

Introduction

This poster presents the experimental findings of trampoline double-bouncing and quantifies the conditions which allow high energy-transfer between users that lead to multi-user injuries.

Hazard

Due to the unpredictable nature of double-bouncing, users are often unable to anticipate the occurrence of a double-bounce, meaning they are physically unprepared or braced for the immense acceleration forces generated by the transfer of energy between users.



Figure 1: Four common domestic trampolines on which children might perform the double-bounce

Aim

There is very little published research on the characteristics of the double bounce phenomenon. Observations indicate that under certain circumstances there is the potential for a high transfer of energy from one user to another, leading to surprisingly higher rebound heights, which result in landing and compression injuries.

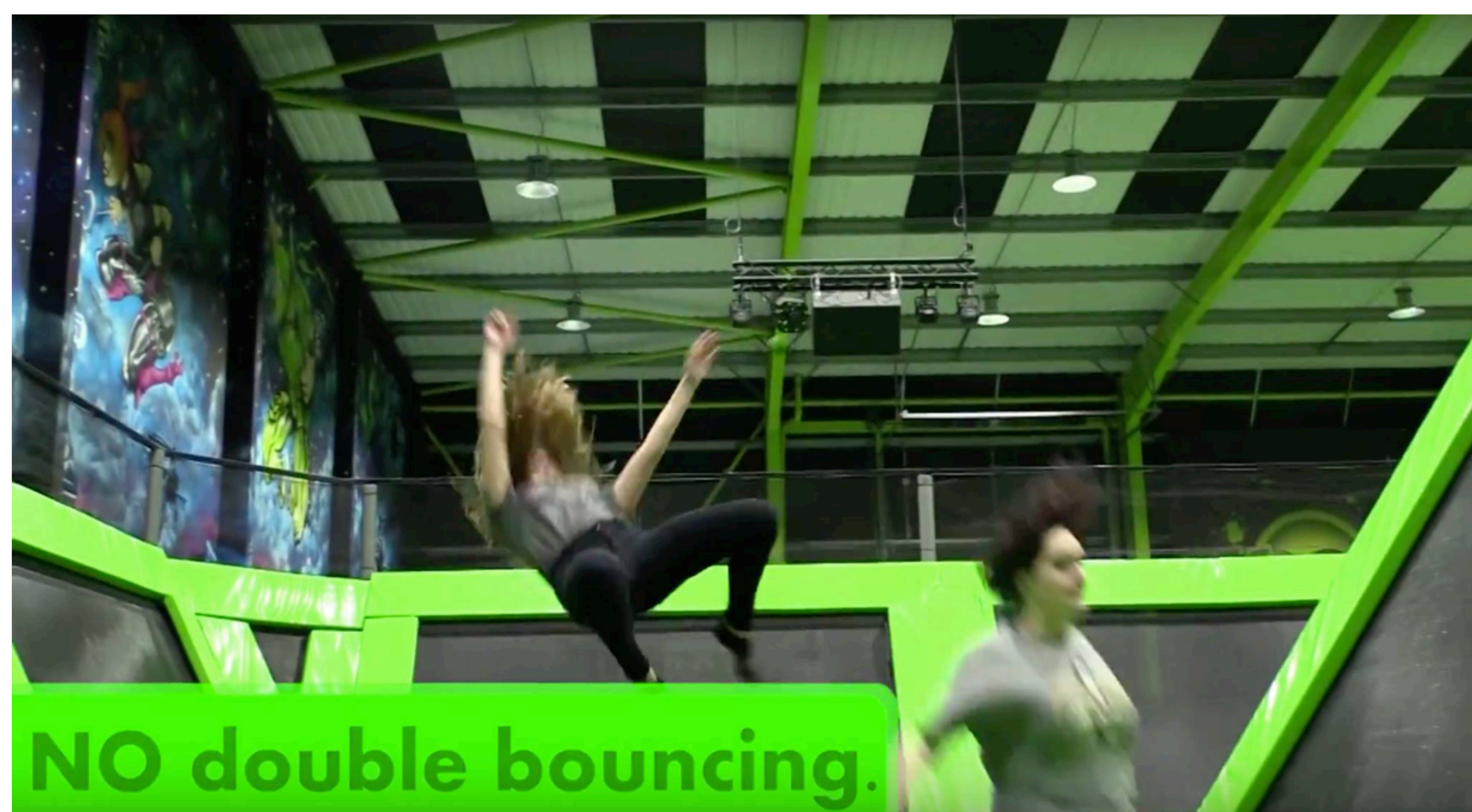


Figure 2: Screen shot of a safety video depicting a double bounce

Method

Medicine balls of various weights, heights and impact location were released from above a trampoline mat to simulate a multi-user impact. The quick release mechanisms were triggered electronically to eliminate any undesired variances in impact timing between tests, allowing for reliable, repeatable testing. Calibrated video analysis is the primary means of data collection.

