The Puck Stops Here: Evolving Social Norms of Helmet Usage in the National Hockey League

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Abstract. Since the mid 1960s, the use of safety helmets in the National Hockey League (NHL) went from virtually nil to almost universal adoption. Despite horrific injuries sustained by players early in the history of the sport, widespread helmet adoption did not take place immediately. Using the NHL as an example, this paper examines the process of emerging norms in a social group, considering peer influence and exogenous policy impacts. The historical circumstances surrounding the NHL helmet usage policy changes are presented, along with a brief survey of the social science modeling of cultural norms. The study presents a peer-influence model in which players helmet usage decisions are influenced by their immediate social network and an exogenous mandate requiring helmet usage for new players. Model results are compared to actual NHL helmet usage trends based on data extracted by review of NHL game footage. The results show eventual dominance of helmet usage, but without the wide fluctuations in the actual historical adoption trends. The study is of interest to policy makers comparing interventionist strategies versus social network based approaches for influencing cultural norms of behavior.

Keywords: Social Norms, Agent-Based Model, National Hockey League

1 Introduction

The Question of Helmets as a Social Norm

In his book *Micromotives and Macrobehavior*, Schelling describes the problem hockey players historically faced regarding whether or not to wear helmets (Schelling, 1978). He frames the issue around Teddy Green, a player who had suffered a traumatic blow to the head in 1978. Despite the clear case this injury made for the League to require helmet use, the National Hockey League would debate whether to mandate helmets for years to come. Today all players are required by the NHL to wear helmets, but the

prolonged transition period only ended in 1997 when the last helmetless player, Craig MacTavish, retired.

The tension regarding helmet use dates back to the 1930s, when Ace Bailey almost died after being hit by Eddie Shore, ending Bailey's playing career. Despite this early indication of the substantial risk players ran in refusing head protection, no change was seen for decades. In the aftermath of Teddy Green's injury, many players publicly stated that they would begin wearing helmets – Schelling cites the example of Don Awrey, who claimed that he would adopt a helmet during the aftermath of Green's injury. Awrey was among the many players who made this commitment but failed to follow through on it. This seems especially surprising in light of the fact that Green's near-death experience came less than a year after another player, Bill Masterton, actually died from an in-game head injury.

With all of these examples of how dangerous helmetless play could be, why would professional hockey players choose not to wear helmets? Significantly, it was not the fact that players inherently disliked helmets. The issue was one of standing out. Some players worried that wearing a helmet might muffle their hearing or range of vision, a disadvantage in playing against unhelmeted players, but their major concern was not their skull but their reputation. Clearly, the issue was the norm, not the helmet.

In spite of the strong social disincentives for wearing helmets, some players did. Most of these individuals did so in the aftermath of serious injuries, a badge of distinction that seems to have preserved their reputation. After his own accident, Green was required by his doctors to wear a helmet when he played, an injunction he was not inclined to ignore: he told the press he didn't "want to look foolish by getting injured again because [he] was asinine enough not to wear a helmet." Eddie Shore, the opposing player involved in Green's injury, was not injured himself but was motivated by the closeness of the experience to don protective gear. There were very few uninjured individuals who were willing to risk the ridicule, with the exception of Jack Crawford who wore a helmet to cover his bald spot. Armed with this understanding of what motivated the earliest adopters, it is easier to predict the development of the system over time.

The process explored in this paper is the adoption of safety helmets in the NHL from the 1960s through the 1980s, however, the general question can be applied to other policy making domains as well. This study addresses the research question of how to choose an optimal policy for influencing change in a social norm: should the policy maker use an immediate active intervention, a time-phased transition, or rely on social evolution and innovation to propagate the change?

2 Methodology

The study makes use of agent-based modeling (ABM) method in order to represent a population of autonomous agents whose decision making is strongly influenced by the decisions of other agents. While the specifics of the adoption of safety helmets in the NHL is chiefly of historical interest to sports fans, the concept of examining how a social norm changes over time and is influenced by a combination of top-down policies and bottom-up agent-to-agent interactions is of more general applicability. A variety of changing social norms can be studied in this context, such as the adoption of emissions reducing equipment by coal-fired power plant operators, the conversion of commercial television broadcasting from analog to digital format, and the gradual decline in cigarette smoking over time by teenagers.

