Formula One Racing: Driver vs. Technology

Stephanie Young
Stanford University

Abstract

In the realm of car racing there is a constant competition between performance enhancing technologies and pure driving skill. This paper looks to a popular racing series in Europe and Asia called Formula One to illustrate this point. An organization worth millions of dollars, Formula One's mission statement is dual fold: to pit the world's best drivers against each other and challenge the world's best car manufacturers in competition. Formula One racing is therefore composed of dual components essential to car racing: the competition between drivers and the competition between technologies. At what point does such an advance of technology diminish the role of the driver? And at what point does regulating technology impede the development of technology for consumer cars? This paper examines several key legislations in the realm of car racing as well as the spillover of technology from car racing into consumer street cars. Ultimately, the author suggests that technology, when properly guided, can serve both car racing and innovation.

Introduction

In 2009 the popular, international race series Formula One introduced the option of using a mechanical kinetic energy recovery system, a system that can capture energy from the deceleration of the car and can store that energy for later use. Later in 2009, the manufacturer of the system announced that the further development can provide a “significantly more compact, efficient, lighter and environmentally-friendly solution than the traditional alternative of electrical-battery systems” (Hanlon, 2011), the same electrical-battery systems utilized by millions of hybrids on the road today. The development of the mechanical kinetic energy recovery system in Formula One cars has the potential to create a whole new class of hyper-efficient hybrid technologies—technologies that can simultaneously reduce emissions and cost, increase efficiency, and become the next standard in vehicle development.

The development of these technologies is intricately linked with the race series that promotes them. Yet, in the realm of car racing, there is a constant debate as to whether these technologies detract from driver skill resulting in a detrimental effect on the integrity of a racing series. The mechanical kinetic energy recovery system is a fairly harmless example. However, there are other technologies (for example, computer-aided braking systems) that literally “stop” driver skill from showing. At what point does an advance in technology diminish the role of the driver? In addition, at what point does regulating technology in order to create a fair environment for drivers impede the development of technology in cars? This paper explores the simultaneous competition and synergy between technologies and drivers in Formula One as well as its effects on innovation in the automotive industry.

Formula One: The Shift

Formula One started as a series in which both technology and driver are very important. Over the course of the season, both individual drivers and constructors, those who build the cars, can rack up points in competition for two championships: one for the drivers and one for the car manufacturers. Therefore, from a historical perspective, Formula One has always been a sport with a dual mission statement—to promote competition between drivers who operate the machinery and between constructors, who develop, produce, test, and then race the technology.

Yet, in recent years, there has been a strong concern that advanced technology is effectively replacing the driver as the controlling force behind the vehicle. These critics claim that the elevated importance and prevalence of technology in Formula One detracts from Formula One as a race series because the technology replaces driver skill (“F1 Technology,” 2008). In recent years, the governing body for Formula One, the Fédération Internationale de l'Automobile (FIA), has made serious moves to support this argument. FIA has outlawed many technologies on the very jurisdiction that they replace driver skill to an extent that they detracted from the sport of Formula One racing. This new focus of the FIA has shifted the mission statement of Formula One; Formula One is becoming a race series where technology is playing a subservient role.

Traction control is one such technology banned from Formula One racing (Lavrinc, 2007). Traction control is an electronic system that works with the traction circle of the tires in order to deliver the “maximum mixture of acceleration and cornering grip” (Formula One, 2012). This electronic system that appears in both street cars and race cars helps stabilize the car under moments of high traction stress. On racing cars, however, it allows the driver to recklessly “throw” the car into the corner and rely on the computer to complete the necessary calculations to maintain traction between the tires and the asphalt. Traction control was first developed in the 1980’s—the FIA had banned it by 1994 (Blachford, 2009). However, teams found traction control so useful that they started integrating it into the engine’s CPU rather than building a separate system, effectively sidestepping the regulation ban (Lavrinc, 2007). The FIA lifted the ban in response to its inability to effectively enforce the rule but reinstated the ban on traction control in 2008 (Formula One, 2012). Traction control has been banned ever since. This recent ban was supported by both the FIA and also by the majority of the participating teams. The drivers themselves were the most enthused by the ban; Formula One drivers Giancarlo Fisichella and Kimi Raikkonen explain: "It's going to make it more difficult for the drivers…it's more in the hands of the drivers to judge the traction at exit of slow corners…I think it's going to be more fun—although, for sure, it's going to make it more difficult to driver over the race distance" ("F1 Drivers," 2007).

