UNICORN HIGHWAY

NALAT PAVI BHUMIKA VINEET PRAD

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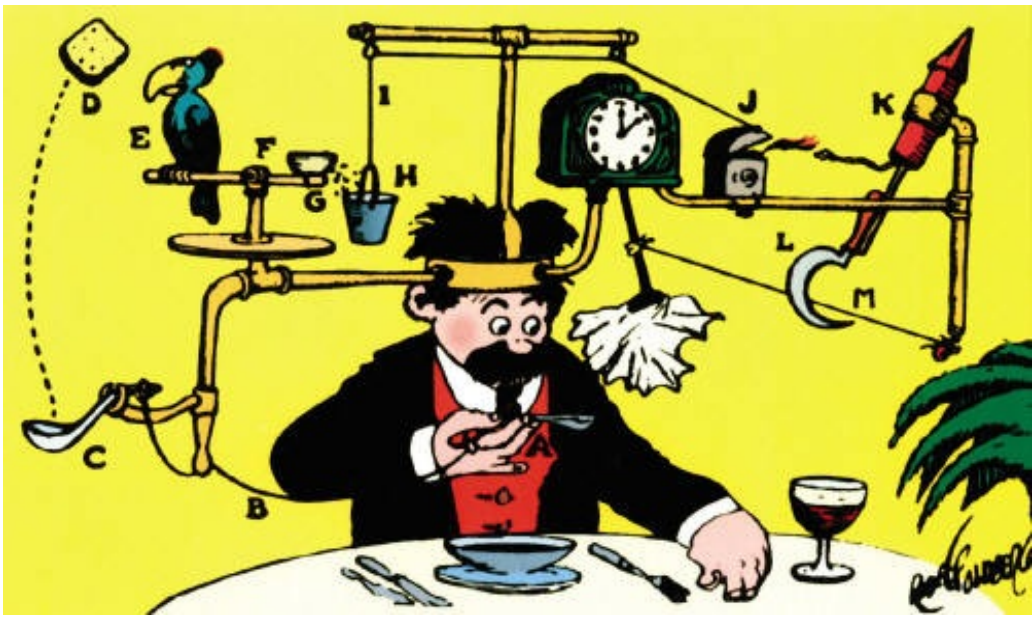
Rube Goldberg Machine

DESIGN CHALLENGE CYCLE WEEK

2013.



Design Brief

In this year's DCC, we came together to build a Rube Goldberg machine to complete with each other for the best one. We started by brainstorming together the ideas that popped into our heads, and discussed what we wanted to complete by the end of the week. We noted down our plans in a sheet of paper and carried out to build the machine part by part, starting from dominoes.

(insert pic of plans)

Design Specifications

The machine must start from the starting point to the end.

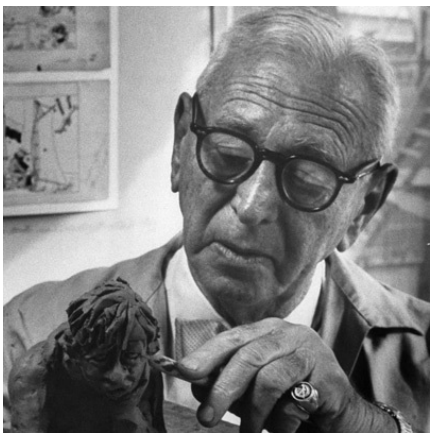
The machine must have 2 potential energy sources from different positions.

The machine needs to have 3 simple machines; inclined plane, wedge and pulley.

The machine must make use of pipes that are provided.

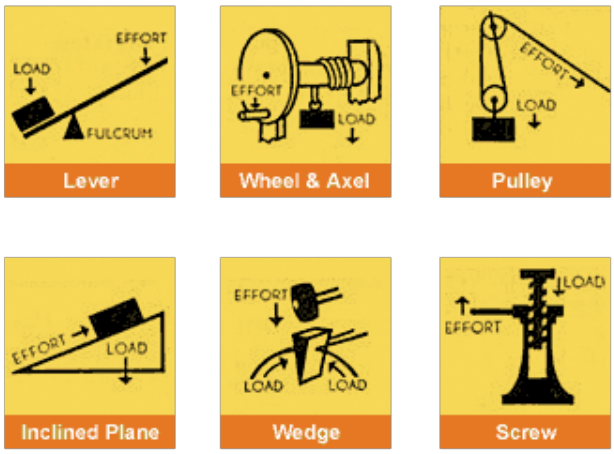
The machine must be on different levels of ground.

