Are There Biases in the Designs of Biometric Technologies?

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Abstract

Biometric technologies permit the identification of people through static raw samples. As a fast-emerging and promising technology, biometrics are steadily becoming more common, especially in security and military industries. However, the popularization of biometrics has also raised ethical concerns such as marginalization, privacy erosion, and autonomy. Ethical concerns here are related to the question of whether technological artifacts are value-neutral or value-laden. This issue has been discussed by philosophers of technology and technoethicists. Although there are some philosophers of technology like Joseph Pitt, who asserts the Value-Neutrality Thesis regarding technological artifacts, there are others like Langdon Winner, who discusses that the design of the artifacts is shaped with biases in the article "Do artifacts have politics?." Bruno Latour also talks about "delegating" ethical values to nonhumans in the design process by giving examples of an automatic door opener and a speed bumper. In this article, we argue that in biometric technologies these ethical concerns come from discriminatory biases that consist in digital program design decisions by focusing on the literature of philosophy of technology and technoethics.

Keywords: biometric technology; value-ladenness of technological artifacts; biases; design of technology

1. Technological Artefacts and Moral Values

One of the most important topics in the philosophy of technology is whether technological artifacts are value-free or value-laden. Langdon Winner, who is one of the most important philosophers of technology discusses this issue in his well-known article "Do Artifacts Have Politics" (1980). In the article, Winner demonstrates how the designs of the architect Robert Moses shaped and embody values in New York City from 1920 to 1970. Winner thinks that Moses has racial prejudice and social-class biases that led him to design lower overpasses leading to Jones Beach not allowing poor people and blacks, who use public transport to get there. This is because it was not possible for the twelve-foot-tall buses to get through the overpasses (Winner 1980, 123-124).

While Winner thinks that our biases and our values are operative in designs, there are also philosophers of technology like Joseph C. Pitt, who asserts the Value Neutrality Thesis with regard to technological artifacts. Pitt discusses the issue by focusing on the slogan "Guns don't kill, people kill," which was secured by the National Rifle Association to defend the right of individuals to own weapons (Pitt 2014, 89). He thinks that although there is some truth in this slogan, there is also something wrong, because it is seldom possible to kill with bare hands, hence not humans, but humans with guns kill (Pitt 2014, 89). It is unquestionable that guns are used by human beings in killing, therefore the slogan is misleading.

The primary aim of Pitt is to elaborate that "technologies themselves cannot in any legitimate sense embody values. Rather, it is people who have values. This is not to deny that specific technologies may result from individuals attempting to implement their value systems in certain ways. It is a result of recognizing that values are the sorts of things that inanimate objects cannot possess, embody, or have" (Pitt 2014, 90). So, he tries to get us to see that, technical artifacts or technologies by themselves cannot embody values, but there may be values assigned by human beings. Only human beings and not artifacts or technologies have values (Pitt 2014, 90). This is supported by the argument that "morality is a social virtue" and it requires the interaction of human beings with others, therefore, they cannot be attributed to artifacts or technology (Pitt 2014, 90)

Pitt worries about relativism. From the perspective of Aristotelian ethics and its motto of achieving the Good Life in general, he criticizes moral theories that aim to turn human beings into a good person. According to Pitt, these moral theories adopt an individualistic perspective, however, the Aristotelian Good Life is not only about *me*, but about all of *us*. That is to say, we are in interaction with others and all of our actions will have an effect on others, therefore, we have to consider the consequences of our actions. Hence, we should be equipped with a set of values to achieve this (Pitt 2014, 92-93). This is something that can be achieved by human beings. In this sense, it is not possible to talk about the motivations of artifacts (Pitt 2014, 93). Pitt accepts the idea that human decisions are value-laden and since artifacts are the products of human beings, then many values are involved in them and these values realize favored states of affairs. However, the purpose to be achieved is possible by the action of a human being. He uses "values" and "intentions" interchangeably and says that technical artifacts cannot have intentions (Pitt 2014, 93).

According to Pitt, values are relevant to states of affairs, however, they are not embedded in artifacts. Hence, since we cannot locate them in artifacts; then the saying "they embody human values" is just a metaphor (Pitt 2014, 95). Actually, Pitt does not deny that human beings assign value to technical artifacts, but he questions the idea that embedded values of technical artifacts have technological values independently of human beings. In that sense, technological objects do not contain technological values (Pitt 2014, 96). As said above, although Pitt appreciates the idea that there are many values contained in the creation of an artifact, this reasoning does not lead us to say that artifacts are value-laden. Take any technological artifact (he gives the example of F16-it is a delight when it is part of a university's military department's show, but it also kills). How it is to be used, depends on human beings' decisions (Pitt 2014, 98).

À la Rudner, Pitt says that even scientific activity is value-laden. He also underlines that any selection of A over B includes values and the decision-making starts with knowledge. From a pragmatist perspective, he defines "knowledge" not as a set of abstract propositions but defines it as a tool that enlightens the context in which it is working. In this sense, knowledge is marked with action and as actions are contextualized, knowledge is also value-laden and contextualized. If your choice ends up nicely, then there is no problem. However, if you fail to achieve a certain end in your choice, then you reconsider everything. He calls this CPR (Common sense Principle of Rationality) (Pitt 2014, 100). Pitt does not say that there are no values involved in a design process, but there are values coming from many people and in Robert Moses's case, we cannot pinpoint one person's value, but so many individuals' values take place in the decision process of the design (Pitt 2014, 101). Therefore, talking about the concept of "embedded values" in technical artifacts is problematic according to Pitt, because so many values of many people are embedded (if they are) that they cannot be pinpointed. He says, "… since artifacts are the results of human decisions and since human decisions are a function of human values, understood as motivators to achieve a certain preferred state of affairs, and since many people are involved in the creation of technological artifacts, it adds nothing to the discussion to say values are embedded in artifacts" (Pitt 2014, 101).

