THE ETHICS OF ARTIFICIAL INTELLIGENCE ON UNMANNED AERIAL VEHICLES

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By

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

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As the amount of data in the world increases and our machines become even more complex we will need to focus on the ethics to prevent abuse that new technology may bring. One application of Artificial Intelligence (AI) that is becoming more prevalent is unmanned aerial vehicles (UAVs). Because of how UAVs have been used in war such as in Iraq, Kosovo, or the Persian Gulf (Johansson, 2011, p.282 – 283) it is necessary to discuss how they can be used ethically. The Science Technology and Society (STS) topic will focus on researching the ethics of artificial intelligence in UAVs, and will more specifically delve into the ethics of decision making with artificial intelligence and the ethics of using unmanned aircraft. The technical topic is comparing voice user interfaces and gesture interfaces to determine if they are viable alternatives to more ubiquitous interfaces. This topic more specifically studies the state of the art in both gesture and voice user interfaces and finds studies where machine learning was used to improve their accuracy and precision. Both the Science Technology and Society (STS) and the technical topic are loosely related around the question of how artificial intelligence or machine learning affects AI decision making. The STS research will culminate in finding the effects of using a semi-autonomous or autonomous unmanned aerial vehicle (UAV) and see if its use is ethical.

The technical thesis is a project that studied the intersection between machine learning and human computer interaction. This project will research alternative user interfaces to see if they could be viable alternatives to more ubiquitous interfaces, such as mouse and keyboard or touch. This project will gather the state of the art research of both voice user interfaces and gesture interfaces to find the most precise and accurate interface. After comparing gesture and voice user interfaces to determine the most accurate interface the most precise and accurate

interface will be compared to ubiquitous interfaces. The technical project resulted in the finding that while both options could be viable alternatives, the voice user interfaces tend

to have a high degree of accuracy as well as a lower loss rate. The best precision and accuracy come from using a Gated Attention model to get a range from 98.2 to 97.6 percent accuracy (Roh, 2019). The gesture interface used a random forest model to get an accuracy of 91 to 99 percent accuracy (Zengeler et al, 2018). While the 99 percent accuracy may seem higher, the range or precision for the gesture interface makes it much less likely to get a good accuracy. Because there is a relatively large degree of error for both voice and gesture interfaces, more dangerous applications such as driving should not rely on either voice or gesture interfacing. However, in less risky applications both are viable interfaces, but voice user interfaces are better.

How Artificial Intelligence Can Learn and Perform Tasks

Artificial Intelligence (AI) is a program which allows a computer to learn and perform a task within a certain range of parameters (Kumar et al., 2016, p. 111). Artificial intelligence can be used to increase the speed at which a task is completed (Kumar et al., 2016, p. 111). An example of this is when a program can be used to help plan, predict, and allocate tasks to predict enemy actions (Rasch, Kott, Forbus, 2003, p. 18-19, 21).

