Acceptance of Drones - Does it Matter who Operates a Drone?

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Abstract

Drones are multifunctional and increasingly used in various aspects of everyday life. Whether it is for military, commercial or recreational use, the application of drones yields many possibilities for the future. However, when implementing drones into everyday life, privacy concerns and safety issues should be taken into consideration. Therefore, this online study examined the acceptance of drones being controlled by different operators. 80 participants were asked to watch a video of one out of three possible operators (police, news journalist, civilian) controlling the drone and then answer questions about their trust, attribution, privacy concern and attitude towards the operator of the drone. It was found that the acceptance differed between the operators with the police reaching the highest acceptance rate, followed by the news journalist. Least accepted was the civilian. Further analyses showed that privacy concern had a negative influence on acceptance. The higher the concern for privacy, the less accepted was the drone. Trust had a positive influence on acceptance rates. For future research, it is recommended to further investigate the relationship between privacy concern and the operators as well as consider adding a variable "fear" to the model when measuring the acceptance of drones.

Introduction

Today's high-technology drones are ubiquitous and used in everyday life in versatile ways. A prediction made by the Federal Aviation Administration states that by this year there will be about seven million drones flying in the skies (Farber, 2016). Unmanned Aerial Vehicles (UAV), also known to the public as drones, can be used for many purposes, such as aerial photography, commercial use, such as package delivery, but also in law enforcement (Mehta et al., 2020). For example, drones could be useful in high-risk situations when instead of a person having to expose themselves to a risk such as a natural disaster, a drone could be used to video film a scene of a disaster and provide valuable information (Culver, 2014). Many organizations are interested in using drone technology such as police departments, National Geographic and mass media (West & Bowman, 2016). Companies such as Amazon could use drones to make delivering packages more efficient and faster (Stolaroff et al., 2018). Nevertheless, controversial opinions should be taken into account when considering implementing drones into the everyday life of society.

In the past, drones have been widely used for military purposes. The first implementation of drones was in the military for collecting military intelligence (West & Bowman, 2016). Nowadays, drone usage in the military sector accounts for 72% of the total usage of drones globally (Teal Group Cooperation, 2015, as cited in Khan et al., 2019, p. 88),

where they are used for drone strikes. However, the public has negative associations with the military using drones due to unintended killings of people by the use of drones (Khan et al., 2019). For example, within 13 months, 200 people were killed by U.S drone airstrikes. However, only 35 of those people were intended as targets of the strikes (Roma, 2017). Due to these negative connotations of drones, the acceptance of the public needs to be considered when wanting to apply them for commercial use which might yield possibilities that can shed a positive light upon the usage of drones.

Until now, a considerable amount of research about drones exists in the area of military use, however, the usage of drones in civilian context has not yet been studied as much (Clarke, 2014). Nevertheless, the drone market is an evolving industry. For example, it is expected that the drone market provides 42 billion British Pounds for Great Britain's economy in the next 10 years (Emmanuel, 2018 as cited in Mehta et al., 2020, p. 3). The trend to use drones as a leisure activity or for security reasons is rising. Most drones can take photos and videos and record audio, but not many people know about how and when drones are used and implemented into everyday life (Eyerman, et al., 2013). Therefore, the use of drones also causes to acknowledge accompanying privacy concerns, because they can be put to use in a wide range of areas. Nevertheless, "drones raise privacy issues no matter for what they are being used since it is often unclear who is operating the drone, or what capabilities it has and or for what purpose it is being used" (Article 29 Data Protection Working Party, 2015 as cited in Finn & Wright, 2016, p. 578). Therefore, it is also important to consider the interference of drones in one's personal space as well as issues in privacy protocols (Blitz et al., 2015).

The possibilities for drone usage is growing. Whether it is the police force who use drones for example for security reasons, the media for obtaining video footage of an event or story, or a civilian person having fun in their spare time. With these possibilities in mind, it is important to know how the drones are accepted by the public since the use of drones, especially in the commercial sector, will increase in the future. However, the public image, which is mostly framed this way by the media, is that drones are dangerous and that the use of drones in civilian daily life will include certain issues such as the deprivation of privacy. Hence, it is important to consider both the positive potential of drone usage as well as take into account possible negative perceptions of the public towards drones. Therefore, the current research aims to find an answer to the following research question: How is the acceptance of drones influenced by a person's attribution, trust and privacy concern towards different operators of a drone?

Theoretical Framework

Several factors influence an individual's acceptance of new technologies, such as a drone, which are highly subjective. The Technology Acceptance Model (TAM) is used to predict and explain the acceptance of new technologies (Davis et al.,1989). This is done by assessing different variables. For one, the perceived usefulness and ease of use is assessed, as well as a person's attitude. This leads to the behavioral intention to use and then the actual usage of a system. The model is used for finding the effect of external factors on attitudes and the intention to use such new technology (Davis et al., 1989). The TAM has already been used as a basis in studies to develop a model for predicting acceptance of drones (Chamata & Winterton, 2018). However, since in this case the participants are not supposed to use the system themselves, but instead evaluate the usage of drones by different operators, the acceptance of the system might also be influenced by other variables. For this study, the variable trust is used as an antecedent for acceptance, because trust influences a person's perception of risk (Gregory & Mendelsohn, 1993) and possibly also an individual's acceptance of the drone. Since the perception of risk is subjective, a person is likely to perceive various purposes of the operator of the drone. Therefore, attribution is also one of the variables used as an antecedent for acceptance of the drone. Furthermore, since drones raise many privacy issues regarding filming and recording audio while flying above public and private areas, privacy concern is also an important factor to consider when measuring the acceptance of a drone. Further details will be presented in the following paragraphs.

Trust as an acceptance factor. Trust is defined as "the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party" (Mayer et al., 1995, p. 712). According to the model of trust proposed by Mayer et al. (1995), three factors influence trustworthiness. These factors are competence, integrity and benevolence. Competence is explained by the abilities and skills an individual demonstrates to contribute to the well-being of the trustor, whereas benevolence is the intent to do good and positive deeds for the person who is giving trust. Integrity is defined as having and upholding moral principles which are significant to the trustor (Tomlinson & Mayer, 2009). Hence, when the trustor sees the individual as having competence, integrity and benevolence they are more likely to trust that individual.

For Gefen et al. (2003) trust is divided into two dimensions when it comes to implementing a new system. There is organizational trust and system trust. The former is the amount of trust one has in the organization implementing the new system and the latter is the

trust one has in the new system itself. From their study, it can be concluded that if an individual has trust in the organization, the acceptance of a newly implemented system by the organization would be more accepted than if there was no trust in the organization. This means that the operator controlling a drone is important when it comes to the acceptance of a drone because the operator stands for the organization.

Attribution as an acceptance factor. One of the first people to explain attribution was Heider in 1958 (Manusov & Spitzberg, 2008). He said that people actively try to interpret the world around them with consistent and logical interpretations. An event is explained and compared to already existing beliefs (Kelley & Michela, 1980). When people have no information available in an ambiguous situation, they may infer certain information themselves (Ramadan et al., 2017). These associations people have may lead to different attributions regarding a certain situation, because individuals are continually looking for explanations that justify what is happening around them (Hayes & Hesketh, 1989). Therefore, when seeing a drone people try to explain its presence with various attributions. Then, the perceived purpose a person associates with the usage of a drone might also influence the acceptance of a drone.

Oltvoort et al. (2019) found that participants most often wanted to know the reason why a drone was operated in a certain environment. This finding supports the notion that individuals make interferences about a situation and try to make sense of them by doing so. By asking themselves about the perceived purpose of a drone in the environment, they make positive or negative attributions which may influence the acceptance of the drone.

When trying to anticipate the different attributions individuals make about drones, results of studies about CCTV (closed-circuit television) cameras can be used to predict what individuals might think of drones. Taylor (2011) found that when people apply reasons for the CCTV camera's presence that seemed logical to them such as preventing crime, they were less concerned with CCTV cameras being present than if they interfered implausible reasons such as thinking the purpose of the camera was there to watch them at any given point in time. These findings may predict that when people see a drone as monitoring them for security reasons, they are more likely to accept the drone than when feeling watched by the drone for commercial purposes or recreational fun.

Boucher (2016) found that if a drone is used for recreational purposes, it was less accepted than if it was seen as useful in a sense that it would help the public for instance in safety situations. Especially public safekeeping, such as search and rescue, the prevention of crimes and monitoring terrorist were accepted purposes for drone usage, where the positive factors of drones outweighed the perceived risk (Aydin, 2019; Roma, 2017). Klauser and

Pedrozo (2017) support this notion by stating that how well drones are accepted depends on the context in which they are used and with what aim. Therefore, the usage of a drone is more likely to be accepted when the purpose perceived by the individual about the drone is positive and seen as meaningful.