Research:



What is a rube goldberg machine and who invented it?

Reuben Garett "Rube" Goldberg an american cartoonist, sculptor, author, engineer, and inventor. Reuben Garett Lucius Goldberg was born July 4, 1883 in San Francisco California to Jewish parents Max and Hannah Goldberg. His cartoon strips were popular but the work that gave him unforgettable life long fame was the Rube Goldberg Machine. A rube goldberg machine is when something is overdone and performs a very simple task in a very complicated matter.



What different types of simple machines can be put into the whole system?

Some of the few easy simple machines that we use every day are the lever, wedge, screw, inclines, planes, wheel and axle, and pulley. These things are incorporated into our daily lives without us even noticing it, because it makes our tasks even more simple; hence simple machines. The simple machines that are combined together are usually called a "compound machine". For example, a lift that we use almost everyday. In science, simple machines are defined as force acting upon an object to move it across a certain distance.

How does a "wedge" work?

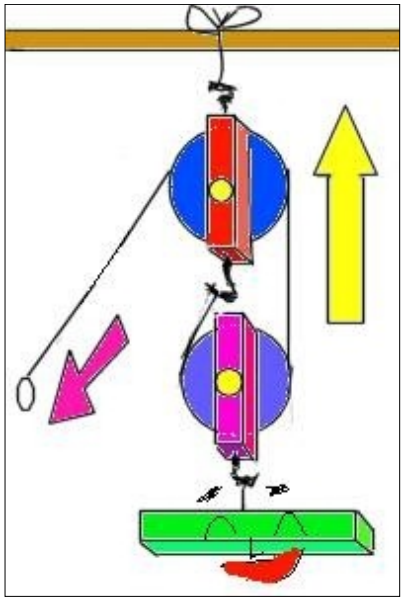
A wedge is a scientific term that means to push two objects apart, or to cut an object into pieces. It also means to hold objects into place. It is also just two inclined planes put together back to back. Some examples of wedges in everyday life is a doorstop, to push apart the door from slamming into the doorframe. In our case, it is used to hold an object into place, like marbles, but in real life, a fork or a knife is also considered a wedge.

How does a "gear" work?

Gears are one of the most important simple machines. They are wheels that has a teeth surrounding them, and are usually called a cog. To work a gear, you will need to have 2 cogs that are suitable for each other. When one gear fits into another, the other one will turn too. Gears come in different shapes and sizes, to match their use in every day life. A watch might have smaller gears than a car, for example. The size of the gears also affect the amount of energy used. if you are turning the big gear to the smaller gear, it will save energy and make everything more efficient. Also, it is possible that there is more than 2 gears; it is called agar chain. Gears are everywhere in our lives. In amusement parks, all the rides that are inclined up will most definitely use gears to transport the people up to the highest point possible. Gears are also on bicycles, without them, the bike will not go. The earliest known use was circa

A.D 50 by Hero of Alexandria, but they can be traced back to the Greek mechanics of the Alexandrian school in the 3rd century B.C. And were developed by the Greek polymath Archimedes (287-212 B.C.).

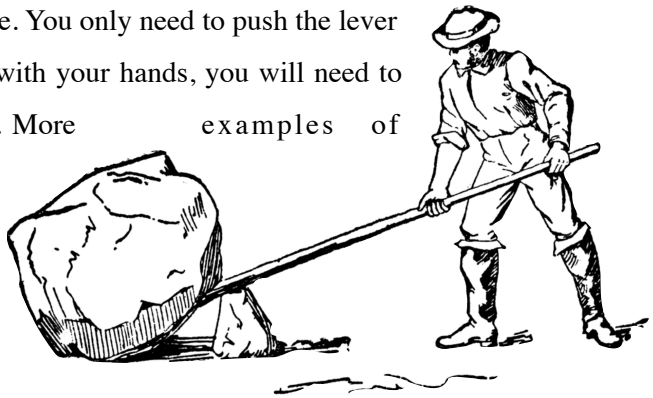
How does a "pulley" work?



