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WHAT TYPE OF PERSON SUPPORTS 24/7 POLICE DRONES OVER NEIGHBORHOODS?

A Regression Analysis

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ABSTRACT

Unmanned Aerial Systems (UAS) have significantly influenced the methods that industries use to conduct business. For example, several large city police forces have welcomed UAS, revolutionizing their surveillance capabilities. However, the influx of UAS does raise potential privacy concerns for citizens living in those areas patrolled with UAS. Therefore, the purpose of this study was to determine what variables predict participants' privacy concerns about UAS police missions above their neighborhood. There were 205 participants in stage 1 and 186 participants in stage 2, and they were presented with hypothetical scenarios involving police issued UAS patrolling near their residence. Following the scenario, they were asked to provide responses to a validated UAS privacy scale and then answer a set of questions that served as potential predictors. The data reveal that seven factors (importance of privacy, attitude towards UAS, perceptions of whether police are corrupt, feeling of safety in the neighborhood, number of children, ethnicity, and support for police activity in the neighborhood) significantly predict participants' privacy concerns about police usage of UAS in their neighborhoods. As the police employ UAS missions in public or near housing residences, it is important to consider the privacy concerns of residents and other citizens in the area. The results from this study provide information about what type of person is most concerned with UAS privacy issues.

Keywords: Privacy Concerns, Unmanned Aerial Vehicle, Police Surveillance, Public Perception

Introduction: Problem Statement

Unmanned aerial systems (UAS), more commonly referred to as drones, are operated by a remote pilot and vary in their technological capabilities and use (Clothier, Greer, Greer, & Mehta, 2015; Finn & Wright, 2012). As UAS gain popularity, more businesses and private agencies are expanding their use to fulfill new tasks and jobs previously completed by people. Business Insider reports that consumer, commercial, and government drones, combined, have the potential to increase sales from $8.5 billion in 2016 to more than $12 billion in 2021 (Meola, 2016). This potential increase is favorable for UAS manufacturing growth but raises potential concerns regarding citizens' privacy. The FAA currently determines the regulations for drone use, and their purpose is to protect the National Airspace System (NAS) and help prevent aircraft collisions (Matiteyahu, 2015). Though necessary to protect passengers and promote safety in the aviation industry, these regulations fail to consider citizens' privacy.

Over the past few decades, the public has grown more and more concerned over privacy rights and the intrusion of the government into their private lives, and properties, without warrants or probable cause. The ability of UAS to access areas and vantage points within properties that would otherwise remain hidden from the public has increased privacy concerns revolving around UAS usage (Villasenor, 2014). While privacy is a significant concern for citizens, it's important to understand the public's overall perception of UAS. To date, few studies have investigated citizens' perceptions of drones used by police and others. Therefore, the purpose of this study is to investigate and identify factors that may predict citizens' perceptions of UAS use by law enforcement agencies.

Privacy Issues

The issue of privacy has been strongly debated throughout American history, with shifting interpretations at different points in time. Marmor (2016) defines privacy as:

> having a reasonable measure of control over ways in which we present ourselves to others, [… and securing] a reasonably predictable environment about the flow of information and the likely consequences of our conduct in the relevant types of contexts (p. 8).

Protecting citizens' privacy is a responsibility of elected Congress officials; therefore, it is important to understand the effect these regulations may have on the Fourth Amendment, which establishes "the right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures" without a warrant (U.S. Const. amend. IV, n.p.). The Fourth Amendment is crucial for citizens' privacy because it limits the government's ability to intrude in a person's life and property without due diligence or probable cause. Nonetheless, the language in the amendment and rulings by the Supreme Court of the United States (SCOTUS) limits the scope of these privacy rights and enables authorities some liberty for searches and surveillance at their discretion (Villasenor, 2014).

A reasonable expectation of privacy should not be misinterpreted as absolute privacy. The fourth amendment does not protect citizens if they are breaking the law in an open space on private property, such as their backyard, front porch, or anywhere where members of the public may feasibly see them (Blitz, 2013). For example, during routine helicopter surveillance of a residential neighborhood, police discovered illegal substances being stored outside a person's home. Despite finding the substances without a warrant on private property, SCOTUS determined the residents did not have a reasonable expectation of privacy because the illegal substance was in plain sight, and the surveilling aircraft complied with the Federal Aviation Administration's (FAA) regulations (Frazier, 2016); thus, the residents were lawfully convicted.