If an individual has certain prejudices about an organization or the organization has done something the individual has disliked in the past, the attribution towards the operator of the drone of that organization is more likely to be negative than of an organization with which they associate positive things (Kelley & Michela, 1980). A study conducted by Klauser and Pedrozo (2017) in Switzerland found that 72% of respondents were in favor of the police controlling a drone. The reason for this was that people perceived drones controlled by the police as more beneficial for the wider community than drones being controlled by private users (Klauser & Pedrozo, 2017). If an individual sees the police as someone who helps prevent crime, then seeing a drone controlled by the police should evoke positive attributions. However, if the individual sees a drone used by a news organization, the individual might infer that the news organization is only there to gather private information about themselves which might not be a positive purpose but instead then have negative attributions towards the news organization.

Privacy concern as an acceptance factor. Privacy concern includes two constructs, the concept of vulnerability and the control over the disclosure of personal information (Dinev & Hart, 2004). Vulnerability outlines the potential risk of disclosure of one's information whereas control over one's information includes the right to withhold certain information. This is also in line with the right for information privacy, which is the right of a person to know what happens and to control one's personal information (Stone et al., 1983 as cited in Smith et al., 1996, p. 168).

Oltvoort et al. (2019) studied the acceptance of drones in different environments. It was noticeable that the drone was least accepted in a park environment. This might be due to the reason that a park is seen as a private place and that people are more understanding when they see a drone in a public environment such as at an event. At an event, people thought it was more logical and understandable to use a drone than using it at a park. Furthermore, it is found that with CCTV cameras individuals feel more insecure when they are being filmed in private places such as in a park than if they are being filmed in a public place such as at an event (Taylor, 2010). However, there are no clear guidelines as to what is a private area and what is public, with an exception being made for private property (Taylor, 2010). Therefore, individuals might feel that the park is a more private place and their acceptance of the drone would be decreasing when they are feeling that a drone was being operated in a private environment.

Since a drone can take photos and videos as well as audio-record (Eyerman, et al., 2013; Finn & Wright, 2016), individuals might ask themselves what happens to the information the drone gathers. People might have different opinions on who is allowed to have information collected by a drone. When the operator of a drone differs, for example, an organization in comparison with a civilian controlling the drone, the individual being filmed by the drone might have different concerns regarding their privacy. Some drone operators might not be aware of infliction on privacy. If private organizations use drones, it is not the government anymore that individuals have to deal with which might raise issues with the Fourth Amendment right to privacy[1] (Culver, 2014). For example, in Australia, there are not that many formal regulations regarding the use of drones by the media (Clarke, 2014). This leaves news organizations to use drones rather freely, which is a good opportunity for the media but raises privacy concerns.

Individuals have to rely on the organization to ensure that ethical reasoning is done and that information is kept private. One can say that privacy at a beach is expected, but that people are allowed to take pictures. However, many people would oppose a news channel having a live broadcast of a beach for a whole day. This raises the issue of ethical debate, since it is not about whether the property you are using a drone to film on is public or private anymore, but instead whether an organization respects an individual's desire for privacy despite being in a public and commonplace (Culver, 2014).

Acceptance may vary due to the operator. In the current study, three different operators were examined. The police representing a law enforcement organization, the news journalist representing a commercial organization and the civilian representing the general population. These three operators are different in such a way that they potentially have different acceptance ratings from individuals when they are seen controlling a drone.

It can be argued that the main focus of news organizations is gathering newsworthy information while neglecting privacy issues (Culver, 2014). For law enforcement, this should be the opposite because their aim is to keep people safe while also ensuring people's privacy. Trust in law enforcement operations might outweigh the potential risks of the usage of drones and lead to accepting a drone of the police while trusting that they have control over the situation. Seeing a civilian person use a drone might lead to opposite attributions since drones are more likely to be rejected when used for private purposes (Aydin, 2019). In a study by Finn and Wright (2016), civil society organization, the data protection authorities and civil aviation authorities rated the risk of drones by different operators. The study found that private

[1] The right for privacy and unreasonable intrusion into one's private life by the government (Legal Information Institute, 2017)

individuals who use a drone pose the highest risk in regard to privacy, data protection and ethical risks. However, also law enforcement and commercial operators of drones are at risk for breaching one of these issues. Nevertheless, seeing a drone being operated by the police might not concern the public as much as seeing a civilian controlling the drone.

The current study

The current study is based on the research of Oltvoort et al. (2019) where public acceptance of government drones was measured in regard to their usage in different contexts and the transparency of information that was provided to the participants. In this study, the acceptance of drones was assessed when different operators controlled a drone. Furthermore, the variables trust, privacy concern and attribution as antecedent for acceptance were measured (see Figure 1). The park environment was chosen, because one may best find indications of what people attribute to different operators of a drone when they least expect to see a drone. Therefore, the park seemed to be a suitable option since it is deemed a more private environment than for example an event. Participants were shown a video of a Virtual Reality environment which portrays a park within a city with either the police, a news journalist or a civilian controlling the drone.

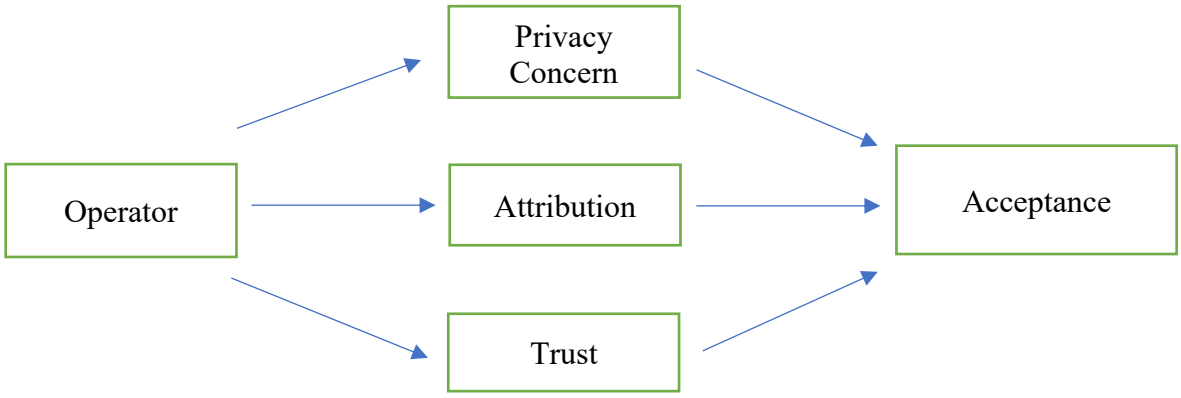

Figure 1: Conceptual model with operator as the independent variable, acceptance as the dependent variable and trust, attribution and privacy concern as mediator variables.

On the basis of the theoretical framework, the following hypotheses were formulated:

H1: It is expected that the acceptance of drones varies when it is being controlled by different operators. If individuals see a drone being controlled by the police, they are more willing to accept it than a drone being controlled by a news journalist and a civilian.

H2: It is expected that the acceptance of drones controlled by different operators is explained by attribution, trust and privacy concern.

H2a: The police could be perceived as more trustworthy and more concerned about an individual's privacy compared to a news journalist and a civilian, which in turn leads to more acceptance of the drone being controlled by the police.

H2b: It is expected that individuals are more likely to perceive positive attributions for a drone being controlled by the police than by a news journalist and a civilian, which in turn leads to more acceptance of the drone being controlled by the police.

Method

Participants and Design

From the 80 participants who took part in the study, 18 were excluded because their answer to the question "Which operator did you see?" did not match the operator that was shown in the video. From the 62 participants, 39 were female, 20 were male, 1 was divers and 2 preferred not to say (M_{age} = 24.61, *SD* = 5.99, range =18 – 55 years).

For recruiting participants a system called "Sona" was used, where students received partial credit points for participating in studies. Additionally, convenience sampling outside the student pool was used. 47 participants of the sample were German, 6 were Dutch and 9 had other nationalities (Austrian, Brazilian, British, Canadian (3x), French (2x), 1 unknown). The highest level of education was distributed as follows: 25 participants indicated that they finished higher secondary education, 23 held a bachelor's degree, 10 held master's degree, 1 finished an apprenticeship, 1 was still in school and 2 indicated "other".

In this online study, the participants were randomly allocated to one of three conditions (Operators: police versus news journalist versus civilian) in a between-participants design with acceptance as the dependent variable. For the operator condition, 15 participants watched the video with the police as the operator, 23 watched the video with the news journalist as the operator and 24 watched the video with the civilian as the operator of the drone.

Procedure

First, participants were solely given some general information about the study, saying that the study was researching the acceptance of drones with the help of a video recording. The study's actual aim to research the effect of different operators influencing the acceptance of the drone was initially withheld in order to not influence the outcome. The participants were also

informed about their rights as participants and had to sign an informed consent form to agree to take part in the study.

Then, the participants were asked to watch a video of the park environment in which an operator was seen controlling a drone. The participants were randomly assigned to watch one of three videos where either the police, a news journalist or a civilian was seen controlling the drone (see Figure 2). Hence, there were three conditions the participants were randomly assigned to. The civilian operating the drone was presented as a person who was standing nearby the participant holding a controller in their hands which then looked as if that person was operating the drone. For the condition in which either the police or news journalist was controlling the drone, a van with either of the two logos printed on it, was parked close by, for the participants to infer that the drone was controlled by the organization belonging to the van.

