Productivity & Play: A First-Person Shooter for Fast and Easy Scene Design

Thomas Fröhlich
University of Bremen
Bremen, Germany
tfr@uni-bremen.de

Jan von Oehsen
University of Bremen
Bremen, Germany
joehsen@tzi.de

Rainer Malaka
University of Bremen
Bremen, Germany
malaka@tzi.de

CHI PLAY'17 Extended Abstracts, October 15–18, 2017, Amsterdam, Netherlands

ACM ISBN 978-1-4503-5111-9/17/10.
https://doi.org/10.1145/3130859.3131319

Abstract
Building 3D scenes for games can be a difficult task, especially for beginners and other non-experts wanting to contribute their own ideas in an easy way. Tools for map or world creation are often complex to understand and use, don't support the creative process of building a scene, and decouple design from player experience. To overcome these problems, we present a First-Person Shooter (FPS) game for level creation using game mechanics for all tasks, making the process more easy and enjoyable while also providing direct experience of the work from a player's point of view. We evaluated our approach in a preliminary study where we compared our game to a simplified version of the Unity editor, representing generic world building tools, and found that users enjoy the our game, find it more usable, and feel more creative.

Author Keywords
productive play, scene design, level design, games with a purpose

ACM Classification Keywords
H.5.2 [User Interfaces]: Interaction styles

Introduction
Generating self-made content for video games allows players to creatively extend their gaming experience with addi-

tional maps or mods, as for example in CounterStrike:GO [11] or Minecraft [9]. Besides the player enjoyment of the additional content, production studios can benefit from user generated content because long-term motivation and playability is supported for a long period of time, at the same time production costs for studios are minimal. For this, games that support user content are often accompanied with tools for map or mod making like Valve's Hammer Editor [10]. However, these world or map builders can be cumbersome to use because of complex user interfaces with a high learning curve and limited UX. Often, the editor perspective doesn't match the play view (e.g. first person games), disconnecting creation and experience through constantly switching perspectives. It is further difficult to position objects in 3D space using the mouse and constantly switching between different Gizmos, often operating only in one dimension at a time. Editors also tend to be oriented on the task, lacking support for creative expression and serendipity, which are both important dimensions of design.

In order to overcome these problems, we introduce a world builder game where the process of creating a 3D scene is play itself. Users of our tool are able to navigate directly in the 3D scene, placing objects in a playful manner by shooting them in the scene for placement and manipulation. We implemented four weapons: A gun for physics enabled placement, a laser gun for more precise positioning and manipulation, a sniper rifle for far distance interaction, and a hand grenade for spawning multiple objects at the same time using an explosion, all allowing for playful interaction with the 3D content. For example, using our tool, users can create a small town by walking through the world, placing houses, crates, and decoration on the go, throwing a tree-grenade to spawn a forest, and using the rifle scope to place object in a detailed manner. With our approach we assume that users find the design of 3D scenes more easy and fun, feel more creative, have less difficulty positioning objects in 3D, and have a lower learning curve compared to standard editors. In this sense, we are interested in the hedonistic and pragmatic qualities of our game, as well as the overall usability of our system. Based on this, we formulate the following research questions:

RQ1: How creative do users feel using the game in comparison to the editor?
RQ2: How does the overall usability of game and editor compare?
RQ3: How do users rate the pragmatic and hedonistic quality of game and editor?

For the evaluation of our approach we conducted an experiment with 17 participants where we compared our game to a simplified version of the Unity editor, representing usability and workflow of standard 3D tools like Hammer. We were interested how users perform both in a free building task and in a replication task where they had to rebuild a 3D scene from a printed template. In addition to this, we conducted a short interview session with each participant, collecting feedback on the approach. Because we assume that our game is more enjoyable and creative as the editor, we were especially interested in the hedonistic and pragmatic dimensions, so we used the AttrakDiff questionnaire [5] which gives insight in both directions. For usability, we chose to use the System Usability Scale (SUS) [2] for a first assessment.

In the following section, we provide an overview of related systems that use playful interaction for productive purposes. Then, we introduce our game, followed by an overview of our study design and procedure. After that, we present the results and conclude the paper with a discussion.

Figure 1: Gun spawned barrel

Figure 2: Laser spawning

Figure 3: Sniper view

Figure 4: Grenade spawning

Related Work

There have been different approaches to improve the enjoyment and of computer tasks by creating or modifying off-the-shelf games so that a productive outcome can be achieved: Chao presented with PSDoom [3] a clone of the game Doom [6], where in contrast to the original game, processes running on a computer can be killed in the form of monsters in the 3D world. PSDoom aims at supporting system administrators with process management, making this task more enjoyable and easy. Users found the software compelling and thought it was an intuitive interface. An interesting approach to file management is the “Brutal File Manager” [8]. Users can walk through a 3D world that represents the file system of the local machine. Folders can be entered by walking into rooms that are filled with objects representing files. These can be deleted by shooting at them. Further, a copy, duplicate, and paste functionality was implemented. Another first-person shooter metaphor was used by [4] for the exploration of libraries. The authors aimed at making the discovery of large library collections more enjoyable and modified Quake II [7]. Books can be selected and information is shown by shooting at them, a second fire round displays extended information, and a third shot could even fill out the respective lending form. The presented play environments, that foremost aim at a productive outcome rather than solely entertainment purpose can be referred to as games or play for productivity [1].

