Prospectus

University of Virginia Library Chrome Extension
(Technical Topic)

Use of Decision-Aid Technologies in Soccer
(STS Topic)

By

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10/30/2019

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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plethora of library databases and catalogs for relevant results, the extension worked to better inform its users, saving them both time and, potentially, money in their everyday content searching. This existing extension is regrettably no longer functional or available, prompting the library to request the creation of an updated version, in the form of a Google Chrome browser extension. My teammates and I will be working to implement this updated version over the 2019-2020 academic year, with improved functionality and more features. Bringing back such a service will boost the visibility of lesser-known resources, and once again help individuals within the UVA community to potentially save both time and book-buying money.

The benefits that such a browser extension yields to its users are plentiful, not only including the reduction of resource ignorance, but also an easily-expandable platform for future improvements and expansions. The development of an extension for the most popular web browser on the internet that will automatically appear on search will make access to UVA library resources highly convenient ("Browser Market Share", 2019, "Browser Market Share Worldwide", 2019). This convenience will be compounded by the inclusion of login functionality, allowing for automatic authentication of users, yielding immediate digital resource access. By providing access to free resources through member accounts, and some free resources for the public, we would be saving many users the potential cost of paying for a product on a site like Amazon. In all of these manners, our extension would both save users time and the costs of accessing these resources through other methods. The extensions is embedded within the Chrome browser which eliminates the extra steps users have to take, such as traversing through the library website, then searching through the Virgo database and then obtaining the result.

In addition to casual users, academic researchers will benefit greatly from the institution of such a proposed tool. Students and researchers at the University of Virginia sometimes visit

the library, only to discover that their desired material was either not available at the library or not in the library system at all. They then have to wait for it to become available or request an interlibrary loan (ILL). With the addition of our Google Chrome extension, a researcher will be able to see the availability of an item at the library through their web browser and potentially request ILL immediately. This will save researchers precious time, meaning they will not have to go to the library to check availability and request ILL.

Lack of knowledge about the university resources and ease of online shopping are two of the most significant factors in the decline of use of the UVA library. The extension we are developing for the library suggests UVA library's books and resources to users while they are searching for books on Amazon, Barnes and Nobles, and Google Scholar. The extension will look over the webpages and look for keywords like ISBN, UPC, and product name, then suggest the relevant resources that are available in the UVA library in an interactive popup bar at the top of the browser containing information of the resources such as title, author, availability and location. Further, we will extend the project to use Machine Learning (ML) and Artificial Intelligence (AI) to suggest the book and train ML/AI based on the user's interaction with the suggestions.

After several client meetings and revision, we have come up with a list of requirements for the extension. These requirements, however, are not final: as we build the product using agile methodology, there is room for additional requirements or improvements coming from clients and test users' feedback.

Gathering system requirements is essential in building a meaningful product. It can easily provide an outline for what goals can be obtained and it can provide the steps needed to take in reaching the goal. Project management tools can be used to list those requirements and it can

help manage tasks based on weekly or daily goals. Tools like Jira can aid in this process and it can also help assign different tasks to each team member. Processes like these are made possible because of adding requirements.

Minimum requirements for this project include:

- Searching for a book on Amazon, Barnes and Nobles and Google Scholar results in the extension showing a banner with the book name, author, availability or method of accessing the material and location of the library if available.
- Clicking the extension icon will also show the results of a search from the listed three websites. Also, users can do additional searches in the extension with search results shown below the search bar (in the extension).

Desired requirements:

- Using asynchronous functions to responds fast to users' browsing result.
- Embedding logging in users.

Optional requirements:

- Extending the chrome extension to search in other universities library.
- Using Machine Learning to analyze search history and show customized recommended books.
- Security of the extension to be further solidified, so users do not misuse the extension and cause any harm to the library database.