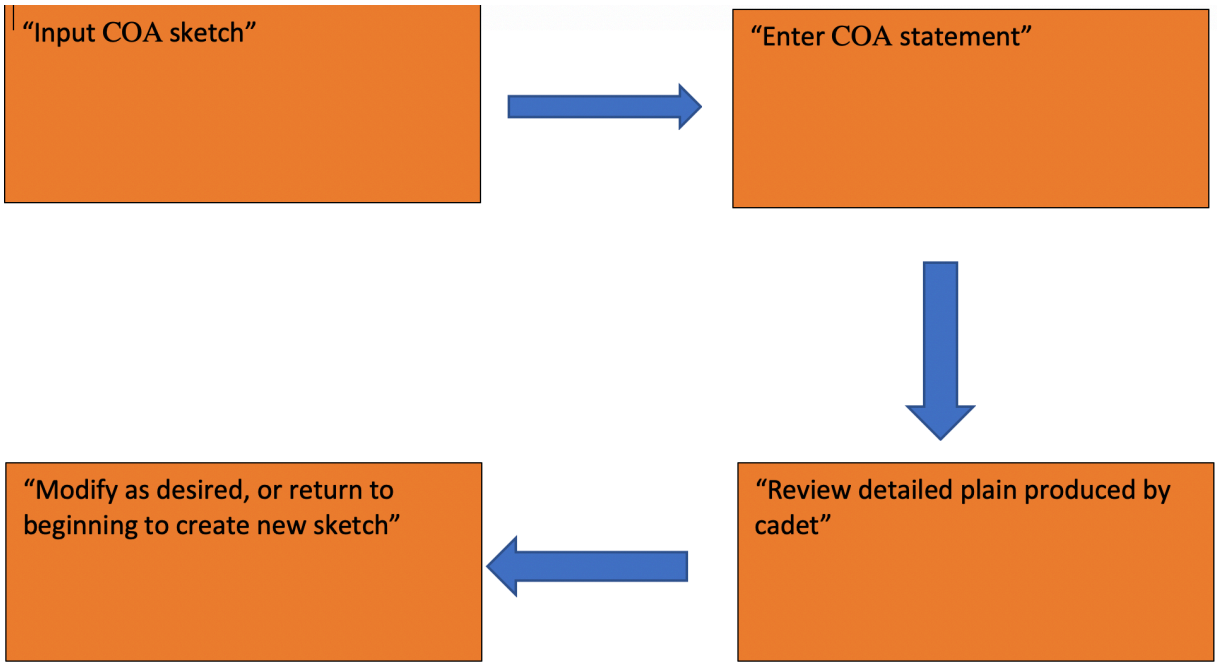

Figure 1: This figure Rasch, Kott, and Forbus shows how to create an "Integrated Course of Action Critiquing and Elaboration System (Rasch, Kott, and Forbus, 2003, p. 21)

As shown in Figure 1, by using AI, sketch-based diagrams can be created to be used by domain experts with little to no training which lowers the threshold required to do such a job (Rasch, 2003, p. 25).

HOW CAN ARTIFICIAL INTELLIGENCE BE USED ETHICALLY

AI should be able to find solutions in a similar manner or with similar results as humans (Kumar et all, 2016, p. 111 – 114). According to Bryson and Kime, "ethical systems are based on notions of identity, and the exaggerated hopes and fears of AI derive from our cultures having not yet accommodated the fact that language and reasoning are no longer uniquely human" (2011, p. 1641). AI technology "gives us the means to do extensive damage" which means artificial intelligence can be used as a good or bad moral agent depending on its use case (Bryson & Kime, 2011, p. 1645). Artificial intelligence's ambiguity as a moral agent makes it especially important to learn how artificial intelligence can be used ethically. On April 2020, drones were

used to make public safety announcements to social distance ("Drones used in effort", 2020). The public safety announcements were a more ethical manner of using drones due to the less invasive use case. The reason public safety announcements were more ethical is because the drones are limited to public spaces due to the guidelines placed by the FAA, which does not allow the drones to spy on people on private property ("Drones used in effort", 2020).

How can we determine the ethics of UAVs? According to Albas et al., "norms are a useful tool in designing the "goodness" of an action" (2019, p. 2). This theory means that precedence dictates ethics. However, the rise of autonomous drones has "raised safety and ethical issues" regarding public safety risks (Albas et al, 2019, p. 1). The ethics of autonomous drones or UAVs could be determined by the outcomes of the actions (Albas et al. 2019, p.2). In this same manner drones could be operated under utilitarian ethics, where the perceived outcome dictates if the use of an unmanned aircraft is ethical or not (Albas et al., 2019, p. 2).

Another method of determining the ethics of UAVs that Albas et al. detail is deontology ethics, which promote the use of social norms as the basis of ethical rules for the artificial intelligence in autonomous drones (Albas et al, 2019, p. 2). This means that society would have to pass laws or guidelines to determine whether society as a collective are using drones ethically. Deontology ethics would mean basing unmanned aircraft operations on human values. In order to make sure that human values are being considered, "UAVs should be studied on the basis of military ethics and human values" (de Swarte, 2019, p. 291). By basing the drones' programming on military ethics and human values there is less of a chance for unnecessary errors in operation.

Part of making sure that the rights of both the individual and society are considered is to define the use of the drone based on "individual or community of which [the drone] is intended

to serve (Albas, et al., 2019, p. 4). This would make it so that the laws and actions for UAVs protect both the individual and the collective.

