Team 8 DCC Report
"Mind's Minions"

Kunya (G6)
Poom (G6)
Arsineh (G7)
Int (G8)
Antonia (G9)
Mind (G10)

Inquiry and Analyzing

Design Brief:

For this year's Design Cycle Challenge week we must create a Rube Goldberg machine that contains at least three actions connected in a chain reaction, two potential energy sources, make sure that incorporates the assigned topic, in our case, an image of what we decided to describe as Binary numbers, and finally that demonstrates our collaboration as a team and creativity.

Research:

What is a Goldberg Machine?

Named after the American inventor Rube Goldberg, the Goldberg Machine is an invention that performs simple actions in quite a developed and complex way, and most of the times include a sequence of reactions where the objects involved, cause consecutive reactions.

Potential Energy VS Kinetic Energy

We must have some knowledge about the different types of energies that are being incorporated in our Rube Goldberg Machine to be able to understand the science behind the machine's functions: For one side, the Potential Energy is the energy is when you give energy to an object, where you expect to get a reaction, and that reaction is called the Kinetic Energy. It is basically stored before it's released and there are effects expected afterwards. Whereas Kinetic Energy is the energy in motion, therefore, everything that has motion is considered to be Kinetic Energy.

Isaac Newton's Laws of Motion

The Laws of Motion written by Isaac Newton during the late 1770s will help us to develop a better and more successful machine since it gives us a good understanding that can be applied to our machine.

1) *Every object in motion tends to remain in motion unless an external force is applied to it: every object will remain at rest or continue to move at a constant speed unless an outside force interferes with it.*

2) *The relationship between an object's mass (m) its acceleration (a), and the applied force (F) is F=MA: if a force acts on an object, the object will accelerate in the direction of the force. The greater the force, the greater the acceleration and the greater the mass, the lesser the acceleration.*

3) *For every action there is an equal and opposite reaction: when an object is pushed or pulled, the force meets with an equal opposite force (the reaction force).*

What are the binary numbers (our topic):
In computer science and math, they are numbers made up out of two digits, typically '1' and '0' to represent numeric values. The system is the foundation of modern technology of computers and is used to decode or trying to explain a message.

The sources we used include: Websites, videos, books, mini Interview (to Mr. Chris V) and articles*

Plan:

To create a Rube Goldberg machine, as a group, we need to consider the assigned visual stimulus and look for inspiration according to that. Then we must plan and mostly brainstorm about the ideas we have and some simple task to begin with, such as slopes, stairs or dominoes falling, to make sure it works. Once we have successfully achieved that small goal, we should proceed to add some functional elements such as levers, pulleys, rolling balls, ramps, rubes, etc. After we've created more than a simple basic machine and test it repeatedly number of times (making sure it works), we need to look for some examples to add some 'difficulty' to the process (new mechanics, for example).

Materials we will use for our machine:
-KIS Dominoes
-Science books
-Broken PC base
-Future Board
-String
-Clay
-Toy racecar track
-Marbles
-Other often used materials (scissors, tape, glue, etc.)

Design Specifications:

The table below shows measurable/ objective design specifications and test statements that describe the way our machine will work and look like, as well as how we will test that specification.

Design Specification	Test
Our machine will be based on our assigned visual stimulus	Since we've been assigned with a specific image to use as inspiration for our machine, our Rube Goldberg machine will be based on Binary numbers
It will contain at least three actions	We will make sure that it contains at least three different actions throughout the whole thing
It will be started and ended with a group of dominoes stacking	We will start and finish our machine with five or more dominoes so that it's easy to connect to the other groups
It will contain at least two potential energy sources	We'll make sure to include two potential energy sources to our machine, such as the marble rolling throughout the machine. This is so that our design can have better ideas and development.
It will connect to groups # 7and #9	It will be connected to these two groups' machines so that it is a whole big piece of work made by the entire school
It will be able to work by itself	After the starting pieces (dominoes) are hit by the group before us, the machine will be able to work by itself with no one interfering
It will fit in the space provided by the school	As the school has provided a determined space for each team to create their product, we will make sure our machine fits in that space
It will include at least 8 different materials	We will try to fit as many materials as we possibly can to our machine so that it has more variety in terms of the actions it performs

DEVELOPING IDEAS

Design Ideas and Changes (process Journal)

Day 1, Tuesday 12:

Today was the first day of our DCC week, and we were told to come up with a brainstorm of ideas for our machine as well as some research. Today we actually had many ideas as a group about what our picture seemed to be for us, where we can include the main two ideas that we got, which are binary numbers and coding. We also looked at some Goldberg machines on YouTube and got some inspiration and ideas from it. After we gathered all of our information, we decided to brainstorm and discuss again about what we found out while researching and what we can actually apply to our machine. Today we actually had some troubles on finding how to give altitude to our machine and even after we asked some teachers, it wasn't possible for us to do it, so we finally opted for using a different method rather than the one some people had suggested and we still managed to achieve out goal. Our first design consisted of:

Design #1

1) Dominoes falling and at the same time gaining altitude with the help of books
2) Marble that goes down through a small ramp that goes from the books to the floor
3) Rolled toilet paper that would eventually be pushed by the marble and be unrolled with a message on it
4) Push other several connections that we have
5) End up with dominoes again

Day 2, Wednesday 13:

On day two, as a team, we progressed a lot compared to the first day, since we successfully put our ideas together and make it as a whole, which would eventually remain the same until the last day. We took some time on trying to find the design we wanted, but we managed to do so and we were quite happy with it. We decided to discard the idea of the toilet paper rolling and the final design came up to be like this:

**Broken PC part where we incorporated the marble that finished the whole thing*

Design #2

1) Dominoes falling and at the same time gaining altitude with the help of books
2) A car connected to the dominoes that goes through a ramp at the same time as the dominoes
3) The car which ended up by falling, hits a book
4) The book hits another two books
5) One of the books had a domino attached to it, which made the rest of the dominoes fall
6) The last domino has a string attached to it and when it fell, it also took one piece of clay that worked as a support for the marble on top of another ramp, which was settled inside a broken part of a PC (which we used specifically because it represented our topic of computer coding and binary numbers)
7) The marble rolls through the rest of the machine until it gets to another group of dominoes
8) The last group of dominoes falls and finally connects to team #9

Day 3, Thursday 14:

On our third day, the design that we came up with on day two didn't quite change. The only thing we did was to improve some of the techniques we used to make it go by itself and to add the binary numbers topic to it, where we painted the dominoes in green and added "1's" and "0's", so that when they fall, those numbers will appear. We also worked on the report and gave the final details to out Rube Goldberg Machine.

Day 4, Friday 15:

All of the testing took place today and I believe that we did quite a good job, since most of the times it ran by itself without any member of the team interfering. Our group is definitely not the one that has the most amazing mechanics, however, I do think that the way we incorporated our topic to it, was really cool and most important, it worked.

CREATING THE SOLUTION

Representation of the image to our machine

As I've already mentioned, there are three parts of the machine that fully represent the assigned visual stimulus we were assigned to represent, and these include the painted the dominoes in green with binary numbers (1 and 0) written in there, located in the very beginning of the machine. We have also added a broken PC, which represents our theme just as well, representing computer coding and binary numbers as well. Finally, one of the coolest things that we added to our machine were the dominoes being coded, which if translated, we would get a translation of the word DCC or Design Cycle Challenge.

EVALUATING

Did we follow the design specifications successfully?

Our group successfully followed the design specifications to achieve the main goal we had as a team, where we:

✓Built our machine related to our theme about the binary numbers and technology (more specified in the section above, as well), which I personally think that worked out pretty well and was very creative.
✓ It contained more than three actions (about nine actions in total)
✓ We started and ended with dominos in order to connect to the other two groups beside us.
✓Talking about the potential energy we incorporated to our machine, we have the dominos to pull out the trigger so that the car could hit the book, as well as putting up the books and let the book hit the dominos that are in front of them so that the dominos could trigger the clay and let down the marbles to hit team 9's dominos.
✓It was connected to both group #7 and #9
✓When we had the final testing, it worked by itself, and for the other tests as well, with small helps
✓It all fit in the space provided
✓It had more than 8 materials in the machine

Changes through the process

During the Design Cycle Week we made a bunch of different changes to be able to achieve out goal and have a good Rube Goldberg Machine that worked properly. These changes happened due to all the ideas we were constantly getting everyday to improve it.
At first we brainstormed about some actions we wanted to include, but for different reasons we weren't able to carry them out, such as using an iPhone app and connect it to the computer, which allows it to turn on without any touching. Also, having visual elements that would allow other people to know what our topic was (a board with "Binary" written on it or small pieces of paper with 1's and 0's on them that were supposed to fall as the machine worked). I also remember about the rolling toilet paper with text on it that we were going to add and finally the balance scale (which I noticed that many people used to gain altitude), but sadly, we couldn't get to do it.
There are other several changes that we went through that are more like technical and make improvements to what's already done, where we can include adding weight to the top of the domino so it falls with less difficulty and lining the dominos differently so that it's easier to fall.
Overall, our machine went well after trying it repeatedly number of times and made many changes to it. We feel comfortable with the final result and the machine worked well most the trials.

Possible Improvements

The machine could have been improved by making the car stable since we have problem with the car falling down the rail before time since the clay is not sticky enough. However, when we stick the clay onto the rail too hard when the domino hits the clay doesn't move so it doesn't trigger the car to hit the book. Another problem we needed to face was the book and the dominos are too far apart. Since we lay out the book far apart from the dominos, the book can't hit the dominos so we had to move the dominos closer/ next to the book so that the book could hit the dominos and fall. We could also develop the machine to work better and have more tactics like the other groups.

Overall

This DCC was surely a big task and a big challenge for all of us, of course that in different aspects, but every group managed to come up with a great machine that worked very well (shown in the final testing on Friday). The challenges we faced as a group always had a solution, and example of small challenges was being able to stop the dominoes from falling every time, since the possibilities of them doing so, increased two times; if either of the group dominos fall one of the group beside would fall too, but despite the number of times that it fell, we would always work as a team and help each other. There are also some big challenges that we faced, where we can include what I already mentioned about the balance scale, but as I said, it always had a solution. We enjoyed this four days of Design Cycle Challenge, since it was extremely fun and sometimes challenging. I personally think that working with other houses was a really good thing to do as well. I hope next year's DCC is as fun as this year!

Works Cited

- "Types of Energy." *Enwin Kids Zone*. N.p., 2007. Web. 15 Nov. 2013. <http://www.enwin.com/kids/electricity/types_of_energy.cfm>.
- "Kids Math." *: Binary Numbers*. N.p., n.d. Web. 15 Nov. 2013. <http://www.ducksters.com/kidsmath/binary_numbers_basics.php>.
- "How to Build a Homemade Rube Goldberg Machine." *WikiHow*. N.p., n.d. Web. 15 Nov. 2013. <http://www.wikihow.com/Build-a-Homemade-Rube-Goldberg-Machine>.
- "10 Brilliant Rube Goldberg Machines." Cool Material. N.p., n.d. Web. 13 Nov. 2013. <http://coolmaterial.com/roundup/rube-goldberg-machines/>.
- "Six Rube Goldberg Machines." *YouTube*. YouTube, 26 May 2009. Web. 15 Nov. 2013. <http://coolmaterial.com/roundup/rube-goldberg-machines/>.