Introduction of Decision-Aid Technology

My technical topic was about building a technology to influence more people to use library resources, whereas my STS topic is about understanding how the use of decision-aid technology has impacted various groups and individuals associated with soccer. Decision-aid technologies consist of a set of multiple technologies that are designed to help match officials make the right decision. Although soccer, in comparison to other sports like tennis and cricket, was late in adopting the technology, the use of decision-aid technologies in sports has skyrocketed since the 2014 World Cup. Decision-aid technologies like goal-line technology (GLT) and video assistant referee (VAR) are now used in almost every major soccer tournament. However, there have been many controversies regarding the adoption of these technologies in soccer.

Fédération Internationale de Football Association (FIFA), a governing body of soccer, was reluctant to bring the new review technology under the presidency of Sepp Blatter (previous president of FIFA). Blatter believed that mistakes of players, coaches and referees bring a human touch to the game (Alvarez, 2017). After the resignation of Sepp Blatter in 2015, various technologies have been introduced in soccer to minimize the referee's error. For the first time in Soccer World Cup history, FIFA introduced VAR in 2018. Even though FIFA claims that these technologies help to make the game fairer, it has created a myriad of controversies and divided people on the decisions made by VAR. Gianni Infantino (current FIFA president) stated: "We can see in the matches, where the game is being interrupted, this creates an additional moment of tension where everyone is waiting" (Govind, 2018, p. 1). Whereas, many people complain that VAR also has taken away the instantaneous joy of goal celebration, which is detrimental to the atmosphere in stadiums (Evans, 2018). Fans are worried about the goal being taken away before

celebrating goals due to the possibility of a review. However, there were also many controversies regarding referees' decisions before GLT and VAR. For example, in a 2010 World Cup game between England and Germany, the referee disallowed a goal when the ball bounced inside the goal line and came out of the line (Smyth & Murray, 2014). Therefore, I will explore the impacts of these technologies on the players, coaches, referees, fans, all other stakeholders, and the game of soccer itself.

Analyzing Impacts of Decision-Aid Technology Through Technological Momentum

In order to understand how the decision-aid technology influences and gets influenced by various social groups and individuals over time, I will use Thomas P. Hughes' (1994) framework of technological momentum. The idea of technological momentum is that both society and technology influence each other depending upon the age of the technology. Hughes (1987) described that a new technological system evolves through various phases like invention, development, innovation, technology transfer, and growth, competition, and consolidation. After the technology matures, it also acquires style and gains momentum. Hughes also used the term 'reverse salient' to describe the component of the technological system that falls behind and prevents the growth of the entire system. According to Hughes's theory of technological momentum, newer technology tends to be more malleable to societal forces while older technology is more independent of outside influence and deterministic in nature. Hughes (1994) uses a case study of a technological system of EBASCO (The Electric Bond and Share Company) to show how the socio-technical system both shaped and was shaped by society on various occasions. When EBASCO was just formed, it was influenced by political and economic

forces of society to change the way it operated, whereas when it started gaining momentum and getting bigger it started shaping other industries and communities.

Looking through the lens of technological momentum, decision-aid technology is in the phase of technological transfer. The technology is being tweaked and altered to fit in various soccer tournaments around the world by the system builders like FIFA and local soccer organizations. The English premier league (EPL), which started using VAR from 2019-20 season, has come up with a different way of implementing the VAR compared to other tournaments. VAR officials have been told to review a subjective incident (like handball or foul decision) a maximum of three times at full speed and three slow-motion replays - and if the offense is not 'clear and obvious,' they should move on with their original decision (Duncan, 2019).

On the other hand, decision-aid technology is slowly beginning to gain momentum as most of the international and domestic tournaments have started using it to officiate the games. Now that the technology is gaining momentum, it has become deterministic by causing players to change the way they play their game. During the 2019 Women's World Cup, VAR enforced goalkeepers to stay within the goal line when the penalty kick was taken. Another chance of penalty kick was awarded if goalkeeper moved off the edge of the line, which goalkeeper had been doing for years (Gregory, 2019). Similarly, VAR has also impacted the way coaches plan their game. Austin Reynolds (2019) describes the changes brought by the implementation of VAR on the way coaches communicate with players during the game. He uses examples of some of VAR review instances during matches of the 2018 World Cup and 2018 Champions League to show how coaches have used the 'VAR breaks' to communicate changes in strategy with players (Figure2).