USING UNMANNED AERIAL VEHICLES IN WAR

Using UAVs in war requires a particularly harsh set of criteria due to both the lives endangered as well as the political impacts between countries. There are two ways to make sure that an autonomous vehicle is being operated on ethically. They are “Jus in Bello” and “Jus ad Bellum” or once in war and reasons for fighting respectively (Johansson, 2011, p. 281). Jus ad Bellum would be fighting a war for a just cause, the right intention, legitimate authority, last resort, proportionality or reasonable chance of success (Johansson, 2011, p. 281-282). Jus in Bello would be discriminating for the correct targets, making sure civilian damage is not excessive, making sure the attack is necessary, and using internationally allowed weapons (ex. No chemical or nuclear weapons) (Johansson, 2011, p. 282). While it may be possible that only Jus in Bello is required due to drones being deployed only war starts, there can be cases made for Jus ad Bellum (Johansson, 2011, p. 282). A similar concept to Jus in Bello and Jus ad Bellum are micro and macro dilemmas. The AI have certain micro and macro dilemmas that they operate under (de Swarte, 2019, p. 293-294). In the context of Macro-Dilemmas, unmanned aircraft cannot be used without precise rules of engagement (de Swarte, 2019, p. 293-294). In the context of Micro-Dilemmas, it means that there are the operational processes by which a drone performs an action (de Swarte, 2019, p. 293-294).

There are also concerns that using UAVs can separate cost from war (Johansson, 2011, p. 282). The idea that unmanned aerial vehicles reduce lives lost is also reciprocated by Li et al., who believes that AI can benefit military technology when applied to jobs which are dull, dirty,

and dangerous (2018, p. 337). War having less cost could possibly cause countries to act less ethically because there would be no harm to their citizens if they enact war on foreign soil. When going to war, a country needs to accept the deaths of their soldiers (Johansson, 2011, p. 283). The lessened cost of war also poses the question, if there are no or less lives lost due to the usage of UAVs does that make the war more ethical?

The ethics of counterterrorism drone strikes is a question which has been answered differently by the Obama and Trump administrations and will be answered by the Biden administration (Savage & Schmitt, 2021). President Obama had a stricter view on using UAVs or drones for counterterrorism, while President Trump had a less strict view (Savage & Schmitt, 2021). President Biden has currently placed a stopgap, or temporary, measure for each drone strike to have the approval of the white house before being carried out (Savage & Schmitt, 2021). This will allow President Biden to make sure that he and his administration are following their own ethical guidelines for counterterrorism drone strikes in the future.

The civilian bystander is one of the major ethical points which are being considered during this stopgap measure by the Biden administration. The current ruling under President Trump has a "near certainty" that no women or children would be near the drone strike while there is a "reasonable certainty" that no man is near the drone strike (Savage & Schmitt, 2021). The Biden administration is trying to see if it is possible to move the classification for men up to near certainty as well or if it would create too many problems (Savage & Schmitt, 2021).

SAFETY

Another issue that unmanned aerial vehicles need to consider is the issue of safety, specifically in military operations. In other words, before using an unmanned aircraft, "they must be safe to operate and maintain and safe to fight alongside" (Sparrow, 2008, p. 171). The UAVs cannot pose more of a risk to any military operations than what systems are currently in place (Sparrow, 2008, p. 171). This means that in order to be sure that using a UAV is better, they also need to be sure that using an unmanned aerial vehicle will not attribute to worse consequences compared to using people. Making sure drones perform similarly to people is especially important because they need to "share an airspace with both military and civilian aircraft" (Sparrow, 2008, p. 171).

To be relatively sure that an unmanned system can compare to a manned system, the unmanned system must be able to achieve a similar performance to a manned system as well as determine friend from foe (Sparrow, 2008, p. 172). What this does is give the UAV a benefit in terms of situations with a high chance of conflict (Sparrow, 2008, p. 172). This is due to the decreased amount of risk taken on without a manned presence.

There is however a risk that if the unmanned system is too risky to leave in enemy territory that lives may be put at risk to retrieve it before an enemy can gain info (Sparrow, 2008, p. 172). This shows that there are two sides to the UAV debate when it comes to risk. On one hand there will be less casualties when there are not people on scene, but on the other hand if the military determines that leaving a drone in enemy territory is too dangerous, then it will cost lives to get back the UAV.

There are also the psychological impacts of operating a UAV. It is possible that deploying unmanned aircraft in armed conflict will expose their operators to new forms of

psychological stress (Sparrow, 2008, p. 174). The psychological impacts show that operating the unmanned aircraft can have that same impact of being on the field as well. Though there is also the impact from having limited control due to the UAV handling some of the decision making as well.

