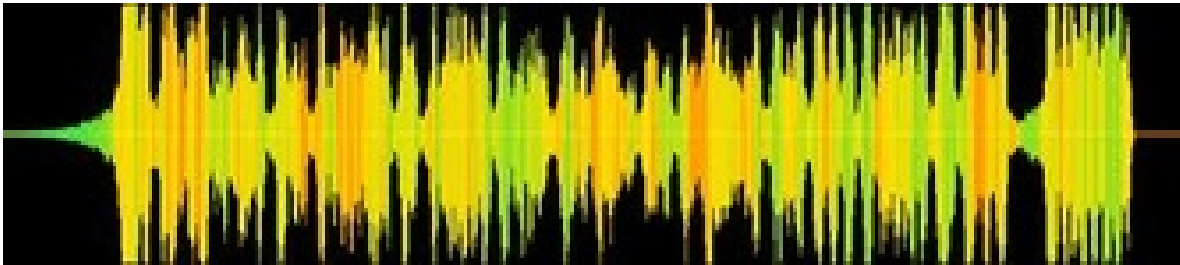


GROUP 20



Design Cycle Challenge  
2013

## **Design Brief**

For our group, we will be creating our own rube goldberg machine inspired by sound wave, which then it will be connected with the other groups machine. We will be creating three different designs, choosing the best one to work with and creating the machine using different materials provided. The final chosen design will be the one with the best quality, which will help us present our theme of sound wave in the machine.

## **Research**

Rube goldberg is a machine or invention from combining many different materials and techniques to create a chain reaction. Creating our own rube goldberg involve with using our imagination to try and make it creative, but it also have to be accurate and tested many times in order to have successful result. By creating the rube goldberg machine, this also involves with physics. For example transfer of momentum (the moving force of the object), when the objects comes in contact with another, the momentum of the object that is in motion then transferred directly to the next object when it hit one another. We can say that if one object move down from a ramp/wedge, it then increase more force and velocity. Therefore when it hits another object, it then transfer its momentum to the next object and so on.

There is also more energy force if we were to placed an object, from a higher point. Therefore it gain more force while moving down, and transferred more energy when it comes in contact with another object.

Rube Goldberg, an American cartoonist, sculptor, engineer, author and inventor, is the inspiration of the Rube Goldberg machine contest. The rube goldberg machine contest is a contest in which college students would use mechanics to complete a task, having the minimum of 20 steps in the style of Rube Goldberg. College students would have 2 minutes to complete the entire process of the task. Students must choose a theme, mostly historical periods or famous films. 60% of the score is based on the machine's ability to complete 2 of the 3 attempts and the remaining 40% of the score is based on the judge's impression; theme, teamwork and the "Goldberg Spirit". If parts of the machine could not function, the team is permitted to continue but will have a penalty every time the object is moved by the team member.

In most of the time, rube goldberg machines may include levers, pulleys, rolling balls, ramps, tubes, and dominos to keep the machine from malfunctioning. Levers are used to load mechanics, to have one side of the mechanic to have a higher amount of potential energy or to move objects around. Pulley is a wheel that supports the movements of a cable in order to load heavier objects or to move an object from one place to another. Balls are more likely to be used to contact another object in order to make it move. Ramp is most likely to be the track of the ball and to make anything stable. Moving smaller objects through the tubes will stabilize the objects from falling away.

Different techniques or materials that we can use in our rube goldberg include, using different shapes such as round, flat and dominos which can be beneficial. Using different types of tools and constantly changing them also help to make it more interesting and it might help the machine to flow better. We also need to consider the science behind it, such as the energy involve (potential and kinetic energy). In order to make the machine work successfully, we also need to follow the plan and process, test out many trials and keep making changes and improvement to the rube goldberg machine.

The physics behind the rube goldberg machine is Newton's First Law of Motion. States that an object would be constant unless the object is in contact with an unbalanced force causing the object to move. An example would be the force of a ball contacting the domino causing the domino to fall. The second law of motion states that the acceleration of an object depends on the net force of the object and its mass. An example would be pushing a car. The person requires more force to the car in order to make the wheel going. The third law states that if one object exerts a force on another object, the second object would experience a force of equal strengths of the opposite direction of the first object. A example would be a car crash to a wall. Both car and wall would experience the same force but within an opposite direction.