An Agent Based Peer Influence Model

Background

The use of helmets can be framed as a tipping model. Schelling highlights the importance of the 'critical number' of other adopters an individual must observe before engaging in the behavior himself, noting that it is usually the case that different people have different numbers. Granovetter builds upon this notion in his discussion of thresholding behavior. (Granovetter, 1978) He notes that the distribution of critical numbers in a population has a significant impact on how the system eventually plays out. Assuming a hundred angry students gather and consider rioting, if every student must see two other people riot before they will feel comfortable joining in, there will be no riot and the students will eventually sulkily disband. If, on the other hand, 98

of those students must see two other students rioting but two of the students have no compunctions about being the first to throw a brick, those two students will touch off a huge riot. The student riot might also unravel, like one of Schelling's dying seminars: if the students successfully start a riot, the departure of one student might tip the number of rioters below another student's threshold, causing the second student to leave with all of the chain reactions that entails. The analogy to helmet usage is clear: the helmet adoption process involves players making conscious decisions about helmet use, trying to anticipate whether enough other players will wear helmets to satisfy their individual critical numbers. The choice to wear or not to wear a helmet is both continuous and reversible.

When the helmet adoption process is framed as a social tipping model, the key dynamic in the system is the interaction of the player with the rest of the population of players. The model utilizes Granovetter's thresholding framework, where each player has some internal critical number of other players he must see wearing helmets before he feels “safe” wearing one himself.

A number of user-controlled options exist, specifically whether a helmet requirement is implemented and when; the initial distribution of individual Player thresholds or “attitudes”; whether or not players factor the attitudes of their teammates into their decisions; and the option to enable a player retirement model within the league. The helmet requirement option allows the simulation to emulate what happened in the real world, where starting in 1979 players joining the NHL were bound by their contracts to wear helmets. The player retirement submodule captures the dynamics of old players leaving the simulation while new ones join, making it easier to reflect changing generational trends in helmet-wearing attitude. The only factor external to the population of players and its interplay is the enforcement of a mandated helmet rule.

Objects

The only behavioral objects in the simulation are the Players. Players are extremely simple behavioral units, characterized by their team affiliation, their current helmet-wearing choice, their injury status, whether they are

contractually bound to wear a helmet, and their critical number thresholds for both the population at large and for their individual team. Players must choose every season whether or not they want to wear a helmet, and they constantly observe the helmet-wearing decisions of others. Players are subject to several processes. Every season, players may potentially suffer a random but unlikely head injury or a relatively more likely retirement due to age or unrecoverable injury.

The process by which Players choose whether or not to wear a helmet is also extremely simple. Firstly, if a Player is contractually bound to wear a helmet, which is to say he is hired when a helmet mandate is in effect, he will do so. If the Player suffers a head injury, he is required to wear a helmet for the rest of his career. Absent either of these, Players look to the rest of the population for guidance. If the number of Players wearing helmets is at least as great as the Player's critical population number, he will choose to wear a helmet. If team dynamics are enabled in the model and the number of helmet-wearing Players within the Player's team is at least as great as his team threshold, he will also choose to wear the helmet. If none of these are true, the Player chooses not to wear a helmet, regardless of any past history of helmet wearing.

Scheduling

The simulation is structured as the change in aggregate helmet-wearing behavior over the number of seasons played, with each tick of the simulation representing one season. At the beginning of every tick, the number of Players who wore helmets during the last season is calculated and all Players make their choices based on these statistics. Retirement happens when a Player leaves and his team is forced to replace him.

Initialization

The initialization of the model is incredibly important to the development of the system. The user can initialize the model, assigning Players their thresholds by a number of different mechanisms. A number of rules are implemented here, representing players who only need to see a few of their peers wear helmets, players who simply don't want to be in the minority either

way, and players who are disinclined to wear helmets but will adopt them if 90% of their peers have already done so. It is also possible to initialize the population of Players with each individual drawing their critical number from a uniform distribution. If team behavior is enabled, these thresholds are applied to both intra-team behavior and the league at large.

3 Data

Data on NHL hockey helmet usage over time has been collected by (Wendorf, 2012), and indicates that while the general trend of helmet usage showed a steady increase, there have been noticeable fluctuations in adoption over time. As noted earlier, the NHL's decision to "grandfather" in players who chose not to wear helmets allowed for older players to choose between using helmets or not using helmets, whereas players new to the league were required to wear helmets and were not exempted. This lead to a steady increase in helmet usage as older players retired and were replaced by newer players who were required to use helmets, but the data shows that there were noticeable fluctuations with both increases and decreases in helmet usage, especially in the late 1960s, and the mid and late 1970s. By the early 1980s, adoption rates were at almost 100%, although the last holdout did not leave the NHL until the late 1990s. The following observations from (Wendorf, 2012) illustrate the trend from the mid 1960s to the mid 1980s (see Figure **1**).

