

Privacy and Ethics Assessment of Roadpricing with GPS

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Abstract

The Danish government has initiated research on how to implement roadpricing, based on a recommendation from the Environmental Economic Council. One of the solutions is to implement a black box that tracks the car's position with GPS and sends it to the Danish tax authorities. The idea is to pay taxes for where you have been with the car. Many of the politicians have discussed the economic and environmental benefits, but what about the privacy and ethical concerns? By looking at control of information and privacy in terms of access, the majority of the privacy definitions say that implementing roadpricing with GPS violates the individual's privacy. However, when it comes to ethics there are some mixed results in favor of and against roadpricing, making it hard to determine if roadpricing with GPS is unethical.

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1 Introduction

Denmark has always been a country that is proud to say that they are an example for the rest of the world when it comes to the green initiatives and saving the climate. There have been a lot of different investments over the years, like lowering taxes on electric cars, providing money to get rid of oil-fired boilers, and building huge wind turbine farms in the middle of the sea. In the last decade, there has been a push from the government to limit the amount of cars being driven in big cities like Copenhagen. In the late 2011 and the early 2012 a proposal to let car owners pay for entering the city of Copenhagen with their vehicle was presented. The idea is to force car owners to take public transport when traveling into Copenhagen rather than the car. This obviously infuriated car owners driving to work every day, now having to pay more in taxes, but also arguing that it would take longer for them to get to work because public transport is not fit for the task. 10 years later, the discussion has returned. The Environmental Economic Council, initiated by the Danish government, has proposed the idea of roadpricing. Roadpricing is a tax that is being added to the driver when the car has been driven around the country [11]. The idea is not fully thought out, but the government is currently testing solutions to see how it works in practice [3]. The key difference is that this is not a one time payment only in Copenhagen. This is a tax for the driver depending on which road the car has been on. While there were heavy disagreement between politicians the last time, now they are more open-minded to the idea. The politicians are mainly looking at this from a financial perspective, concluding that it is a fair solution. However, politicians are not talking about the technology that the government is testing in order to make this happen in practice. The idea is to add a black box to every car. The black box is a GPS tracker that sends information to the Danish tax payment institute called SKAT. This information includes time, date and location of the driver [10]. This essay is going to cover the privacy and ethical aspects of the solution, in order to contribute with something broader than just economical perspectives. Specifically, I will try to answer the following research questions:

- Does roadpricing with GPS tracking violate the privacy of the common people?
- Is it ethical to use roadpricing using GPS tracking technology in order to add taxes?

The essay will do so by (1) give an introduction to the problem (2) provide some detail into the history of the GPS technology, how it works, and its use cases, (3) summarize the theory on privacy and ethics, (4) go into a discussion covering the two research questions above, and (5) deliver a conclusion based on the discussion with respect to the questions answered.

2 GPS - Global Positioning System

GPS is short for Global Positioning System. It was invented by the US military with a prototype in the 1980s and then later fully operational with 24 satellites in the year of

1993. The first GPS system is called NAVSTAR GPS. Originally, the system was not intended for civilian use, but for the US military to gain an advantage on the battlefield. However, after an incident of accidentally shooting a plane down, the United States of America issued a bill opening the tracking technology to the public. This service was called the GPS Standard Positioning Service (GPS SPS). However, GPS SPS muddled the signal, thus making the positioning imprecise. In fact, it was having a 100-meter precision whereas today we have a precision down to the centimeter. The NAVSTAR GPS system is still maintained by the USA [15]. This has caused other countries, like Russia and China, to implement their own GPS system.

The NAVSTAR GPS was implemented by having three components, namely satellites, ground stations, and receivers. Receivers are small devices, such as a mobile phone, tablet, computer or even smartwatches. As mentioned, the system has 24 satellites which travel in orbit. The system knows exactly where each satellite is supposed to be at any given moment. It uses the ground station to calculate its distance to four or more satellites that is supposed to be closest to the station. It calculates the distances to the satellites, to be sure that it knows the exact position of the satellites. When the distance has been calculated, the exact position of the receiver is calculated and known [6]. Later, GPSs have been further developed, thus becoming more precise but also more complex. Some GPS systems launched by different countries now collaborate in delivering precise location. This also makes the systems more resilient to satellite crashes.

