the substantial influence of SDT's higher-level factors. Indeed, although predictors showed only a weak level of multicollinearity (see VIFs in the notes below Tables 2 and 3), zero-order correlations showed that awe was not only weakly to moderately correlated to enjoyment but also to the satisfaction of the SDT needs (see supplementary material: <https://osf.io/4fxwp/>).

Overall, the present results explain why 'great graphics' and rich virtual worlds constitute a specific entertainment value in video games. Advancing the so far deficient state of research, the present study further verified awe as relevant element of players' experience and specifically as determinant of affectively complex states (appreciation). The much stronger effects of the SDT-need satisfaction on players' sense of entertainment revealed here suggest that aspects of video games related to agency and interactivity, to social connections and challenges [20] can be considered more central to players' overall experience. Nevertheless, awe emerges as additional component in the long list [1] of 'reasons why' players enjoy, appreciate, and continue to play games. Hence, game makers decisions to invest aggressively in the audiovisual appeal of their virtual worlds address a demonstrably relevant entertainment factor. The limited audience success of the game *Fallout 76* showcases that inducing awe is not sufficient to sell games. That said, adding 'Wow-effects' likely makes playing more attractive. How to intertwine awe with the other dimensions of game design—narrative and agency in particular—therefore emerges as follow-up question for research and practice. Moreover, awe may or may not require expensive audiovisual technology—how game makers impress and fascinate players is a promising avenue of future game creation and research.

## References

1. Klimmt, C., Possler, D.: A Synergistic Multiprocess Model of Video Game Entertainment. In: Vorderer, P. and Klimmt, C. (eds.) *The Oxford Handbook of Entertainment Theory*. pp. 622–646. Oxford University Press, Oxford (2021). <https://doi.org/10.1093/oxfordhb/9780190072216.013.33>.

2. Hemenover, S.H., Bowman, N.D.: Video games, emotion, and emotion regulation: expanding the scope. *Annals of the International Communication Association*. 42, 126–143 (2018). <https://doi.org/10.1080/23808985.2018.1442239>.
3. Daneels, R., Bowman, N.D., Possler, D., Mekler, E.D.: The ‘Eudaimonic Experience’: A Scoping Review of the Concept in Digital Games Research. *MaC*. 9, 178–190 (2021). <https://doi.org/10.17645/mac.v9i2.3824>.
4. Possler, D., Klimmt, C., Raney, A.A.: Gaming is Awesome! A Theoretical Model on Cognitive Demands and the Elicitation of Awe During Video Game Play. In: Bowman, N.D. (ed.) *Video Games – A Medium that Demands our Attention*. pp. 74–91. Routledge, New York (2018). <https://doi.org/10.4324/9781351235266-5>.
5. Possler, D.: Faszinierende Unterhaltung: Die Entstehung und unterhaltsame Qualität der Emotion Awe (Ehrfurcht) bei der Medienrezeption am Beispiel von Videospiele[n] [Fascinating Entertainment: The Elicitation and Entertaining Quality of the Emotion Awe in Media Reception Using Video Games as a Case Example]. Springer VS, Wiesbaden (in Press).
6. Possler, D., Raney, A.A.: Entertained by Amazement and Wonder: The Role of the Emotion Awe in Media Reception. In: Vorderer, P. and Klimmt, C. (eds.) *The Oxford Handbook of Entertainment Theory*. pp. 418–436. Oxford University Press, Oxford (2021). <https://doi.org/10.1093/oxfordhb/9780190072216.013.23>.
7. Possler, D., Klimmt, C., Raney, A.A., Steger, F., Landmann, L., Seibert, J.-M.: The “Wow!”-Effect: Introducing Awe as Novel Element of the (VR) Video Game Experience. Paper presented at the 69th annual conference of the International Communication Association, Washington D.C., USA (2019).
8. McGonigal, J.: *Reality is Broken: Why Games Make Us Better and How They Can Change the World*. Penguin Press, New York (2011).
9. Therrien, C.: Graphics in Video Games. In: Wolf, M.J.P. (ed.) *The Video Game Explosion: A History from PONG to Playstation and Beyond*. pp. 239–250. Greenwood Press, Westport (2008).
10. Sony: PlayStation®5, <https://www.playstation.com/en-us/ps5/>.
11. Keren, I.: Boss Up: Boss Battle Design Fundamentals and Retrospective. Game Developers Conference, San Francisco (2018). <https://www.gdcvault.com/play/1024921/Boss-Up-Boss-Battle-Design>.
12. Possler, D., Scheper, J., Kreissl, J., Raney, A.A., Kumpel, A.S., Unkel, J.: Awe-inspirational gaming: Exploring the formation and entertaining effects of awe in video games. Paper presented at the 69th annual conference of the International Communication Association, Washington D.C., USA (2019).
13. Bowman, N.D., Banks, J., Rittenour, C.E.: Country roads through 1s and 0s: Sense of place for and recollection of West Virginia following long-term engagement with Fallout 76. *Technology, Mind, and Behavior*. 1, (2020). <https://doi.org/10.1037/tmb0000001>.
14. Mekler, E.D., Bopp, J.A., Tuch, A.N., Opwis, K.: A systematic review of quantitative studies on the enjoyment of digital entertainment games. In: Jones, M. and Palanque, P. (eds.) *Conference on Human Factors in Computing Systems - Proceedings*. pp. 927–936 (2014). <https://doi.org/10.1145/2556288.2557078>.
15. Vorderer, P., Klimmt, C., Ritterfeld, U.: Enjoyment: At the heart of media entertainment. *Communication Theory*. 14, 388–408 (2004). <https://doi.org/10.1111/j.1468-2885.2004.tb00321.x>.
16. Vorderer, P., Reinecke, L.: From Mood to Meaning: The Changing Model of the User in Entertainment Research. *Communication Theory*. 25, 447–453 (2015). <https://doi.org/10.1111/comt.12082>.

