

## **Prospectus**

### **Analyzing Patterns in User Interactions with IOT Voice History**

(Technical Report)

### **Exploring Modern Sign-Stealing Sociotechnical Systems in Major League Baseball Through Assemblage Theory**

(STS Research Paper)

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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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## I. Introduction

The integration of Internet of Things (IOT) voice assistant devices (VADs), which “listen” to users’ voiced commands and can execute various audio operations, presents many new and exciting opportunities to improve many peoples’ lifestyles (Turner-Lee, 2019). However, in the few short years since the appearance of such devices, many public concerns have arisen. There are economic concerns (Acquisti et al., 2016; Elvy, 2017), ethical and legal concerns (Campbell & Barrett, 2019), and security threat concerns, having seen many demonstrations of malicious skills (skills are applications for VADs) bypassing systems’ security policies (Bräunlein & Frerichs, 2019). Despite all of these issues, many users do not understand how easily their privacy can be compromised. As an example, Dubois et al. (2020) revealed that even something as simple as a loud TV program can wake VADs, causing them to record your conversations without your knowledge. The technical project will seek to address this issue, and, in addition, provide users with a way to track and interact with their personal data.

Unrelated to the technical project, stealing opposing teams’ pitching signs have been a part of baseball since its inception. One might think that stealing opposing signals would be illegal; however, there has never been an explicit rule in the official Major League Baseball (MLB) rulebook banning the practice (Major League Baseball, 2019), lending itself to become an “unwritten rule.” However, both the current and previous Commissioners of MLB issued memos to teams banning electronic and off-field sign-stealing (Verducci, 2020); therefore, it is “cheating.” But that has not stopped several recent teams from partaking anyway (Verducci, 2020). It is imperative for MLB to address recent, sophisticated SSSs to both maintain the integrity of the game, and to preserve the public’s trust – a critical element for any business – in order to prevent a further decline in fan viewership (Bejou et al., 1998). The STS research will

seek to identify critical actors in the SSS in order to ultimately uncover effective practices and policies which, if implemented, would work to eliminate illegal SSSs from MLB.

## **II. Technical Topic**

In order to help users better manage their personal data, it was determined that a Google Chrome browser extension would be created to help monitor user interactions with Amazon's Alexa Voice Assistant technology. The short-term goal of the extension is to provide users with the capability to manage their voice history such that they can quickly download it, identify unintended or unwanted data, and delete these data with the click of a button. Amazon does offer the capability to delete unwanted Alexa recordings on their website (Amazon, n.d.); however, it is clunky to use and forces users to delete just one recording at a time. On top of that, trying to find specific recordings from over a month ago is very difficult if one has hundreds or thousands of interactions. The extension will seek to allow for faster searching and to flag potentially unwanted recordings. An indirect user benefit of such an application is that they will gain knowledge of their own usage patterns and exactly how much Alexa "hears."

Applications that perform some similar functions as the one mentioned above do already exist (Malkin et al., 2019). However, there is a longer-term, novel question that this project will seek to answer – can an artificially intelligent (AI) software that will automatically suggest VAD interactions to delete based upon that user's former deletion-patterns be developed? The natural question to follow from this is how would the software form these patterns? The answer can be gleaned from noting labels (verbalizations that the VAD recognized as an intended user-spoken phrase) from recordings users delete through the extension (, and the user-defined reasons for its deletion (Horiguchi et al., 2018). These two types of data form what are known as *personal classifiers*, a pattern a given user follows in their decision to delete certain recordings (Horiguchi

et al., 2018). This leads into the main question the extension seeks to answer – what do users delete, and why do they delete it? The answers to this question would form a robust foundation for the afore mentioned AI software that can automatically suggest interactions for deletion. Therefore, the answer to the latter question will be sought, and the development of the previously defined AI software will be left as future research. To illustrate what is meant by building personal classifiers, consider the following example. A user owns a slightly malfunctioning IOT VAD. The VAD misinterprets the word “potato” as a wake word – a word that activates the listening technology. Unfortunately, the VAD is situated in the kitchen of a family that really likes potatoes. The goal is that the extension would capture data of the individual’s repeated deletions of interactions containing the word “potato.” This data would be analyzed to draw conclusions of what, and to what extent, these variables will contribute to the formation of personal classifiers; in this case, these researchers would hone in on the “potato” label and mark it as a likely component of that user’s personal classifier. Eventually, the goal is to have the previously discussed AI software form these trends automatically, but that is beyond the scope of this project. Therefore, it is the task of these researchers to collect necessary label data and specified reasons of deletion, which will be done through the Chrome browser extension interface.

### **III. STS Topic**

As previously established, it is essential for users of IOT VADs to be aware of the risks presented associated with said devices, and how their data can be used against their wishes. However, many users fail to understand these risks. This is partly because users are typically presented with user agreements packed with legal jargon. The overwhelmed users then accept the terms without reading them first (Moallem, 2017). It would be useful to explore the ethical

implications of this system, and how it can be harmful to users. However, the topic of ethics in IOT devices is well-researched in computer science and STS. Instead, the STS research paper will focus upon recent sign-stealing systems (SSSs) in MLB, which has not received the same level of attention, but holds great significance in the modern shaping of baseball culture and its code of unwritten rules.