The length of each video was between 33-36 seconds. In the video, the participants looked at the park environment as if it was their own point of view. The sound of a drone was audible during the entire video. After a few seconds, the drone appeared and became visible in the observer's field of vision, which then followed the drone around flying over the park. Next, the video zoomed in to the person controlling the drone and the observer could see that person holding a controller in their hands and watch the drone flying around the park for a few seconds in order for the participant to make interferences about the operator of the drone.

After watching the video, the participants were asked to state which operator they saw controlling the drone in the video and answer questions about the variables measured in this study: acceptance, trust, attribution and privacy concern. The questionnaire is described under the section "measures". In the end, the participants read a debriefing text, informing them about the aim of the study and why information was withheld from them in the beginning. By filling in the demographic questions they consented to the use of their data for the study once more.

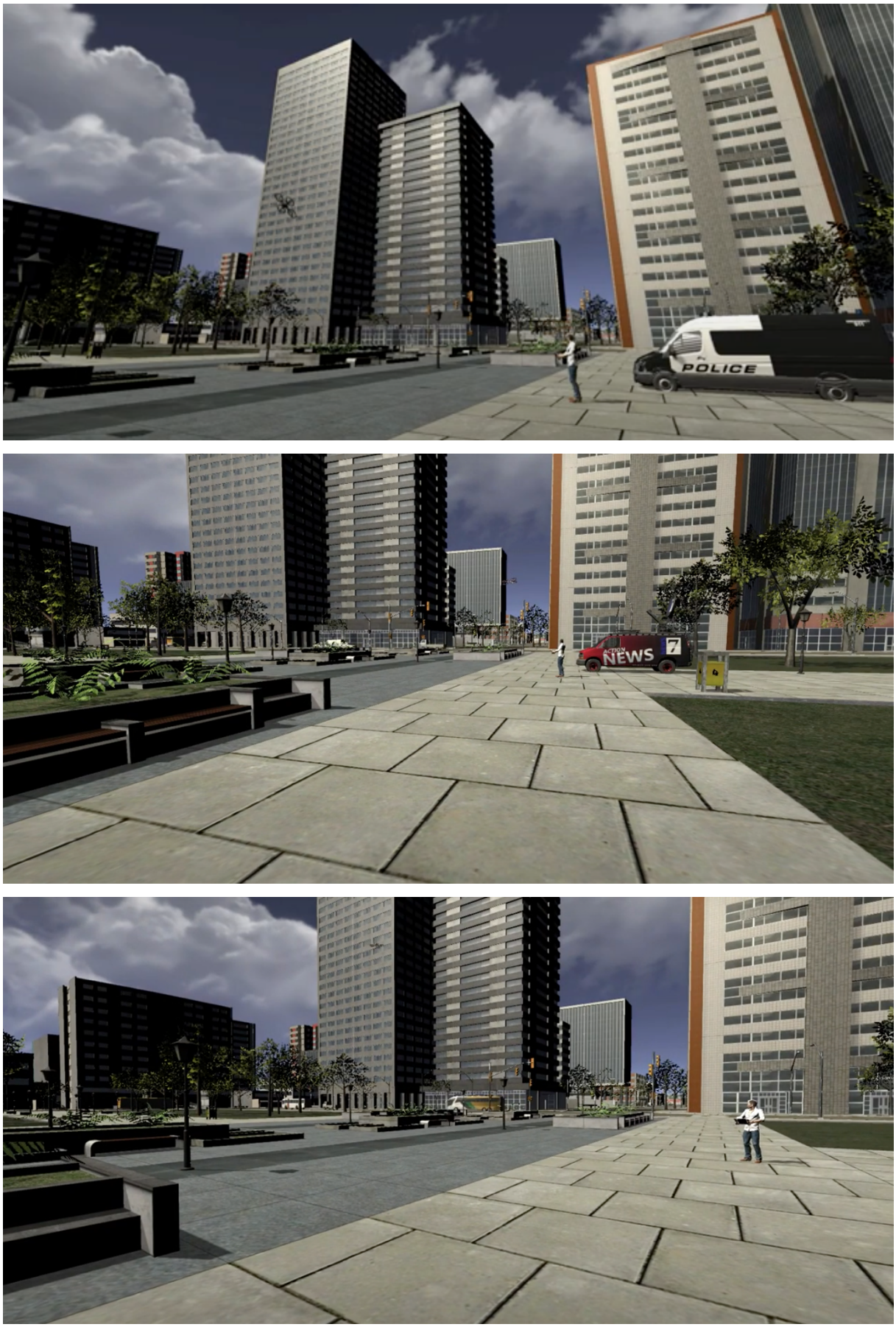

Figure 2. Pictures of the videos: police as an operator (top), news journalist as an operator (middle), civilian as an operator (bottom) controlling the drone flying in the air.

Materials

The study was conducted as an online survey with integrated video footage. For this, the park environment with a drone flying around was created in Unity with the help of the Design Lab of the University of Twente. A video of the environment was then created by recording the screen of the Unity program with PowerPoint©. For creating and distributing the questionnaire (including the video) the program Qualtrics© was used. The participants needed a working internet connection and access to the link on Qualtrics to participate in the study.

Measures

The questionnaire was composed of five measures measuring the variables Acceptance, Trust, Privacy Concern and Attribution as well as asking four demographic questions (age, gender, nationality, highest level of education). Furthermore, a manipulation check for the different operators was constructed with six statements, two for each operator. The full questionnaire can be found in Appendix 1.

Trust. First, 15 items measured the concept of trust on a 7-point Likert scale (1 = strongly disagree to 7 = strongly agree). The concept was divided into 4 sub-groups which included the three dimensions of trust benevolence, integrity and competence, as well as overall trust. The questions were based on items from Rawlins (2008) and adjustments made by Oltvoort et al. (2019). One more adjustment by adding the question *"I trust the drone operator not to disclose any personal information about me."* was made in order for the items to fit this study.

Overall trust was measured with five questions such as *"I trust the operator to take care of people like me."*(α = .73 and λ_2 = .76). Benevolence was measured with three items such as *"I believe that the operator is interested in the well-being of people like me, not just themselves"* (α = .69 and λ_2 = .69). An example of the four items of integrity is *"The operator treats people like me fairly and justly"* (α = .88 and λ_2 = .88). Competence was measured with three items such as *"The operator has the ability to accomplish what it says it will do"* (α = .73 and λ_2 = .73).

Privacy concern. The construct privacy concern was measured with 13 questions from the bachelor thesis by Usmanova (2018). A sample question is *"The use of drones as surveillance is an invasion of privacy".* The items were measured using a 7-point Likert scale with a range from 1 = strongly disagree to 7 = strongly agree (α = .81 and λ_2 = .82).

Attribution. Attribution was measured by using the items from the study of Van Rompay et al. (2015), as well as questions created based on Weiner's (1985) three dimensions of attribution (control, stability, responsibility). Sample questions of the seven Likert items include *"I think the operator has commercial goals."* and "*I think the operator is interested in newsgathering."* (α = .80 and λ_2 = .81).

Acceptance. For measuring acceptance of drones, the acceptance scale of Van der Laan et al. (1997) was used. The nine Likert items were slightly adjusted in order for participants that do not speak English as their native language to be easier understandable. For example, changing "*My judgements of the operator controlling the drone are… effective □□□□□□□ superfluous"* to "*My judgements of the operator controlling the drone are… effective □□□□□□□ ineffective"* (α = .89 and λ_2 = .90). The acceptance scale can be divided into two subscales: the usefulness scale (useful, good, effective, assisting, raising alertness; α = .77 and λ_2 = .81) and satisfaction scale (pleasant, nice, likeable, desirable; α = .88 and λ_2 = .88). Because this scale measures participants' attitudes towards the drone, the variable is called "Attitude" in the analysis.

To also know the participants' true score of acceptance, the question *"To what extent do you accept the operator controlling the drone?"* was asked. The answers were measured on a scale between 0 = "not at all" to 10 = "a great deal". This variable is called "Acceptance" in the following analysis. This leads to two measures for acceptance so that a more elaborate analysis can be done and more results can be found. The participants were also asked to imagine the other two operators instead of the one they saw in the video controlling the drone and then rate their acceptance on a scale from 0 = "not at all" to 10 = " a great deal" with the question "*Imagine the police is controlling the drone. To what extent would you accept the drone?"* (α = .47 and λ_2 = .47).

In hindsight, there was reason to assume that the measure of privacy concern was an independent variable rather than a mediator variable. The reason was that the questions measuring privacy concern were measuring privacy concern as a trait variable rather than a state variable. Therefore, the variable privacy concern was more suitable as an independent variable and is handled as such in the following analyses (see Figure 3).