Currently, UAS have a wide array of capabilities, including geolocational tracking, cameras, live video streams, radar, and communication interception (Cavoukian, 2013). UAS capabilities are used to support military operations, agriculture, search and rescue, surveillance, land survey, and recreational purposes (Winter et al., 2016; Zhang & Kovacs, 2012). With so many different possibilities for UAS, concerns over Fourth Amendment violations are not unfounded. While the public widely uses UAS for a variety of purposes including surveillance and recording, it could be argued that the scope of these previous rulings was not in the context of current technology and that the software on law enforcement drones may render the UAS as a device 'not in general public use.' This is an import-

ant aspect because previous court rulings have sided with the plaintiff because the technology being used by the defendant was not considered 'general public use.' Technology outside of general public use can include sophisticated camera zoom options, live video streaming, geo-locational tracking, infrared thermal imaging, radar, etc. (Cavoukian, 2013). However, as these technologies become cheaper and more accessible, they may start to fall into the category of 'general public use,' which could negatively affect the protection of citizen's privacy.

Another concern regarding possible privacy violations is video and audio recording by civilians without consent. States laws vary in their interpretation of how recording without consent violates or fails to violate, constitutional law. For example, the Seventh Circuit in Illinois decided that audio recording is illegal without consent from all parties being recorded (Kaminski, 2012). Additionally, Texas state law bans video recording of private property without the owner's consent. The differing laws create controversy due to the conflicting nature of the Fourth and First Amendment, which protects free speech (U.S. Const. amend. I). In Fields v. Philadelphia (2017), the court stated in the opinion regarding the recording of police officers that "the First Amendment protects actual photos, videos, and recordings, […] and for this protection to have meaning, the Amendment must also protect the act of creating that material" (n. p.) The discrepancy between these amendments may hinder the progress of new legislation or create conflicts when law enforcement uses UAS. For this reason, it is essential to explore the nature of privacy concerns regarding their use. The present study expands upon privacy perception as it relates to UAS.

Privacy Issues in UAS Missions

Prior studies have sought to determine people's willingness to accept drone use in a variety of scenarios. Vincenzi, Ison, and Liu (2013) found that privacy was the top concern regarding the domestic use of UAS, followed by safety. More than 50% of respondents were not comfortable with the use of drones outside of military airspace, but they supported their use for firefighting, weather monitoring, natural disaster management, and pipeline patrol, while applications by law enforcement, including surveillance, were rated unfavorably.

Winter, Rice, Tamilselvan, and Takorski (2016) explored participants' concerns regarding the scope of UAS employment, which consisted of police using the drones for 24/7 surveillance, or using them only during specific missions. Also, the researchers also explored whether any emotions mediated the relationship between perception of privacy concerns and whether the UAS was used 24/7 or mission-specific. Results indicated that participants experienced higher privacy concerns when the police planned to use the drones for 24/7 surveillance rather than during specific missions only. Furthermore, affect (emotion) mediated the relationship between privacy concern scores and drone-use type, with disgust and fear as significant predictors.

Heen, Lieberman, and Miethe (2018) found that public support for UAS use by police was highest when used in reactive policing contexts, such as responding to calls, search and rescue, etc. Proactive policing applications of drones received less than half the support that reactive applications did from participants. The authors propose that the results are akin to literature regarding public attitudes toward citizen-police interactions, with a possible explanation being that the intent and scope may be less clear and available to the public in proactive missions than reactive missions, where intent and scope are clear and directed.

Perry and Winter (2016) found that participants' concerns about privacy were higher when presented with a UAS scenario involving audio/video capability and almost neutral when no equipment was present. Overall, females scored higher regarding privacy concerns when the drones were equipped with the capability of audio, video, or a combination of the two. Rice and colleagues (2018) further explored this gender difference and found that the gender differences varied depending on mission type, appearing only when the mission involved unmarked UAS, real estate, online sales, and construction, with females scoring higher on privacy concerns.

The results of these studies lay the framework for a basis of the investigation, which may lead to a more insightful way to implement and use drones as part of law enforcement surveillance strategies. Once citizens' perceptions and concerns of this technology are better understood, laws and regulations can be developed that garner support from people regardless of their race, political affiliation, residential location, and other accompanying demographics that form American neighborhoods.