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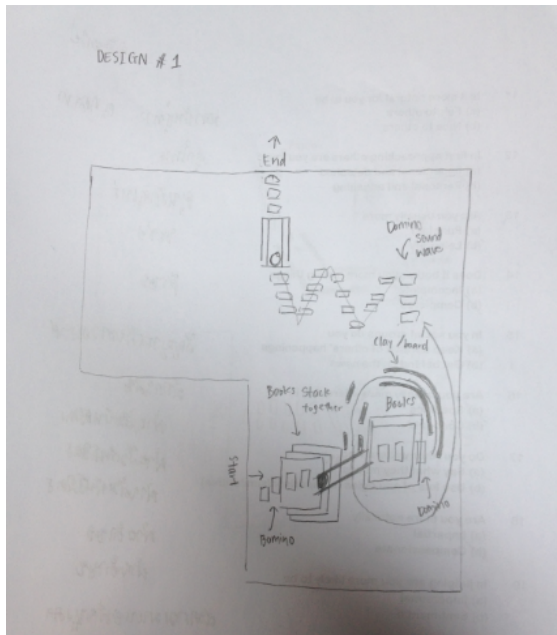
Book:

Duffy, John, Sandy Gardner, James Foster, Jason Howell, Lucy Muncaster, John Myers, Steven Phillips, Adrian Schmit, Claire Stebbing, Moira Steven, and Mike Thompson. *GCSE Additional Science*. Ed. Ellen Bowness, Gemma Hallam, Sharon Keely, Andy Park, Kate Redmond, Alan Rix, Ami Snelling, Claire Thompson, and Julie Wakeling. Oxford: Oxford UP, 2006. Print.

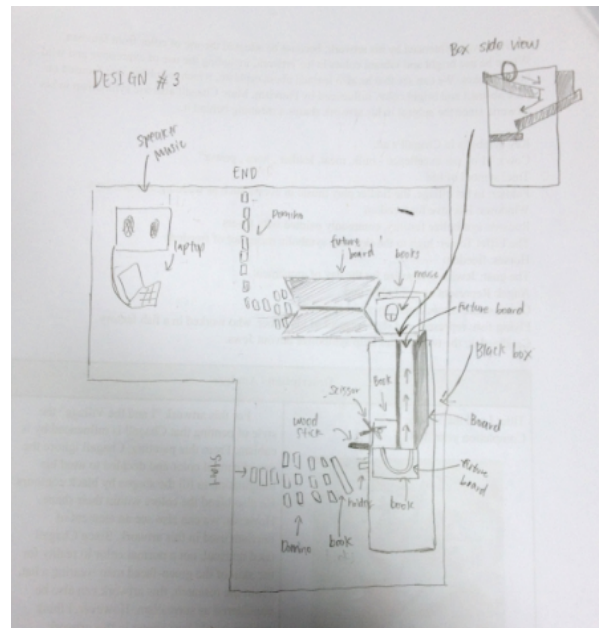
Interview: Doiron, Janice. "Rube Goldberg." Personal interview. 14 Nov. 2013.

## Developing Ideas

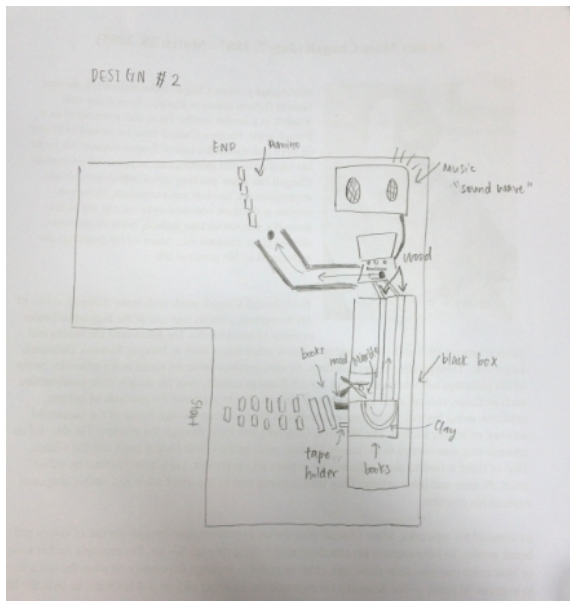
### Design #1



### Design #3



### Design #2



### Design #1

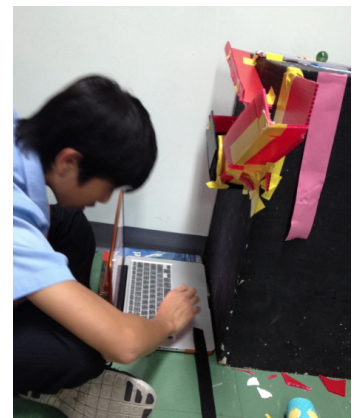
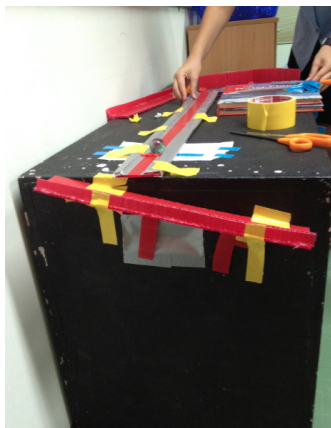
We first start off with basic ideas, which we decided to use books and dominoes to create a visual image of a wave going up and down. Placing the dominoes on the book in a steps formation, then create a track between the books for the marble to travel over. The marble will then end up hitting the dominoes in the end.

