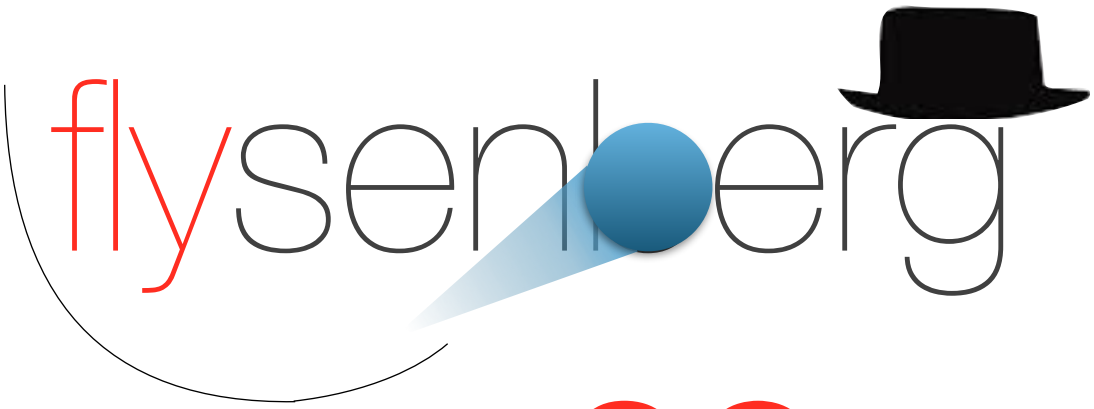


team28

design report

denim // zoey // jean // byte // pranav

inquiry + analysis

design brief

We created a complex machine with 6 actions and 3 potential energy sources. After collaborating together and developing our chosen idea, we settled on the current machine with many tweaks and improvements, and inputs from all parts of the team. It relates to our object of inspiration through dominos, color, combination of curves and jagged lines, and through it's creation.

research + inquiry

questions

1. What is a Rube Goldberg machine?
2. How do the 6 simple machines work?
3. Where does our object of inspiration come from?
    1. In which ways can we fit that into our design?

answers

1. A Rube Goldberg machine is "a comically involved, complicated invention, laboriously contrived to perform a simple operation." *(Webster's New World Dictionary)*. It's origins are in the cartoonist Rube Goldberg's funny machines that were designed to make simple tasks work through hyper-complex machines. He also sometimes displayed messages through them but the most popular ones were for comic effect. Most of his work is interpreted today as showing the "promise and pitfalls of technology" (Source 5). Many people around the world build advanced Rube Goldberg machines using a combination of some of the simple machines along with other materials.
2. The 6 simple machines are:
    1. **Pulley**: A grooved wheel with a string through it and objects attached to either side. The objects can be used to counterbalance each other. Elevators use this system.
    2. **Lever**: A straight plank placed on a fulcrum, the point around which the plank pivots on a horizontal axis. It is used in see-saws and can be used to start rolling objects using weights.
    3. **Wheel/Axle**: Two cylinders spinning around a rod. Thing can be placed on the rod or 2+ sets of rods to create a land based vehicle.
    4. **Inclined Plane**: Simply a flat surface rotated on the horizontal axis. It can work as a ramp or a grade for lifting up or lowering things safely (marbles can roll on them).
    5. **Gear**: A toothed object that interlocks with other objects to rotate them. It also works with chains to transport kinetic energy over long distances.
    6. **Wedge**: has two uses: the first one is a portable inclined plane, and the second one is to be used as a separator (the sharp/thin edge goes in and separates the material).
3. After conducting a google image search, we found a website describing our object of inspiration, and we found that it was a dress for a fashion show by Daniel Widrig (Source 1). He explores the intersection of art and craft. He uses jagged edges to create a circular pattern of the dress. We can incorporate this into our design, using a mix of technology and creation, with fashion and art. One way is to create a ramp that lets our marble fly, creating an arc behind it, and the ramp also being in a curved format, material constraints would force us to leave straight and jagged edges.

bibliography

1. Advertorial Post. "A look at three creatives taking part in COLLECT by The Crafts Council." *It's Nice That*. It's Nice That.com, 3 May 2013. Web. 14 Nov. 2013. <http://www.itsnicethat.com/articles/crafts-council-collect-2013>.Agnes, Michael. "Rube Goldberg." *Webster's New World Dictionary*. 2003. Print.

