

# Towards the Gamification of VR Authoring Environments

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## Abstract

*The creation of content for educational Virtual Reality (VR) environments is still challenging – particularly for non-experts in the field of VR, resulting in a lack of motivation. Gamification is a tool that has shown motivational benefits in different fields, however, it remains unclear if and how it can be applied to VR authoring. In this paper, we investigate the use of established lightweight gamification mechanics within a VR authoring tool and conclude (based on user study) that our gamification improved the software quality by pragmatic qualities.*

## CCS Concepts

• **Human-centered computing** → Virtual reality; • **Applied computing** → Computer games;

## 1. Introduction

Virtual Reality (VR) authoring commonly takes place within a non-playful context and is driven by extrinsic motivation – a VR system or content for such shall be created for a given purpose. Learning to author VR systems is still challenging, particularly for non-experts in the field of VR [ABM\*20]. In educational scenarios, for example, when participating in a VR university course, this extrinsic motivation may be additionally reduced (students may participate only for the sake of grading and not for creating a running VR system). The introduction of gamification mechanics within VR authoring software tools could help students increase their intrinsic motivation. Regarding software, such intrinsic motivation is strongly tied to hedonic qualities (e.g., pleasure while using a software). In this paper, we explore the effect of gamification mechanics within VR authoring software on hedonic and pragmatic (e.g., usability) qualities and investigate how established lightweight gamification elements (leaderboards, quests, and achievements) can be incorporated within a VR authoring software. We conducted a user study, and compare our gamified version of VR Forge to two existing ones.

## 2. Related Work

Work by Naraghi-Taghi-Off, Horst, and Dörner [NTOHD20] investigates the gamification of VR authoring procedures. They utilize VR Forge – a VR authoring tool that is based on VR Nuggets. Initial studies with VR Forge and VR Nuggets (e.g., [HNTORD21]) indicate that layperson authors could successfully create VR content with the given VR Nuggets as a starting point. Based on these concepts, Naraghi-Taghi-Off, Horst, and Dörner [NTOHD20] introduce a custom-tailored story line revolving around the authoring

process with VR Forge. However, on a meta level, storywriting involves various challenges itself during the authoring, particularly when involving layperson authors, so that the introduction of new VR Nuggets or new features by the community would result in a large overhead. More lightweight and generic gamification elements (for current reviews see [BJP\*22]) might be more suitable in terms of the overall authoring expense. Furthermore, although the narratively enhanced version of VR Forge was positively evaluated, it was not compared against a baseline, which might reveal distinct aspects that were improved or impaired by the narrative gamification.

## 3. Gamification Mechanics and Evaluation

We conducted a user study with a gamified version of VR Forge that utilized three lightweight gamification elements (leaderboards, quests, achievements). For implementing leaderboards, we introduced a rating system into VR Forge where two user roles can rate the individual VR Nuggets: 1) Authors that utilize ready-made VR Nuggets as a starting point for their own implementations, 2) actual VR users of the finalized VR Nugget applications (e.g., with a head-mounted display, Fig. 1 left). For our prototype implementation, we utilized simple star-rating schemes for both user groups ranging from 0 to 5 stars that can be attributed. In order to avoid that a first-time author is demotivated by a low rating on the leaderboard, their own current rating is displayed in the middle of the board and comparable ratings from other authors are listed above and below it (cross-situational leaderboard). However, we still allowed the authors to change the display of the leaderboard, for example, to see the overall top 10 VR Nugget authors.

For implementing quests, we chose a dynamic implementation approach with a generic type of quests, as typical for role playing



**Figure 1:** The VR users' rating query within the 3D environment.

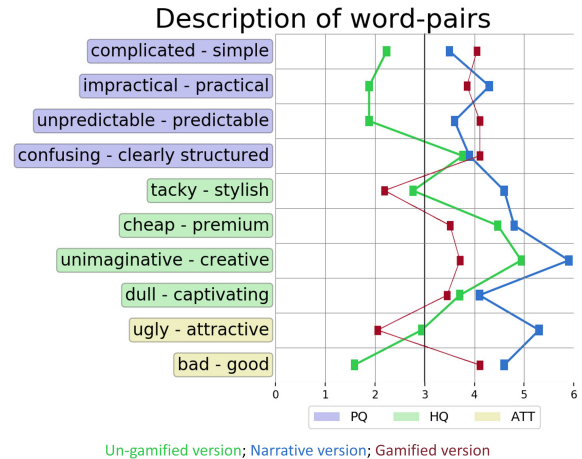
games (e.g., equivalent to common fetch or kill quest etc.), for example, a number of VR Nuggets to be rated (*rate quest type*) or published to be available as a template for other authors (*publish quest type*), which could be used to synergize with the leaderboard mechanic. *VR Nugget quests* represent the number of VR Nugget types to be created, suitable for recurring quests with fixed intervals (e.g., weekly or daily quests).

In contrast to the constantly updating leaderboards or recurring quests, we chose the achievement mechanic as our last established lightweight sample mechanic. Achievements (or also badges) are awarded as permanent recognition of an achievement made by the authors during the authoring procedure. They complement the competitive leaderboards with a social aspect of independent recognition of one's own performance. Both can be made available within a larger (e.g., the entirety of VR Forge authors) or a smaller author group (e.g., a single VR class within the university) to enhance social motivation among students. For our prototype, we coupled the achievements with successfully completed quests.

We conducted a user-study as an exploratory, moderated, and task-based remote user test involving 15 student participants (between 24 and 31 years with a mean ( $\bar{O}$ ) 29.86). The participants of the study classified themselves as non-experts in the field of VR. We asked our participants to perform ten tasks with our gamified prototype of VR Forge. The tasks included authoring activities with different VR Nuggets, ensuring the use of all gamification mechanics. Finally, we asked our participants to fill out a questionnaire that consisted of the established AttrakDiff questionnaire that measures a software's user experience by means of hedonic and pragmatic qualities and the attractiveness.

We analyzed the results of our study compared to the results of the studies against the initial (un-gamified) version of VR Forge [HNTORD21] and the narrative version [NTOHD20] (between subject design), which also utilized the AttrakDiff. The results are shown in Fig. 2. It shows that our gamified version was rated with significantly less hedonic quality than the narrative version and also less than the original version. The figure also shows that our software obtained the highest of scores regarding its pragmatic quality, with a larger confidence range (dashed areas). In terms of the attractiveness factor of our software, it exceeded the original VR Forge version significantly, however, it did not surpass the narrative one. Specifically the item 'ugly-attractive' stands out, which indicates

further UI polishing is necessary. Fig. 2 also shows that our gamified prototype was rated best in three of four categories relating to pragmatic qualities, but interestingly it did significantly obtain the lowest of scores for all four hedonic quality categories.



**Figure 2:** Word-pairs visualization of the AttrakDiff values.

#### 4. Conclusions and Future Work

In this paper, we investigated the application of gamification mechanics within VR authoring software. Our implementation did only verify improvements concerning pragmatic qualities, which is interesting due to the hedonic nature that typically comes along with game software elements. This can be based on the fact that we introduced social and particularly competitive elements to the software (e.g., visible badges and leaderboards) that can remind of grading situations in our educational context with students. This correlation should be investigated further in future work. Based on our findings, also more work will focus on social computing elements in general to draw from the potential of large communities of less use-case driven and more complex VR authoring environments, such as the Unity game engine or Unreal Engine, already have.

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