Toon Dimension

Conclusion

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Table Of Contents

1. Final Results

1.1 Code

As stated in the alpha release chapter, the initial software architecture held with only one greater refactoring. Nevertheless, after adding more and more controllers and the code for the characters, the performance on the Xbox dropped bellow an acceptable rate.
On one side we had a low frame rate in the draw routine which was fixed by introducing a view frustrum clipping of meshes and merging small meshes to a big one.
On the other side we had a periodic lag which introduced two problems: The first was the frequency in which it appears, the other was the duration of the freezing.
We increased the time between two lags by reducing the amount of memory allocations, since the garbage collector starts a sweep each megabyte of allocated heap memory. This also required smaller adaptions as replacing 'foreach'-loops which allocate iterators by the traditional 'for'-loops.
Decreasing the time that a garbage collection round takes was reduced by changing the quaternion class used by the character animation as key frames to a struct. Since this animation data was only allocated at initialisation it did not further influence the frequency in which the garbage collector was activated. But since these arrays contained around 60'000 references to classes, the time for each collection round was tremendous.
Applying these changes increased the time between lags from two seconds up to around ten and decreased the duration of a lag by half.
Further allocations in the BEPUPhysics code, unreachable for us to improve, avoided a complete extermination of the lag problem.
However, the final result is playable, robust and would even allow further game elements.

1.2 Graphics

The shadows introduced in the alpha release had to be removed due to performance issues since they used an additional render pass. However, once familiar to the improved game experience gained from the shadows, we could barely present the game without them and so we had to compromise.
We therefore forego the dynamic shadows and created high resolution shadow maps of the levels in advance for more or less smooth shadows which can be applied in one render pass.
We also searched for a method to improve the clean and sometimes boring scenery without loosing the cartoony look and tried out leaving the borders of the edges white as if the surfaces weren't fully coloured. But it looked to symmetric and did not solve our problem.
The final solution was to use the curvature of the mesh for introducing a white fade and to increase the number of shadow attenuations in the cel-shading model from two to five. This introduced more colours in the scenery, accentuating more details.

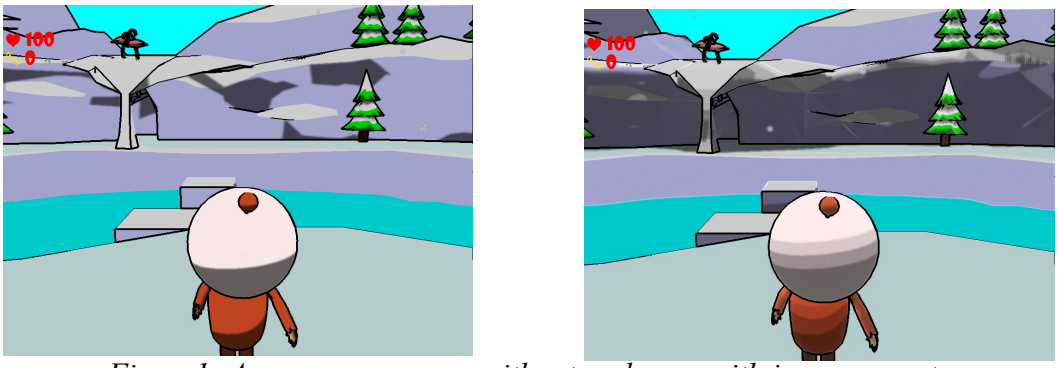

Figure1: A game scene once without and once with improvements

1.3 Art

The art didn't change significantly since the Alpha release. Most changes here were cleaning and trying to improve the existing ones, but also add details with special textures for things like the keyhole or sign posts.

1.4 Characters

Initially we tried a new approach to do character animation. Intelligent animation has been implemented, where the animation adapt itself to the movement of the player. Although it looked nice, our test players had problems with the controls, since they focus on the visible character and tried to countersteer when he walked a nice curve instead of strictly rotating according to user input. Therefore we switched back to the common approach.

2. Experiences

2.2 Realisation

Taking a look back at the formal game proposal we mainly achieved what we hoped for. We created a cartoon-like game where players solve puzzles in a cooperative way and defeat enemies to reach the next level.
However, our intention was to animate more than just one player and also enemies which could not be done because of lacking time.
And we dropped additional weapons to withdraw the focus from fighting and focusing more on the cooperative aspects.
In exchange we realised more and more sophisticated maps than initially intended. The game now takes new players about one hour to play the whole story mode.
We also implemented the 'mayhem' mode in which the players can compete with each other.
The 'high target' goal is clearly reached, taking into account the changes caused by game play decisions. We even implemented a basic AI for enemies stated in the 'extra' goal.

2.3 Schedule

The schedule shown in the appendix reflects the points made in the realisation section. Additional weapons were left out in favour of more sophisticated shaders and shadows. Multiple player characters have been left out as well as animated enemies as for example the walking bomb.
Map creation tasks were often rescheduled and adapted on other requirements, but finally more was produced than expected.