Pulleys are very important in our daily lives. The purpose if it is to be able to move a heavy object with lesser force and effort. It is usually made up of rope that is attached to wheels. The wheels are able to turn freely. The rope is then pulled from one end and make its way up the pulley to pull the object out. The number of pulleys use also affect one person's force. For example, if you add more wheels to a system, the longer the distance the rope has to be, but the lesser the effort of the person has to pull. This is how most pulley systems are set up. the object will move up with the object as the rope is pulled up and around the wheel.

How does a "lever" work?

A lever is a long object that is used to push or pull against a fulcrum to move something will lesser force. Whenever a person moves or picks up something heavy, our elbows act as the fulcrum of the lever. For example, if you want to move a heavy rock, you might not be able to life it with your own hands, but if you use a lever to do so, you will get a scientific advantage. You only need to push the lever down and the rock will move up, but if you pick the rock up with your hands, you will need to move a greater distance and apply more effort and force to it. More examples of lever is a hammer being used to pull out a nail. Have you ever wondered how difficult is it to remove a staple or a nail only using your hands? but find it very easy to use a hammer or stapler itself to remove it? these are examples of levers used in real life. A lever replies greatly relies on the fulcrum.



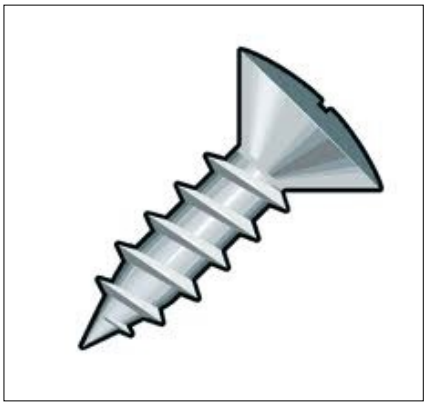
How does a "wheel or axel" work?

When we have to move a really heavy load, it is very difficult for us. This is mostly because of friction, which forces us to apply more effort into moving the load. Another thing that is effecting us greatly is the gravitational force, that is the force of -9.8 pushing the object down. The wheel and axle fixes the problem in a matter of seconds. In this simple machine, a wheel is locked into a central axle and they rotate each other when a force is applied. When we apply heavy load on the axle, the rotation of the wheels reduces that friction greatly. We see the wheel and axle in our everyday lives; a car, a wheel barrow, the door handles even the steering wheels!

How does an "incline plane" work?

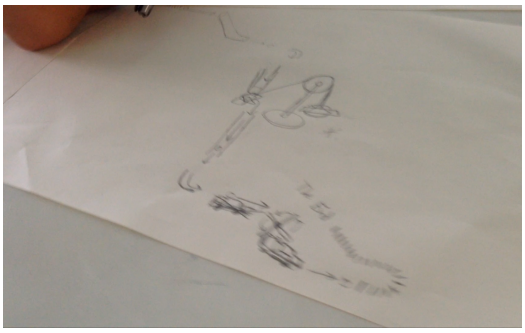
An inclined plane is a slope or a ramp, like a slide or the wheelchair ramp. It makes it easier to transport or lift something heavy, like a pile of rocks or bricks. Instead of pulling the rocks directly up, you can push it a greater distance, but the force that is applied to it is less than pulling it up. If the ramp is steeper, the amount of force is used more, but if the ramp is almost flat, the force is lesser. An example of an inclined plane is a flight of stairs. People use this simple machine everyday but do not notice it!

How does a "screw" work?