The purposes of a GPS are many. Some of them is used for locating who is nearby in a dating app or for sharing the route that you have taken while jogging. Even some insurance companies use GPS locations to provide a cheaper travel insurance by only providing insurance in the countries that you have visited. However, the downsides are also that this can be leveraged by hackers or other parties to track the location of specific individuals. Companies like Google, Apple and Microsoft are known to use a user's tracking information to provide services and suggestions in real time. Articles about hackers getting this information or selling to third-party companies that do not have control of this data have surfaced at a higher rate. A recent example being the Cambridge Analytica scandal [2]. Moreover, governments are also looking into how GPS technologies can be used and leveraged for different scenarios. A recent example is the roadpricing that the Danish government has proposed. Even the Chinese government has implemented GPS trackers in cars in a specific region of the country due to a spike of murders [8].

2.1 Roadpricing

As mentioned, roadpricing is the concept of putting taxes on the driver of the car depending on where the car has been and at what time. The Danish government has invested 20 million Danish kroner into researching solutions for roadpricing. The technology that keeps getting attention in the media and from the politicians is a small black box getting installed into cars. It primarily consists of a GPS receiver that is activated when the car is turned on. During the trip, the black box tracks the position of the car and timestamp. The idea is to send the information to the Danish tax authorities, SKAT, for them to perform the

calculations of how much the driver should pay in taxes. Since this is in the early stages, and the research of how such a solution could work was initiated early 2023 [4], there is little to no information on precisely what information is being sent to SKAT.

3 Theory

In this section I explain key theory to be used for answering the research questions presented in the introduction. The theories presented are mainly based on Stanford Encyclopedia of Philosophy. The theories are related to the concept of roadpricing in the discussion section. First, I present theory on privacy, thereafter I cover ethics.

3.1 Privacy

In the philosophical realm there is no common definition of privacy. The first well written essay about privacy was introduced by Samuel Warren and Louis Brandeis with the title *The Right to Privacy* [13]. They state that the individual should have the "Right to be alone". Warren and Brandeis examined if existing law is able to protect the privacy of the individual, where they would later explain how and to what extent the law would protect the individual.

They focused in a large part on the press and publicity due to the newly inventions of photography and newspapers that could violate and invade privacy by public dissemination. In their essay, they express that some of the cases that they reviewed could be protected in a more general "right to privacy". This "right to privacy" should protect individuals to the extent that one's thoughts, sentiments, and emotions could be shared to others. After the publication of their essay, the public, state and courts were expanding the right to privacy. In order to systematize and describe the rights of privacy, William Prosser presented four different interests in privacy:

1. Intrusion upon a person's seclusion or solitude, or into his private affairs
2. Public disclosure of embarrassing private facts about an individual
3. Publicity placing one in a false light in the public eye
4. Appropriation of one's likeness for the advantage of another [9, p. 389]

Warren and Brandeis laid the foundation of a definition of privacy known as control of information about oneself. Other more recent views of privacy focusing on control over information have also been presented.

One of them is Alan Westin who describes privacy as the individuals' ability to determine when, how, and to what extent information about us is communicated [14]. Thus, Westin emphasizes the importance of the individual's possibility of consent and co-determination. However, another theorist named William Parent, views privacy as the condition of not having personal information known or possessed by others. Parent states that the condition

on privacy is a moral value for those who value individuality and freedom. It is not a moral or legal right to privacy. In other words, it is not a right we have but more of a value to strive for if we want freedom. Also, in Parent's perspective personal information is factual, i.e. the information is true. They are facts that we as individuals don't want the public to know about us. This could be information about our health, salary, democratic orientation, etc. The line is drawn when this information is documented for the public i.e. it is in newspapers or other public documents. This means that there is no invasion of privacy once it is public knowledge. Privacy is only violated when new undocumented, factual information is gained about an individual [7].

Another view is privacy in terms of access. Sissela Bok describes this view where privacy protects the access to information about an individual and that we as an individual has exclusive rights to our information [1]. Ruth Gavison agrees by arguing that privacy is related with the concern over accessibility to others. In her perspective privacy is gained by three independent ways that are interrelated, namely through secrecy, anonymity, and solitude. Gavison further defines the three properties of privacy, by stating that secrecy is when no one has information about one, anonymity is when no one pays attention to one, and solitude is when no one has physical access to one [5]. In other words, privacy is about having limited access to the individual. To achieve perfect privacy requires the information to be completely inaccessible to others i.e. not violating secrecy, anonymity, nor solitude.

3.2 Ethics

Philosophy has three main view on ethics, namely ethics of duty (also known as Deontological ethics), Virtue ethics and Utilitarianism. For that reason this section covers some central theory about these perspectives.

