Thesis Project Portfolio

Football Helmet: Head to Ground Test Device

(Technical Report)

The Impact of Helmet Advancements on Concussion Rates in the NFL

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

Introduction

This portfolio explores the intersection of engineering innovation and social impact through the development of a novel football helmet testing apparatus and an in-depth analysis of helmet technology's influence on player safety in professional football. The technical and STS components work in tandem to investigate how engineering solutions contribute to mitigating the risks associated with head trauma in high-impact sports, particularly within the National Football League (NFL).

Technical Capstone

The technical project, titled Football Helmet: Head to Ground Testing Device, addresses a gap in current helmet evaluation standards by focusing specifically on head-to-ground impacts—one of the leading mechanisms of concussions in football. Existing tests primarily assess helmet performance during helmet-to-helmet collisions, often overlooking the rotational and linear forces generated when a player's head strikes the playing surface. In collaboration with the Richard Kent, this project introduces a curved track testing device designed to simulate head-to-ground impacts by guiding a dummy along a controlled path and releasing it onto turf. By offering a repeatable and controlled environment to evaluate helmets under realistic fall conditions, the device contributes to the development of safer helmet designs and more comprehensive performance metrics.

STS Research Paper

Complementing the technical work is the STS research paper, The Impact of Helmet Advancements on Concussion Rates in the NFL, which investigates whether improvements in

helmet technology have decreased concussion rates among NFL athletes. Using the framework of technological momentum, the paper argues that helmet innovation, while significant, is constrained by broader institutional, cultural, and economic systems. These include athlete behavior, media narratives, and equipment marketing. The research shows that although newer helmets reduce certain types of impact forces, their effectiveness is undermined by entrenched norms around aggressive play and inconsistent enforcement of concussion protocols.

Conclusion

Together, the technical and sociocultural investigations reveal the limitations of viewing sports safety as a purely technical problem. While engineering solutions like improved testing devices and helmet designs are essential, their impact is shaped—and often limited—by organizational behavior, social expectations, and systemic inertia. Thus, a holistic approach that integrates technical innovation with institutional reform and behavioral change is necessary to meaningfully reduce head injuries in contact sports.