A screw is one of the most used mechanical devices in the world. It is used in your computer, your phone and even your house door. There is rotational motion, and linear motion. Threads are important in a screw. The more the threads, it will require more rotations to screw and the wider the threads require more force in rotations. It is used to hold things together, lift heavy loads, and drill holes into an object such as tables and chairs.

Developing Ideas



We had quite a few designs at first, and slowly developed and added new ideas that were possible to complete into the whole machine. On the first day, we got to know each other and started to plan our ideas and brainstorm into a scrap piece of paper. We planned to have 3 simple machines that we incorporated into the design; the pulley, the inclined plane, and the wedge.

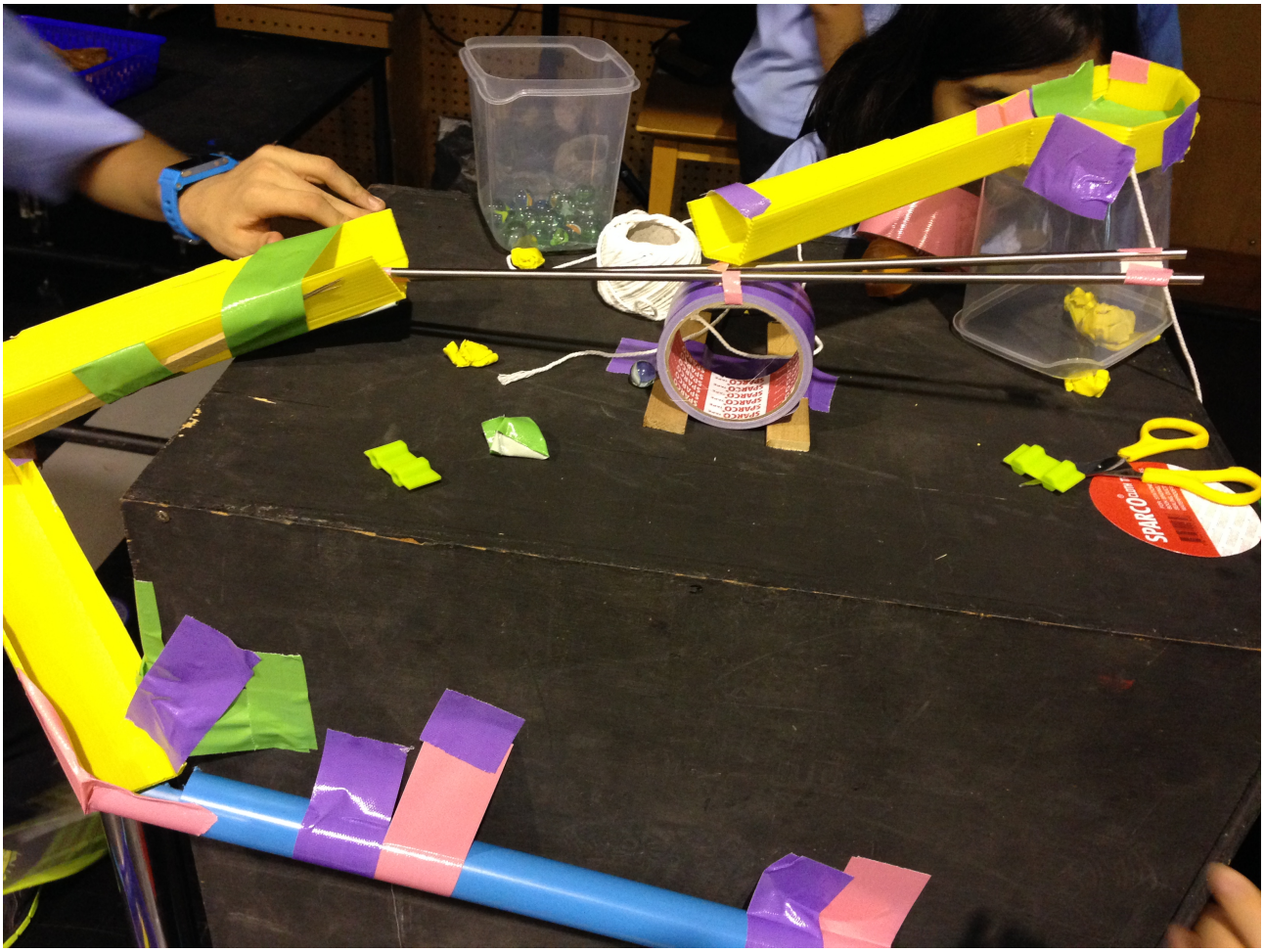
In the first design, we planned to start off with a domino, that slowly rises up a number of books that are stacked up, to push a car at the top to hit a number of books. The reason why we used incline plane her is to allow the car to gain more kinetic energy and have a higher percentage in pushing the book over. The books will then snag a line that is connected to a wedge, which will catapult a ping pong ball to hit a range of marbles that will travel down a zigzag trail to fall into a pulley, which will slowly fall down to release the balls to hit another car, and allowing the car to hit several more dominos, to finish off our whole machine.