Unwritten rules, “developed” by ballplayers themselves based upon their collective on-field experiences, ultimately decide what on-field behavior is acceptable and what is not (Turbow & Duca, 2010). Some have sought to study the ethical and philosophical morality behind them (Cushman et al., 2012; McAleer, 2009). Others have sought to, ironically, write out the unwritten rules (Turbow & Duca, 2010). However, the focus of this research paper will be the unwritten rule regarding sign-stealing, specifically focusing on the “wrong ways to steal signs” (Barna, 2019, p. 7). Recent SSSs have threatened MLB’s moral duty to provide fair, unbiased entertainment to its fans, which harms consumer trust, potentially resulting in the loss of fans (Bejou et al., 1998). It is therefore essential that recent SSSs be studied in order to find ways of preventing illegal sign-stealing.

To study SSSs, Assemblage Theory (AT) will be utilized. This framework will be used due to its successful implementation in related literature exploring cheating in gambling (Johnson, 2018) and in online gaming (De Paoli & Kerr, 2009). AT is similar to Actor-Network Theory (ANT) in many aspects, including its principle that relationships between actors are essential to the functioning network (DeLanda, 2006; Latour, 1996). However, there is a significant difference that aligns itself well with the Astros’ cheating scandal – it does not assume actors to be fixed. AT builds in as an assumption that humans, specifically, are unpredictable, and that it is the symbiotic relationship between the components, the actors, that

when added to the raw parts makes the whole (DeLanda, 2006). While De Paoli and Kerr (2009) more directly apply AT in their analysis, Johnson (2018) implements a hybrid between ANT and AT. He explains the benefit in doing so is that “This perspective allows researchers to seek out actors that are ordinarily stable in a network designed to prevent cheating, and how the same set of actors must be subverted, or put to other purposes...” (p. 305). In other words, if one can find and exploit the “weak link” in a cheating network and destabilize it, the whole system would crash (p. 317).

Teams and players share two common interests which drive the majority of their professional actions – money and winning, and there exists a positive relationship between the two. Teams want the team to win in order to gain more money in ticket sales for postseason games (Vrooman, 2012). Players, on the other hand, want to win to earn salary bonuses for postseason play. In 2008, Vrooman (2012) calculates that players received, on average, approximately \$18,000 per postseason game. More recently, in 2017 Kirshner (2017) estimates that players received an average of nearly \$25,000 per postseason game. Expanding beyond the obvious monetary motivations, Kinyon (2020) suggests there are psychological factors at play which cause a lapse in a team’s cost-benefit analysis of whether to employ SSSs. Such factors include representative heuristics, availability bias, and anchoring heuristics (Kinyon, 2020). One of the themes present in Kinyon’s argument is that of the “Prisoner’s Dilemma.” That is, there are two options for two opponents, an optimal one, and a sub-optimal one. The catch is that if both select the optimal option, both receive punishments, as is the case if both teams employ SSSs. However, one does not want to be the team that selects the suboptimal option while the opponent chooses the optimal one, as that would punish only oneself (Kinyon, 2020). It is

implied that the fear of the latter case influenced the Astros to make the decision to cheat. This fear is one of the subtle, yet crucial, actor-relationships that will be explored.

### ***Research Question and Methods***

Using the 2017 Houston Astros Sign-Stealing System (HASSS) as a case study, the STS research paper will pose the broad question: How can MLB most easily and cheaply reduce similar SSSs in the future? The HASSS is utilized as a case study due to the large amount of media attention surrounding it, which allows for in-depth study into the well-publicized actors, motivations, and relationships among actors. The first step of the research will be to consider the motivations behind the Astros' actions. Without that context, the human relationships in the assemblage will be very difficult to assess (Kinyon, 2020). The second step will progress to deconstructing the intricate sociotechnical HASSS through the lens of the Assemblage Theory framework. Namely, this involves breaking the system down to its actors and identifying their crucial relationships (DeLanda, 2006). This method is very similar to the ones employed by De Paoli & Kerr (2009) and Johnson (2018) to analyze their online video game and gambling networks, respectively.

The final step will be to identify the system's "weakest link." The "weakest link" refers to the actor or actor-relationship which can be most easily and cheaply removed or dissolved, respectively. Assemblage theory suggests that, despite human unpredictability, that eliminating any relationship in an assemblage will cause it to crumble (DeLanda, 2006). That is why identifying the weakest link is so crucial – since its elimination collapses the network, it points to real-world solutions that will, in this case, defend against illegal sign-stealing (Johnson, 2018).

### **IV. Timeline and Expected Outcomes**

The hoped-for result of the technical project is the successful releasing of the chrome extension that is downloaded and used enough in order to collect meaningful labels and user

reasons for deletion. These researchers anticipate an outcome where common labels and reasons for recording deletions are identified such that eventually work can begin in developing software that forms personalized classifiers. The type of paper these researchers will write has not yet been determined, but will soon be decided. This paper will mostly likely be due sometime in between April and May, 2021. A prototype of the extension is expected to be released by March, 2021 so that data collection may commence before the semester ends. It is hoped that enough data will have been collected by the end of the semester such that significant analysis can follow.

As for the STS research paper, the desired outcome is the identification of one or more weak links in illegal SSSs, with the hope that this will point to one or more feasible solutions MLB can implement to prevent similar incidences in the future. The STS thesis is projected to be completed in April, 2020, near the end of the semester.

Word Count: 2090



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