

## Design Cycle Challenge Week 2013

Our design is very complicated to produce, yet also simple to re-create. It starts off with a book staircase with dominos on it. Then the final domino hits a ball in to a cup that pulls the straw away from a marble on a ledge. The ball falls down until it hits a domino that goes behind the ledge to hit another marble down another ramp. The marble will then hit another domino that is stopping the string which is attached to a Swiss army knife that will fall down the pipe and pops the balloon. The pressure from the balloon when it pops will then force the dominos to fall by them selves and this is connected to the next group.

### Design Specifications

1. We must time our final product to see how long will it take for the Rube Goldberg to be completed (no longer than 40 seconds)
2. We must use at least 1 pulley system in our Rube Goldberg machine
3. There must be a balloon that pops in our machine
4. We must build something that includes the incline place machine.
5. All dominos must fall by its self continuously without any interruptions.

### Design Specification Test Statement

1. We will use a timer to time the process of our Rube Goldberg.
2. We will create a pulley system by using a string, pulley, and two cups.
3. We will figure out a method that will force a needle/pin to pop the balloon
4. We will use a protractor to measure four inclines to be 20°. Four inclines will be attached to a rectangle future board.
5. We will test our Rube Goldberg machine to make sure that all dominos and other machines work without any interruptions

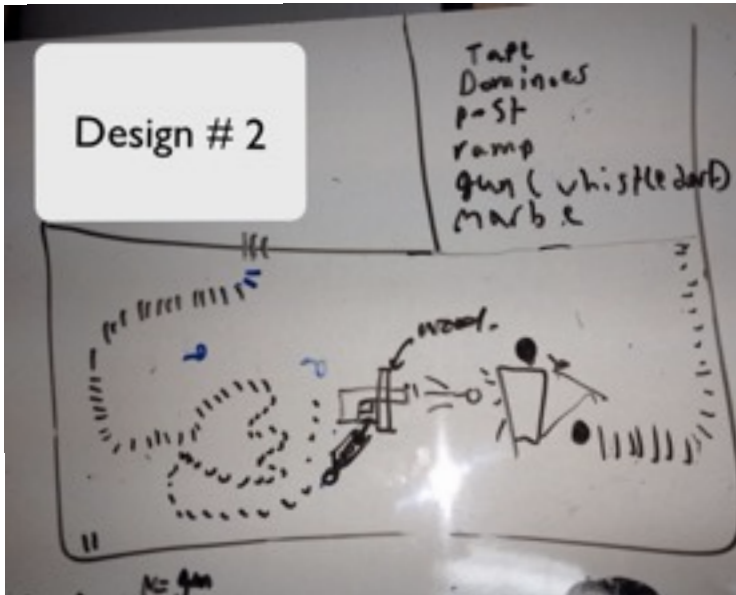
### Our designs

#### Design # 1

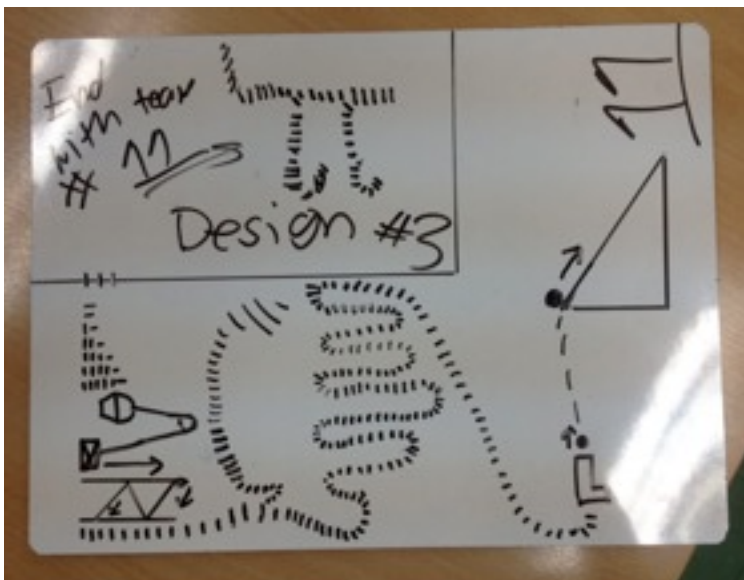
The first design was really simple. What we were doing were putting down ideas of what our Rube Goldberg machine would look like. We had not go through the 7 types of simple machines that were posted on the website yet. This was pure critical thinking/brainstorming. What we planed was to start with dominos then a gunshot (nerf gun). The force of the bullet will then cause a marble to fall down a incline plane due to the resistant and force of the incline. It will then hit another set of dominos which is connect to another group.



## Design # 2



The second design was developed from our first design. We had not thought about how the Nerf gun is going to trigger the bullet. That is one of the changes we thought of making during our second design. We thought of attaching a string to the trigger but we still have to think of how the string will pull the trigger. The reason we chose to use a Nerf gun is because the theme of our Rube Goldberg is a fingerprint or crime scene. The second change we've made was to make the domino shape of a hand. This was based on the theme of our machine.