The anti-lock braking system is another one of these technologies banned in Formula One racing (Formula One, 2012). Formula One cars have disc brakes like most modern road-cars; the brakes work by squeezing a rotor, removing kinetic energy and slowing the car down through friction, releasing heat and light as byproducts (Formula One, 2012). "Brake lock" occurs when the power applied to the brakes overpowers the traction the tire can make with the asphalt, causing the tire to break adhesion with the ground, spinning the car out of control. Anti-lock braking systems (ABS) are electronic systems that control force input into each of the four brakes at the four wheels of the car, eliminating brake lock regardless of driver input into the brake pedal. In road cars, ABS systems are imperative in preventing brake lock and subsequent spinning and loss of control. However, when applied to racing ABS allows drivers to simply "stomp" on the brake pedals applying maximum force, letting the computer modulate the actual force on the brake rotor i.e. essentially negating the "driver art" of brake modulation. This detracted enough from driver skill that the FIA banned ABS systems in Formula One cars in the 1990's (Formula One, 2012). In fact, according to the race organizers, "Formula One cars are surprisingly closely related to their road-going cousins. Indeed as ABS anti-skid systems have been banned from Formula One racing, most modern road cars can lay claim to having considerably cleverer retardation [braking ability]." Ironically, many bans make Formula One cars less advanced than cars on the road. The FIA deems this necessary at times to highlight the skill of their drivers. With ABS systems, it would be difficult to tell which is stopping the car: the driver's artful manipulation of the brake pedal, or an engineer's artful manipulation of computer programming.

These bans are two among many of technological regulations imposed by the FIA in an effort to "put more emphasis on driver skill rather than technological prowess" (Lavrinc, 2007). In fact, the FIA now specifies regulations for car components ranging from tire compound to the exact material (steel or cast iron) and specifications of internal engine parts (Formula One, 2012). These regulations are the result of a new school of thought that pinpoints technology in Formula One as "distracting" to the sport on the basis that it detracts from a demonstration of driver skill. Because of this new mindset, the FIA has been forced to take a stronger regulatory role against technology, creating and enforcing new bans on technology in an effort to retain the driver as an essential component of Formula One racing.

The Technology Ban

This new philosophy calls for the FIA to ban certain technologies from Formula One on the basis that it prevents drivers from demonstrating skill. Yet, is this really the proper solution? While these bans shift the immediate spotlight to driver skill, they also have consequent impacts on the very technology that we use in cars we drive on the streets. Racing encourages car manufacturers to develop new technology and then provides them an obvious way to test it. Many of these innovations find their way onto the street as important components in road cars. These technologies usually enhance both performance and safety. According to BMW's Director of Central Marketing and BMW Brand Management, Torsten Muller:

> [Formula One] as a globally high-profile and widely familiar platform for technical innovation … represents for us an ideal communication tool for the BMW technology campaign. Since we became involved in Formula One, technology transfer has enabled us to generate significant added value both for our production cars and for the Formula One vehicles. Integrating our technology campaign in our Formula One communications is a valid and logical step through which we can show our customers how varying technologies are implemented in road cars and in Formula One, and where the similarities lie. (Fontanelle, n.d.).