Deontological ethics views a choice or act as ethical by what is moral. It states that even if the act is considered good then it is not ethical if it isn't moral. By considering if something is ethical or not, the consequences of the choice cannot be taken into consideration. This is due to the fact that a choice could have good consequences in the future, but at the same time be morally forbidden to do so. In other words, what is right comes over what is good. Kant provided a way to determine if something is ethical or not in the perspective of Deontology. He presented a way to determine whether something is morally permissible or not. It is determined by creating a thought experiment, where one imagine a universal law being added to the world. The question to answer is not whether it is good if everyone acted like the law was stated, but rather if it is possible to will it as a law. If this world creates a paradox then the law is not moral. An example could be a world where everyone is allowed to cheat. This creates a world where cheating is not really cheating anymore since it is allowed, thus we have reached a paradox. For that reason it is not right and in terms of Deontological ethics it is wrong to cheat.

Utilitarianism is a part of the ethics that examines if a choice or action does any good i.e. utilitarians is of the opinion that the morally right action is the action that does the most good. Utilitarianism wants to maximise utility. Utility is described by Bentham as, a property in any object that creates benefit, advantage, pleasure, good. It can also be

considered to be preventing pain, evil or unhappiness for those involved. As an example if you point the gun at an individual who is going to kill millions, and you have to decide if you want to kill this man or not. If you kill him, you save millions of people. On the contrary you have to live with killing a person. Killing that single person would be an ethical choice in the perspective of utilitarianism, since the maximum overall good is to save millions of people compared to saving one person.

Virtue ethics on the contrary looks at a person's virtues. A virtue is characterized as an excellent trait of character. This is something that a person really possesses. Such traits are to notice, expect, value, feel, choose, or act in certain ways. In order to say that an individual possesses a virtue, the intentions of that individual has to be wholehearted from specific thoughts of reason for doing that action. More specifically if the individual is kind to someone, it is because he recognizes that "otherwise would be mean". This is in contrast to a person who is kind due to the fear of being disliked. The reasoning of taking the action is what makes the person really possess a virtue. In virtue ethics not only the virtue but also the motives need to be considered. Micheal Slote defines virtue ethics as understanding "rightness in terms of good motivations and wrongness in terms of the having of bad motives" [12]. Also, Zagzebski has defined a wrong act as something where we would feel guilty doing it as it goes against our virtue and therefore might not do it anyway [16]. An example of something that virtue ethics would view as ethical, is that a person is helping someone that is blind over the road because that person has the motivation to help. In the eye of Zagzebski, this would be rightfull as the act doesn't go against that persons virtue and doesn't make him feel bad. However, if the person did it to impress somebody, let us say a girl that he likes, then the motivation is to impress that girl, and he is using the blind man to do so. This would be unethical as his motive is not virtuous.

4 Discussion

In this section I first discuss if the roadpricing GPS technology is going to violate privacy for the common people. Secondly, I touch upon some ethical views of using this technology in order to add taxes. Since the roadpricing technology is not yet in the final stages, we are going to assume that the technology sends GPS locations and timestamps to the Danish tax authorities. Furthermore, we assume that if this becomes a law, the Danish people do not have a choice other than to install this black box GPS device into their cars.

Looking at the solution from the perspective of Warren and Brandeis right to privacy definition, the Danish people should be protected from exposing ones thoughts, sentiments and emotions from being shared. As information about locations and timestamp doesn't reveal any information about an individuals intentions, thoughts or anything else in that matter, it does not violate their definition of privacy.

However, the four interests of privacy by Prosser, don't give the same answer. As his first interests states, the "Intrusion upon a person's seclusion or solitude, or into his private affairs". In Prossers eyes this would be violated, mainly due to the last part of

the sentence, "private affairs". Exposing the location of an individual would intrude an individual's private affairs. Private affairs aren't very narrow. If the individual is known for being healthy, but goes out to get an ice cream. Then the location could reveal that the individual has been to a place known for getting an ice cream, thus revealing a private affair to the public. Looking at the second interest, it states that "public disclosure of embarrassing private facts about an individual" would violate privacy. At first glance, looking at the locations of an individual wouldn't reveal much information. However, in the situation where the location ends at a location such as red-light district, would for some individuals be an embarrassing private thing to share with the public. Thus, this scenario does reveal embarrassing facts about the whereabouts of an individual, again violating privacy concerns. Prossers third privacy interest, "Publicity placing one in a false light in the public eye" could in some sense be violated. In a world where everyone only drives a car that each individual have bought, wouldn't reveal any false information to the public. In fact, the system is designed to know exactly where the car has been. However, a car could be used by anyone. Since the car is registered to a specific person it would look like the individual owning the car, drove to some particular place in the eye of the public. Since everyone can drive the car, then it could also have been a family member who used the car in the particular moment. This could potentially place a specific person at a location that the individual may not have been at, making it violate the third interest as well. The last interest of privacy could also be violated. It states that the "Appropriation of one's likeness for the advantage of another". However, this is only violated in the situation where the information about the whereabouts of the individual is leaked and used in some sort of smear campaign, that puts someone else in a better light.