## Design # 3

If we compare our third design to the two designs previously. This design is very developed and there were more ideas. During the making of our third design, we realized that we must use parts of the 7 types of simple machines that was posted on the website. We chose to go with the pulley and the inclined plane since they are the two most common and it also meets our design specifications. We chose to create the pulley by using two cups. The domino at the start will force the marble to fall down one cup which makes the second cup rise. The second cup will then hit another marble and this marble will fall down four inclined plane that is attached to a future board. It will then hit a set of dominoes and spread in two directions. One will create a zig-zag while the other one is attached to the end of the zig-zag. It will continue and trigger the gun down another inclined plane and connects to the next group.

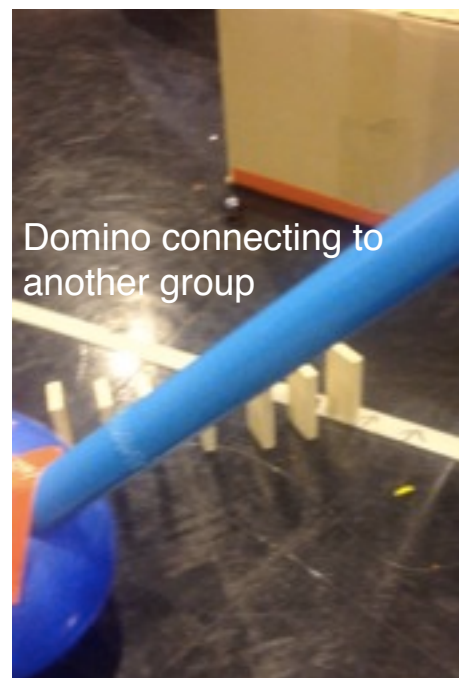
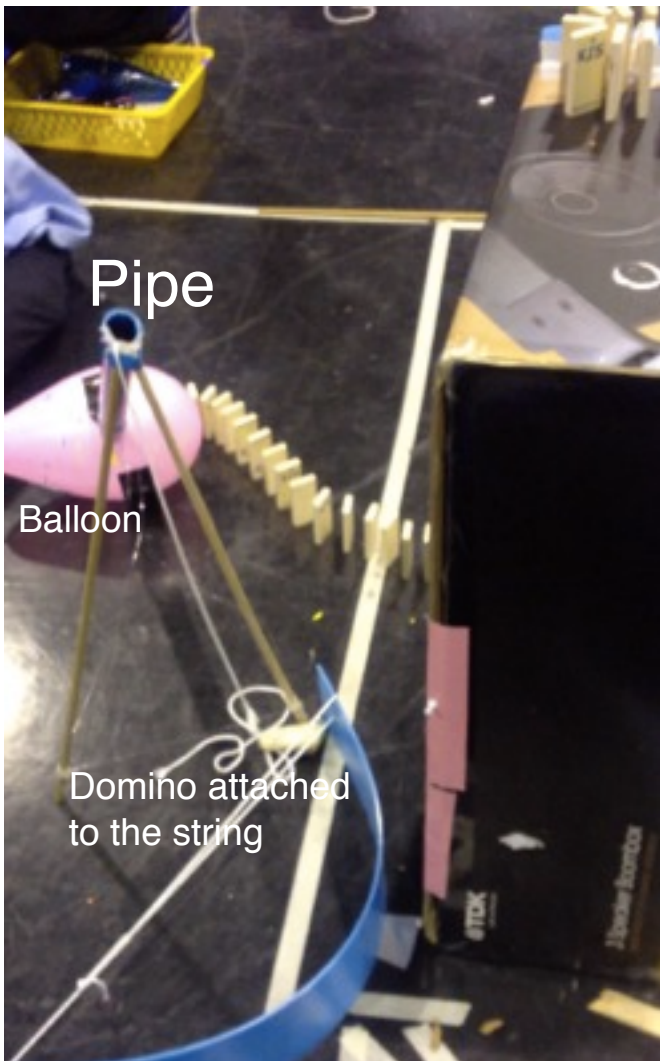
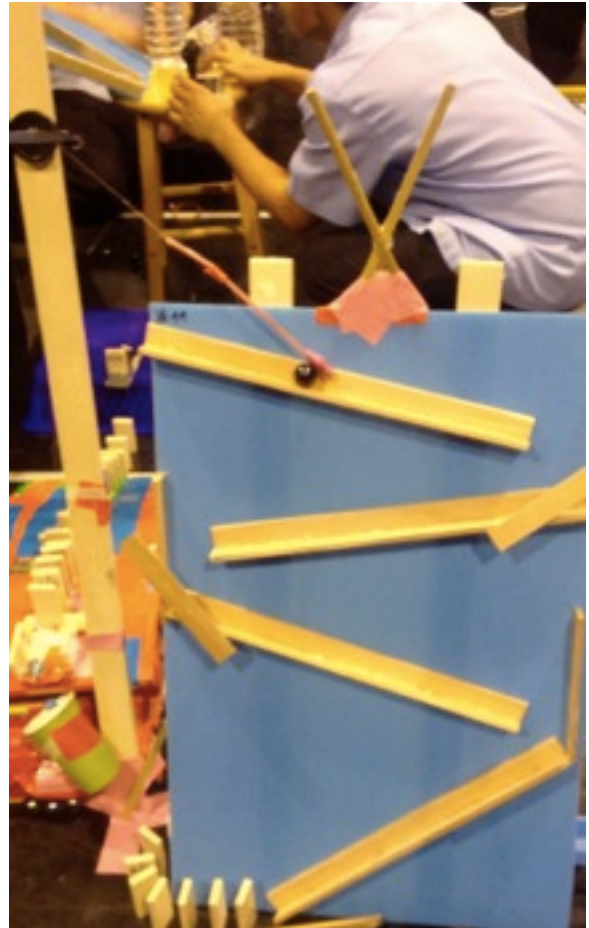
However, we did make some changes. We did not use a Nerf gun or create a zig-zag domino because there wasn't enough dominoes for us and there were complications with how the trigger will work since it was really stiff.