BMW, for example, has recently taken the direct steering system used on its Formula One cars and has managed to integrate it into BMW sedans, a technology called "BMW Active Steering" (Fontanelle, n.d.). This adaptation of racing technology into road cars is one of many examples of the successful transfer of technologies. Regulations on technology use in Formula One obviously stifle technological development capping the creative origins of many technologies. These bans also call into question whether car manufacturers will be willing to spend millions of dollars sponsoring and developing technology for their Formula One cars if new technology bans become so strict that car manufacturers will have little to do with the performance of the team. Is it fair to jeopardize the development of potentially life-saving technologies and sponsorship money on the basis that it creates a "fairer" racing series?

Formula One: The Middleman

To answer the aforementioned questions, one can begin by examining the intimate relationship between the development of technology and race series. Similarly, is it not possible for car manufacturers to enhance car and safety performance without a race series acting in-between?

Upon close examination, the direct injection of "Formula One funds" as a middleman into research and development seems more efficient than relying on the car manufacturer. This is because Formula One makes technological development cost-efficient. For example, the annual budget for the Toyota Formula One racing team is $290,400,000 a year, which includes everything from research and development to driver salaries, travel expenses, and corporate entertainment. Ninety-one percent of this money is spent directly towards the development of technology. Meanwhile, Toyota spends $8,285,500,000 a year on research and development (Jusko, 2006). Formula One's annual budget represents only 3.5% of Toyota's yearly research and development sum. The competitiveness of Formula One forces car manufacturers to stay innovative. Teams have to pioneer creative ways to enhance performance in their cars. All the while, these teams are under a strict budget and tight time-line. These pressures make technological development in Formula One far more efficient than other types of research and development. Teams are also given a chance to test and prove their technologies on the track. FIA streamlines this developmental process by only opening regulations in specific areas giving teams direction for development, which makes research more efficient. Formula One gives teams a strict budget, a time-line, and an obvious method for testing their technology. These three factors, when combined with a competitive race series that demands constant innovation, create a potent combination that encourages efficient innovative technology development.

Technology Trickle-Down

Innovation in Formula One experiences a trickle-down effect where many novel technologies find their way into various other industries. For example, Ian Goddart from the Renault Formula One teams explains that Formula One was "...one of the breakthrough industries in pushing carbon fiber composite technology. It was the first industry to move away from the welded metallic structures to look at carbon fiber monocoque [chassis (car frame)] and fiber tub construction [for use in cars], resulting in a significant step forward in terms of performance than a traditional welded structure would have offered...because of their lightweight and high-strength properties" (Shuler, 2009). Carbon fiber is now a staple on almost all high-performance cars. This composite materials revolution was embraced by car culture and remains one of Formula One's best-known contributions towards vehicle development and manufacturing today.

We also see this trickle-down effect affecting non-automotive industries; for example, the new partnership between bicycle designer and manufacturer, Specialized, and major Formula One team, McLaren Racing, illustrates this fact. Their cooperation resulted in an ultra high-performance all carbon fiber road-racing bicycle called "Venge." Once Specialized built a frame it was happy with—the S-Works Venge—it challenged McLaren "to lower the weight and increase lateral stiffness using the same materials and molds" (Bradley, 2011). According to both Specialized and McLaren, although "the bikes look identical, the McLaren weights 14 percent less and is 15 percent stiff (for better handling and efficiency). The differences stem from how the carbon fiber is cut, oriented, and cured, with the McLaren taking three times longer to make" (Bradley, 2011). Two days after the bike's debut, Australian Matt Goss rode it to victory in Italy's Milan-San Remo bicycle road race, backing the bicycle's title as the "fastest complete-performance bike in the world" ("McLaren Applied Technologies," n.d.). The remarkable performance gains that Formula One teams could achieve through the use of composite materials sparked substantial interest in other industries to adapt the technology for their own uses. Since Formula One's first use of these composite materials, it has become the leader in composite fiber technology, creating a dependency where other industries seek them for advice in how to integrate and achieve performance from technology for their own uses. This is one of many examples where Formula One's relative free developmental structure leads to innovations that eventually "trickle-down" to have various uses in industries, automotive or unrelated.