The reason why this did not work was because we were too late in getting books and they all ran out. That was the stopping point of our first idea.

The second idea was lining up a domino, that will trigger several heavy marbles to knock the books down. The line that is connected to the top of the high box, will snag and the doorway that is loaded with marbles will drop down and travel down in a zigzag way, to hit a domino, and then wheels, and then a car at the end to represent the car in our picture. The second idea worked! The doorway that is loaded with marbles were our highlight and best simple machine using the wedge. All of the simple machines work together harmoniously and made a compound machine.

The last idea that we used was the final design that we used on the final run of the whole DCC week. We used the same idea that we applied in the second idea, and added a few more interesting points, for example, the pin and the gigantic balloon that will make a loud popping noise that the end. It will make the people be more surprised. We tried to incorporate a pulley system to the whole machine, but it was too late, and we couldn't find a position to put the pulley system into the machine to incorporate it nicely together.

The reason why we chose our final design that we had today was because the whole machine had a total of 2 simple machines that were all over the system and works flawlessly together. We used wedge, inclined planes to make the machine work it's purpose. Another reason why we chose this design as our final design is because how easy it was to set up the whole machine. It will roughly take up 5 minutes of our time to set up the machine because we only have to focus on the dominos and the wedge door at the top. The consistency of our whole design is also very reliable. It will work every time if there was no material issues such as the duct tape coming off. Overall, we are very proud of our whole design because it works well with other team's machine and is very reliable.



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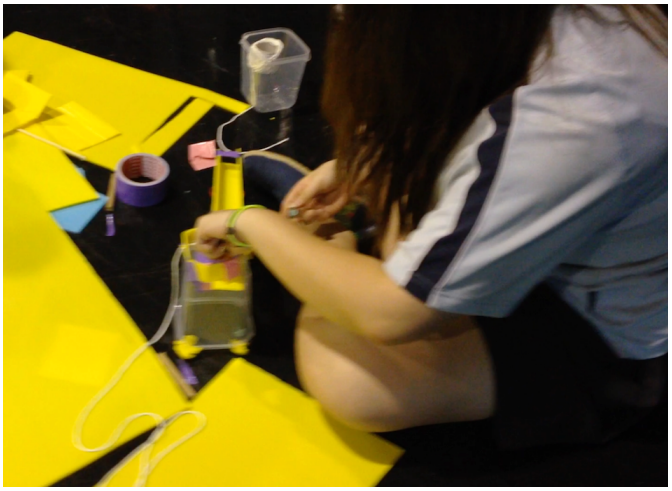
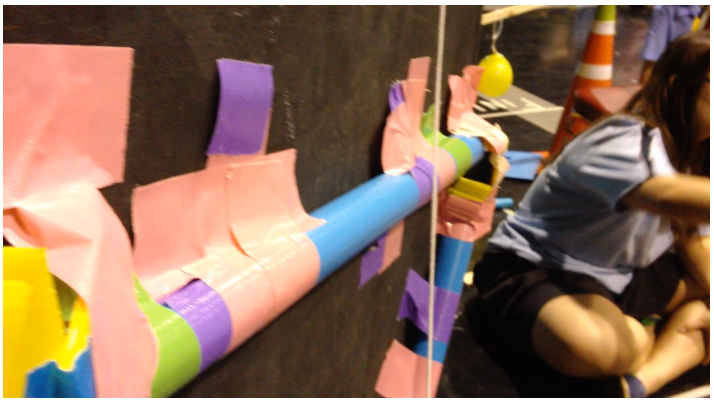
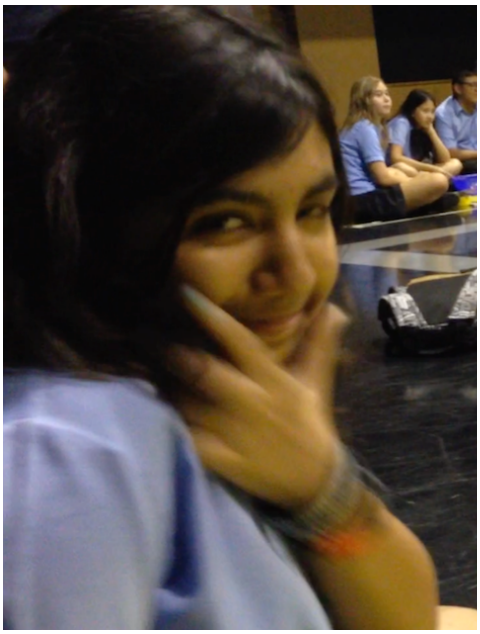
Creating the Solution