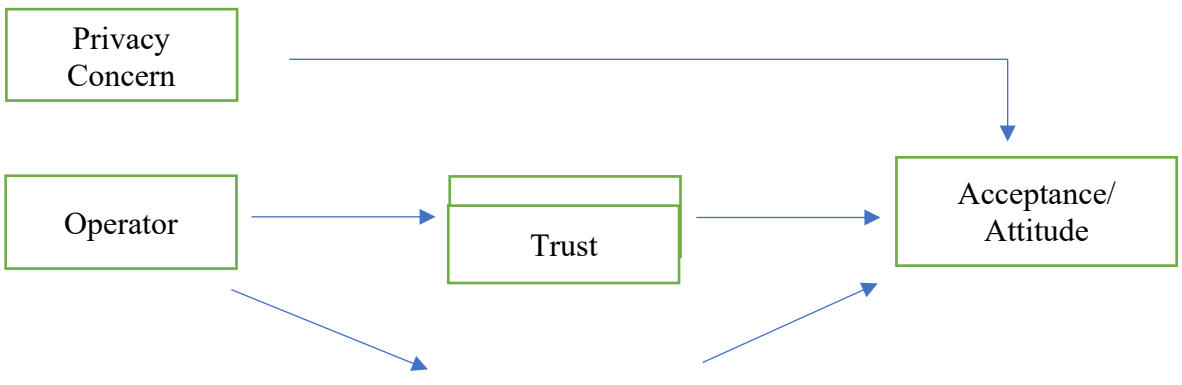

Figure 3. New conceptual model, with Privacy Concern as an independent variable rather than a an antecedent for Acceptance/Attitude.

Results

General analysis of participants and variables

The outcome variable was measured with two different constructs. One of them measured attitude as an acceptance variable, which is therefore called Attitude in the following analysis. The question to what extent the participant accepted the operator controlling the drone is taken as the second construct, where the variable is called Acceptance in the analysis. The descriptive statistics for all variables and their correlation can be found in Table 1. The variable Attitude ranged from 1.56 to 5.33. For the “usefulness scale” and the “satisfaction scale”, the values leveled at “neither agree nor disagree”. The variable Acceptance ranged from 0 - 10.

While creating a correlation table it was found that there are 13 significant correlations between the main variables Acceptance, Attitude, Privacy concern, Attribution and Trust. What stands out from the correlation table, is that both outcome variables, Acceptance and Attitude, are statistically significantly correlated with all other variables. Privacy concern is negatively correlated with all other variables. This shows, that the concern for privacy is decreasing if the other variables increase.

Table 1

Means (M), standard deviations (SD) and correlations between all main variables [a]

	M	*SD*	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.
1. Dummy Civilian	-	-	-															
2. Dummy News journalist	-	-	-.61**	-														
3.Acceptance	4.93	2.5	.10	-.01	-													
4. Acceptance Police	5.13	1.5	-.09	.15	.21	-												
5.Acceptance Civilian	3.99	1.5	-.11	.19	.13	.05	-											
6. Acceptance News journalist	4.77	1.2	-.01	.12	-.06	.09	.57**	-										
7. Attitude	3.48	1.18	-.17	.11	.71**	.16	.30*	.02	-									
8. Privacy	4.97	0.75	-.04	-.10	-.50**	-.34**	-.15	.07	-.53**	-								
9. Attribution	4.2	0.93	-.41**	-.38**	.57**	.12	.11	.04	.46**	-.35**	-							
10. Trust	3.36	0.90	.07	-.07	.73**	.19	.24	.10	.69**	-.42**	.66**	-						
11. Overall Trust	2.96	0.98	.11	-.07	.72**	.14	.26*	.01	.66**	-.51**	.65**	.89**	-					
12. Benevolence	3.76	1.06	.07	-.09	.67**	.25*	.18	.16	.60**	-.32*	.65**	.86**	.64**	-				
13. Integrity	3.92	1.09	.06	-.07	.70**	.21	.19	.10	.61**	-.38**	.64**	.93**	.77**	.82**	-			
14. Competence	4.24	1.0	-.06	-.02	.36**	.07	.20	.12	.49**	-.16	.25	.73**	.51**	.53**	.57**	-		
15. Usefulness scale	3.91	1.21	-.33**	.18	.61**	.16	.33**	.06	.93**	-.47**	.33*	.60**	.56**	.51**	.55**	.43**	-	
16. Satisfaction scale	4.59	0.79	-.01	.04	.71**	.13	.25*	-.01	.93**	-.52**	.53**	.66**	.66**	.59**	.57**	.40**	.73*	-

Note: Pearson's correlation.

**.correlation is significant at the 0.01 level (2-tailed).

*correlation is significant at the 0.05 level (2-tailed).

[a] N=62

Effect of Operator on main variables. To test whether the operator had an effect on the acceptance and attitude towards drones a Multivariate ANOVA was conducted with Acceptance, Attitude, Trust and Attribution as dependent variables and Operator as independent variable. As established above, Privacy Concern is also used as an independent variable. For this, a median split of the variable was conducted. Furthermore, the standardized values of Privacy concern, Attitude, Acceptance, Attribution and Trust were created, for the variables to be on the same scale.

A statistical significant main effect of the Operator was found as well as for Privacy Concern. The interaction effect of Privacy Concern and Operator was non-significant (see Table 2) These results provide partial support for hypothesis 1, because the manipulation of the operator produced the desired effect by influencing acceptance and attitude of the drone.

Table 2

Multivariate effects of Operator and Privacy concern

Variable	Wilks λ	F	p	df	df error	η_p^2
Operator	.59	4.02	.00	8	106	.23
Privacy concern	.73	4.93	.00	4	53	.32
Operator*Privacyconcern	.78	1.71	.10	8	106	.11

Operator. In further tests of between-subject effects, a statistically significant effect of Operator on Attribution [$F(2,59) = 7.46$, $p < .05$, $\eta_p^2 = .21$] was found. This result shows that there was a significant effect on the difference of attributions towards the different operators, which is partially in line with hypothesis 2b. The effect of Operator on Attitude, Trust and Acceptance was non-significant.

To follow up on the significant effect of the Operator on Attribution, a Bonferroni adjusted pairwise comparison was done. For Attribution a statistically significant difference between the Civilian and the News journalist ($M_{difference} = 0.91$, $SE = 0.24$, $p < .05$) was found, but not between any other of the operators (Police vs. Civilian: $M_{difference} = -0.40$, $SE = 0.27$, *ns.*; Police vs. News: $M_{difference} = 0.18$, $SE = 0.28$, *ns.*). These results do not show support for hypothesis 2b. The police is not perceived as having more positive attributions compared to a civilian and a news journalist. Instead, it shows that the civilian operator was more positively attributed than the news journalist when controlling the drone. No statistically significant effects for neither Trust and Attitude nor Acceptance was found (see Appendix 2).

Privacy Concern. Another finding of the Multivariate ANOVA showed that the effect of Privacy Concern on Attitude [$F(1,59) = 16.58$, $p < .05$, η_p^2=.23], Trust [$F(1,59) = 10.77$, $p < .05$, η_p^2=.16], Attribution [$F(1,59) = 10.07$, $p < .05$, $\eta_p^2 = .15$] and Acceptance [$F(1,59) = 16.77$, $p < .05$, $\eta_p^2 = .23$] was statistically significant. This shows that concern for privacy has an effect on acceptance.

Further pairwise comparisons between high and low Privacy Concern and the variables Acceptance, Attitude, Trust and Attribution showed that when Privacy Concern was high, Acceptance and Attitude was lower than Privacy Concern was low ($M_{difference}$ = - 0.96, $p < .05$). Also, when Privacy Concern was high, Trust was lower than if Privacy Concern was low ($M_{difference}$ = - 0.82, $p < .05$). This also holds for Attribution which was lower when Privacy Concern was high ($M_{difference}$ = - 0.71, $p < .05$).

Effect of mediator variables on Attitude. For further analysis of the data, a hierarchical regression analysis was conducted to predict Attitude from the Operator, Privacy Concern, Trust, and Attribution. The dependent variable was Attitude. The operator variable was coded into a dummy variable, comparing the Civilian and the News journalist to the reference category Police in order to fit a regression model (see Figure 4).

For the first block, the predictor variable Operator was analyzed. The results revealed a model that was not statistically significant. In the second block, the predictor variables Privacy Concern, Trust and Attribution were added to the regression analysis. The results of the model showed a statistical significance $F(5,56) = 16.99$, $p < .05$. The R^2 value .60 ($p < .05$) for this model suggests that the addition of the predictor variables Privacy Concern, Trust and Attribution to the model of the first block account for 60% of the variation in Attitude. This supports hypothesis 2, that attitude is influenced by attribution, trust and privacy.

The direct effect of both operators, Civilian and News journalist, on Attitude in model 1 was insignificant. However, in the second block, the Civilian (b = -0.28, t = -2.47, p = .02) showed statistically significant results, when Privacy Concern, Trust and Attribution were included in the analysis. The News journalist did not show statistically significant results. Because the reference category was the Police, these results show that there is an increased positive attitude towards the police in comparison with the civilian. This shows partial support for hypothesis 1, that the police is more accepted than the civilian.