Racing as Entertainment

We can also use entertainment value as a metric in analyzing the role of technology in car racing. For many viewers, the thrill of technological competition outweighs their want for a "pure driver competition." Technology seems to be a major draw to Formula One racing. When we compare Formula One to other popular race series, such as NASCAR or IRL, we find that there are fundamental differences between the way the series approach the art of racing. NASCAR and IRL are both race series in which the focus is very much centered on driver skill, at the expense of freedom for technological development. In 1997, confronted with advanced technologies being introduced on the racing cars, Tony George, the founder of the Indy Racing League (IRL), took the driver-focused philosophy a step further when he specified new technical rules for "less expensive cars and 'production based' engines" for IRL, also known as IndyCars ("IndyCar Series Press Conference," 2007). These new specifications called for almost uniform technological specifications for all the cars. These new standard cars resulted in "an overall loss of interest in open-wheel motor racing in North America" evident by IRL's serious decline in popularity. ("IndyCar Confirms Rule Changes," 2010).

The National Association for Stock Car Auto Racing (NASCAR) is another predominantly U.S. based series that has had significantly more success than IndyCar; it is the second most viewed sport in the United States (only behind professional football), and has gained a foothold in international markets as well—it is broadcasted in over 150 countries (Official Site of NASCAR, 2012). When we compare NASCAR to Formula One, we find that NASCAR's focus on the driver aligns itself closely with the IRL. This can be seen from its technical regulations: "all cars used in a NASCAR Sprint Cup race must use a custom steel body made to fit a template that controls the shape of the car. These cars and then adorned with decals…[but realistically] the bodies bear very little resemblance to actual production vehicles. With the introduction of the 'Car of Tomorrow' the differences between different models were significantly lessened…" (Official Site of NASCAR, 2012). Like IRL, these strict regulations limit the teams' ability to innovative—resulting in a series where technology is featured much less prominently than in Formula One.

Therefore, we can see that both IRL and NASCAR turn their focus onto the driver by standardizing all their cars, limiting technological development and testing, and providing strict regulations that stifle most novel technological development for the cars in their series. Although NASCAR has had much more success than the declining IRL series, how can they both compare to Formula One?

These differences are reflected in the viewership for each series. IndyCar has an average global television audience of 10.37 million viewers over the course of a season, while NASCAR pulls an average of 148.17 million viewers ("IndyCar Price," 2009). Compare this to Formula One, which generates an average global television audience of 527 million people over the course of a season ("Formula One," 2011). Viewership for Formula One is over three times that of IRL and NASCAR combined. When interviewing viewers about their choice in watching Formula One, many people referenced the thrill of technological competition. Formula One seems to attract not only speed-enthusiasts and car-lovers, but "gadget-junkies" as well. Dave Banks (2011) of Wired magazine wrote a column highlighting the ten reasons why people should be watching Formula One. Some of the items on his list were: "1. The engineers are as important as the drivers, 2. Science! 3. Teams know the importance of a good computer, 4. They create some really cool technology, 5. It captures the best of science fiction & fantasy, 6. The athletes are superhuman, 7. It filters technology, like NASA, 8. Beam me up: the alien beauty of the cars". In addition, the competition between technologies also attracts sponsors, which has a direct influence on viewership. Sponsors are more willing to sponsor a car when they know the technology they develop will be the differentiating factor between winning and losing. This leads to more sponsorship money, more advertisements and marketing, more press, and ultimately more hype, fanfare and viewership.