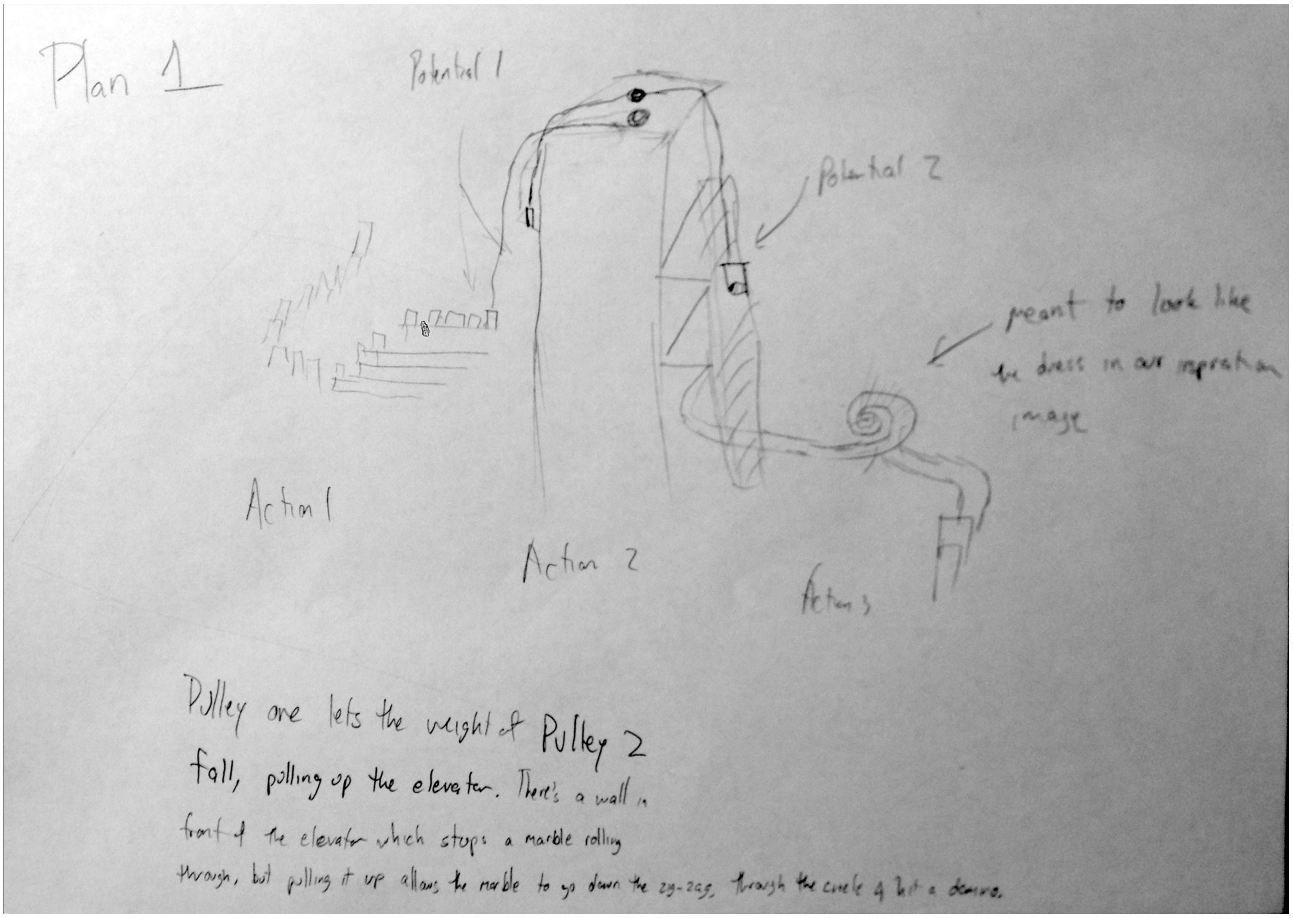
2. Breithaupt, Jim. *Physics*. 3rd ed. Cheltenham: Nelson Thornes, 2001. Print.
3. Chaichanawanich, Nanut. Personal interview. 12 Nov. 2013.
4. HV14. "7 Types of Simple Machines Flashcards." *Quizlet.com*. Quizlet, 2013. Web. 14 Nov. 2013. <http://quizlet.com/12552322/info>.
5. "Rube Goldberg : Home of the Official Rube Goldberg Machine Contests." *Rube Goldberg*. N.p., n.d. Web. 14 Nov. 2013. <http://www.rubegoldberg.com>.
6. "Rube Goldberg machine." *Wikipedia*. Wikimedia Foundation, 13 Nov. 2013. Web. 14 Nov. 2013. <http://en.wikipedia.org/wiki/Rube_Goldberg_machine>.

