Thesis Project Portfolio

Football Helmet: Head to Ground Test Device

(Technical Report)

Youth Tackle Football Participation

(STS Research Paper)

An Undergraduate Thesis

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Executive Summary

Tackle football is one of the most dangerous sports in the world; causing over a million injuries every year amongst all levels of play. My capstone project is to design a device that can simulate the impact of an NFL player's head hitting the ground after a tackle. This device will be used to test the effectiveness of football helmets at preventing concussions. My STS research paper analyzes recent efforts to make youth tackle football safer, as well as new methods that should be implemented. The reasoning behind this research is to determine whether youth tackle football is reasonably safe for children to play, given the high risk of injuries. These two topics are related because they both analyze the causes of football injuries and share the goal of making football safer.

The device we designed for our capstone project is a simple and easily repeatable solution. Our device uses a two track system that could fit an anthropomorphic test device (ATD) in the middle, and ride down the tracks like a ramp. The ATD is launched from various heights and angles to achieve a wide range of velocities, similar to those seen on NFL football fields. The launch of the ATD is powered by gravity and a constant force spring (the strength of which can also be changed). The simplicity of this design allows it to be easily recreated by helmet companies so they can further their research and development of their products. With this research, football helmets can be improved to reduce concussions at all levels.

Due to money constraints, we decided to create a scaled model of our device. This model would serve as a proof of concept that could be scaled to the size needed by helmet companies. The values achieved from our scaled model did show the relationship that we expected between drop heights, spring strength, and resultant velocities. Additionally, we were able to achieve a wide range of rotational velocities from our tests. However, the launches of the device were not

as consistent as we had hoped. This could be due to a high coefficient of friction that we did not account for, as well as the sturdiness of the device being weakened as testing occurred. However, both of these could be improved in the full scale model by using a good lubricant and machining the device to the exact tolerances needed. With these changes, this design is feasible for full scale testing, and could benefit helmet companies.

My STS paper is researching whether or not youth football is safe for children to continue playing, and if not, what measures need to be taken to improve the safety of the sport. Every year there are deaths and countless injuries amongst youth tackle football players. Additionally, recent studies have shown a connection between playing football at a young age and being more likely to develop progressive degenerative brain diseases. With all the possible consequences it is important to evaluate whether the benefits outweigh the risks of kids playing football. The method for data collection and analysis for this paper was literature review. Additionally, the data gathered was analyzed using the technological momentum theory which analyzes the process of societies accepting new technologies.

There has been a lot of progress made to improve the safety of football at the NFL and college levels. This includes rule changes and equipment requirements to reduce injuries. However, these changes are not being implemented nationwide at the high school and youth levels due to social norms conflicting with best safety practices. Until these rule and equipment changes are enforced nationwide at all levels of play, the risks outweigh the benefits. Therefore, tackle football should not be played by children.