Safe Racing

When considering IRL and NASCAR, we find that the lack of technological development has immediately detrimental effects on the direct safety of the racing drivers. All three series—Formula One, IRL, and NASCAR—have stringent safety measures for teams and drivers. However, Formula One's relative freedom for technological development allows teams to develop even safer technology than the ones mandated, whether by design, or as a positive byproduct for a new technology or material used to improve performance. Less restricted technological development leads to a natural technological evolution that usually improves safety. This point is especially relevant in light of the tragic accident involving IndyCar driver Dan Wheldon in October 2011 at the Las Vegas 300 Grand Prix as part of the IZOD IndyCar World Championship ("Dan Wheldon," 2011). IndyCar has had three fatalities since late 2003: Tony Renna on October 22nd, 2003, Paul Dana on March 26th, 2006, and finally Dan Wheldon, on October 16th, 2011 (Davidson & Shaffer, 2006). Contrast this to Formula One—the last fatality was Ayrton Senna, 17 years ago in 1994 (Williamson, 2008). There have been seven IndyCar fatalities in that time period since 1994. Since Senna's death, Formula One has instigated serious safety improvements (Senna et.al., 2012*)* and while there have been massive crashes and accidents, there hasn't been a fatality or a close-fatality since. In both series, horrific crashes serve as landmark learning opportunities for the governing body in its effort to protect drivers, the crew, and the audience. We see that in both series, new regulations combined with technological innovation allow drivers to walk away relatively unscathed from accidents that surely would have been fatal only years before. Yet, there is something to be said for technological freedom, where teams are allowed to go beyond the regulations and develop their own technology for safety. Due to greater technological freedom, Formula One drivers are better protected than their IRL and NASCAR counterparts. Perhaps the limitation on technological development inhibits teams from best protecting their drivers.

Driver Replacement

Insofar, we've focused on technologies that serve as driver replacements. These technologies make it hard to distinguish actual driver skill from good car development. However, there are technologies that can serve to "spotlight" good drivers. For example, the new 2011 Formula One technological additions included a drag reduction system (DRS) and an adjustable rear wing (Formula One, 2012). These technologies both serve as a way to separate exceptional drivers from mediocre ones. Both the DRS and the adjustable rear wing actually improve performance and speed, but only when used at the right speed, at the right part of the track, and with the correct combination of circumstances. Both technologies cannot be controlled remotely by the team, but must be activated and deactivated by the driver on track (Formula One, 2012). Thus, it is up to the drivers to decide which situations prove prudent for use of each system, and then exercise the system through in-car controls.

The usage of these tools serves a means to differentiate quick, adaptable drivers from their less talented counterparts, drivers who are able to work with technology and direct it from those who are unable to adapt their driving styles.

The Solution

The FIA's historically unique stance on technology has made Formula One a standout compared to NASCAR and IRL. But recently, there are genuine concerns that runaway technological development can severely detract from Formula One. As technology advances, how can we stop it from taking over? The recent FIA response has been to simply ban many of these technologies. While these bans solve the problem in the short-term, they detract severely from many of the positive aspects of Formula One racing. Taking technology out of the equation is simply not the answer. Rather than stifling technological development, the FIA should encourage it while simultaneously being careful to regulate and direct the flow of these technological advancements. But what is the right amount of regulation—what does appropriate regulation look like?

Both the DRS system and the adjustable rear wing are examples of appropriate technology regulation. Rather than serving as a replacement for driver capabilities, they serve as additional tools that drivers are allowed to utilize. When technology is regulated, we can get the "best of both worlds." We can continue to see all the advantages of technological development, increased viewership and development of new technology, while eliminating the concern that technology goes so far as to replace the driver.

Technology has always been a central feature in Formula One. However, as technology becomes more advanced and has the ability to take the place of the driver, some argue that technological advances are unchecked and steps should be taken to ban it. However, it is clear that abolishing technological development within Formula One is not the right approach. Fans are drawn to the technology race in Formula One, a fact supported by the high viewership of Formula One in contrast to Indy or NASCAR. In addition, banning technological development would stifle important advances made in racing that eventually find their way to road cars. Finally, technology can serve as a way to further distinguish adaptable and exceptional drivers. Rather than stifle technological development, a more reasonable option would be to encourage it, albeit with regulations. Technological development when properly guided and regulated can powerfully serve the interests that are central to Formula One racing.

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