Current Study

The current study has two main goals. In study one, the purpose was to generate a descriptive regression model of 19 variables and their effect on the perception of privacy concerns. The 19 variables tested were: age, gender, ethnicity, political affiliation, number of children, education level, income, number of times broken the law, perceptions of whether the police protect us, perceptions of whether police are corrupt, feeling of safety in the neighborhood, importance of privacy, support for police activity in the neighborhood, trust in aviation technology, attitude towards aviation technology, attitude towards UAS, trust in technology, trust in the police, and knowledge about UAS. In study two, the purpose was to validate the model generated to measure privacy concern, and to test model fit. The following hypothesis was presented for this study:

> H_{a1}: At least one of the predictors (age, gender, ethnicity, political affiliation, number of children, education level, or income) would be a significant predictor of privacy concerns when controlling for all other variables.

Methods

Participants

In study one there were 205 (83 females) participants from the United States, while study two utilized 186 (78 females) participants from the United States. Both stages recruited participants via convenience sampling on Amazon's © Mechanical Turk © (MTurk). MTurk is a web-based platform which allows individuals to complete human intelligence tasks (HITs) in exchange for monetary compensation. Data from MTurk has been shown to have similar reliability to that of traditional data gathered in a laboratory and is arguably more generalizable than a university subject pool (Buhrmester, 2011; Germine et al., 2012; Rice et al., 2017). The mean age of participants was 36.88 (SD = 12.15) years old.

Procedure and Materials

First, participants were presented with a consent form and were then required to sign it digitally. Participants were then given instructions on completing the subsequent survey. The first section of the survey was a hypothetical scenario which read "*Imagine a situation where your local police department announces plans to use unmanned aerial vehicles (UAS) to patrol the skies of your neighborhood 24/7 (day and night) every day of the year in order to assist with police activities. These UAS would fly at various altitudes and provide aerial coverage with video feedback of the entire neighborhoods at all times*."

Upon reading this hypothetical scenario, participants filled out a previously validated UAS Privacy concerns scale (Mehta, Rice, Winter, Moore, & Oyman, 2015; See Appendix A). The final section of the survey required participants to answer demographic questions that were as follows: age, gender, ethnicity, political affiliation, number of children, education level, income, number of times participant has broken the law, perceptions of whether the police protect us, perceptions of whether police are corrupt, feeling of safety in the neighborhood, importance of privacy, support for police activity in the neighborhood, trust in aviation technology, attitude towards aviation technology, attitude towards UAS, trust in technology, trust in the police, and knowledge about UAS (the last eleven factors were measured on a seven-point Likert-type scale with varying anchors). Upon completion, participants were debriefed and paid.

Results

This research was divided into two stages. The first stage used stepwise regression analysis to determine the predictors of statistical significance. The second stage tested the equation generated in stage 1 for model fit using an independent secondary sample, validating the model. Stage 1 utilized 205 participants with stage 2 containing an independent sample of 186 participants. Using G*Power, the minimum sample sizes required for the study were 187 participants with the following criterion: small effect size of .15, power (beta) of .90, an alpha level of significance .05, and the 19 predictors.

Stage 1

A stepwise regression analysis was conducted to determine the statistically significant predictors of UAS Privacy in this study. The regression analysis generated seven significant predictors listed below. The regression equations generated was:

$$Y = -.937+.322X1 -.184X2 +.096X3 +.151X4 -.105X5 +.816X6 -.105X7$$

where Y was the predicted UAS privacy scores, and X1 through X7 were the importance of privacy, attitude towards UAS, perceptions of whether police are corrupt, feeling of safety in the neighborhood, number of children, ethnicity (mixed), and support for police activity in the neighborhood, respectively. The overall regression model accounted for 39.60% (37.50% adjusted) of the variance in privacy related to UAS, and was a statistically significant model with $F(7,197) = 18.46$, $p < 0.001$.

Stage 2

In stage 2, an independent set of participants was used to collect the second sample. This sample was used to test the equation created in stage 1, thus validating the predictive nature of the model. This model fit validation was conducted in three ways, using t-tests, correlations between actual and predicted scores and cross-validated R^2. Through the application of the regression equation to the second sample, a set of predicted scores of UAS privacy were generated. These predicted scores were compared with the actual scores of the participants in the second sample.

The first test conducted in stage 2 was the t-test between the two sets of data (predicted scores calculated from the regression equation from stage 1 and the actual scores of the second sample). The test produced statistically insignificant differences between the two sets of data, where $t(185) = -.230$, $p = .818$. Based on this analysis, it can be inferred that the actual and predicted scores do not vary significantly and therefore the prediction model is valid.