Alan Westin would agree that roadpricing violates one's privacy, but does so from another perspective. His view is focused on the control of information i.e. when, how and to what extent the information is used. As this is going to be a law, the issue is that the individual does not have much to say. Meaning, the individual is not free to choose the car as transport without being tracked. Also, the solution about how they are being tracked is not up to the individual either, being that this is imposed by the government. Furthermore, to what extent is not yet stated by the government. One could imagine a world where the government initially only shares this information with the Danish tax authorities, but later allows the police to use similar information to fight crime. The individual does not have much to say about the control of to what extent their information is used, and for that reason roadpricing violates privacy from Alan Westin's view as well.

Looking at the perspective of access by Ruth Gavison, there are privacy and perfect privacy. Based on the three properties, namely secrecy, anonymity, and solitude nearly all of them is violated, hence not providing perfect privacy. This is due to the property of solitude, which Gavison defines as "no one has physical access to one". Since roadpricing only focuses on sending pieces of location information from the individual car, then there is no physical aspect, when it comes to getting access to the individual. This entails that there is some level of privacy since the property, solitude, isn't violated. Furthermore, secrecy, which gavison states as "when no one has information about one", is violated due to the

fact that the black box sends location information together with details of the car. This links the owner and the location information, hence there is no secrecy. The same argument can be given to the property anonymity. According to Gavison, anonymity is "when no one pays attention to one". Since SKAT needs to link location and owner of the car, such that they can forward taxes to the right individual, means that there is no anonymity.

In order to look at roadpricing from an ethical perspective, the essay will assess the roadpricing GPS technology from each ethical view, starting with deontological.

The Deontological perspective states that consequences of the act cannot be taken into consideration. To assess the act, only the moral reason needs to be considered to be ethical. Looking at roadpricing, the council proposing it, reasons that making it more expensive to use the car on certain roads, will result in fewer cars being driven. The reasoning behind it, is to reduce CO_2 being emitted by cars. Since we do not look at the outcome of the situation, then this reasoning cannot be taken into consideration. However, using the discussion on privacy, it can be argued that the action of tracking and potentially violating one's privacy when driving, isn't moral. Thus, according to deontological ethics, it would not be ethical to implement roadpricing with GPS tracking, even though the outcome might be good.

From the perspective of virtue ethics, the theory states that the action or choice that an individual makes should make them a better person. There are two views that can be looked at: Whether the council and government implementing roadpricing acts virtuous and therefore ethical, and whether the government helps people becoming virtuous. The council that is proposing roadpricing does it with the intention to limit the amount of cars to save the climate. The intention of making the world more clean by limiting the amount of cars used is a virtuous motive to have. However, it is difficult to determine if this is the real intention or not. One could argue that roadpricing is also proposed in order for the state to make more money, and the environmental argument is a cover-up. If the real intention is to save the environment, wouldn't it be better to get rid of diesel cars and make the switch to electric cars? It is hard to say what the real reason is for the government to implement roadpricing. If the real reason is to save the environment and limit the amount of CO_2 emitted from cars then it is virtuous for the right reason, making it ethical. However, if the real reason is to make more money, then it is making it unethical. Looking at it from the other perspective, if this law is being imposed, could it help the individual to make a choice that makes the individual a better person? The individual would make a good choice by not using the car. However, do they do it for the right reason. This raises the question, if an individual is choosing not to use the car due to the climate, then why do they have a car to begin with? In fact, some of those who previously chose the car, would probably choose not to, due to economic reasons or that they feel like being under surveillance. This means that even though, it would be virtuous not using the car due to the environment, then most of the individuals doing so, would probably do it for another reason. Since the individual isn't wholehearted in the reason making a virtuous choice, it would make the act unethical in the perspective of virtue ethics.

With the utilitarian perspective we want to maximize the good outcome. There are

several arguments in favor of roadpricing but also against. By imposing roadpricing even though the government are tracking each individual position, the money that is being gathered can be used to invest in better roads. There is also the possibility that fewer would use their car and instead use public transport limiting the overall CO_2 being emitted by cars. At the same time, if the police is allowed access to the location information gained, it could help solve some cases. On the contrary the people might start feeling watched and get their privacy invaded. There is a danger of people feeling less free, when they go for a drive. Misuse of the information is also a possibility. Therefore, it is hard to determine which outcome is the best.