design specs

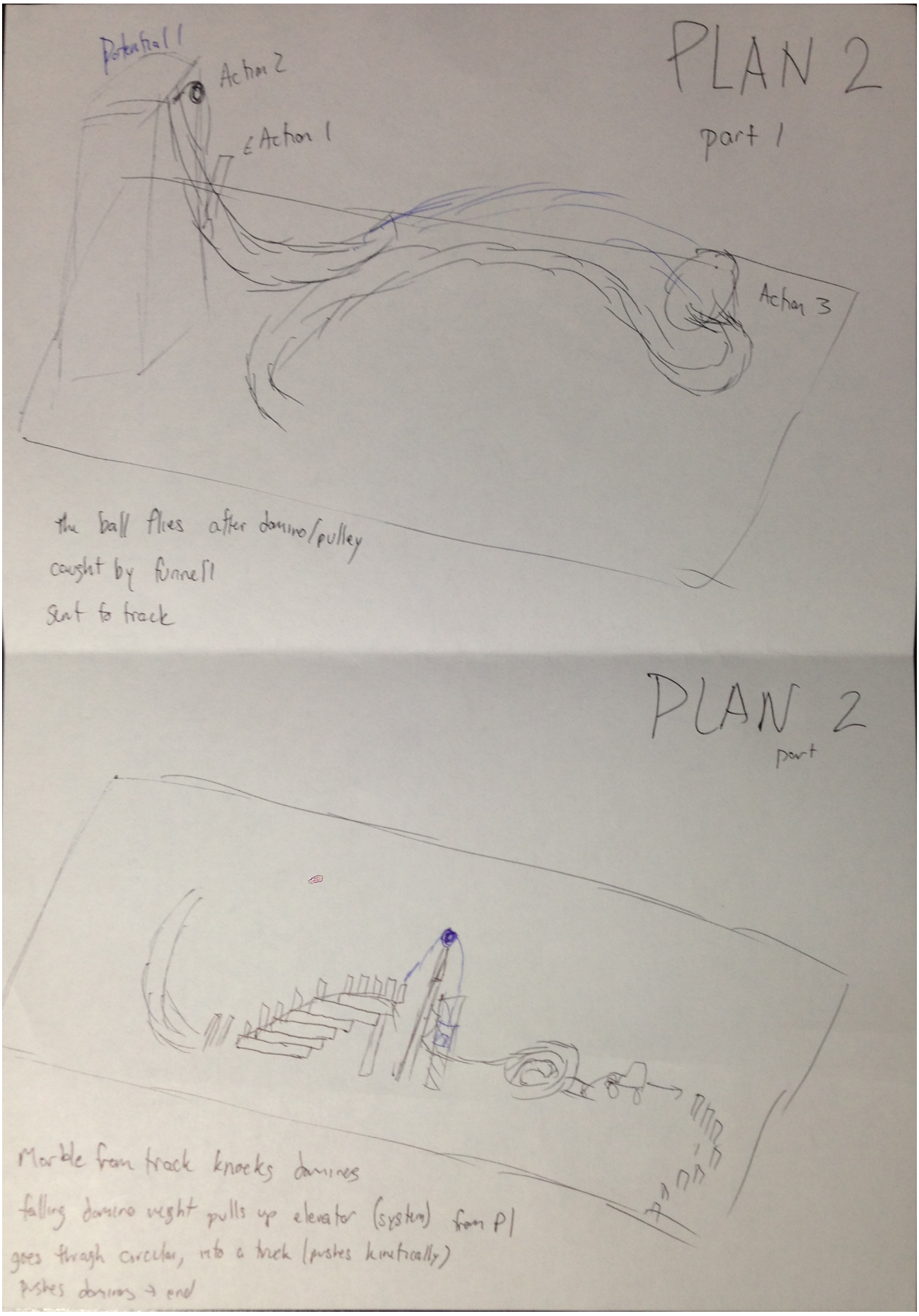
1. It should be a Rube Goldberg Machine with at least 3 processes.
    1. We will define separate processes, then count the number, and compare it against the spec
2. There should be 2 (or more) sources of potential energy.
    1. Find objects that remain still until released and use their potential energy and count them.
3. The consistency of the machine should be at least 3/5 (60%).
    1. We will run the machine 5 times and count the times it works without human intervention
4. 3 or more of the simple machines of physics should be used.
    1. Observe and count the number of simple machines part of the machine.
5. It should reflect our object of inspiration in some way or another.
    1. The design should reflect and show the how the object of inspiration affected the design.
6. At some point of the machine a certain part must be in a free flying state.
    1. Run the machine and see if any moving part is moving through the air without assistance