The second test conducted in stage 2 was a correlation analysis between the same two sets of data of predicted and actuals scores. This analysis revealed a statistically significant correlation, where $r(185) = .634$, $p < .0001$. Based on this analysis it can be inferred that the actual and predicted scores correlate significantly and therefore the prediction model is valid.

The final analysis of stage 2 was the cross-validated R^2 test. The cross-validated $R'^2 = 1 - (1 - R^2)[(n+k)/(n-k)]$, where R^2 is overall R^2 from the initial model, n is the sample size of the stage 1 sample, and k is the degrees of freedom. The purpose of this test is to determine the application strength of the initial model onto following samples and the population. The results of this test showed $R'^2 = .353$. Since the cross-validated R^2 was very close to the overall R^2, it can be inferred that model fit exists.

Surrounding the use of UAS in communities where they are viewed negatively, educating individuals on the types of situations UAS may be used could alleviate people's concerns. The lack of knowledge and transparency surrounding UAS programs may affect people's privacy concerns of UAS in their neighborhood. Allowing a community to become involved in creating a UAS program, similar to a neighborhood watch program, will promote buy-in to the idea. Lawmakers and law enforcement adopting a community-centric approach to legislation and use of UAS are crucial for success.

Discussion

The current research had two main goals. First, we hypothesized that at least one of the predictors (age, gender, ethnicity, political affiliation, number of children, education level, income, number of times broken the law, perceptions of whether the police protect us, perceptions of whether police are corrupt, feeling of safety in the neighborhood, importance of privacy, support for police activity in the neighborhood, trust in aviation technology, attitude towards aviation technology, attitude towards UAS, trust in technology, trust in the police, and knowledge about UAS) would be a significant predictor of privacy concerns when controlling for all other variables. Second, we wanted to test the predictive regression model on a subsequent data set, thus confirming the model fit.

Stage 1 indicated seven significant predictors: the importance of privacy, attitude towards UAS, perceptions of whether police are corrupt, feeling of safety in the neighborhood, number of children, ethnicity, and support for police activity in the neighborhood. These predictors make intuitive sense, as individuals with negative attitudes towards UAS or police may feel that police drone surveillance threatens their privacy. Previous research has indicated that citizens feel differently about UAS usage depending on their gender, the UAS operator, and their emotions (Rice et al., 2018; Winter et al., 2016). Therefore, it is reasonable to assume that both individual differences and the situational context influence an individual's concern over privacy when a UAS is present. Also, those who place a higher importance on privacy understandably have more privacy concerns. Individuals express many concerns about their privacy around UAS, including but not limited to: recording information, stalking, and being in private places, or engaged in private activities and conversations (Wang, Xia, Yao, & Huang, 2016). Therefore, the finding that the importance of privacy and feelings of safety are two significant model predictors supports current literature. Also, individual differences such as ethnicity have been shown to influence perceptions of emergent technologies (e.g., driverless vehicles; Anania, Rice, Walters, Pierce, Winter, & Milner, 2018).

Stage 2 indicated that the model fit was strong for the equation generated by Stage 1. First, a t-test indicated that the scores were not significantly different between the two sets of data. Second, correlation analyses indicated a significant correlation. Finally, the model fit was assessed using cross-validated R^2, attempting to indicate whether the model could be applied to other samples. Cross-validated R^2 was similar to the overall R^2, indicating model fit.

Theoretical Contributions and Practical Applications

The current research contributes to the literature in several ways. First, it builds off previous UAS literature which indicates that individuals have differential levels of privacy concerns when considering different types of UAS (Rice et al., 2018). While previous research had identified a select few variables that influence an individual's privacy concerns, the current work expanded beyond this to consider new variables. In addition, the current research uses a regression model to help predict an individual's level of privacy concerns in regards to UAS. This adds to the body of literature regarding attitudes toward privacy, which has not focused on predictive models, but rather on the intersect between attitude and behavior (Kokolakis, 2015). However, the current results do support the previous literature in that individuals are concerned about their privacy when it comes to new technologies such as personal health records (Lafky & Horan, 2011) and new retail technologies (e.g., kiosks, mobile apps, "scan and go" technology; Inman & Nikolova, 2017).

