

# INNOVATIVE ANALYSIS

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## FOOTBALL HELMET INNOVATION

*Case studies from classes led by Dr. Ron Fulbright, University of South Carolina Upstate*

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## 1. Brief description of the situation

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In the NFL a football helmet is supposed to protect a football players head from concussion and injury, but violent collisions can cause the football player to get a head injury or concussion. These violent collisions are entertainment for fans and help to sell tickets and increase the number of TV viewers which increase the NFL profits. Concussions caused by violent collisions in the NFL cause the game being played to be delayed, and cause the player that received the concussion to have to sit out the next game. The concussed player having to sit out the next game causes lost revenue for the team and the player. Concussion causing hits in the NFL are causing new league wide rules to be implemented which are causing players to be fined for causing concussions to other players. These violent football collisions are caused by the fact that NFL players are getting bigger faster and stronger with no improvements to their equipment to equate for these bigger, faster and stronger players. Performance enhancing supplements are one of the root causes for these players becoming bigger, faster and stronger. The NFL player not being able to see a tackle coming before it comes causes him not to be able to brace for the tackle. The NFL player not being able to brace for the hit makes his body limber which causes the hit to be more violent.

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## 2. Detailed description of the situation

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### 2.1 SUPERSYSTEM/SUBSYSTEM ANALYSIS

The football helmet is composed of many different components and parts. The outside of the football helmet is composed of a hard polymer type plastic which is a polycarbonate Frame, and this is the main part of the helmet that is designed to protect the majority of the cranium. Then it has a chin strap which is a padded piece of plastic that holds the helmet in place on the head during play. The chin strap also protects the chin from injury. Then there is the face mask, and its primary function is to protect the face and mouth from injury during play. The face mask typically consists of a series of bars, eye shields and visors. The visor is a clear shield that goes over the eyes, protecting them from injury and is an optional feature on most helmets.

### 2.2 INPUT/OUTPUT ANALYSIS

The different inputs for the football helmet are the chin strap snaps, and the padding snaps on the inside of the helmet. The output would be that the helmet stays snug to the football player head and doesn't move.

### 2.3 CAUSE/EFFECT ANALYSIS

The football player puts the helmet on. The effect of this is that it protects his head. The football player may request to wear an optional visor and if so the effect of this would be less UV light in his eyes. The football player tightens the helmet up and effect is the helmet does not move.

### 2.4 PAST/FUTURE ANALYSIS

The first football helmets were made from leather and they were just a forming fitting helmet. Later on they added straps to these form fitting leather helmets, and by the mid-1940s, helmets were finally required in the NFL. They were still made of leather, but with improved manufacturing techniques had assumed their more familiar spherical shape. By the 1950s, the introduction of polymers brought the leather helmet era to an end. The face mask was also recommended for players by the NFL in 1955 which reduced the number of broken noses and teeth, but also necessitating new rules prohibiting opposing players from grabbing the face mask. In 2002, American football equipment manufacturer Riddell released a new design of helmet called the Revolution which was a step forward in helmet design because it helped to reduce concussions. In 2007, Schutt Sports announced the arrival of a next generation helmet, the Schutt ION 4D. This next generation design was in response to the demand for a safer football helmet. The design includes an integrated faceguard. This new faceguard design features shock absorbing "Energy Wedges" that reduce the force of impacts to the faceguard. This Schutt design is the latest in football helmet protection and is currently used now in 2010.

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### 3. resources, constraints, and limitations

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#### 3.1 AVAILABLE RESOURCES

The helmet outer shell is constructed of a tough plastic called polycarbonate alloy. Foam-based liners are made in several pieces—one is for the back, neck, and sides of the helmet and another is for the crown. Vinyl is then placed over the die cut foam. One-piece liners are inflatable and are used in the helmet for obtaining proper fit and to aid in dispersing the energy imparted by an impact. Molded polycarbonate shells are used for chin straps; this is due to weight and strength of material. The face masks are made out of steel wire and coated with plastic. The face masks are made out of steel wire and coated with plastic. The helmets can be painted. Materials used for helmets must be approved by NOCSEA, all incoming raw materials are subject to inspection.

#### 3.2 ALLOWABLE CHANGES TO THE SYSTEM

Every single component on the football helmet is subject to change which includes the helmet, facemask, visor, padding, screws and chin strap.