developing ideas

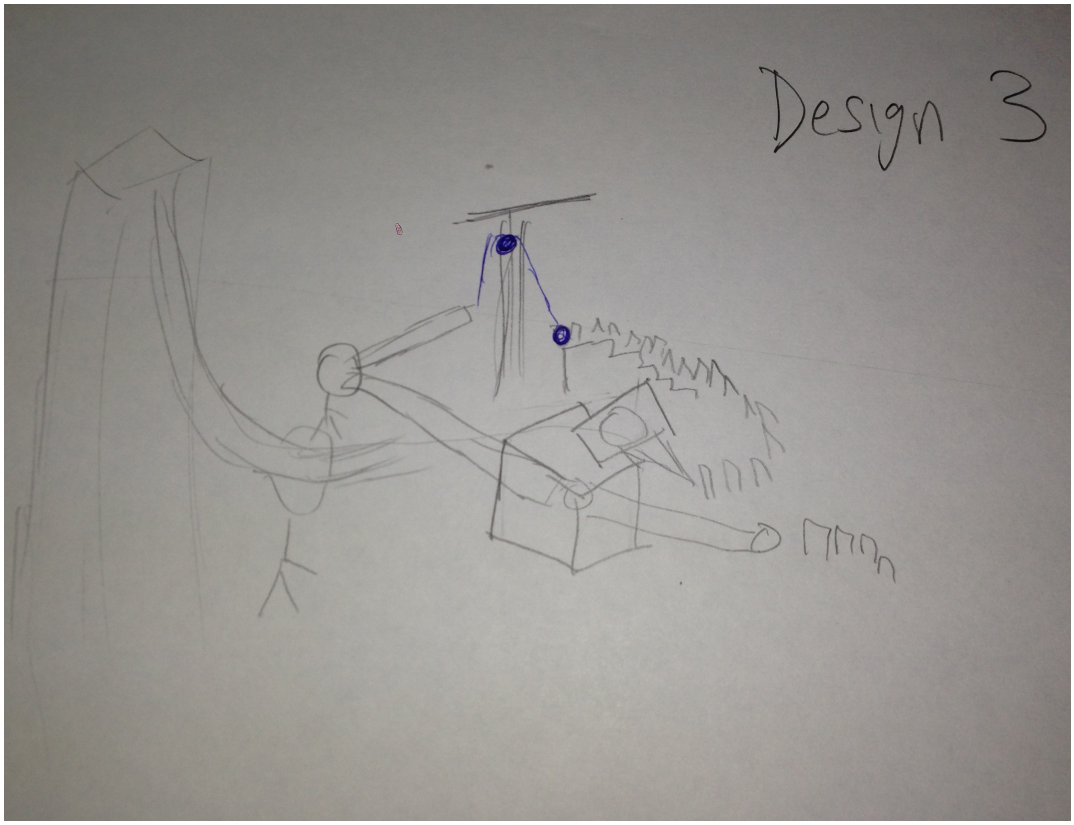
design one



design two


Potential
Action 2
Action 1
PLAN 2
part 1
Action 3
the ball flies after domino/pulley
caught by funnel
sent to track
PLAN 2
part
Marble from track knocks dominos
falling domino weight pulls up elevator (system) from P1
goes through circular, into a track (pushes kinetically)
pushes dominos → end

design three



details and final choice

Design one is fairly complicated. A few dominos fall in sequence and one is connected to a pulley, pulling up an elevator on the other side which frees a ball to fall through a “zig zag” sequence, into a circular descender, to hit more dominos. More or less the only way it connected to our object was going to be by how we dressed up the circular part.

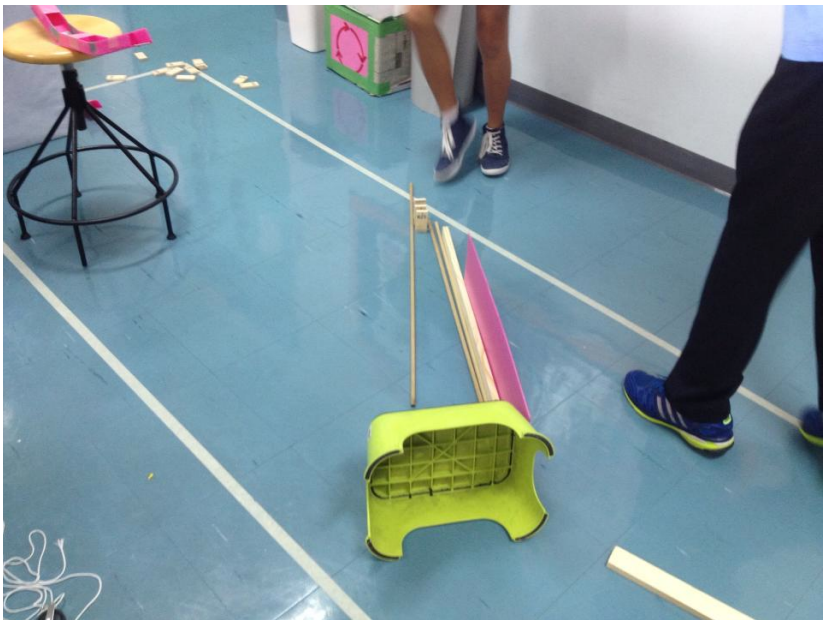
Design two is much closer to our current design but not completely there. The flying part is over estimated, and theres a track that goes around and hits a domino to start the elevator, down the circular descender, into a truck, to hit dominos. Once again we don’t have much connecting the two, and when we tried to build it, there wasn’t really enough space, and most parts were conducive to failure. Thats when we created design three.

Design three is almost completely the final design. The only differences from the final design are that we replaced the direct domino line from the cone with a track, and the final push from changing from a PVC pipe to a Pendulum hitting the final domino. It also reflects the design more because it has many circular parts, we dressed up the dominos in outfits, and also created it in a similar manner to the dress itself: we planned it and executed it immediately after, only tweaking two parts later on.

Our final choice was Design Three because really our design process led us to it. We created a few plans and really iterated upon the past ones by building them and figuring out what was wrong. The final one also reflects a lot of the object of inspiration and our objectives in making it. We wanted to make it extravagant and give it the “cool” factor which we did with the flying marble. It’s different but we like it and it works most of the time so that’s good.