In addition to supporting and building on the literature, the current research also has several practical applications. Using this prediction model to understand people's perceptions of UAS privacy in specific situations can provide insight to lawmakers and law enforcement who may implement, regulate, or use UAS. The researchers suggest that lawmakers and law enforcement should consider the seven significant predictors identified in the regression analysis of this study to better understand the concerns of the population which they are tasked to serve. A population's attitude towards UAS, the importance they place on privacy, their perceptions of whether the police are corrupt, their feeling of safety in their respective neighborhood, number of children, ethnicity (mixed), and support for police activity in the neighborhood (respectively) should all be considered and may be assuaged by involving the community in the creation of regulations regarding UAS use. These considerations may avoid future issues such as protesting and individual action against UAS.

In recent years, community policing has become a significant point of discussion between lawmakers, law enforcement, and many communities. Involving the community in decisions made by lawmakers and law enforcement may be an appropriate strategy in decreasing concerns surrounding the use of UAS in communities where they are viewed negatively. Allowing a community to become involved in creating a UAS program, similar to a neighborhood watch program, could promote buy-in to the idea. Lawmakers and law enforcement adopting a community-centric approach to legislation and use of UAS could be crucial.

Understanding the demographic composition of a given neighborhood, lawmakers and law enforcement may be able to understand the concerns of a community better before using a UAS in the neighborhood. This knowledge will allow them to address a community's unique concerns directly. For instance, concern in communities where residents perceive the neighborhood as safe, the police as positive, and have a large population of children would likely be

addressed differently than a community that offers little support for the police and perceives them as corrupt. In each case, the concerns of the respective communities are unique, and as such, lawmakers and law enforcement may not be able to assume blanket legislation or use of UAS. This is an example where community policing may play a role. As each community is unique, involving the community before using a UAS in their neighborhood may be the most appropriate way to address their concerns.

Limitations

One limitation of this study was the use of a convenient sample population via Amazon's ® MTurk. The use of this online survey tool limits researchers in their ability to identify if the participants were the appropriate age to participate in the survey or if the informed consent was read thoroughly. Also, the results of this study can only be generalized to the population of online users of MTurk. MTurk also limits our ability in making universal generalizations from our data due to the lack of external validity. However, prior research has suggested that data gathered using MTurk is equally reliable as data collected from a laboratory setting (Buhrmester, Kwang, & Gosling, 2011; Germine et al., 2012; Rice, Winter, Doherty & Milner, 2017).

Conclusions

The purpose of this paper was to gain a better understanding of the public's perception of police use of UAS. Previous research has shown that the public tends to have negative perceptions when it comes to the police usage of UAS in their neighborhood. However, there has not been a substantial amount of research that focuses on the specific demographics of those who do not favor police usage of UAS. The results from this study bridge this gap by revealing seven factors (importance of privacy, attitude towards UAS, perceptions of whether police are corrupt, feeling of safety in the neighborhood, number of children, ethnicity, and support for police activity in the neighborhood) that significantly predict participants' privacy concerns about police use of UAS in their neighborhoods.

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APPENDIX A - UAV PRIVACY SCALE (MEHTA ET AL., 2015).

Please respond how strongly you agree or disagree with the following statements:

1. In this situation, I believe that my privacy could be violated by the presence of this UAV.

Strongly Disagree Disagree Neutral Agree Strongly Agree

2. I believe that the owner/operator of this UAV could have access to too much private information about me in this situation.

Strongly Disagree Disagree Neutral Agree Strongly Agree

3. I believe that my control over my own privacy would be lessened in this situation.

Strongly Disagree Disagree Neutral Agree Strongly Agree

4. I would not be comfortable with how much information this UAV could gather about me in this situation.

Strongly Disagree Disagree Neutral Agree Strongly Agree

5. In this situation, the amount of private information that this UAV could gather about me makes me feel uncomfortable.

Strongly Disagree Disagree Neutral Agree Strongly Agree

6. This situation makes me concerned about how my privacy could be violated by the presence of this UAV.

Strongly Disagree Disagree Neutral Agree Strongly Agree

7. This situation generates privacy concerns with regards to the presence of this UAV.

Strongly Disagree Disagree Neutral Agree Strongly Agree

8. In this situation, I feel my loss of privacy is greater than what can be gained through usage of this UAV.

Strongly Disagree Disagree Neutral Agree Strongly Agree

9. In this situation, the presence of this UAV poses a threat to my privacy.

Strongly Disagree Disagree Neutral Agree Strongly Agree