Concordia University - Fall 2016

COMP477 - Animation for computer games

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Project Report: Ragdoll Dismemberment

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Abstract

The purpose of our project is to explore and take advantage of physics simulations to animate a ragdoll, in particular exploring how spring systems can be used to stretch and deform objects.

Motivation

This project was chosen since we were interested in learning about how physics can be used to create realistic animations, something that was covered in the lectures but not in the assignments. Furthermore, we thought that a ragdoll would be a great use case since it is a well known object used for physics demonstrations, and naturally has the properties needed to test physics spring systems.

External Resources

We used Unity engine to render the graphics and handle some physics components.
For the sounds we used https://www.freesound.org/, in pareticular the following sounds:
https://www.freesound.org/people/BMacZero/sounds/96132/
https://www.freesound.org/people/sergeeo/sounds/202575/
https://www.freesound.org/people/juskiddink/sounds/140867/
https://www.freesound.org/people/the_toilet_guy/sounds/98931/
https://www.freesound.org/people/sandyrb/sounds/90954/
https://www.freesound.org/people/InspectorJ/sounds/352514/
https://www.freesound.org/people/ryansnook/sounds/110113/
https://www.freesound.org/people/justincase1021/sounds/88401/
https://www.freesound.org/people/muel2002/sounds/266965/
https://www.freesound.org/people/adcbicycle/sounds/13948/
https://www.freesound.org/people/newagesoup/sounds/348243/

https://www.freesound.org/people/omarstone/sounds/196841/
https://www.freesound.org/people/allietron/sounds/269342/

And for the scenery we used assets directly from the unity asset store, in particular the following two assets:
Handpainted Forest Environment Free Sample
Low Poly Environment

Compilation Directions

This is a unity project, all that is needed to compile is downloading the project, and then using the unity game engine to open it (version must be 5 or greater as on the school lab computers).

Design Decisions

We decided that the ragdoll should be in a fixed hanging position, this way we would not have to deal with issues unrelated to our project. In addition, we went with our own custom implementation of the ragdoll instead of unity's so as to achieve better control over the physics and scriptability of our ragdoll. On the other hand, if we were to begin or project again we would probably use Unity's ragdoll implementation in order to avoid any ambiguities between team members. There was a misunderstanding and team members used modded versions of our initial ragdoll causing merging problem afterward as well as unusable code.

The reason behind having a custom implementation was to have a hierarchy between objects. For example the hand is the child of the wrist, the wrist is the child of the forearm, etc. What it does is that it speeds up the lookup process for the parent joint. Instead of having to search through all gameobjects, we can just access the object's

parent directly. Unfortunately, this caused difficulties that will be covered later on this report.

Algorithmic Decisions

There were multiple ways to implement the desired spring effect. Our options were the following:

a) Use a static spring animation that is not influenced by force (Look: average, difficulty: easy)
b) Use euler explicit time integration with spring equations (Look: good, difficulty: significant)
c) Use euler implicit time integration with spring equations (Look: average+, difficulty: hard)

We first decided to go for option B because even though option A was easier better we felt that it we should use something within the scope of this class such as time integration.

What Worked and Difficulties Faced

The main difficulty we had was to use source control with Unity. All team members managed to complete their given tasks but merging them together revealed itself to be harder than we all thought it would be. When the time came to merge we realised that some necessary components for one task are supposed to be disabled for some other tasks. More precisely we had this issue when trying to merge the following tasks:

Reattaching a limb on collider contact
Spring effect on limb that is being pulled

The main problem we had when it came time to merge these two tasks were scaling problems. In task B we only deactivated the joint between two limbs while keeping the parenting relationship but in task A we had to destroy this link which caused the scaling to behave inadequately. The reason for this is that the scaling is relative to parent objects, so when we removed a child from its parent its scale changed as well, since it was now relative to the world.

At first, our spring simulation did not look as good as expected. There were lots of collisions between the joints and the bones which resulted in vibrations. Sometimes vibrations were so strong that it caused the model to “explode”. We were not able to fix this problem using our first model. The solution was to recreate a new ragdoll with different attributes and structure.

Additionally, communications problem could probably been avoided by using only one branch in our source control service. Having only one branch forces teammates to communicate throughout their changes if they want to prevent conflicts. For a project this size it would have been conceivable.

Balancing the Load

To balance the load we assigned different tasks to each team member, as multiple team members focusing on the same task could have been impractical for us since team members would need to be in very tight communication, which is difficult since we all have different schedules. Unfortunately this approach created some issues since it encouraged individualistic work over real teamwork, and thus resulted in poor communication which was eventually resolved after it came time to merge and we realised how vital effective communication and teamwork is.

Conclusion and Results

In conclusion, we realised that we had underrated the difficulty and the time it would take us to implement all the functionalities, **especially in a polished manner**. Nonetheless, we believe we have achieved a decent overall result with our project; that has certainly taught us the difficulty of implementing realistic physics animations and other related effects. We can only imagine the amount of work and the tuning necessary to simulate cloth using the spring model architecture as seen in class!