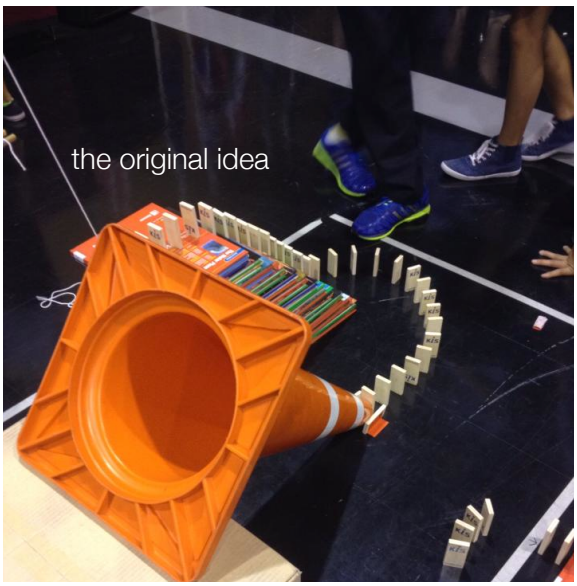
Design one really fails that specs as it misses the part about the usage of 3+ simple machines, doesn’t reflect the object of inspiration too well, and doesn’t have a flying part, and wasn’t very consistent either. The second design doesn’t really meet the one about the simple machines, but the only other issue it really has is with consistency, which we weren’t too sure about. The final design is good because it uses three machines (pulley, inclined plane, lever) and was consistent 3/5 times in the first trials and 4/5 times in our later trials. That’s why we settled on Design Three.