17. Oliver, M.B., Bartsch, A.: Appreciation as audience response: Exploring entertainment gratifications beyond hedonism. *Human Communication Research*. 36, 53–81 (2010). <https://doi.org/10.1111/j.1468-2958.2009.01368.x>.
18. Rogers, R., Woolley, J.K., Sherrick, B., Bowman, N.D., Oliver, M.B.: Fun Versus Meaningful Video Game Experiences: A Qualitative Analysis of User Responses. *The Computer Games Journal*. 6, 63–79 (2017). <https://doi.org/10.1007/s40869-016-0029-9>.
19. Ryan, R.M., Deci, E.L.: Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *The American psychologist*. 55, 68–78 (2000). <https://doi.org/10.1037/0003-066X.55.1.68>.
20. Ryan, R.M., Rigby, C.S., Przybylski, A.K.: The motivational pull of video games: A self-determination theory approach. *Motivation and Emotion*. 30, 347–363 (2006). <https://doi.org/10.1007/s11031-006-9051-8>.
21. Oliver, M.B., Bowman, N.D., Woolley, J.K., Rogers, R., Sherrick, B., Chung, M.-Y.: Video games as meaningful entertainment experiences. *Psychology of Popular Media Culture*. 5, 390–405 (2016). <https://doi.org/10.1037/ppm0000066>.
22. Keltner, D., Haidt, J.: Approaching awe, a moral, spiritual, and aesthetic emotion. *Cognition and Emotion*. 17, 297–314 (2003). <https://doi.org/10.1080/02699930302297>.
23. Kant, I.: *Critique of Judgement*. Hackett Publishing Company, Indianapolis (1987).
24. Shaw, P.: *The Sublime*. Routledge, New York (2017).
25. Bai, Y., Maruskin, L.A., Chen, S., Gordon, A.M., Stellar, J.E., McNeil, G.D., Peng, K., Keltner, D.: Awe, the diminished self, and collective engagement: Universals and cultural variations in the small self. *Journal of Personality and Social Psychology*. 113, 185–209 (2017). <https://doi.org/10.1037/pspa0000087>.
26. Allen, S.: *The Science of Awe*. Greater Good Science Center at UC Berkeley (2018). [https://ggsc.berkeley.edu/images/uploads/GGSC-JTF\\_White\\_Paper-Awe\\_FINAL.pdf](https://ggsc.berkeley.edu/images/uploads/GGSC-JTF_White_Paper-Awe_FINAL.pdf)
27. Piff, P.K., Dietze, P., Feinberg, M., Stancato, D.M., Keltner, D.: Awe, the small self, and prosocial behavior. *Journal of Personality and Social Psychology*. 108, 883–899 (2015). <https://doi.org/10.1037/pspi0000018>.
28. Gordon, A.M., Stellar, J.E., Anderson, C.L., McNeil, G.D., Loew, D., Keltner, D.: The dark side of the sublime: Distinguishing a threat-based variant of awe. *Journal of Personality and Social Psychology*. 113, 310–328 (2017). <https://doi.org/10.1037/pspp0000120>.
29. Griskevicius, V., Shiota, M.N., Neufeld, S.L., Kaptein, M., Markopoulos, P., Ruyter, B.D., Aarts, E., Menzel, A.J.: Influence of different positive emotions on persuasion processing: a functional evolutionary approach. *Emotion*. 10, 190–206 (2010). <https://doi.org/10.1037/a0018421>.
30. Bowman, N.D.: The Demanding Nature of Video Game Play. In: Bowman, N.D. (ed.) *Video Games – A Medium that Demands our Attention*. pp. 1–24. Routledge, New York (2018).
31. Tan, E.S.-H.: Film-induced affect as a witness emotion. *Poetics*. 23, 7–32 (1995). [https://doi.org/10.1016/0304-422X\(94\)00024-Z](https://doi.org/10.1016/0304-422X(94)00024-Z).
32. Chirico, A., Ferrise, F., Cordella, L., Gaggioli, A.: Designing Awe in Virtual Reality: An Experimental Study. *Frontiers in Psychology*. 8, Article 2351 (2018). <https://doi.org/10.3389/fpsyg.2017.02351>.
33. Wehden, L.-O., Reer, F., Janzik, R., Tang, W.Y., Quandt, T.: The Slippery Path to Total Presence: How Omnidirectional Virtual Reality Treadmills Influence the Gaming Experience. *MaC*. 9, 5–16 (2021). <https://doi.org/10.17645/mac.v9i1.3170>.
34. Frederick, S., Loewenstein, G.: Hedonic adaptation. In: Kahneman, D., Diener, E., and Schwarz, N. (eds.) *Well-being: The foundations of hedonic psychology*. pp. 302–329. Russell Sage Foundation, New York, US (1999).