5 Conclusion

This essay has described the current roadpricing situation in Denmark, GPS technology, and theory on privacy and ethics. Furthermore, the discussion used the theory to answer both the privacy and ethical research question. Looking at the privacy discussion, the definitions regarding both control of information and access to information was used. In terms of privacy it shows that Warren and Brandeis definition has an emotional perspective. As can be seen in the discussion it is also the only definition that says roadpricing isn't violating privacy. The argument being that GPS tracking doesn't expose the individuals thoughts, sentiments or emotions. On the contrary, Prosser's interests show that all four interests are violated. It shows that some situations could provoke the violation of privacy, especially the disclosure of private affairs. Shifting to privacy regarding control of information, Westin's definition agrees that roadpricing violates privacy. As shown in the discussion, the issue with roadpricing is that the individual can't use the car without being tracked. The individual does not have control on when, how and to what extent they are sharing information. Furthermore, looking at the discussion on control of access, it shows that the roadpricing solution does provide some privacy but not perfect privacy. This is due to roadpricing having to deliver information about who and where, which violates the secrecy and anonymity property.

Shifting the focus to ethics, in the eyes of Deontological ethics, roadpricing isn't ethical. This is mainly due to the violation of privacy for the majority of definitions regarding the privacy discussion. Since this perspective doesn't look at the outcome of the action, implementing roadpricing and violating privacy is unethical. Virtue ethics agree to some degree. Here the discussion visits two views, the government taking the decision to implement roadpricing and the government implementing roadpricing in order to help people become better persons. However, as shown in the discussion there can be asked questions about the reason, for both views making it a bit unclear if it is ethical or not.

From the Utilitarian perspective, which looks at maximizing the good outcome there are many arguments in favor of roadpricing. One of the arguments being, that roadpricing might reduce emitted CO_2 due to having fewer cars on the road. The downside is that the individual might feel that they are under surveillance while driving and they people's privacy might be violated.

To sum up, a majority of the definitions are saying that roadpricing with GPS violates privacy. The problems revolve around access to the individual and lack of control of information about oneself. Furthermore, the ethical perspectives covered are leaning towards roadpricing being unethical, but this is not completely clear.

References

- [1] Sissela Bok. *Secrets: On the Ethics of Concealment and Revelation*. Oxford University Press, 1982.
- [2] Nicholas Confessore. Cambridge analytica and facebook: The scandal and the fallout so far. Internet, 2018. Accessed: 20-05-2023.
- [3] Casper Dalgård. 2500 bilister i storstilet forsøg - vil de betale for at køre på københavnske veje? Internet, 2022. Accessed: 20-05-2023.
- [4] Thomas Frederiksen. 2200 bilister på landsplan skal de næste par år deltage i et forsøg om roadpricing. halvdelen af deltagerne er fra hovedstadsområdet. Internet, 2023. Accessed: 20-05-2023.
- [5] Ruth Gavison. Privacy and the limits of law. *The Yale Law Journal*, 89(3):421–471, 1980.
- [6] NASA. How does gps work? Internet, 2019. Accessed: 20-05-2023.
- [7] W. A. Parent. Privacy, morality, and the law. *Philosophy and Public Affairs*, 12(4):269–288, 1983.
- [8] Tom Phillips. China orders gps tracking of every car in troubled region. Internet, 2017. Accessed: 20-05-2023.
- [9] Wilam L. Prosser. Privacy. *California Law Review*, 48(3):383–423, 1960.
- [10] Ritzau. Betalingsring overhalet af ny teknologi. Internet, 2011. Accessed: 20-05-2023.
- [11] Ritzau. Vismænd vil droppe bilafgift. Internert, 2013. Accessed: 20-05-2023.
- [12] Michael Slote. *Morals from Motives*. Oxford University Press, 2001.
- [13] Samuel D. Warren and Louis D. Brandeis. The right to privacy. *Harvard Law Review*, 4(5):193–220, 1890.
- [14] Alan F. Westin. Privacy and freedom. *Administrative Law Review*, 22(1), 1969.
- [15] Wikipedia. Global postioning system. Internet, 2023. Accessed: 20-05-2023.
- [16] Linda Trinkaus Zagzebski. *Divine Motivation Theory*. Cambridge University Press, 2004.