Level Design Shooter

Our game uses mechanics similar to common first-person shooters. The player navigates using the WASD keys on the keyboard for movement and the mouse to look around. Objects can be placed in the scene by “shooting” them into the world using the left mouse button. Weapon loading is implemented in a Minecraft-like menu on the right side of the screen. Four different weapons for object placement

Figure 5: Game view with gun selected.
Top right: Menu with manipulators (Delete, scale, rotate, translate, and assets), Bottom right: Gun, laser rifle, sniper, grenade

and manipulation can be selected, each having individual functions. The weapons can be loaded with either 3D assets or manipulators, which are translation, rotation, and scaling. When shooting with a 3D asset loaded, the object is placed in the scene, influenced by weapon specific functions. Shooting a manipulator at an object in the scene leads to either translation, rotation, or scaling of the target object. This way, already placed objects can be repositioned, rotated, or scaled up and down.

For object placement, we implemented the four different weapons: A gun, laser gun, sniper rifle, and a hand grenade. The gun spawns objects at the muzzle, adding a forward directed force using the physics engine and when objects hit the ground, they slide a small distance before coming to halt, see Figure 1. When aiming with the laser gun, a red shaded preview of the selected object is drawn in the world, indicating the final placement upon shooting as depicted in Figure 2. The sniper rifle draws a target point in the world,

Figure 6: Template scene

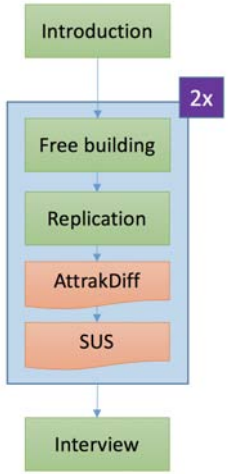

Figure 7: Study overview

indicating the placement position. This weapon has a rifle scope (Figure 3), allowing for precise positioning from far distances. Upon shooting, the selected object directly appears at the target position. Throwing a hand grenade into the scene spawns multiple objects in an explosion, distributing them in a circularly around the detonation point, see Figure 4.

Manipulations to already placed scene objects can be done by shooting at a target object with one of the manipulators translation, rotation, or scaling selected. With the gun and sniper rifle, translations in X,Z space are done by applying small forces to the target object, physically moving it in the direction of shooting. Rotation is done the same way, only target object have to be shot at the outside edges of the target object, rotating it on each shot a small bit around the Y axis. Scaling works similarly by hitting either the top or bottom half of the target object, increasing the size equally in all three dimensions. With the rail gun, objects can be directly re-positioned in X,Z dimensions by hold-shooting and moving the mouse. Scaling and rotation work the same way. Hand grenades do not have manipulation functionality. 3D objects can be selected using the mouse wheel from the right hand menu. When pressing the TAB key, another window appears and using the mouse, other objects can be added to the game menu using drag and drop.

User Study

We conducted a within-subject experiment with 17 male participants (25 years on average, $SD = 5.3$), all having an undergraduate computer science background. For baseline comparison, we decided to evaluate our game against the Unity editor as a representative tool for standard world editors. In order to not over-complicate editor over game use for novices, we simplified the UI of the editor by excluding unnecessary options and highlighting task relevant elements like the asset library and providing large thumbnails of the required assets. The experimental task was to a) freely explore either the game or editor while creating an own scene, and b) replicate a sample scene (Figure 6) using both tools.

Method

Our experiment has two conditions: a game and an editor condition. Every participant performed both conditions, randomly starting with either the editor or game. In each condition, after an introduction to the respective tool, participants performed a free building phase of three minutes where they could experiment to their extend. Subsequent to this, in the replication task, participants were asked to recreate a given scene within 5 minutes using the same tool. The template scene (see Figure 6) was shown on two print outs, each from a different perspective for better overview and were not removed during this phase. Upon reaching the five minute time limit, the task was discontinued. We did not randomize the task order (free building / replication) because of the small number of participants.

Procedure

The overall procedure is depicted in Figure 7. After welcoming and a general introduction, the participants were introduced to the first tool (game or editor), where the controls were explained and questions could be asked. We provided a “cheat sheet” with the controls listed for convenience. Then, the 3 minute free building phase began and after finishing, the resulting scene was saved by the experimenter. Following, using the same tool, the participants replicated the template scene while being instructed to think-aloud. After completing the replication phase, participants filled out the AttrakDiff questionnaire and the System Usability Scale. Then, the participants performed the second condition with the same procedure, only using the

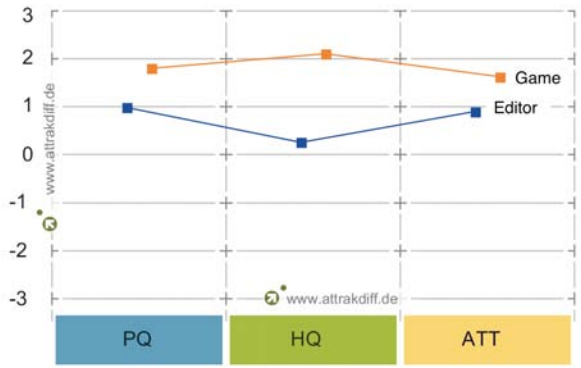

Figure 8: Average pragmatic (PQ), hedonistic (HQ), and attractiveness (ATT) ratings

alternative tool. After both conditions were finished, in the final step, a short structured interview was conducted.