Furthermore, Trust positively predicted Attitude (b = 0.48, t = 3.98, $p < .05$) while Privacy Concern negatively predicted Attitude (b = -0.28, t = -2.87, $p < .05$). Attribution does not suggest a statistically significant prediction of Attitude (see Appendix 3). This shows partial support for hypothesis 2, in the way that trust and privacy concern influence attitude, while attribution does not.

The analysis resulted in statistically significant results for Trust and Privacy Concern. Therefore, further regression analyses were conducted. Trust was the dependent variable, while the dummy variables of the operator Civilian and News journalist were the independent variables. The operators Civilian and News journalist as a predictor variable for Trust showed non-significant results (see Appendix 4).

For the regression analysis with Attribution as the dependent variable and the operators, Civilian and News journalist, as dummy variables, a marginally significant effect was found for the Civilian (b = 0.28, t = 1.92, p = .06), but for the News journalist no statistically significant effect was found. These results suggest that there is no direct effect of the operator neither on trust nor on privacy concern. However, for the Civilian a marginally significant effect on Attribution can be found, which means that there are different attributions for the civilian and the police. This partially supports hypothesis 2. Nevertheless, the civilian receives more positive attributions than the police which rejects hypothesis 2b. Since the results are only marginally significant, interpretation should be done with care. However, attribution does not statistically significantly predict acceptance, as seen in the analysis above.

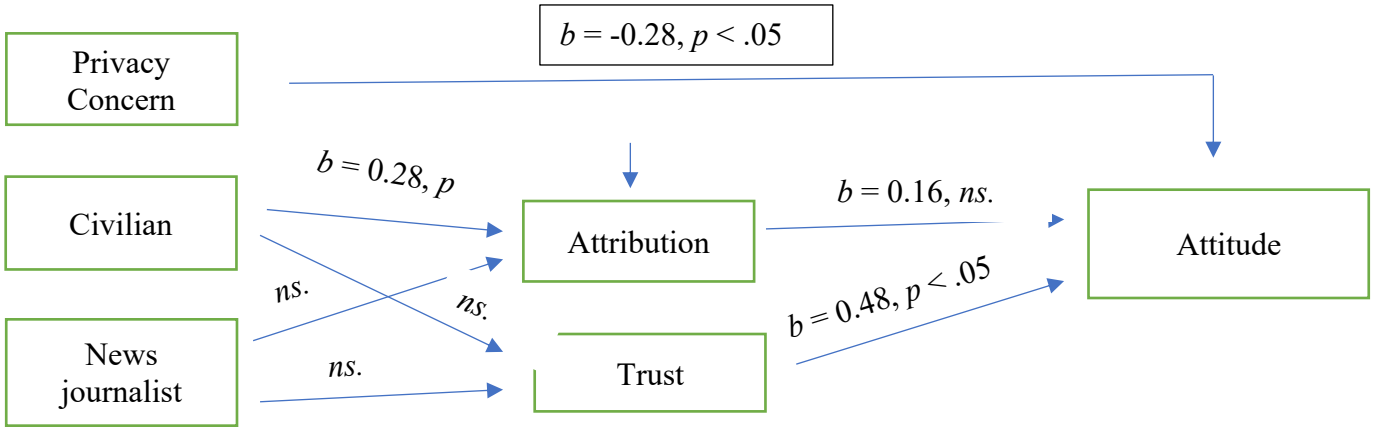

Figure 4. Results of regression analysis displayed on the conceptual model.

Effect of mediator variables on Acceptance. Another hierarchical regression analysis was conducted to predict Acceptance from the Operator, Privacy Concern, Trust, and Attribution. The dependent variable was the acceptance measure. The operator variable was coded into a dummy variable, comparing the Civilian and the News journalist to the reference category the Police in order to fit a regression model.

For the first block, the predictor variable Operator was analyzed. The results revealed a model that was not statistically significant. In the second block, the predictor variables Privacy Concern, Trust and Attribution were added to the regression analysis. The results of the model showed a statistical significance $F(5,56) = 16.49$, $p < .05$. The R^2 value .60 ($p < .05$) for this

model suggests that the addition of the predictor variables Privacy Concern, Trust and Attribution to the model of the first block accounts for 60% of the variation in Acceptance.

The direct effect of both operators, Civilian and News journalist, on Acceptance in model 1 was insignificant. Both operators, Civilian and News journalist, also showed statistically non-significant results in the second model.

The best predictor variable of Acceptance was Trust (b = 0.56, t = 4.57, p < .05). Privacy Concern negatively predicted Acceptance (b = -0.20, t = -2.06, p = .04). Attribution did not suggest a statistically significant prediction of Acceptance (see Appendix 5). This suggests, that there is partial support for hypothesis 2, in which trust and privacy concern influence acceptance, while attribution does not.

Exploratory analysis with subconstructs of Attitude. The measure Attitude can be divided into two subscales, the "usefulness scale" and the "satisfaction scale". To see whether the participants thought that the drone was useful or if they were satisfied with the use of the drone two hierarchical regression analyses were conducted. For the first regression analysis, the components of the variable for the usefulness scale (useful, good, effective, assisting, raising alertness) were the dependent variable and the operator as the dummy variable, Privacy Concern, Trust and Attribution were the independent variables.

For the first block, with the dummy variables of the Operator as independent variables and the variable of the "usefulness scale" as the dependent variable, the Civilian showed statistically significant results (b = -0.34, t = -2.20, p = .03). For the second block, Privacy Concern, Trust and Attribution were added as independent variables. Again, the Civilian showed statistically significant results (b = -0.42, t = -3.59, p < .05), as well as Trust (b = 0.46, t = 3.62, p < .05), and Privacy Concern (b = -0.26, t = -2.56, p = .01). The variables Attribution and News journalist did not show significant results (see Appendix 6). These results suggest that there is a significant effect on how useful the drone is perceived. Because the reference category is the police and the civilian shows a negative b-value, it can be said that the use of the drone by the police is perceived as more useful than if it is used by the civilian. This is a new finding and supports the fact that the use of the drone by the police is more accepted. Furthermore, when there is more trust and less concern for privacy, the drone is perceived as more useful.

For the second regression, the components of the variable for the "satisfaction scale" (pleasant, nice, likeable, desirable) were the dependent variable and the independent variables were the same as mentioned above. For the first block, with the dummy variables of the operator

as independent variables and the variable of the "satisfaction scale" as the dependent variable, neither the Civilian nor the News journalist showed significant results.

For the second block, Privacy Concern, Trust and Attribution were added as independent variables. Here, Trust ($b = 0.40$, $t = 3.57$, $p < .05$), and Privacy Concern ($b = -0.26$, $t = -2.52$, $p = .02$) showed statistically significant results. Attribution, the Civilian and the News journalist did not show significant results (see Appendix 6). In this analysis, neither the news journalist nor the civilian showed any significant results when it comes to being satisfied with their control of the drone. However, the drone was perceived as more satisfying when being used, when there was more trust and less concern for privacy.

Exploratory analysis with subconstructs of Trust. To answer the question of how trust influences the acceptance of the different operators, the four components of Trust were analyzed in a regression analysis. The three subconstructs of Trust, Benevolence, Competency and Integrity as well as the component Overall Trust were the predictor variables and Attitude was the dependent variable. The Pearson correlation for all four sub-measurements of Trust was statistically significantly correlated with Attitude ($p < .05$).

Out of the four predictor variables, Overall Trust significantly predicted attitude scores ($b = 0.44$, $t(57) = 2.95$, $p < .05$). The other three predictor variables Benevolence, Competence and Integrity did not show significant support for predicting Attitude. The whole model, with all four components of Trust taken together, explained a significant proportion of variance in Attitude scores $F(4,57) = 13.38$, $p < .05$, $R^2 = .48$.

The same regression analysis was repeated only this time with Acceptance being the dependent variable. Trust in its subconstructs, Overall Trust, Benevolence, Competence and Integrity, were the predictor variables. For this analysis, the z-scores of all variables were used in order for them to be on an equal measurement scale.

For predicting Acceptance, Overall Trust ($b = 0.45$, $t = 3.45$, $p < .05$) and Benevolence ($b = 0.30$, $t = 2.06$, $p = .04$) showed statistically significant results. Integrity and Competence showed non-significant results (see Appendix 7). These results suggest that trust was an effective predictor for attitude, but only partially predicts acceptance.

Effect of Acceptance among the different Operators. A within-subject one-way repeated measures ANOVA with questions regarding acceptance scores for the three operators when the participants imagined the police, news journalist or civilian controlling the drone was conducted. Each participant was only shown the questions for the operator which they did not see in the video. The missing values were used from the general acceptance score accordingly.

The results of the within-subject analysis showed that the acceptance rates differed significantly between the operators $F(2,60) = 6.23$, $p < .05$, Wilks $\lambda = .83$. This is in line with hypothesis 1. For all three questions, the range of the answers was between 0-10. The mean values of the answers showed support for acceptance of the police as an operator (Police $M = 5.69$, $SD = 3.07$, News journalist $M = 4.13$, $SD = 2.67$, Civilian $M = 4.34$, $SD = 2.60$).

