

A4_4 An Experimental Analysis Of An Icy Demise

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Abstract

The SAW films are a series of graphic horror films featuring a serial killer intent on testing the will of his victims through a series of traps. One such trap features an elaborate seesaw mechanism. At one side of the seesaw is an ice block with a man suspended above it, and on the other side, a man harnessed to an electric chair, such that when the ice block melts, the chair will activate and both men will meet their end. In this paper, an experimental investigation is conducted to determine how long such a process would take and whether it would fit within the 90 minute time frame given in the film. The results indicate it would take 65 ± 2.5 minutes for the ice block to melt sufficiently for both men to meet their icy demise.

Introduction

The SAW movie franchise focuses around a serial killer whom tests his victims via a series of contraptions with the aim of determining how much they value their lives. In the fourth film, SAW IV, the victims are presented with a tortuous trap as shown in Figure 1.



Figure 1: A screen clip from the film SAW IV illustrating the seesaw trap [1].

The trap consists of a seesaw mechanism, where on the left side of the seesaw, a man is held by a noose dangling above a block of ice and on the right side of the seesaw, a man is strapped to an electric chair. The seesaw is trough like in design, hence any of the ice block that melts is contained and eventually causes the seesaw to tip as a result of the shifting weight. This process is accelerated due to a series of heaters warming the ice. The electric chair is con-

nected to a number of metal cables which lie at the base of the chair, with a power source connected to the edge of seesaw; hence when the ice melts sufficiently enough to allow the seesaw to tip, the water will conduct electricity between the source and the chair, electrocuting the man. As the ice block decreases in height, the noose around the other man's neck will tighten, eventually causing death by asphyxiation. The fate of both men rests on the other victims of the film, who must reach them before a 90 minute timer expires at which point the seesaw tips.

Methodology

In order to investigate the feasibility of this trap, an experimental method was utilised. The man atop the block of ice is only making contact with the ice with the soles of his feet, a scenario that can be recreated easily using a person's fingertips. By scaling the size of an average man's inside leg length [2] to the size of a finger, the rest of the trap could be downsized according to this scale factor.

When scaling the trap, the masses of the trap and the victims must also be considered to ensure the seesaw was balanced. Firstly, it was assumed both men weigh 80 kg and the electric chair weighs 10 kg. Then, by comparing the ice block in the film, to the size of the men and the surroundings, the approximate dimensions of the ice block were estimated to be 60 cm by 40 cm by 25 cm, allowing a volume of 0.06 m^3 to

be calculated. The density of ice is known to be 917 kgm^{-3} [3], therefore the mass of the ice block was calculated easily, producing an answer of 55 kg.

Once the ice intended for use in the experiment was molded to the correct dimensions, the ice was then weighed which allowed for a scaling factor to be generated for the other masses within the trap. As the scaling factor of both the masses, and the lengths were approximated, the principle of moments was required to adjust the experimental set up slightly to ensure the seesaw was balanced. The dimensions of the trap before the scaling are outlined in Figure 2.

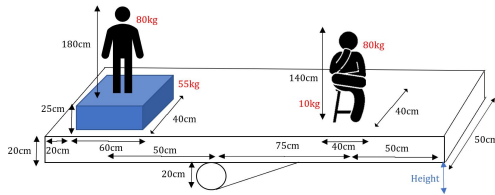


Figure 2: An illustrative diagram indicating approximate lengths and weights of the trap and victims as seen in the film.

The equipment used for the experiment consisted of a block of ice held in position with a small tab, on top of a seesaw, with small weights on either side of the seesaw and a 30 W filament lamp, positioned 20 cm from the ice block, pointing towards the ice to act as a heater. The seesaw was designed out of light cardboard to ensure it contributed negligibly to the overall mass, and covered with plastic so as not to absorb the melting ice. The experiment was conducted by maintaining light contact with two fingers on top of the ice block and measuring the distance from the ground to the edge of the seesaw, indicated as the height in Figure 2. As the ice block melted, the finger tips were lowered to maintain constant contact with the ice block, however minimal pressure was applied to ensure this did not effect the tipping of the seesaw. The height was remeasured every five minutes up until the maximum allowed time of ninety minutes. At the time when the seesaw tips completely, and the height is zero, both men are assumed to perish as outlined earlier.

Results

The results of the experiment can be seen in Figure 3. An error bound of ± 10 seconds and $\pm 0.5\text{mm}$ is assumed for all measurements, representative of the lowest precision allowed by the ruler and considering the time taken to complete the measurements.

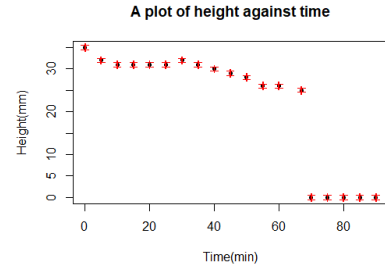


Figure 3: A graphical representation of the change in height of the seesaw with time.

Discussion and conclusion

From the results, the time at which the seesaw tipped is 65 ± 2.5 minutes. In the film, a maximum time frame of 90 minutes is given to the other victims to find the men on the seesaw [1]; the victims reach the men with seconds to spare, unfortunately the results of this experiment indicate that the men would have already died despite their best efforts.

However, the methodology assumed that the larger block of ice would melt at the same rate as the scaled down experimental version, which is an assumption that is unlikely to be true. As the surface area to volume ratio is much larger for the smaller block, this means it will melt quicker, as more ice is exposed to the warmer surroundings. Other errors may arise from the heating of the block and environmental conditions. In the film there appears to be four powerful heaters directed at the ice, however only one lamp was used in this experiment, which would heat the ice at a slower rate. There may also be variance in the ambient room temperature. Finally, a persons finger tips would output more heat directly to the ice block than the mans feet which were covered by socks, therefore this may also have sped up the rate at which the ice melted.

In conclusion, whilst the experiment shows that the men would not have survived the 90 minute duration of the film, the methodology could be improved to closer replicate the conditions shown in the film.

References

- [1] http://sawfilms.wikia.com/wiki/Ice_Block_Trap [Accessed 9 October]
- [2] <https://m.asos.com/Men/jeans-and-trousers-size-guide/?szgid=24&szgtid=2> [Accessed 10 October]
- [3] <https://hypertextbook.com/facts/2000/AlexDallas.shtml> [Accessed 10 October]