35. Rudd, M., Vohs, K.D., Aaker, J.L.: Awe expands people's perception of time, alters decision making, and enhances well-being. *Psychological science*. 23, 1130–6 (2012). <https://doi.org/10.1177/0956797612438731>.
36. Shiota, M.N., Keltner, D., Mossman, A.: The nature of awe: Elicitors, appraisals, and effects on self-concept. *Cognition & Emotion*. 21, 944–963 (2007). <https://doi.org/10.1080/02699930600923668>.
37. Yaden, D.B., Haidt, J., Hood Jr., R.W., Vago, D.R., Newberg, A.B.: The varieties of self-transcendent experience. *Review of General Psychology*. 21, 143–160 (2017). <https://doi.org/10.1037/gpr0000102>.
38. Baumeister, R.F., Vohs, K.D., Aaker, J.L., Garbinsky, E.N.: Some key differences between a happy life and a meaningful life. *The Journal of Positive Psychology*. 8, 505–516 (2013). <https://doi.org/10.1080/17439760.2013.830764>.
39. Fiske, A.P., Seibt, B., Schubert, T.W.: The Sudden Devotion Emotion: Kama Muta and the Cultural Practices Whose Function Is to Evoke It. *Emotion Review*. 11, 74–86 (2019). <https://doi.org/10.1177/1754073917723167>.
40. King, L.A., Hicks, J.A.: Detecting and constructing meaning in life events. *Journal of Positive Psychology*. 4, 317–330 (2009). <https://doi.org/10.1080/17439760902992316>.
41. Donnellan, M.B., Lucas, R.E.: Secondary Data Analysis. In: Little, T.D. (ed.) *The Oxford Handbook of Quantitative Methods in Psychology: Vol. 2: Statistical Analysis*. pp. 665–677. Oxford University Press (2013).
42. Nielsen, H.: *Fallout 76 review – a pointless walk in the post-apocalypse*, <https://www.theguardian.com/games/2018/nov/19/fallout-76-review-playstation-xbox-pc>, (2018).