Results

The System Usability Scale (SUS) yields an overall of 85 points for the game and 63 for the editor. We tested the SUS categories for significant results using an Wilcoxon-Test and found the following answers being statistically significant ($p < 0.05$). A higher score means more agreement. Q1: Would like to use the system frequently: Game 3.94 ($SD = 0.97$), Editor 3.18 ($SD = 1.13$), Q2: Found the system unnecessarily complex: Game 1.53 ($SD = 1$), Editor = 2.24 ($SD = 1.15$), Q4: Would need the support of a technical person: Game 1.47 ($SD = 0.62$), Editor 2.59 ($SD = 1.37$), Q5: Functions are well integrated: Game 4.41 ($SD = 0.87$), Editor 3.59 ($SD = 1$), Q7: Most people would learn this system very quickly: Game 4.59 ($SD = 0.8$), Editor 2.88 ($SD = 1.41$), Q8: System is very cumbersome to use: Game 1.53 ($SD = 0.62$), Editor 2.76 ($SD = 1.09$).

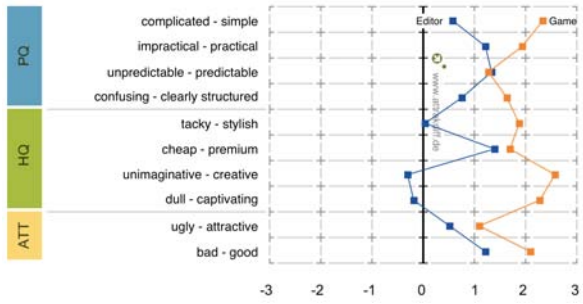

Figure 9: Profile of the word pairs (PQ = pragmatic quality, HQ = hedonistic quality, ATT = attractiveness)

AttrakDiff results of the average pragmatic, hedonistic, and overall attractiveness of both the game and the editor can be seen in Figure 8. Figure 9 shows the individual ratings of the word pairs used in the questionnaire. We further applied a Wilcoxon-Test to the individual categories of the AttrakDiff questionnaire and found the following statistically significant ratings ($p < 0.05$), a higher score means better. Simple - complicated: Game 6.35 ($SD = 0.79$), Editor 4.59 ($SD = 1.62$), good - bad: Game 6.13 ($SD = 0.7$), Editor 5.24 ($SD = 1.4$), captivating - dull: Game 6.3 ($SD = 1.1$), Editor 3.8 ($SD = 1.42$)„ creative - unimaginative: Game 6.59 ($SD = 0.87$), Editor 3.71 ($SD = 1.89$), attractive - ugly: Game 5.88 ($SD = 1.36$), Editor 4.06 ($SD = 1.48$).

Discussion

For the discussion of the results, we present the main findings of our experiment. Regarding overall usability, we found statistically significant advantages of the game in comparison to the editor, where also the absolute SUS score of 85 for the game and 63 for the editor demonstrates a higher usability of game. In this regard, we found that users would like to use the game more frequently, found

it less complex, would not need technical support and appreciate the learnability and ease of use. As we were especially interested in the pragmatic and hedonistic value of our game, we included the AttrakDiff questionnaire. Here, we found that hedonistic and, interestingly, also the pragmatic quality of the game is rated higher than for the editor. This is surprising because the editor is very task oriented and pragmatic in it's design, functionality, and user experience. More data is needed to investigate this unexpected result. In relation to our research questions we can say that users felt more creative and had more fun using the game. Based on the SUS results, there is evidence that the game usability is generally higher, and the AttrakDiff results indicate that also the hedonistic and pragmatic values are also in favor of the game. In a short interview session after the experiment we collected further verbal feedback from the participants. In essence, they mostly liked the playful interaction and highlighted the easy and fun way of creating a scene and stated multiple times that they felt more creative using the game. On the negative side, they were not sure to what extend the approach can be used for more complex scenes and detailed positioning, and missed some further editing functionalities for larger projects.

In future work we want to explore how the game functionality can be increased for more detailed positioning, better asset selection, and further tools like copy and paste, layering and for connecting objects. As our work is still ongoing, we will further investigate and evaluate the scenes created by the participants in relation to creative aspects, building time, and efficiency in the replication task. On a higher level, we aim to further explore how digital play in general can be used as a productivity tool because the approach clearly has a positive impact on usability as well as creativity and seems to be appealing for a large audience.

Acknowledgements

This project has received funding from the EU Horizon 2020 research and innovation programme under grant agreement No 688244, project first.stage.

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