Analysis

Why does it need to use a computational approach?

First of all, I need to simulate gravity. This requires a lot of calculations every tick, way too many for a human to do it by themselves in a reasonable amount of time. Also it can become even more complex if there is a scenario where multiple wells act on the same object.

Secondly it needs to be able to share users own level designs with their friends, this needs to be done computationally because if it isn’t it would take the user a lot of time to draw and use it, whereas if it is does computationally you can share and run your friends level within seconds.

Thirdly it needs to be available to 30+ children of varying ability, where the teacher would need to print off and help them without it, they can now just show them all how it works on a projector and there will be little to no problems. This makes the teacher’s job a lot easier and frees them up to help children who really need it.

Who are the stakeholders?

I myself am a stakeholder because I have a vested interest in the quality of the program because my A level grade is determined by it.

The students are stakeholders in this because they have a vested interest in the quality of the product because their education depends on how well the program communicates the concept of gravity to them.

The physics teachers are stakeholders because they will be the ones using it to teach 30+ children at once, so every little bug in the program will be amplified thirty-fold. Therefore the program needs to be suitably robust so the teacher can spend more time helping them with questions about the physics and spend less time helping them with questions about the program.

The school is also a stakeholder because it is their children being taught and the school is judged on how well the children perform. Also if the children are enjoying the program then they will not be misbehaving, which makes it easier on the teacher and the school itself will be better off.

Research

*Gravity launch – URL:* [*sciencenetlinks.com/interactives/gravity.html*](sciencenetlinks.com/interactives/gravity.html)

Gravity launch lacks the feature of designing and sharing your own levels, this means the children cannot play around in an open sandbox with gravity so they will have a more limited understanding of the concept, whereas in my program they will have access to a level editor so they can try things they are uncertain about. Also then you could share the level you have just created with your friends, which will retain their attention more.

Gravity launch also takes a different approach on some matters, such as the thrust and angle gauges. While they do increase repeatability in their launches, I don’t think it is very intuitive and it feels quite clunky to use. So I think the way I’m approaching it (drag the mouse in the direction and magnitude you want the object to go in) is far superior because it is very simple to use and you can get a grasp of it very easily.

It also takes a different approach on the instructions of how to play, in gravity launch the instructions are just one big wall of text that is not very fun to read to say the least. My instructions will be short, sweet, and how pictures to help the user along. Hopefully then the students will actually read the instructions and not just see a big wall of text and think “it’s not worth it”.

*Gravity simulator – URL:* [*testtubegames.com/gravity.html*](http://www.testtubegames.com/gravity.html)

Gravity simulator also lacks some features such as there is no objective to collect. Without this vital feature it will struggle to keep the child’s attention for enough time to teach them the concept of gravity. This is why my program will have objectives on every level.

I think gravity simulator also has some bad features too, one being that it tracks where every gravity well and planet has been for the entire session, and this very quickly clutters up the screen and makes the entire thing look very messy and confusing. I do think that you should be able to see where the planets have been but there should be a cut off, you shouldn’t be able to see where they have been for the entire session.

Gravity simulator does have some interesting features though to its credit, one such example is it uses a modified version of the click and drag feature I intend to use, where instead of dragging in the direction you want the planet to go, you drag the opposite way. I like this very much and I may do it this way as it feels a little bit like you are using a slingshot to fire it in the other direction.

Another interesting feature is that you can change the strength and position of the gravity wells after you have placed it, this seems like a perfect feature to add into my level editor so that if they misplace one well they don’t need to make the entire level again. This will result in a lot less anger from the students and therefore will increase the fun and learning capacity of my program.

*Super planet crash – URL:* [*stefanom.org/spc/#*](http://www.stefanom.org/spc/)

Super planet crash, in my opinion, lacks a few features; such as you cannot share builds with your friends meaning that the students will get bored of it much quicker, this is a very similar problem to gravity launch so I will not repeat myself on this problem.

Super planet crash also has some bad features too, one such example of this is that your planets cannot go beyond 2AU from the centre star. While I recognise that it is what makes the game challenging, I think it hinders the children’s learning by making it a more confined environment and you cannot experience some of the things gravity can do, like slingshot planets around a star extremely quickly.

Another bad feature is that if you spawn in a larger planet it will attract a smaller planet, while this would make it more accurate, I believe that it will make it too complex for the children to deal with or use properly.

One interesting part of super planet crash are the aesthetics it has, they are very simple and pleasing to look at, I also like the faded look of the tail of where the planets have been. I think I may take some design inspiration from this.

*Questionnaire – questions*

1. Do you have any trouble teaching the concept of gravity to children?
2. Are there any specific misconceptions that always crop up when teaching the topic?
3. What kind of resources do you use to teach the students about gravity?
4. What do you think of them?
5. If you don’t already, would you prefer to use software as a resource?

*Summary of the answers*

1. Being able to physically see gravity affecting the planets seems to be something the teachers want, I could perhaps do this by adding an option to see arrows of what forces are acting on an object.
2. They seem to think that gravity is the same magnitude on every planet. I could solve this by having different strengths of gravity well available.

They also seem to think that gravity is a universal down force and not a force that pulls to the centre of mass. Luckily the whole concept of my game will dispel this misconception.

They also seem to think that there is no gravity on the moon, I can dispel this misconception by talking about it in some of the explanation.

1. Teachers seem to rely on more practical demonstrations of gravity, but air resistance can get in the way of that and cause a bit of confusion with the children. They can combat this with vacuum chambers but they are very expensive and some schools cannot afford them.
2. They seem quite content with what they have at the moment, but they seem to be very open to using software though.
3. Yes, they would find it useful for demonstrating things they cannot show in class, like things that have a different gravity to Earth.