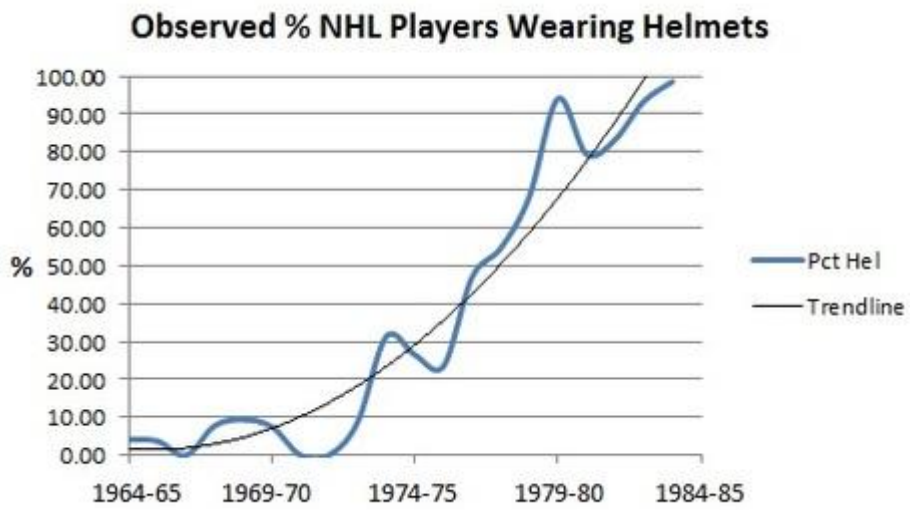

Figure 1. Observed Percentage of NLH Players Wearing Helmets (Wendorf, 2012)

4 Results

The agent-based tipping point model as implemented has three major assumptions to configure: the presumed rate of retirement, the presence or absence of team influence on helmet choice, and the profile of player attitudes that characterizes the overall population of players. Additionally, the user may choose whether to enforce a helmet mandate at any point in the simulation. Each of the configurations discussed here was run 30 times, and the resulting helmet adoption trends of all of the runs are plotted on the graphs, showing the range of outcomes possible under the same parameters. The total number of players in the system was 980, and in each instance the system was run for 100 seasons. The profiles indicate how the agent's thresholds are distributed.

Figure 2 presents an example of how helmet usage patterns vary with agent attitudes and how team influence impacts that process – the extreme importance of team influence in the uniform and mixed scenarios versus its negligible effect in the other cases. It is especially interesting to consider these cases where the helmet mandate is never enforced, yet the system transitions to full helmet adoption, which happens in the team-enabled

mixed attitudes but not in the mixed attitude situation without team influence.

Even given the same distribution of player attitudes and team influence, Figure 3 shows that changing the rate of retirement impacts the system. Of particular interest are the situations in which there is no mandate requiring helmet usage. For example, in the case of the 1% retirement rate, every run ends up with at least half of the population wearing helmets. This widespread usage contrasts with the 10% retirement rate no instance sees more than 20% adoption. The greater the rate of retirement, it seems, the less the chance of suffering a head injury and sticking around long enough to influence other socially susceptible teammates. The system by no means must end up in a state of universal adoption, and under the right circumstances it frequently does not.