The pairwise comparison of the factors of the repeated measure ANOVA showed that the Police was significantly different in acceptance rates than the News journalist ($M_{difference} = 1.57$, $SE = 0.45$, $p = .05$). Also, the Police differed significantly in acceptance rate compared to the Civilian ($M_{difference} = 1.36$, $SE = .0.48$, $p = .01$). When comparing the News journalist to the Civilian no significant difference was found (see Appendix 8). These results support hypothesis 1, stating that the police as an operator is more accepted than the news journalist and the civilian.

At the end of the survey, the participants were asked to answer the question to what extent they thought it was logic and understandable that the three operators controlled the drone in the park. To compare the within-subject scores a one-way repeated-measure ANOVA was conducted. The results showed that the operators differed significantly in acceptance rates $F(2,60))=13.69$, $p < .05$, Wilks $\lambda = .69$. Acceptance was highest with the Police, and lowest with the Civilian as an operator (Police: $M = 5.13$, $SD = 1.5$; News journalist: $M = 4.77$, $SD = 1.2$; Civilian: $M = 3.99$, $SD = 1.5$).

For further analysis, a pairwise comparison was conducted. The results showed that the Police was significantly more accepted than the Civilian ($M_{difference} = 1.14$, $SE = 0.26$, $p < .05$). Also, the News journalist was more accepted than the Civilian ($M_{difference} = .77$, $SE = 0.16$, $p < .05$). No significant results were found when comparing the Police and the News journalist (see Appendix 9). This partially supports hypothesis 1, because the police was more accepted than the civilian, but a statement about the police being more accepted than the news journalist should be considered with care because no significant results could be found in the pairwise comparison, but the mean score of the variable acceptance showed a difference.

Discussion

The current study examined the acceptance of drones when they were being controlled by different operators. 80 people were asked to watch a video in which they were randomly assigned to an operator (police, news journalist, civilian) who was seen controlling a drone. The acceptance of the drone was examined in regard to a person's attribution, trust and privacy concern towards the different operators of the drone. On the basis of the quantitative analyses, various conclusions can be drawn.

Acceptance. Firstly, it was expected that the acceptance of the drone would differ if different operators controlled the drone (H1). More specifically, it was assumed that the police operating the drone was more accepted than the civilian and the news journalist. Hypothesis 1 is supported because the operator did have an influence on the acceptance of the drone. When asking whether it was logical and understandable to see the different operators controlling the drone, the results expressed the assumed outcome: the police was more accepted than the news journalist and the civilian. However, when doing further analysis by comparing the acceptance scores of the operators to each other, it was found that the police and the news journalist were better accepted than the civilian but that no statement could be made about whether the police was better accepted than the news journalist. When asking participants to imagine a different operator than which they had seen in the video controlling the drone, the results showed that the police was the operator that was accepted the most, followed by the news journalist. Least accepted was the civilian which confirms the view of Aydin (2019) that drones are more likely to be rejected when used for private purposes.

Additionally, a civilian operator does not have the support of an organization which has to follow rules and regulations for controlling a drone. However, people are looking for guidelines that organizations have to follow in order for them to be able to protect themselves in case the information which was gathered by the drone is misused (Roma, 2017). Since it might seem easier for the public to hold organizations responsible than a civilian, it might be one of the reasons that the news journalist and the police as an organization is better accepted. In practice, this means that more guidelines might be useful to put in place for operating with drones in general, in order for individuals to accept them more if they can be sure that they can complain about misconduct if necessary. Therefore, not accepting the civilian as much as the news journalist and the police might be due to the fact that a civilian is an individual and that the implementation of existing guidelines is difficult to execute (Stoica, 2018). Drones are regulated under the guidelines of other unmanned aerial vehicles such as air balloons that have existed prior to the invention of drones. However, the transfer of those already regulated guidelines to drones is difficult to implement, because risks and other issues of drones are not yet researched as well as other technologies (Clarke, 2014; Stoica, 2018).

Secondly, it was expected that acceptance is explained by attribution, trust and privacy concern and that the police would be seen as more trustworthy as well as more concerned about an individual's privacy than the news journalist and the civilian (H2a). Partial support was found for hypothesis 2a because of trust and privacy concern influencing acceptance. When concern for privacy increases, acceptance decreases. This might be explained by the

circumstance that people feel more insecure when they are being filmed in private places compared to public places (Taylor, 2010). Therefore, the acceptance of a drone that makes one feel insecure decreases. For trust the opposite can be found, when trust increases, acceptance does as well. This is in line with the proposed model of trust by Mayer et al. (1995). If the operator is perceived as being competent and benevolent, as well as having integrity, then they are more likely to be trusted and acceptance increases.

Nevertheless, support for attribution predicting acceptance could not be found. Not finding significant results that support attribution as being a predictor for acceptance, could be explained by the unclarity when it comes to the purpose for what a drone is used and what capabilities it has (Article 29 Data Protection Working Party, 2015 as cited in Finn & Wright, 2016, p. 578). This is often only vaguely known, if not completely unclear. According to Oltvoort et al. (2019), people were most interested in finding out why a drone is used. This issue could also be resolved with information provided to people's smartphone. Nowadays, it can be assumed that most people own a smartphone, which makes this idea a very viable one. Literature shows (Article 29 Data Protection Working Party, 2015 as cited in Finn & Wright, 2016; Oltvoort et al., 2019) that informing people should lead to greater acceptance. With this in mind, operators of a drone should take into consideration informing people when they are in an area where a drone is being operated. Thomasen (2017) suggests sending a notification to people's smartphone once they are in sight of the drone. This way, people could receive information and might be less inclined to associate negative attributes to the drone. For the people that do not own a smartphone, an additional stand-up display could be positioned near the place where the drone is flying around.

Thirdly, it was expected that more positive purposes were attributed to the police controlling the drone than attributed to the news journalist and the civilian (H2b). This hypothesis can only be partially substantiated. A difference in attributions towards the different operators was found, however, it was not found that the police is more positively attributed than the civilian nor the news journalist. Instead, it was found that the civilian was more positively attributed than the news journalist.

Having no concerns regarding a civilian operating a drone might be due to the reason that nowadays people are already willing to share a lot of personal information on the internet when they use social media platforms or the like (Staples, 2013 as cited in Graham et al., 2019, p. 12). This might explain the fact that civilians have a higher attribution score because it might not have mattered as much to participants what a civilian would do with the information the drone they flew had gathered. The usage of the information for a civilian would not have been

so useful compared to the news journalist whose main aim of flying a drone can be assumed to be newsgathering since that is what a journalist usually does in its field of work.

These findings are in line with the split opinions about news journalists and their usage of drones. On the one hand, some news journalists such as paparazzi have a negative reputation. This might hinder the public to accept drones of news organizations because they might associate drones with an invasion of their privacy and lack of respect for their privacy (Culver, 2014). On the other hand, drone usage in journalism has a lot of potential, as they are useful in high-risk situations such as taking video footage of a scene of disaster when it might be too dangerous for a news journalist to obtain the footage (Culver, 2014).

Additional findings

Trust. In addition, the subconstructs of trust were researched to see whether the subconstructs of trust had different results than the compound variable. The compound variable as a whole which is made of benevolence, competence and integrity and overall trust, did show a significant effect on acceptance. However, the single constructs did not influence acceptance in a significant way. Only benevolence showed significant results in the analysis. This might be explained by the fact that benevolence is the intent to perform a positive action for the trustor (Mayer et al., 1995). Participants in this study might have thought about the operator as in doing good things, such as surveil the area for protection, when they were asked questions about their attribution towards the operator. However, for competence and integrity, the abilities and moral intentions of the operators were not directly assessed which could have been the reason for those subconstructs not to be significant in this study.

Nevertheless, the current findings were expected, by confirming that trust in an organization is more important than in the system (Gefen et al., 2003). If the police can be considered as part of a law enforcement organization and the news journalist part of a publishing/newsgathering organization, then it can be supported that individuals representing an organization are more accepted than an individual on its own. This finding could be used by organizations to gain greater acceptance for the use of drones by making sure that it is clear who operates the drone by for example marking the drone with a symbol of the organization operating it.

Privacy concern. The results suggest that privacy concern affect the acceptance of drones. However, the questionnaire that was used did not measure privacy concern as a state variable, instead it measured concern for privacy as a trait variable. This means that the answers of the participants are measuring privacy concern as a universal concern privacy in everyday

situations of the participant, but not only and directly the situation in which the operator is controlling the drone. Therefore, the variable privacy concern had to be changed to an independent variable rather than a mediator variable.