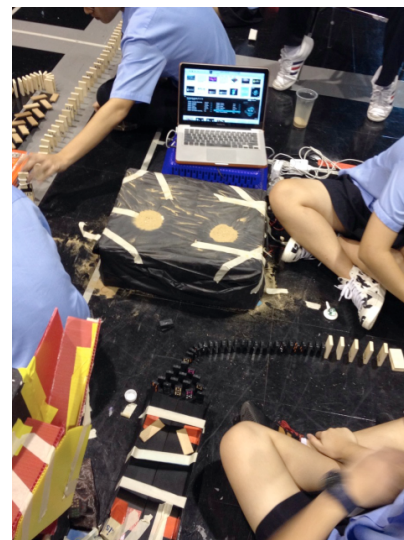
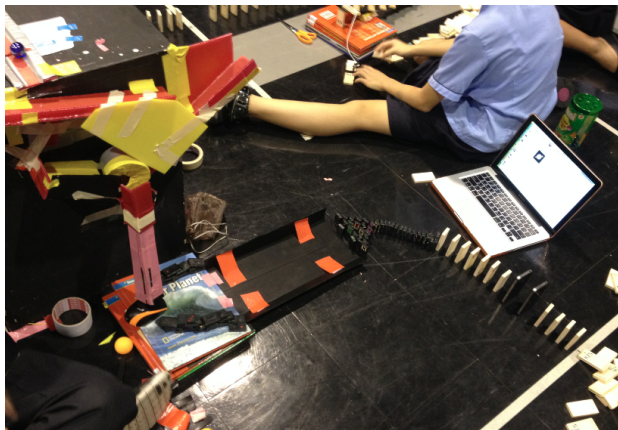
## Design #2 and #3

For our second design, we decided to incorporate the big black box, starting from the ground with dominoes hitting the long stick. The stick will then hit the scissor, which then will push the marble to travel along the track and goes down hitting the computer button to turn on the music. Then it will flow down on to the track, which will lead the marble to hit the dominoes in the end. Our third design is inspired by second designs, which we made more changes and improvements to the materials, the placement, making them more stable and effective.

After planning out all the three designs for our rube goldberg machine, our team final machine design choice is the third design. The third design is the best one that works, with new improvements we made it help our machine to work better. The reasons that we chose the third design is because, we made lots of improvements in term of the material use and it was more accurate compared to the first and second designs.

## Photo





Building specifications:

- 3 actions
- 2 potential energy sources
- 1 working KIS Rube goldberg machine
- The Rube goldberg machine will have to start and end with dominoes
- The machine will have to present and show our group theme of “sound wave”

We tried to create and make changes throughout the design cycle in order to create a successful Rube goldberg machine and try to follow our design specification. We tried creating and testing our Rube goldberg machine, which we include the dominoes during the start and end of the machine. The result of using the dominoes works well with our machine, we also need to make sure that the techniques or the tools that we use, will be effective enough to help the marble move on throughout the machine. We apply our ideas of using the speaker, and turning on the music in our machine, to present our group theme of sound wave. From testing out many trials during the creation stage, we were able to ensure that that our Rube goldberg did worked. Even though our machine doesn't always run smoothly in every trials.

There were lots of changes and improvements made throughout the design cycle process. Such as the black box that we decided to add onto our second and third design. Since we thought that adding the box will give more potential energy for the machine, placing the object on a higher position. Since there are more energy and force when it move from a higher point, down the slope or the track on the block. We also thought that adding the block will make our design and machine look more interesting and creative, even though it might be challenging to make everything flow smoothly.

We also added stronger materials, and the placement of the objects in our machine. We decided to change the trackway from wood stick to future board instead. By using and modifying the future board into a track, we can create a border along the side to prevent the marble from falling. We also replaced the clay to future board instead, since future board have a stronger surface. Therefore it will give more energy to push and bounce the marble off, once it was push by the scissor and travel onto the track.

We also added a long tube, in the end of the track to help the marble move accurately straight down onto the wireless mouse. Since our theme was about sound wave, we decided to include a laptop and speaker. So that when the marble was dropped and hit the mouse, it will turn on the music which we thought it was a good idea to help present our theme.

I think we did well creating the machine together, and applying our ideas that will help present our theme of sound wave. Even though our machine might not be that successful and run smoothly during testing. Our rube goldberg machine could have been better if we worked faster during testing, to help us get through all the trials and make more improvement. The machine could have been improved, if we can find a way to make the first part of the machine run smoothly. Since it is not certain that the wood will always fall and hit the scissor, which then will push the marble. Therefore we might need to add more weight or organize the dominoes properly to make the wood fall. We should also find better ways or techniques, to help the mouse click so the music can turn on by itself.