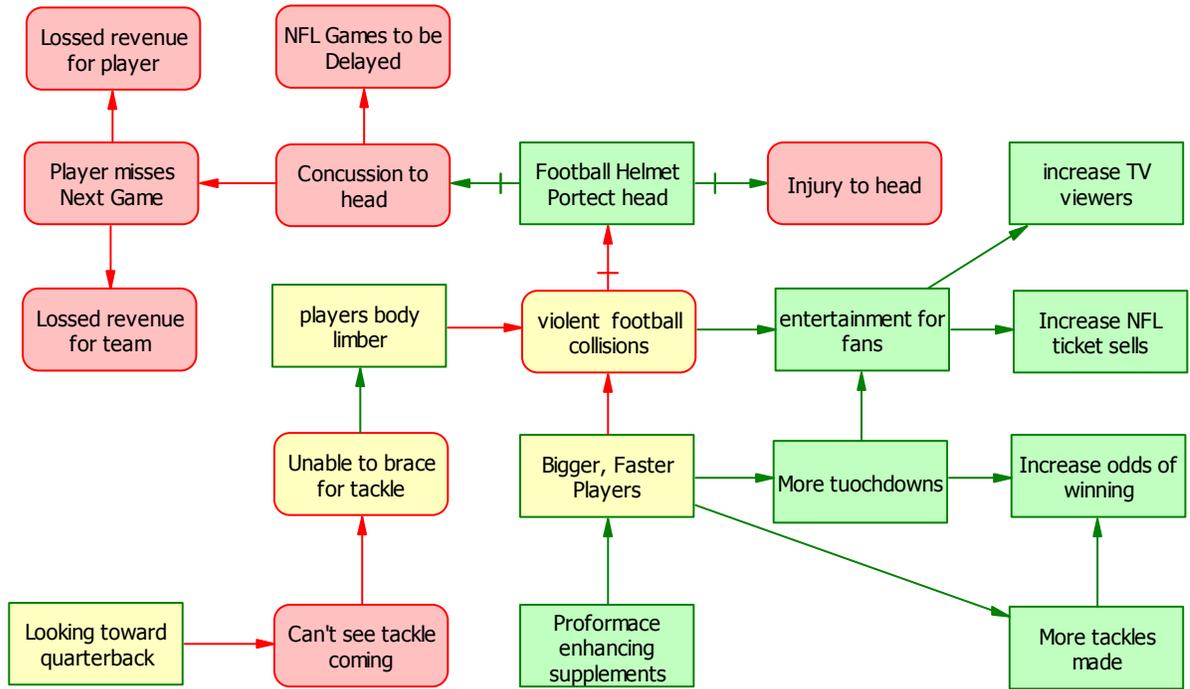
#### 3.3 CONSTRAINTS AND LIMITATIONS

The football helmet must be able to fit the players head and it must be able to protect the football players head from injury and concussion. The helmet must be able to be taken off easily during a game, and the helmet must be snug on the football players head while he is moving.

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## 4. Problem formulation

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## 5. Ideas

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### Protect System from Harm (Modify an available substance)

Place two pinhole cameras on the back of both sides of the helmet that would display an image on the football helmet visor. These two cameras being able to let the football player see in both of his blind spots would allow him to have a 360 degree view of the football field. The football player being able to have a 360 degree view of the field would allow him to be able to protect himself or dodge violent collisions.

### Reduce harmful effects (Facilitate detection in advance)

With this I would put two motion detectors on the back of both sides of the helmet and have a red light attached to the right and left side of the football players facemask in the front where it is visible. So when a football player has his back to an opposing defender the proximity light would go off when a tackler is coming in to hit the player. This proximity light would blink on the left if the tackle is coming from the left side and blink on the right if the tackle if coming from the right side. The idea here is that the football player doesn't need to know what is about to hit him he just needs to know that is coming. So you set the helmet to go off when a violent collision is within 5 meters of an opposing player. So when the red light goes off and alerts the player it would give him time to dodge or brace for the tackle which could prevent a concussion from happening. I would make this system have an on and off switch so that it would not be going off during the whole game, so the player could turn on this mechanism only when he needed it.

### Synthesize new system (Combine known systems)

I would make the helmet and the shoulder pads one isolating unit. In the neck area I would put a bendable but sturdy substance to connect the two together. The idea behind this is that when a football player has a helmet to helmet collisions with another football player the substance around the neck area would keep the football players head from whiplashing keeping him from having a concussion.

### Lower harmful parameters (Use flexible materials)

I would add a soft rubber type material to the outside of the helmet, and the theory behind this would be that this rubber type material would lower the affects of helmet to helmet collisions. When another helmet strikes another helmet this rubber type material would

absorb some of the force from the collision. By the rubber on the outside of helmet absorbing some of the force from the collision it would be less likely that the football player would get a concussion from the tackle.