creating the solution

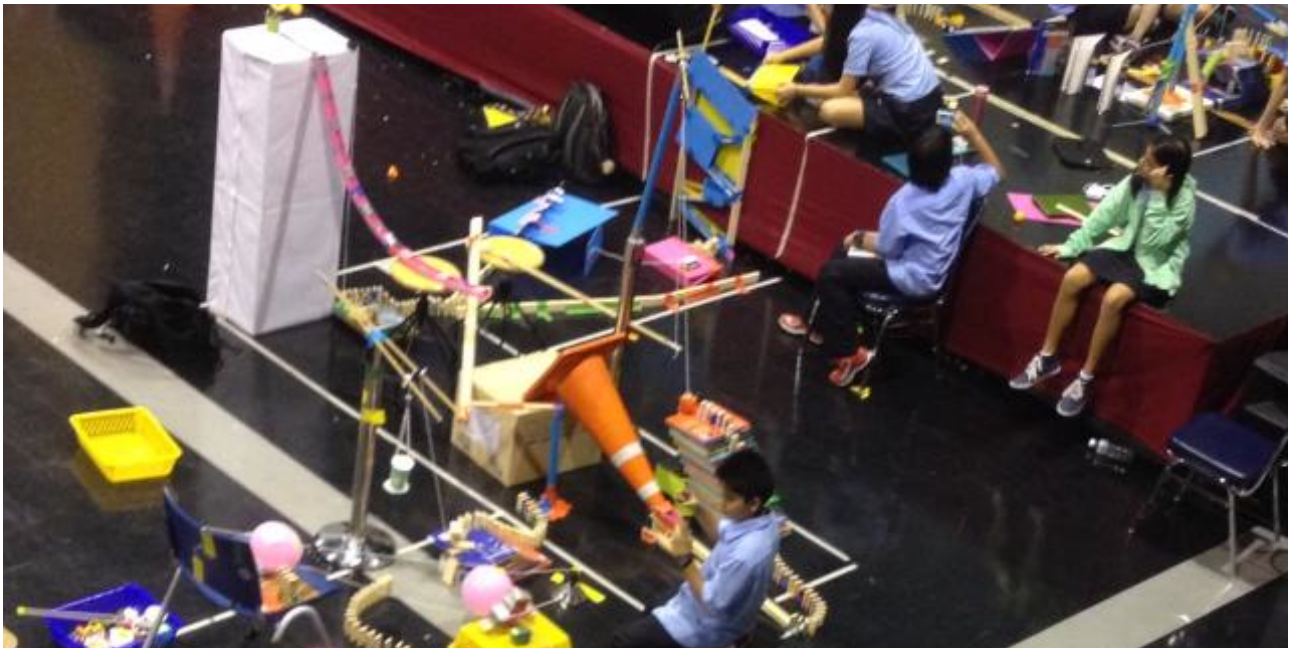


Testing the ramp for design 2

the track from the alteration of the final design


the original idea


the pendulum ending in action



evaluating

evaluation of machine against design specs

1. It should be a Rube Goldberg Machine with at least 3 processes.
   - It has 8 actions so it goes above and beyond the spec (Dominos, Ball flies, Caught & Tracked, Dominos, Pulley/Track, Ball track, Pendulum, Dominos)

2. There should be 2 (or more) sources of potential energy.
   - There are 3 sources of potential energy (Ball on top of ramp, Ball on track, Pendulum)

3. The consistency of the machine should be at least 3/5 (60%).
   - We got exactly 3/5 (60%) in our consistency test and later on achieved 4/5.

4. 3 or more of the simple machines of physics should be used.
   - The machine contains a pulley, many inclined planes, and a lever. (and a pendulum if it counts)

5. It should reflect our object of inspiration in some way or another.
   - It reflects our object of inspiration in many manners as described previously.

6. At some point of the machine a certain part must be in a free flying state.
   - The machine starts out with a flying ball.

changes in the design

Day 1:

1. We build and try out our first design
2. We realize it doesn't work so we dismantle it and work on our next design.
3. We create the flying part of the ramp as our second design.
4. We develop and create our second design to incorporate it.

Day 2:

1. We modify our second design to try to make it work better.
2. The second design is built.
3. After running it a few times we realise it is too inconsistent.
4. We use our third design and start incorporating elements from the second design so we don't have to start from scratch.
5. We finish our third design.

Day 3:

1. We run our third design a few times.
2. We modify the part from the cone to the ramp with a track and change the ending to add a pendulum.
3. The consistency test is run (3/5).
4. Finish, painted, and dressed up dominoes are added to the machine
5. We try swapping out the future board ramp with wood but it doesn't work.

Day 4:

1. A few morning runs show us that we need to alter the pendulum design to make it more consistent and also recalibrate the ramp.

improving the machine

I give this machine one word for improvement: consistency. We really could have ramped up the consistency if we had one more day as we didn't have enough time to simply go through the design cycle a few times and get the machine completely right. I think we should have worked on consistency more though.