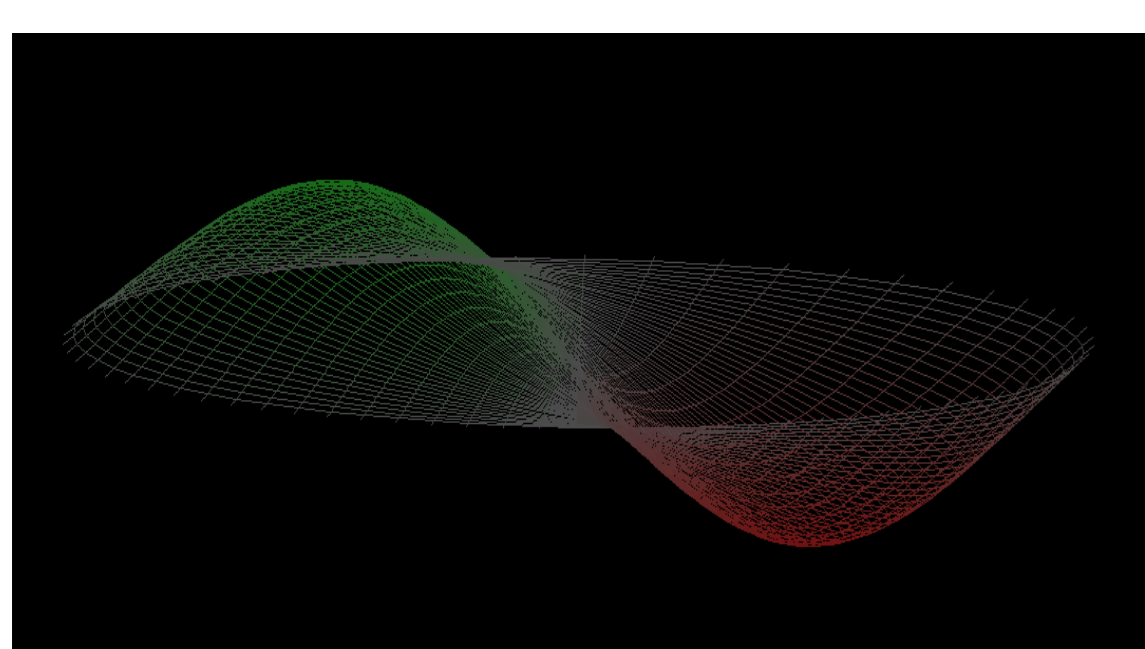


Figure 3: Second mode of vibration for a circular membrane

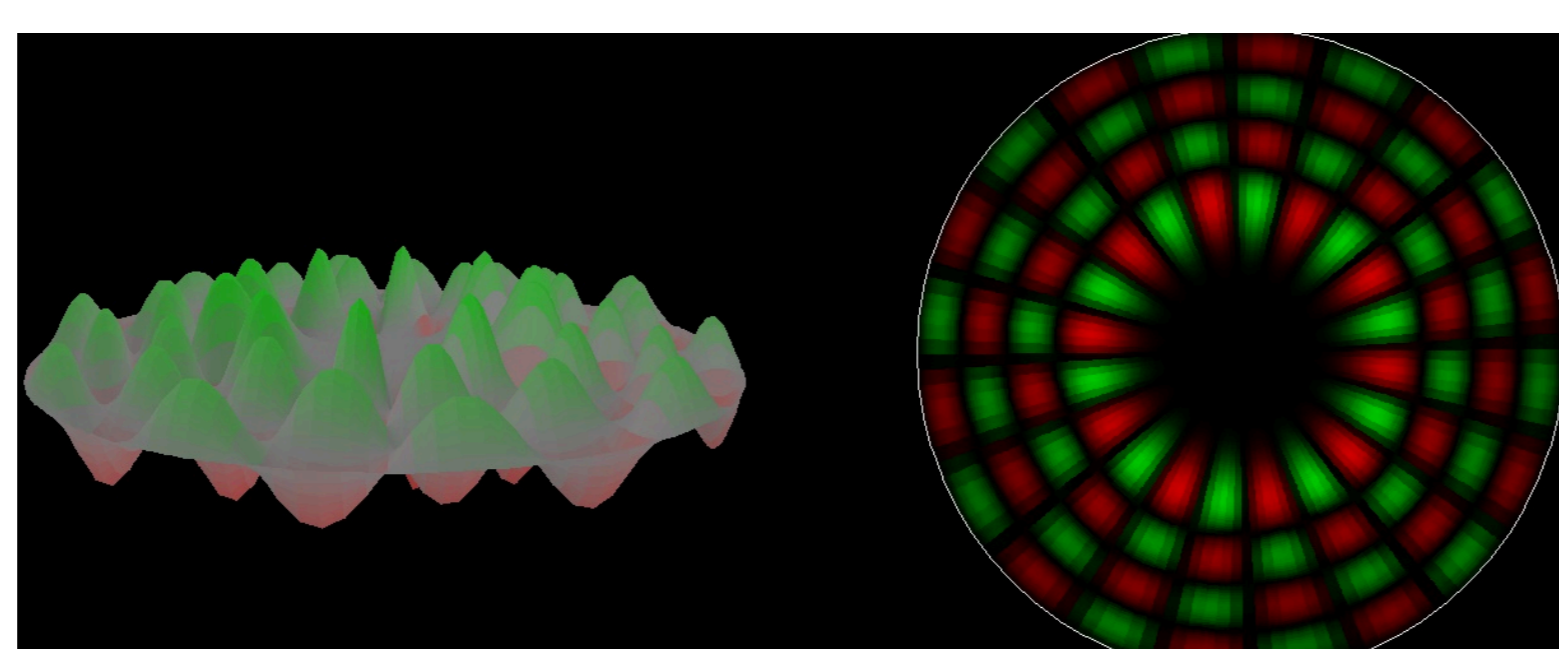


Figure 4: Higher order modes of vibration for a circular membrane

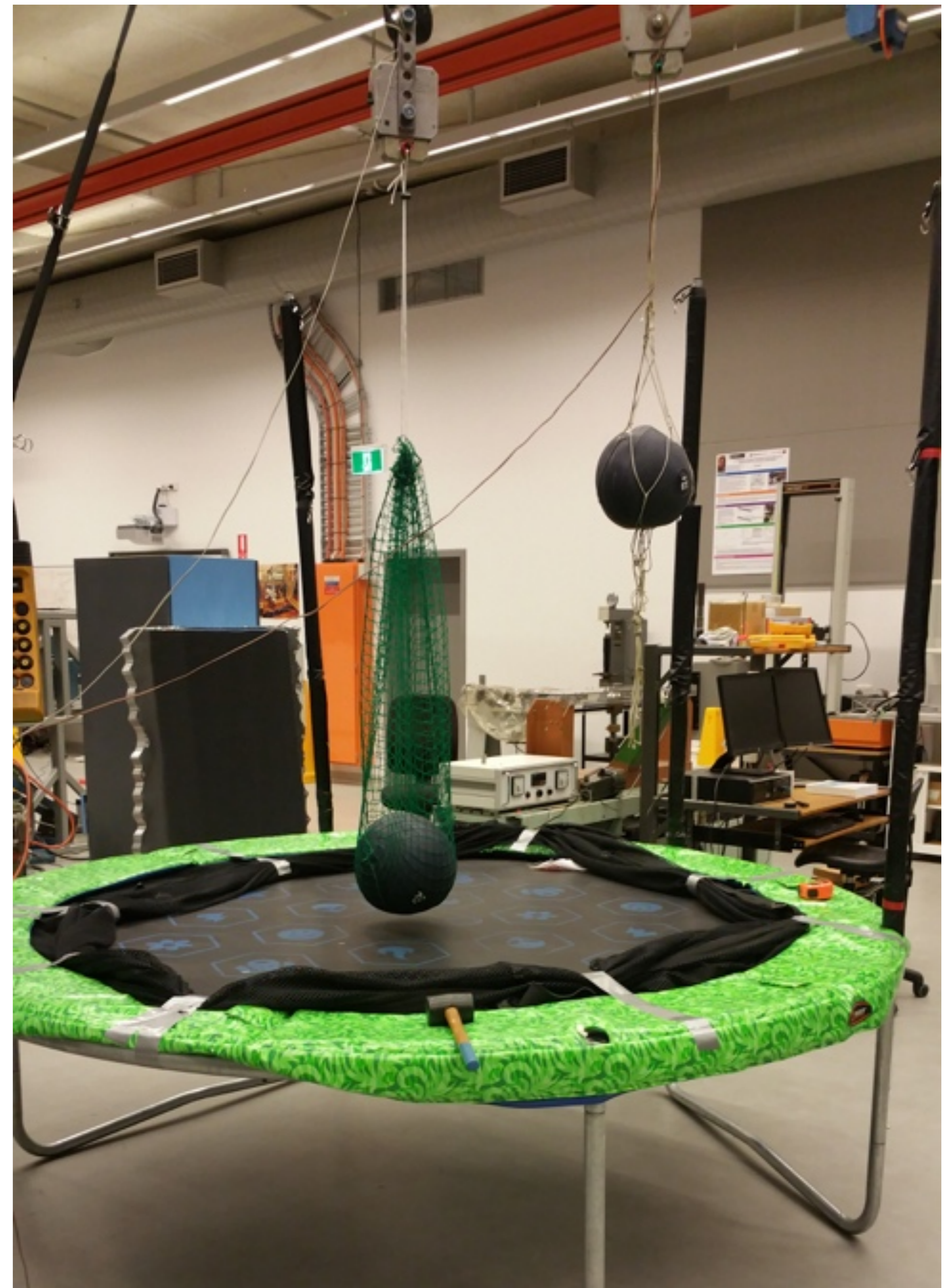
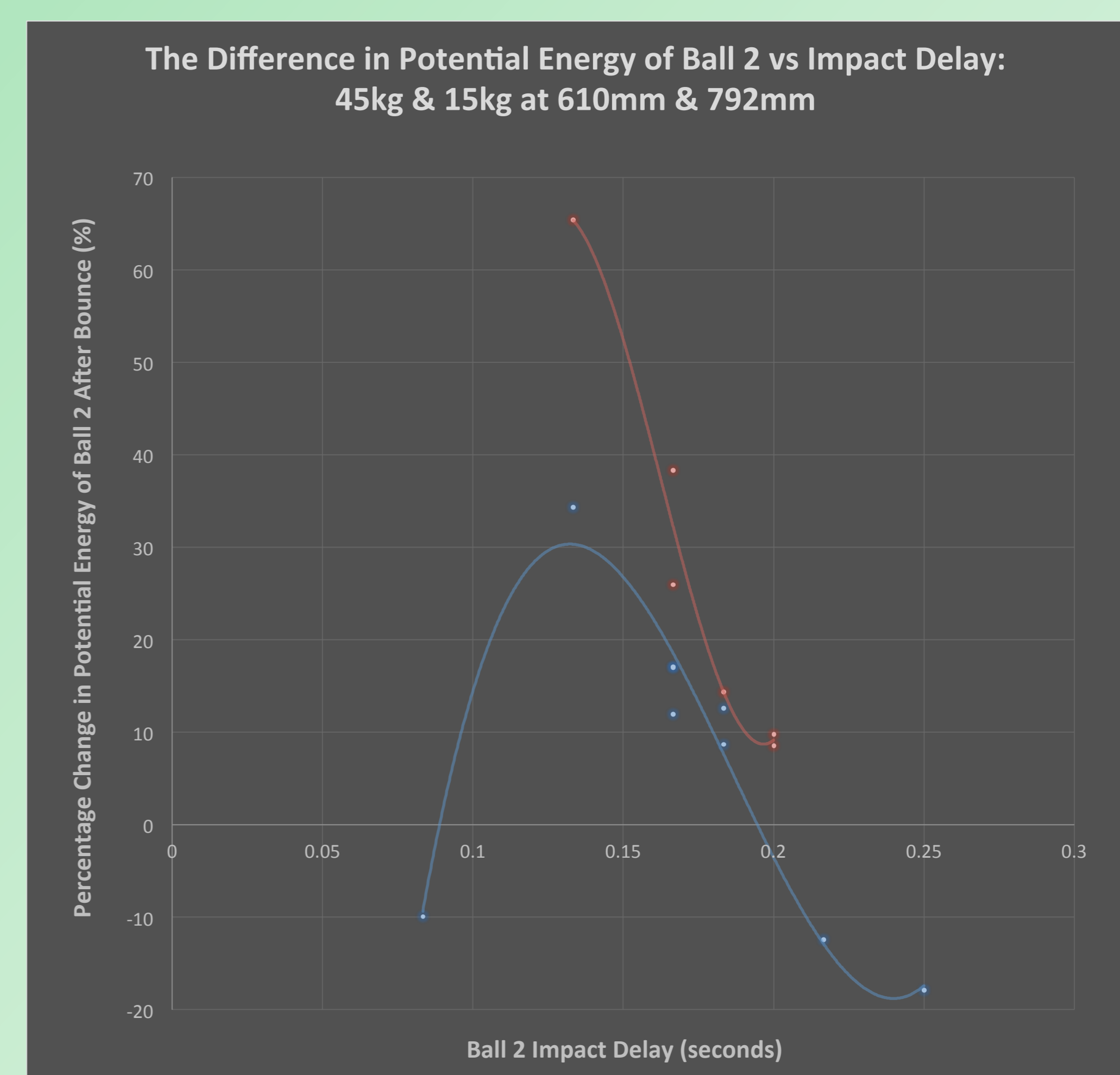


Figure 5: Experimental setup with trampoline, two suspended medicine balls attached to the overhead crane by bomb quick release mechanisms

Results

The greatest effect was observed when the ratio of the ball's masses was 3:1 with the heavy one released 130ms before the lighter one, and the horizontal separation was 792mm, or 25% of the trampoline diameter. This resulted in an increase of 65% in rebound energy for the second ball.



Conclusion

The double bouncing manoeuvre is real and dangerous and should be discouraged for children and adolescents using trampolines.