Figure 2. Jurgen Klopp, Coach of Liverpool Football club, speaking to his players during a 2018 Champions League match while VAR was the reviewing decision (Image source: Botterill, 2018)

Besides coaches and players, soccer fans have also been impacted a lot by the implementation of decision-aid technology. Mathiew Winland and Craig Fergusion (2018) argue that the introduction of decision-aid technology like Goal Line Technology (GLT) has lessened the live supporters' satisfaction at the game event. They used a quantitative approach based on an online questionnaire to collect the information from the supporters to understand the perceptions of Scottish football supporters toward GLT. By analyzing the data, they got from the interviews, they found that the decision-aid technology had significantly impacted the atmosphere of the stadium, which fans consider is the most crucial component of satisfaction at a sports event. Similarly, Michael Lynch (2019) has argued how VAR is destroying the ambiance and mood in the stands by stopping the continuous flow and rhythm of the game. The continuous and constant

movement of the play is what makes soccer unique from other sports, and VAR is removing that fundamental part from soccer.

Research Questions and Methods

My research question is: How has decision-aid technology impacted the stakeholders and the overall game of soccer? The implementation of technologies like VAR and GLT has changed the way soccer is played, coached, and viewed. Therefore, I will research how primary stakeholders, like players, coaches, and fans, have been influenced by technology. In order to gather evidence, I will use both primary and secondary sources. I will conduct surveys on social media sites like Reddit and Facebook groups that focus on English Premier League (EPL) and Spanish League (La Liga) to collect information about the opinions of soccer fans about decision-aid technology. I will create a set of questionnaires that will help me analyze how the introduction of technology has impacted their viewing experience of soccer. I will also go to the soccer stadium and directly observe the fans' reaction when decision-aid technology is used in a match. After the game, I will interview with the audience and ask them about their thoughts on the use of technology. Austin Reynolds (2019) mentioned in his article that VAR has allowed coaches to meet up with the players and adjust the formation and overall strategy of the game in the middle of a match. So, I will try to carefully observe what coaches do during VAR breaks and how do they adjust the tactics of the game in the stadium (if VAR review occurs). For gathering information from the secondary sources, I will watch more videos of the matched where VAR and GLT were used. Primarily, I will watch the videos of the matches, in which the technology changed the outcome of the match. For example, in a Champions League semi-final match between Manchester City and Tottenham Hotspurs in 2019, VAR denied the goal scored

by Manchester City in the final minute of the match and caused them to lose the match. Watching game videos and press releases of these matches will help me to understand how players, coaches, and fans felt about the technology being used in the match.

Since the decision-aid technology is gaining momentum and proliferating, I will use the technological momentum framework to understand how this technology is starting to become deterministic and independent of social influence. I will use the framework to analyze the various evolution phases of the decision-aid technology as well. Furthermore, I will also try to find the 'reverse salient' of this technological system that is lagging the entire system from achieving its goal of "minimum interference – maximum benefit" (Homewood, 2017, p. 1).

Expected Results and Timeline

I will research the significance of the decision-aided technology affecting the stakeholders of soccer. This research will produce a critical analysis of the benefits and risks of using decision-aid technologies like GLT and VAR to officiate the matches by evaluating the influence of the technology through the framework of technological momentum. I will start collecting secondary sources of arguments and watching match videos and press releases during winter break. I will also try to conduct online surveys of soccer fans at the same time. Then, around March I will collect primary sources by going to soccer stadiums and observing the fans directly. After that, I plan on finishing my research paper by the end of March.

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