2.4 Project Structure

The clear structure of the development process helped a lot to reach the target. The formal game proposal made us thinking about the game and already building it up in our minds. Proposing a schedule also forced us to get deeper into the different aspects of our game and planning them through. In later times, one could just apply to it and knew what has to be done. The other elements of the project structure helped as milestones to avoid the last-minute-effect.
Especially the game testing phase improved the quality of our game since it has been reviewed by people which were not too close to the project.

3. Impressions

All in all the course was a very good opportunity to self-actualise and realise an own game idea. It advanced our soft skills, communication ability and our team work.
We especially enjoyed the lectures of the people from the industry since they gave an insight in how it is done in a greater and more professional scale.
Lectures of participants from the last years also were very helpful since they passed their knowledge to the next generation and should be kept or even extended for future courses.
Using XNA on a XBox also gave insight in console development and strongly increased our skill to optimize and improve code adapting to a specific platform.
Although the time was a little bit too short to realise a game of the size we intended for ToonDimension, we are happy with what we reached and can proudly call our project a success.

Appendix A

The term (x/y) stands for x hours expected, in y hours realized. Green entries are additional work which has been completed, red terms are partially or not at all complete.

Date	Course Items	Peter	Christian	Nicola
24.02.		- FGP (3/3) - Sketches(2/2) - Mock up Scene (5/7)	- FGP (-/8)	- Design (-/4) - Skeleton (-/4) - Physics (-/16) - FGP (-/8)
03.03.	Formal Game Proposal	- Simple Map(10/8) - Meshload (5/4) - Ghost cam (-/3)		- Character Controller (20/15) - Power-Up Prototype (-/10)
10.03.	Mutual Project Critiques	- Project Critiques (1/1) - Simple Map editor (20/20)	- Project Critiques (1/1)	- Project Critiques (1/1) - Dimensions (15/15) - Box Controller (4/10)
17.03. 09	Game Prototype, Functional Minimum	- Map-Modelling (5/3) - Map editor (15/13) - Refactoring (-/2) - Separating editor solution (-/5)	- Character modelling (12/4) - Prototype video (-/24)	- Bomb Controller (20/15) - Refactoring (-/15)
24.03. 09		- Textures (5/1) - Mapeditor (15/15) - DM-Map (10/10)	- Animated character (12/6)	- Menu (20/12) - Character Controller (-/8) - Shader (-/3)
31.03.		- Textures (5/-) - DM-Map (15/-) - Introduction Map (20/20) - Map-Save/Load (3/3) - Mesh-Controller (4/4)	- Animation clip production (20/5)	- Multi Player (20/10) - Character Controller (-/10) - Pre–Alpha Tests (-/2) - Shader (-/3)
07.04.	Interim Report, Low Target	- Sound Effects (10/10) - Props-Modelling(10/3) - Map adjustments (5/5) - Interim Report (3/3)	- Realistic locomotion generation (20/25)	- Power-Ups (10/5) - Weapon (5/-) - Interim Report (5/1) - Interface (-/3) - Model Binding (-/5) - Menu (-/5)
14.04.		- Enemies (20/10) - Map-Editor (-/3) - Mapping (-/10) - Event-System (-/5)	- Several character models (16/10)	- Switch (4/6) - Elevator (8/8) - Door (8/2) - Testplaying (-/2) - Camera (-/2)
21.04.		- Mapping (10/15) - Decorate (10/5) - Varia (-/5)	- Character actions (20/24)	- Puzzle controllers (20/5) - Shadows (-/16)

				- Enemy (-/5)
29.04.		- Mapping (15/20) - Music (5/2) - Debugging (-/5) - Graphics (-/4)	- Improved character rendering (10/2)	- Effects (20/10) - Basic AI (-/10)
05.05.	Alpha Release, Desirable Target	- AR-Report (5/1) - Balancing (10/0) - Controllers (-/10) - Mapping (-/15)	- Basic AI (10/15) - Intelligent bomb (6/-) - AR Report (1/2)	- Mech. Enemy (10/10) - AR-Report (5/3) - Adjustments (5/8)
12.05.	Playtesting	- Playtesting (10/0) - Model Cleanup (10/-) - Map-Tweaks (-/10) - Loading animation (-/6) - Optimisations (-/5) - Logo & Fonts (-/6)	- Better AI (10/15) - Animation clip production (-/10)	- Rocket (10/-) - Playtesting (10/10) - Corrections (-/10) - Playtest Report (-/6)
19.05.	Debriefing	- Shaders (10/-) - fixed Morbo (-/3) - GIMP experiment for possible shaders (-/3) - updated Textures (-/4) - Movie-capturing (-/8) - Morbo animation (-/6)	- Better Character Collision handling (12/-) - Better animation (-/10)	- Doomsday Bomb (10/-) - Shaders (10/15) - Bug Fixing (-/10) - Movie Camera (-/5)
26.05.	Public Presentation, High Target	- Movie-Editing (-/18) - Presentation (15/2) - Profiling/Optimizing (-/12)	- Presentation (15/3) - Optimisation (-/5)	- Presentation (20/12) - Video (8/8) - Optimisation (-/8)
29.05. 09	Conclusion, Video	- Video (10/-) - Conclusion (5/3)	- Conclusion (5/2)	- Conclusion (8/8)
		(301/341)	(170/171)	(276/359)