Avalanche Simulation in a Particle System

As a part of the Master - Module 3D-Animation in the Hochschule Rhein Main purely written in Python and OpenGL

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ABSTRACT

(What did we do. As tiny as possible)
- the question(s) you investigated (or purpose), (from Introduction)
- state the purpose very clearly in the first or second sentence.
- the experimental design and methods used, (from Methods)
- clearly express the basic design of the study.
- Name or briefly describe the basic methodology used without going into excessive detail-be sure to indicate the key techniques used.
- the major findings including key quantitative results, or trends (from Results)
- report those results which answer the questions you were asking
- identify trends, relative change or differences, etc.
- a brief summary of your interpetations and conclusions. (from Discussion)
- clearly state the implications of the answers your results gave you.

An Avalanche. A natural dreaded force of many snow and ice particles rushing down a Slope, driven by the Gravity. As many as snowflakes and ice particles which are included in an avalanche as good as we can play with them in an Particle System. One of the best examples for dynamicly rendered simulations for Particle Systems a snow Avalanche will be the central Part in our Project.
In order also to start just from the basics we decided to not use huge frameworks and start from the OpenGL Scatch. We will just use OpenGL Basics.

We will solve some Physically based Problems which comes around with the Topic of an Avalanche like:
- Particles with seperated masses, driven by a force.
- Physically Effects, bouncing Particles and combining ones.
and some OpenGL based Problems like:
- shadow for every seperated Particle
- performance Issues and optimization.

We have developed a piece of Software, we want to simulate a physic driven avalanche. The Core features are mainly dedicated to understand and solving physical Problems. We created Particles which reacts on physical forces from outside. These happens physically correct. After that we took some work to give the Particles a good-looking view, which should give a better understanding what we try to simulate at the first look.

Keywords

ACM proceedings; LaTeX; text tagging

1. INTRODUCTION

(What is the problem) Quite literally, the Introduction must answer the questions, "What was I studying? Why was it an important question? What did we know about it before I did this study? How will this study advance our knowledge?"

The Timeline of Avalanche Simulation is as big as the benefit we get from this simulations. With the help of this Simulation protection ramparts can be build and avlanche breakers can put in the optimal position. Not only usefull aspects of Avalanche Simulation should be mentioned, also the esthetic Aspect is a huge one in 3D-Animation.
To solve the exercise to develop a physically correct Avalanche from the Scratch, we must understand all the physically Problems involved. Furthermore, we should learn the Basic Frameworks we want to use. In the Meantime, our understanding from Particle-Systems, Avalanches as itself, Snow and physically Basics are much better than before the Project.

2. MATERIALS AND METHODS

(How did I solve the problem?)
- the the organism(s) studied (plant, animal, human, etc.) and, when relevant, their pre-experiment handling and care,

and when and where the study was carried out (only if location and time are important factors); note that the term ”subject” is used ONLY for human studies.
- if you did a field study, provide a description of the study site, including the significant physical and biological features, and the precise location (latitude and longitude, map, etc);
- the experimental OR sampling design (i.e., how the experiment or study was structured. For example, controls, treatments, what variable(s) were measured, how many samples were collected, replication, the final form of the data, etc.);
- the protocol for collecting data, i.e., how the experimental procedures were carried out, and,
- how the data were analyzed (qualitative analyses and/or statistical procedures used to determine significance, data transformations used, what probability was used to decide significance, etc).

We used Basic Frameworks to solve our Problems. As Basic Programming language, we used Python. One of us haven't seen Python before, so he must learn it while he was developing on the Project. We used Python, because it gives us an easy start to develop. All our future fit with Python, like using OpenGL. Which is the second point to mention.
OpenGL is the most common used Graphic Framework. We used it to give us a fast View, to build our viewable Things like the Window or our Particles and the Terrain.
Furthermore, we used Blender to create our 3D Models, like our Terrain and our Snow Particles. We created every Model at our own which is visible in the Program.
We used an external OBJ-Loader written in Python, which we included. We wanted to use an external one, because we want the main Focus on the physically Problems and not on the Modelling Part.
To write the Documentation we used Latex TeXworks and as last mentioned Tool wen used Google Presentation to create our Presentation at the End.

3. RESULTS

(What did I find out?) What are the ”results”?: When you pose a testable hypothesis that can be answered experimentally, or ask a question that can be answered by collecting samples, you accumulate observations about those organisms or phenomena. Those observations are then analyzed to yield an answer to the question. In general, the answer is the ” key result”.
Like:
We orient on the Presentation
OpenGL (Python). Endlich etwas sehen!
Erste Bewegung
Beschleunigung/Geschwindigkeit
Gravitation
Modelle erstellen/einlesen/konvertieren/anzeige
n Welt in Datenstruktur abbilden
Kollisionen
mit Terrain
mit anderen Partikeln
Probleme lÃűsen!!!
Kollision mit Terrain lange nicht richtig.

4. DISCUSSION

(What does it mean?) - Do your results provide answers to your testable hypotheses? If so, how do you interpret your findings?
- Do your findings agree with what others have shown? If not, do they suggest an alternative explanation or perhaps a unforseen design flaw in your experiment (or theirs?)
- Given your conclusions, what is our new understanding of the problem you investigated and outlined in the Introduction?
- If warranted, what would be the next step in your study, e.g., what experiments would you do next?