Our group's visual stimulus was a car. In our design, we used a lot of future board, which represents the road tracks that we used every day. In the final design, we drew in road tracks that showed it more clearly. We also have a car at the end, which shows how far the car has travelled down our machine safety and efficiently, with the help of our simple machine. In the end, the car came to a stop at the end of the domino to show that the whole journey has ended, and it was time for the next group to showcase their stimulus. The car is also related to everyday life, so as simple machines, cars and inclined planes go together.

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Evaluating

The machine must start from the starting point to the end.

The whole machine worked very well from the start to the end, and had very little technical issues that appeared throughout the whole system. The parts where we had problems were the part of the pipes, where we had some problems with the tapes and how we overused it, which affected the journey of the marbles in the long run.

The machine must have 2 potential energy sources from different positions.

The whole machine has a total of 4 potential energy sources. The first one was the heavy marbles, that will receive kinetic energy from the falling dominos at the start. The marbles will then travel down and hit a science book that will fall down and snag a string connecting to a wedge, which will release a handful of marbles at the top, then it will fall down the pipe in a zig zag line to gain more energy to finally hit the remaining domino and car at the very bottom. There are more than 2 potential energy positions than we initially planned.

The machine needs to have 3 simple machines; inclined plane, wedge and pulley.

We have inclined plane and a wedge but, unfortunately, we didn't have a proper place to place a pulley that will help improve our design. The design that we have was already working perfectly fine, and if we added in a pulley, we would have to sit down and re-plan the whole machine. We didn't have enough time to do that. We are happy with our machine at the moment.

The machine must be on different levels of ground.

We used different levels of ground, which one was on the floor, and up to a height of 100 centimetres. The marbles travelled all over the given height, which clearly completes the this design specification.

Changes

- The number of simple machines that we planned to use was not as expected (pulley not included in final)
- The metal bar at the top of the machine was replaced with the future board because it was not consistent (the marble kept falling off the trail)
- The amount of large marbles were slowly added so that the amount of force that is used to push the science book ensures that the book falls and snag the line (made the line shorter)
- Added a pin and a balloon to the machine so that it makes a loud bang when the book falls to snag the line (balloons make everything more interesting)
- Added in car tracks to the whole machine (using permanent marker)
- Added in a car at the end of the machine to finish of the car machine.

Improvement

- Should have used less duct tape because the whole system looks very messy.
- Should have used more complex machines to make the whole system more interesting.
- Should have taken more risk and came up with a more intriguing design.
- Should have used more hot glue gun as the whole thing will stay together more and not fall apart as it is.

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