Although, we went with the final design because it was further developed than two previous designs. The machines that were going to be used also meet our specifications and the design seems to be easy to create and re-create.

### Creating the Solution

Our machine does function perfectly with the other group. The dominos were properly placed to connect with the following group. Our machine worked without any interruption once. There weren't any major complications. Only minors like the domino that was attached to the string fell but the string is still begins stopped even though the domino fell. However, we did figure out a solution and it worked perfectly well.

### Our Rube Goldberg





## Evaluation

## Design Specification Achievement

We have achieved 80% of our goal. We did use a pulley and an incline plane in our Rube Goldberg machine. We also included a balloon that pops itself using a Swiss army knife due to the force of the knife falling down the  $0 > 90$  degree angle. The Rube Goldberg Machine also worked without any interruptions. However, we did not test how long our machine was and that is why our goal was not 100% achieved.

## Changes that were made throughout the design cycle process

There were *a lot* of changes that we've made through out this process. We did not completely follow our third design because we had better ideas and there were some complications that weren't also working such as the trigger as a major difficulty. Since our theme is crime scene, we chose to use an army knife to pop the balloon which also creates a loud noise as well. That was our solution instead of using a nerf gun. We've made changes like the angle of the pipe given more force to the army knife when falling to pop the balloon. The angle of the pipe was  $0 \leftrightarrow 10$  degrees and there was not enough force so I decided to make the pipe  $45 \leftrightarrow 55$  degrees instead. This will give more resistant and force to the army knife as it slides through the pipe.

## How the machine could have been improved

I honestly think that we did not have enough time to brainstorm as much as we can down. If we have had more time, our final product would have been more creative and interesting than it was. However, I think we did very well. Although, some improvements we could have made was moving objects after each trial *if there were still complications like interruptions* for consistency when testing it again. Another improvement that we could have made was making sure than there was enough force for the marble to fall down an incline, turns in a semi-circle and hits a single domino that is stopping the string which is attached to an army knife that will pop the balloon. The domino did fall, but it did not stop the knife from not falling. This is because there was not enough force when the marble is falling the incline. *If the inclined was more angled to  $45^\circ$ , there could have been more force.*

## Evaluation the team

I think that we all did very well. We all helped each other throughout the making of our Rube Goldberg Machine. Everyone had their own job to work on and fix on but we did communicate about the things that might not work and we have to change it. However, during the process of brainstorming ideas. Atom and Sammy were extremely creative. I added more ideas down as I was drawing a diagram of how the machine could look like. There were arguments like disagreements between Atom, Sammy and myself because we either don't think it's too challenging etc. However, Sabi and Yuhan have been really quiet throughout the brainstorming part of the design cycle week but they were really good at what they were suppose to do. They were great at building the domino track and that was really helpful because the rest of us were busy building other parts of the machine. In conclusion, we all have different jobs to finish during the making of this Rube Goldberg machine and everyone did very well with what they were suppose to do. We all listened to each other even though we disagree and we try to find a solution to it.

Works Cited

- "The Cereal Feeding Machine." YouTube. Jacksgap, n.d. Web. 12 Nov. 2013. <<http://www.youtube.com/watch?v=Hk8o1OXRZ1g>>.
- "How Is It Made?" Interview. How Is It Made? Discovery Channel. Discovery Channel, New York City, New York, n.d. Television.
- "Hundred Must See Domino Tricks." YouTube. DominoKing11, n.d. Web. 14 Nov. 2013. <[http://www.youtube.com/watch?v=F\\_tYwwsJXF8](http://www.youtube.com/watch?v=F_tYwwsJXF8)>.
- "Insane Domino Tricks." YouTube. Hevesh 5 and Million Dollar Boy, n.d. Web. 12 Nov. 2013. <<http://www.youtube.com/watch?v=ARM42-eorzE>>.
- "What Is a Pulley." YouTube. MocomiKIds, n.d. Web. 12 Nov. 2013. <<http://www.youtube.com/watch?v=LiBcur1aqcg>>.