When the country who can operate a UAV is fighting a country which does not have that option it becomes a matter of just cause. Is it ethical to fight a weaker country? This depends on if the view of ethics is more utilitarian or about fairness (Johansson, 2011, p. 288-289). A more utilitarian approach would dictate that safety is the highest priority and that the least amount of lives lost, the better. The approach based on fairness would say that the country that has the drones have an unfair advantage, and that using such an advantage against a weaker country would be unfair and cause resentment. An attack from a country with UAVs against a country without would be considered unethical based on virtue ethics as a result (Johansson, 2011, p. 289). When it comes to this theory utilitarian ethics is more appealing due to limiting casualties on the side the country with the UAVs would be fighting for. A country has more of an obligation to their citizens first before they need to worry about other countries citizens. However, a country's obligation to its people does not mean however that a country should send a drone strike without any proof, or invade a country with drones.

The use of UAVs in Pakistan has stirred "anti-American sentiments" (Johansson, 2011, p.283). This is probably due to the fact that there is a sense of unfairness, or that America is hiding behind their military might instead of facing them in a fair fight. Because of this there is propaganda spreading that is asking for "revenge for drone attacks" (Johansson, 2011, p.283).

SOCIOTECHNICAL MODEL

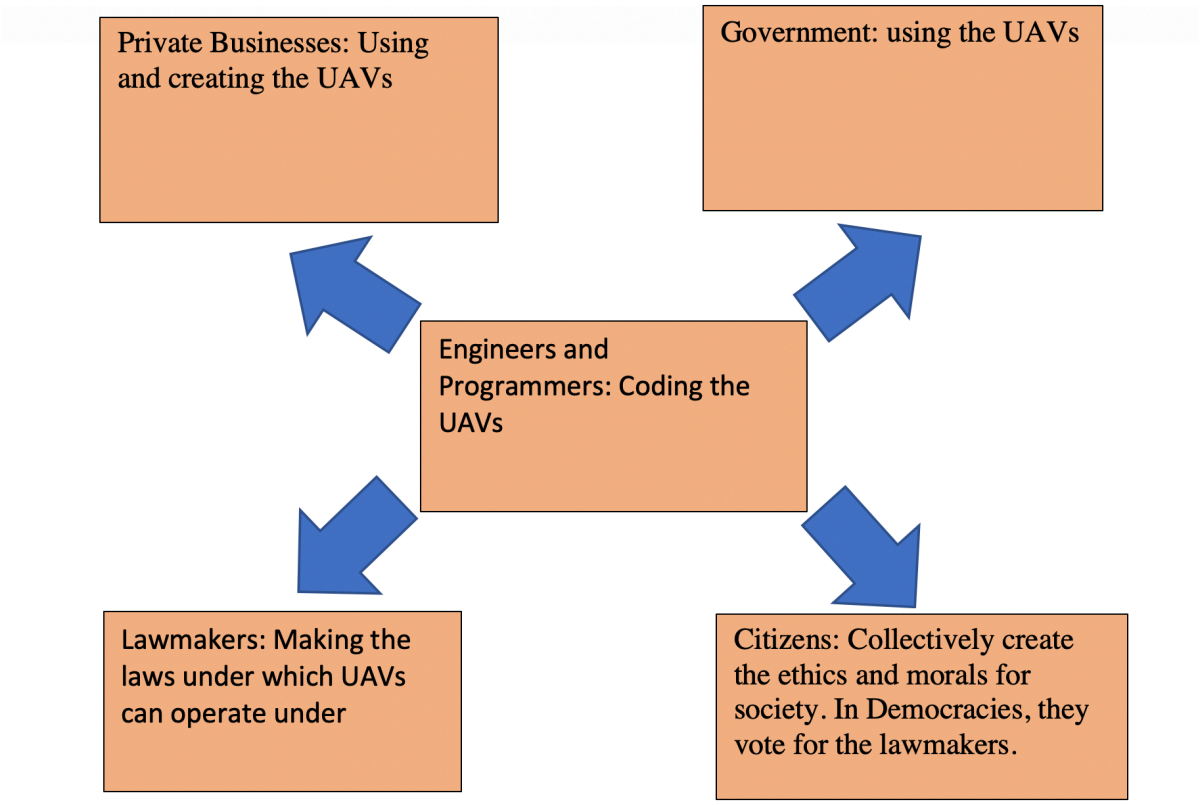

Figure 2: Social Construction of Technology (SCOT) model. This shows the Engineers and Programmers who create the UAVs how they interact with the private businesses, government, lawmakers, and citizens (Garimella, 2020)