Nevertheless, it was found that privacy concern has an influence on acceptance, as well as on attribution and trust. The acceptance of the drone is higher when concern for privacy is lower, which confirms the assumption that seeing a drone in a park environment might be perceived as a privacy threat (Gill & Spriggs, 2005). Also, the higher the concern for privacy was, the lower was trust and attribution. This is in accordance with Taylor (2010), who found that when being filmed in a private place, people feel more insecure. The park environment is a rather private environment which might explain the concern for privacy and the lower acceptance when concern for privacy was high. It might then be interesting to see whether the acceptance of drones and the concern of privacy is different in a different environment which is less private. Oltvoort et al. (2019) found that acceptance of drones differs in different environments. In future research this study could be further combined with the study of Oltvoort et al. (2019) to see whether various operators are accepted differently in various environments.

In contrast to this finding stands the normalcy of sharing ones private information and insight into one's private life voluntarily on the internet such as on social media platforms (Staples, 2013 as cited in Graham et al., 2019, p.12). This does not mean that individuals do not care about their privacy when being filmed by a drone. However, it does raise the question whether the perception of privacy is changing within the present society as more people use the internet to share parts of their life.

Difference in acceptance and attitude measure. The outcome variable acceptance was split into two measures in the analysis, because the construct for acceptance by Van der Laan et al. (1997) measured acceptance in the way that it asked for participants attitude towards the drone. Because there were more questions added to the questionnaire, one of them asking about the extent to which the participant accepted the operator controlling the drone, the response to this question was used as the measure for acceptance. This is the reason why several similar analyses were conducted, because there were two outcome variables. Both acceptance and attitude showed similar results. Trust and privacy concern significantly affected acceptance and attitude, but attribution did not predict neither acceptance nor attitude.

The only difference between the two measures which was found, was that an increased positive attitude towards the police in comparison with the civilian operator was found, when trust, attribution and privacy concern were taken into consideration. An explanation could be that the attitude measure consisted of two subscales, the usefulness and satisfaction scale. It

was found that the drone being controlled by the police was perceived as being more useful than if it was used by the civilian operator. This can be seen as additional support for hypothesis 1. The Technology Acceptance Model (TAM) suggests that perceived usefulness and ease of use influence the intent to use the technology (Davis et al., 1989). When wanting to apply the drone in law enforcement or for commercial use, it could be useful to take into consideration that the perceived usefulness of a drone influences in the acceptance of the drone.

Limitations

Initially, the study was designed as a Virtual Reality (VR) study. However, it had to be adjusted due to circumstances related to the Coronavirus. In a VR environment, the participants would have gotten the chance to take time to look around at their surrounding instead of watching a prerecorded video which meant that they had to look at exactly what the video showed them. If the participants have had the chance to explore the environment by themselves and take their time to get used to what was happening around them, it might have been easier for them to infer which operator was controlling the drone. With the video, the participants found it relatively hard to infer which operator controlled the drone. Almost ¼ of the answers to the question of which operator the participants saw controlling the drone in the video did not match the video sequence the participants watched. Due to the removal of the answers of those participants, a disproportional distribution of participants in the categories police, news journalist and civilian with the largest number of participants answering the questions for the civilian operator, occurred. This might have led to some results being less accurate than what they could have been. To make it more explicit and clearer to the participants who is controlling the drone, the operator could wear a uniform representing the organization to which they belong to. This could make the operator better recognizable. However, conducting the study as an online questionnaire instead of a VR study, was a chance of reaching a more diverse participant pool, especially in the range of age.

Future research

Future research could focus on the issue of privacy more. Khan et al. (2019) already found that concern for privacy is a major worry when it comes to drone acceptance. For this study is could mean to expand the assessment of a person's concern for privacy as a state variable rather than as a trait variable. Then, it could become clearer what the target group thinks about an invasion of privacy in certain situations. It has to be made clear what is a private environment and where people would accept a drone.

Additionally, according to Roma (2017), the perceived risk of new technology, such as security issues, is based on an individual's subjective judgement and their knowledge about the

risks included in the use of such technology. If people are not familiar with a drone, what it is used for and what it can do, their perceived risk is higher, because people tend to fear the unknown as well as new items that influence their perception of risk (Khan et al., 2019). Therefore, it has already been suggested to extend the TAM created by Venkatesh and Davis (1996) with the variable "privacy fears" which influences the variables "perceived usefulness" and "perceived ease of use" (Khan et al., 2019). Regarding this research, this could mean to add specific questions about fear. The relationship between fear and different operators could then also be assessed.

Conclusion

To answer the research question, acceptance of drones differed with different operators controlling it. As expected it was found that the police was more accepted compared to the news journalist and the civilian operator. This could be seen as confirmation that it does matter who operates a drone, because different operators differ in acceptance and attribution. Even though the police was accepted the most, the civilian operator received more positive attributions. Nevertheless, these results need to be interpreted with caution, because a contradiction was found.

Furthermore, it was found that acceptance is positively influenced by trust and negatively influenced by privacy concern. Acceptance increased when trust increased but decreased when concern for privacy increased. Overall trust in the operator was most important to the participants' acceptance. Additionally, it was found that when looking at the operator controlling the drone a benevolent attitude of the operator seemed important to the participants as well. However, in the case of attribution further research has yet to be conducted to find a suitable measure to predict acceptance. The perceived attributions of an operator did vary, however, attribution did not significantly predict acceptance. Here, the information that was given to the participants about the drone should be taken into consideration. Possibly more information about where, when, who and why a drone is used should be given to people, for example directly on their smartphones or with a stand-up display near the place where the drone is being operated. This could make people more aware of the drone and consequently increase the acceptance of the operator controlling the drone.

Future research should consider peoples fearfulness of new technologies such as a drone, trust in different organizations and their influence on acceptance as well as people's concern for privacy when trying to implement drones into everyday life. Marking the drone with a symbol representing the organization which is controlling the drone could be taken into consideration. This way, people know what to do in case their personal information, which was

gathered by the drone, is being misused. Altogether it can be said that drones being controlled by various operators should be further researched because a difference in acceptance scores among the different operators was found which makes it plausible to think that it matters who operates a drone when it comes to accepting the drone being controlled in a certain area. Also, drones will be practical to utilize in several areas, such as for commercial use and disaster prevention and will probably be a large part of society someday as technology advances.

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Appendix 1 - Questionnaire drones and safety

Welcome to the study about drones and safety which examines the acceptance of drones with the help of a video recording. After watching the video, you will be asked to answer a few questions. This will take approximately 15 minutes.

Participation in this study is voluntary. You have the right to decline to participate in the study as well as the right to withdraw from the experiment at any time without any consequences.

Your data will be treated confidentially. All responses will be anonymous and you will not be asked to state your name.
If you have any questions regarding your rights as a participant or the research itself, you can contact me through my e-mail: j.ahrendt@student.utwente.nl

I have fully read and understood the text above and I am willing to participate in this study:

- Yes
- No

In the following part, you will be asked to watch a video.
You will be located in a park which is situated in the middle of a city. The video is filmed as if it was your point of view. Please try to put yourself in the shoes of the observer: imagine that it is you who is standing in the park.

Please **put on your sound** and watch the video carefully. It is essential that you imagine yourself in the presented situation and that you pay close attention to your surrounding. You will be asked questions about it later on.

Video (every participant watched only one of the three videos)
- Drone1= civilian
- Drone2= News
- Drone3=Police

Which operator did you see controlling the drone in the park?
- The police
- A News journalist
- A civilian

Attribution (7-point Likert scale)
Please answer the questions according to your observations in the video. Please keep in mind the operator who you saw controlling the drone.

Please answer some questions about your perceived purpose of the operator controlling the drone first:
1. I think the operator is interested in my safety.
2. I think that the operator is spying on other people.
3. I think the operator acts responsible.
4. I worry that the operator is using the information the drone gathers in a wrongful manner.

5. I feel comfortable walking through the park with the operator controlling the drone.
6. I think the operator is interested in news gathering.
7. I think the operator has commercial goals.
8. I think the operator is enjoying himself.
9. I think the operator is interested in gathering information about myself.

Overall trust (7-point Likert scale)
In the following please indicate your agreement with some statements about your Overall Trust, Goodwill, Integrity and Competence of the operator of the drone.

1. I am willing to let the operator make decisions for people like me
2. I think it is important to watch this operator closely so that it does not take advantage of people like me.
3. I trust the operator to take care of people like me.
4. I trust the operator to make decisions for people like me.
5. I trust the drone operator not to disclose any personal information about me.

Benevolence (7-point Likert scale)

1. I believe that the operator is interested in the well-being of people like me, not just themselves.
2. I believe the operator takes opinions like mine into account when making decisions.
3. Whenever the operator makes a decision, I know it will be concerned about people like me

Integrity (7-point Likert scale)

1. The operator treats people like me fairly and justly.
2. The operator can be relied on to keep its promises.
3. Sound principles seem to guide the behavior of the operator.
4. The operator does not mislead people like me.

Competence (7-point Likert scale)

1. I feel very confident about the skills of the operator.
2. The operator has the ability to accomplish what it says it will do.
3. The operator is known to be successful at the things it tries to do.