We could also have made the machine more inspired by the object of inspiration. Our final design doesn't make it obvious how the design was inspired by the object of inspiration or if it was simply discarded. We did make our thinking process similar to the creators of the dress and also dressed up our dominos. We could also have interpreted the image in a more abstract manner and then changed our design to include it or even have created some sort of ramp that looked like the dress and reflected the image.

Finally, I would say the machine could have had more spark or life to it. We were trying to get the ball to take more time and space flying through the air but weren't able to edit the design to make it go further. It is complex but it doesn't take too much time or have too much of an impact. This also affects how it reflects the object of inspiration as it is very starkly different from everyday dresses and makes it clear, unlike our design.

a few notes of feedback from pranav

Firstly I would like to thank all the teachers involved in making this DCC work and reading all of the reports on the weekend. However I would like to give some constructive criticisms of this year's DCC. I know that there were issues with the school being closed for a day but I think there are a few major areas that could easily have been improved. This DCC was definitely too report heavy. The concept of DCC Week is supposed to be for the students to go through the Design Cycle and have fun but I think the emphasis on the report was too much and instead there should be more emphasis on the build section (around 50-50). The video journals were a good step here because they made it much easier to follow the design cycle. As for the build, I think the build could easily have been better as the only test of consistency didn't make it work. People with the simplest machines had the most consistency and this goes against the idea of creativity and collaboration. Finally, I think the object of inspiration was a bit of a limiter, as it rarely enhanced the machine, and mostly served the limit the creativity, or as another "thing you *have* to do." The base idea of Rube Goldberg machines was good but this could work much better in the future. I know that the teachers put in a lot of effort into DCC and we thank you for and would like to help you make it a success.