The Figure above shows that Lawmakers, Citizens, Private Businesses, and the government all dictate how the UAVs are being built. There are examples of multiple groups which, while not mutually exclusive, dictate how drones can be used. The citizens are the group who will be affected by UAVs flying around them, so their values and ethics should dictate how unmanned aircraft can operate. Without their consent it will be hard to operate unmanned aerial vehicles such as the drones for the Covid 19 relief effort being “pulled over due to the residents’

privacy concerns" ("Drones used in effort", 2020). The lawmakers are the ones who write laws for how unmanned aircraft can act based on their constituents. Private Businesses create the drones, meaning they have the power to hire engineers and programmers to create it as well as lobby lawmakers. The government, which covers both the military as well as agencies such as the FAA, has the power to write guidelines for the use of unmanned aircraft ("Drones used in effort", 2020). Both the private businesses and government also use the unmanned aerial vehicles in business and military endeavors such as with Amazon's delivery service or counterterrorism strikes. This requires the programmers and engineers to be mindful of how they are building their artificial intelligence, as they should be safe for their clients.

The SCOT model is a good choice for UAVs because there are many different factors in society which overlap and connect together to make the final product. Without each of the parts of Figure 2, the final product or current stage of unmanned aircraft would be different. Programmers and engineers that make the UAVs rely on the rest of society to make the decisions on what they are allowed to create. Multiple groups can act at the same time to affect an action taken by unmanned aerial vehicles such as when multiple agencies received drones to combat Covid 19, but the citizens were unwilling to accept the drones ("Drones used in effort", 2020). As seen, the tradeoff is between safety from unethical use and freedom for drones to act in whatever capacity they can. The tradeoffs will be reflected in the technology by how the UAV is programmed to respond and learn in a situation as well as instructions given by those operating the drones. By understanding how each group affects UAVs, programmers and engineers can work to build an unmanned aerial vehicle which the multiple parties can accept. The SCOT model does have a weakness where it does not consider that the programmers and engineers can also create a newer version of an unmanned aerial vehicle that has abilities that laws cannot

catch. Programmers and engineers should think about the projects that they are working on and should decide if the project is ethical. If the project is not ethical then they should consider talking to the company they are working for or consider quitting the project. In turn businesses which are in charge of manufacturing the drones should make sure they are not participating in unethical business practices or forcing their employees to participate.

By showing how the programmers and engineers rely on the other parts of society it allows them to be more mindful of their actions so that they can create a machine tailored for their user base while also meeting the required specifications to stay ethical. To make sure that they are acting ethically they should build the UAV considering "individual or community of which [the drone] is intended to serve" (Albas, et al., 2019, p. 4). The programmers and engineers should consider this from a utilitarian perspective by making sure the outcome is ethical, a deontology perspective, by making sure the unmanned aerial vehicle is operating within social norms, and through a virtue ethics perspective by making sure that they are acting with morality and fairness.

UNMANNED AERIAL VEHICLES CAN BE USED ETHICALLY

This STS paper researched how artificial intelligence in UAVs could be ethical. To be able to use drones ethically the person or group using the drone need to consider if they are viewing it through a utilitarian, deontology, and a virtue ethics lens. Also, in cases of war it is important to note the reasons for fighting and the actions taken once in war, or Jus ad Bellum and Jus in Bello. By keeping these phrases in mind, it is possible to remember that there is a cost to war, even if people controlling the UAVs are separated from.

The use of drones with Covid social distancing and President Biden's stopgap measure shows that UAVs are a relevant issue in society, making them a necessary topic for discussion. The ethics of using unmanned aerial vehicles include safety as well because the AI in the UAVs have to be able to perform on an equal level to manned missions. They also need to perform on a level where they cannot pose a risk to any people on a mission. This does help the drone's case, because if the programming is good enough it could keep people out of danger. A couple downsides to this are that people may be put into risk by trying to retrieve a drone from enemy territory and that a weaker country may become frustrated and grow more hostile due to resentment from drone strikes. Keeping active duty troops from danger does portray a certain viewpoint on which ethics is correct, of utilitarian ethics is more correct for a country when it is between their citizens and another county's. This is because a country has a higher obligation to its citizens than to other people on the planet.

The STS model shows how intertwined all aspects of society are, and that programmers and engineers are unable to help without listening to their employers, the government, society and lawmakers. The interconnectedness of different parts of society makes them beholden to create the drones based on their rules. The SCOT model was the best choice because it was the model which best showcases that all aspects of society overlap and are interconnected. By having rules and regulations in place for UAVs to follow and operate under, which are created by a mixture of utilitarian, deontology, and virtue ethics, it is possible to design and create a UAV which is acting ethically.

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