Privacy Concern (7-point Likert scale)
The next questions focus on your concern about privacy:

1. I would object to my photograph appearing in a public place without my permission.
2. No organization or person should disseminate personal information about me without my knowledge.
3. I would not mind appearing on television.
4. Video cameras should be used in public places to improve public safety and security.
5. I worry about the possibility that my conversations will be overheard.
6. It usually bothers me when organizations ask me for personal information.
7. I am concerned that organizations are collecting too much personal information about me.

8. Organizations should take more steps to make sure that unauthorized people cannot access personal information.
9. Companies should not use personal information for any purpose unless it has been authorized by the individuals who provided the information.
10. Organizations should never sell the personal information in their computer databases to other organizations.
11. The use of drones as surveillance reduces crime.
12. The use of drones as surveillance is an invasion of privacy.
13. The use of CCTV is an invasion of privacy.

Acceptance

Now, I would like to know how you think and feel about the use of drones by the operator, in other words: to what extent do you accept the use of drones by the operator?

According to my judgment of the operator, the drone is:

Useful …… useless
Pleasant …… unpleasant
Bad ……good
Nice ……annoying
Effective ……ineffective
Irritating ……likeable
Assisting ……worthless
Undesirable ……desirable
Raising alertness……sleep-inducing

To what extent do you accept the drone being controlled by the operator?

Not at all									A great deal
1	2	3	4	5	6	7	8	9	10
o	o	o	o	o	o	o	o	o	o

Imagine the police is controlling the drone. To what extent would you accept the drone?

Not at all									A great deal
1	2	3	4	5	6	7	8	9	10
o	o	o	o	o	o	o	o	o	o

Imagine a News journalist is controlling the drone. To what extent would you accept the drone?

Not at all									A great deal
1	2	3	4	5	6	7	8	9	10
o	o	o	o	o	o	o	o	o	o

Imagine a civilian is controlling the drone. To what extent would you accept the drone?

Not at all									A great deal
1	2	3	4	5	6	7	8	9	10
o	o	o	o	o	o	o	o	o	o

Operator

In the following please indicate your agreement to with some statements concerning **the police** controlling the drone.

1. I understand why the police uses the drone in a park.
2. It is logical that the police uses the drone in a park.

In the following please indicate your agreement to with some statements concerning **a news journalist** controlling the drone.

1. I understand why a news journalist uses the drone in a park.
2. It is logical that a news journalist uses the drone in a park.

In the following please indicate your agreement to with some statements concerning **a civilian** controlling the drone.

1. I understand why a civilian uses the drone in a park.
2. It is logical that a civilian uses the drone in a park.

This is the end of the study. Thank you for participating!

In this study the acceptance of drones was the main focus. However, not only did I want to research your acceptance, but also your attributions towards different operators of the drone. For this study, there are 3 videos with different operators controlling the drone. The police, a news journalist and a civilian were possible operators of the drone. Your attribution towards the operator you saw controlling the drone in the video was measured, as well as your privacy concern and trust in the operator.

If you still agree with your participation in this study and the use of your data, please fill out the questions about yourself, so that I can make a general description of the research participants.

- What is your age?
  - _____
- What is your gender?
  - Female
  - Male
  - Divers
  - Prefer not to say
- What is your nationality
  - German
  - Dutch
  - Other: _____
- What is your highest completed level of education?
  - Still in school

- Secondary education (HAVO, VWO, Abitur)
- Apprenticeship (Ausbildung)
- Bachelor's degree
- Master's degree
- Doctoral degree
- Other: _____

If you have any further questions, you can send me an e-mail: j.ahrendt@student.utwente.nl

Thank you for participation!

Appendix 2 – Results of Multivariate ANOVA

Table 1

Test of between-subject effects for Operator

Variable	Description	*F*	*p*	*df*	*df* error
Operator	Acceptance	0.01	.99	2	56
	Attitude	2.34	.11	2	56
	Trust	0.21	.81	2	56
	Attribution	7.46	.00	2	56

Table 2

Multiple Comparisons of operator with Acceptance, Attitude, Trust and Attribution

Variable	Operator (I)	Operator (II)	*Mean-Difference*	*Std. Error*	*p*
Acceptance	Police	News	-0.18	0.30	1.00
		Civilian	-0.32	0.30	.86
	News	Police	0.18	0.30	1.00
		Civilian	-0.14	0.26	1.000
	Civilian	Police	0.32	0.29	.86
		News	0.14	0.26	1.00
Attitude	Police	News	-0.01	0.30	1.00
		Civilian	0.34	0.29	0.74
	News	Police	0.01	0.30	1.00
		Civilian	0.36	0.26	0.53
	Civilian	Police	-0.34	0.29	0.74
		News	-0.36	0.26	0.53
Trust	Police	News	0.11	0.31	1.00
		Civilian	-0.07	0.31	1.00
	News	Police	-0.11	0.31	1.00
		Civilian	-0.18	0.28	1.00
	Civilian	Police	0.07	.31	1.00
		News	0.18	0.28	1.00
Attribution	Police	News	0.42	0.28	.42
		Civilian	-0.58	0.28	.13

	News	Police	-0.42	0.28	.48
		Civilian	-1.00	0.25	.00
	Civilian	Police	0.58	0.28	.13
		News	1.00	0.25	.00

Appendix 3 – Regression analysis with Attitude as dependent variable

Table 1

Table of coefficients of variables[a]

Model	*beta*	*t*	*p*
1. Civilian	-0.17	-1.04	.30
News journalist	0.01	0.04	.97
2. Civilian	-0.28	-2.46	.02
News journalist	0.01	0.10	.92
Privacy concern	-0.28	-2.87	.01
Attribution	0.16	1.24	.22
Trust	0.48	3.98	.00

[a]dependent variable is Attitude

Appendix 4 – Regression analyses with Attitude as dependent variable

Table 1

Table of coefficients of Operators[a]

Model	*beta*	*t*	*p*
Civilian	0.03	0.21	.84
News journalist	-0.5	-0.32	.75

[a]dependent variable is Trust

Table 2

Table of coefficients of Operators[a]

Model	*beta*	*t*	*p*
Civilian	0.28	1.92	.06
News journalist	-.21	-1.39	.17

[a]dependent variable is Attribution

Appendix 5 – Regression analysis with Acceptance as dependent variable

Table 1

Table of coefficients of variables[a]

Model	*beta*	*t*	*p*
1. Civilian	0.16	.95	.35
News journalist	0.09	0.54	.59
2. Civilian	0.07	0.57	.60
News journalist	0.11	0.94	.35
Privacy concern	-0.20	-2.06	.04
Attribution	0.14	1.04	.31
Trust	0.56	4.59	.00

[a]dependent variable is Acceptance

Appendix 6 – Regression analysis with usefulness and satisfaction scale as dependent variable

Table 1

Table of coefficients of variables[a]

Model	*beta*	*t*	*p*
1. Civilian	-0.34	-2.20	.03
News journalist	-0.03	-0.16	.87
2. Civilian	-0.42	-3.59	.00
News journalist	-0.03	-0.29	.76
Privacy concern	-0.26	-2.56	.01
Attribution	0.09	0.64	.53
Trust	0.46	3.62	.00

[a]dependent variable is Usefulness scale

Table 2

Table of coefficients of variables[a]

Model	*beta*	*t*	*p*
1. Civilian	0.03	.15	.88

News journalist	0.05	0.32	.75
2. Civilian	-0.10	-0.81	.42
News journalist	0.07	0.59	.56
Privacy concern	-0.26	-2.52	.02
Attribution	0.24	1.67	.10
Trust	0.40	3.06	.03

[a]dependent variable is Satisfaction scale

Appendix 7 – Regression analysis of subconstructs of Trust

Table 1

Table of coefficients of variables[a]

Model	*beta*	*t*	*p*
Overall Trust	0.44	2.95	.01
Benevolence	0.27	1.64	.11
Integrity	-0.00	-0.01	.99
Competence	0.09	0.78	.44

[a]dependent variable is Attitude

Table 2

Table of coefficients of variables[a]

Model	*beta*	*t*	*p*
Overall Trust	0.45	3.45	.00
Benevolence	0.30	2.06	.04
Integrity	0.18	1.05	.30
Competence	-0.14	-1.32	.19

[a]dependent variable is Acceptance

Appendix 8 – Repeated measures ANOVA with imaginative operator questions

Table 1

Pairwise comparisons of the factors

Factor	Factor	*Mean-Difference*	*Std. Error*	*p*

Police	News	1.57	0.45	.00
	Civilian	1.36	0.48	.02
News	Police	-1.57	0.45	.00
	Civilian	-0.21	0.39	1.00
Civilian	Police	-1.36	0.48	.02
	News	0.21	0.39	1.00

Appendix 9 – Repeated measures ANOVA with logic operator questions

Table 1
Pairwise comparisons of the factors

Factor	Factor	*Mean-Difference*	*Std. Error*	*P*
Police	News	0.36	0.23	.37
	Civilian	1.14	0.26	.00
News	Police	-0.36	0.23	.37
	Civilian	0.77	0.16	.00
Civilian	Police	-1.14	0.26	.00
	News	-0.77	0.16	.00