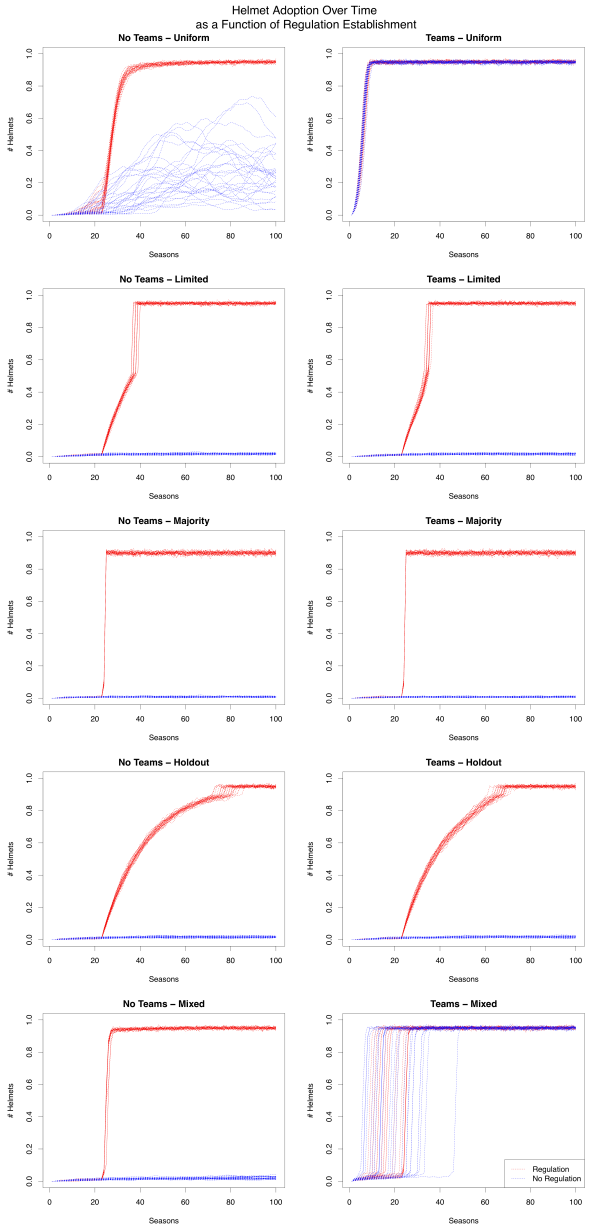

Figure 2. Comparison of impact of enabling teams relative to various profiles of player attitudes, given a 5% chance of retirement

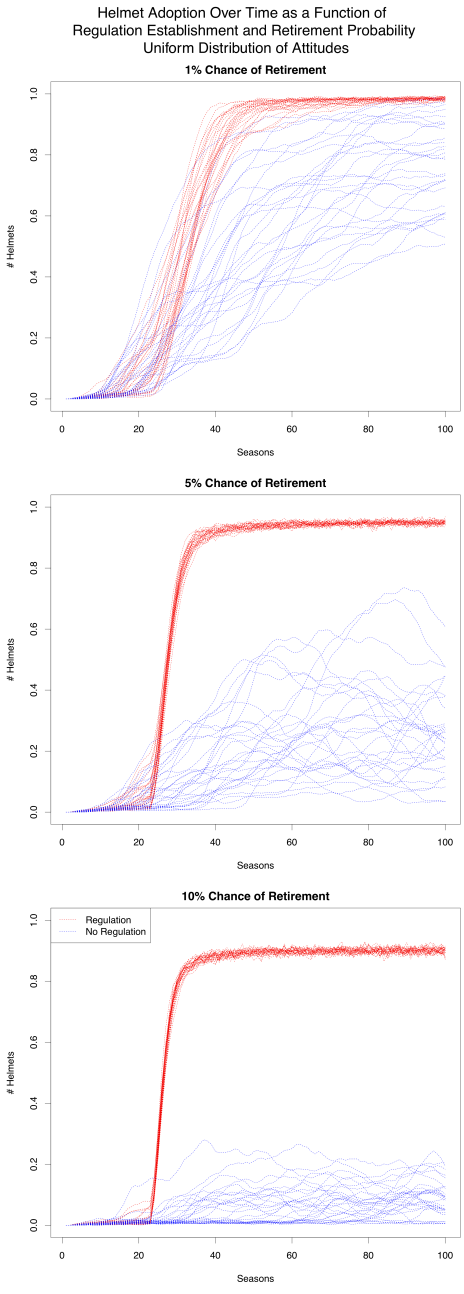

Figure 3. Comparison of different rates of retirement with no team influence

5 Conclusions

The agent-based tipping point model was effective in demonstrating the eventual total adoption of helmet usage, and also showed some interesting fluctuations in adaption rates. As the chance of agent retirement increases, the probability of eventual widespread adoption decreases. Likewise, as members of a population require more and more widespread adoption before they themselves will make the shift, the shift grows less and less likely to ever happen. Compared to actual NHL helmet adaption rates, the model only approximately reproduces the dynamics of the use of helmets from 1965 to 1985. Although there was a general increasing trend in helmet usage, there were noticeable fluctuations in the adaption rate. In contrast, the model shows a fairly smooth adoption rate, and fails to reproduce the pronounced upward and downward swings observed in the NHL data. Nevertheless, the model shows various adoption profiles, based on the thresholds selected, and provides a good representation of how a population might adopt an innovation when subject to peer pressure or social norms.

One of the key features of this study was the interplay between pure social adoption forces and exogenous policy. Since new players were required to use helmets and players tend to have relatively short careers, the effect of this policy was to ensure that helmets would eventually be universally adopted. In effect, the NHL policy removed any stigma associated with helmet usage and encouraged adoption.

The application of this work for more general policy analysis is that for influencing changes in social norms, the use of a time-phased implementation is an effective way to accomplish social policy implementation. The combination of the positive effects observed from peer groups in “tipping” adoption decisions combined with a time-phased regulation for compliance, leads to eventual widespread adoption without onerous enforcement. As Thaler and Sunstein contend (Thaler and Sunstein, 2008), a “nudge” in the right direction can be very effective at changing social behavior.

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