Pitt also thinks that the slogan "either people or guns kill" is problematic. The better way to formulate it is: "Guns don't kill, people kill using guns, knives, their hands, garrotes, automobiles, fighter planes, poison, voodoo dolls, etc." (Pitt 2014, 101). Pitt defends a weaker version of the Value Neutrality Thesis; it consists of two theses. The first one is; we cannot read the values by looking at the structure and design of technical artifacts. The second is, we cannot pinpoint a responsible person embedding values, because there are many values and many individuals involved in the process. Pitt's arguments and the Value-Neutrality thesis are criticized by others, one of whom is Boaz Miller. In "Is Technology Value-Neutral?" he questions Pitt's value-neutrality thesis.

Miller underlines the importance of value-talk of technologies and thinks that material properties of technical artifacts are not external to technical artifacts, but they are part of normative and political order. They are not external and because of their long period of existence, their value-ladenness exceeds their designers and builders (Miller 2021, 54). According to Miller, Pitt's argument revolves around the idea that it is not possible for us to see or identify empirically the values in technical artifacts (Miller 2021, 58). Miller denies VNT (Value Neutrality Thesis) on the basis that it is possible for historians, designers, and philosophers of technology to identify embedded values of technical artifacts (Miller 2021, 60). Pitt says that they cannot be directly readable off or observable from design form. However, according to Miller, "…design documents provide an empirical way to identify values that are embedded in the artifacts. Moreover, some artifacts bear slogans like 'designed for fun' or 'Environmentally friendly,' which explicitly express the values they are supposed to bear. Technology may also have expressive meaning that implicitly conveys values" (Miller 2021, 61). For example, the "danger" sign is the representation of the value of safety (Miller 2021, 61). Miller says that in that case, we cannot distinguish expressive content from the material, because the content cannot be expressed without the material tools.

Miller underlines that the material longevity of technical artifacts makes the values embedded in them important and not trivial. In that sense, Pitt's characterization of technical artifacts is problematic. Robert Moses's design of the low overpasses is still effective in restricting Afro-Americans to go to Jones Beach State Park. This is because values are physically embedded in artifacts. Miller states that this idea may be objected on the basis that there are changes in technology. In case there are changes in technology use, they may not lead to the same effects. However, it is very difficult for large technical systems to be changed easily. This is because the rectification and changes are expensive, and the implementation of them are not as easy as they may sound. Besides, with the application of changes, there may be the loss of value-laden embedded knowledge (Miller 2021, 66-67). Therefore, Miller thinks that embedded values shape our habits and ways of living. According to Miller, the neutrality thesis is supported by designers, engineers, technicians, and bureaucrats to avoid responsibility for the damaging consequences of technologies; it also inhibits technocrats' from asking questions about the ethics of technologies (Miller 2021, 70).

On the other hand, Maarten Franssen claims that "bad" artifacts are bad due to their design, not in the way they are used. But for Franssen concentrating on these possibilities of side effects makes it easy to miss what makes these artifacts "bad". The artifact can only be bad if it was designed wrong, meaning that it should not have been created in the first place. The reason it should not have been designed is because at its core, the bad artifact is meant to be used for bad purposes. Consequently, an artifact is bad if it has harmful side effects (von Wright, 1963).

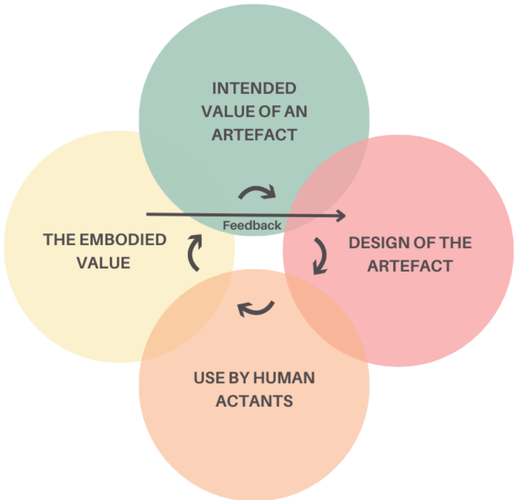
An artifact that is "good" is one that is functional for the reason it was designed for, says Franssen (2014, 216). A good knife is a knife that is good at cutting what it was made for, it is a second-order attribute to its sharpness and ease of use. This means the instrumental value of the knife is rooted in normative judgments. This way of thinking puts the artifact into boxes of intended consequences and non-intended consequences and raises the question about the side effects of the artifacts. In Franssen's view, this means most weapons are not bad since they are not designed for bad purposes, although they can be used for bad purposes, that is not their primary task. One can argue that a gun is a good artifact when it is used for self-defense. On the other hand, an instrument of torture, specifically designed to cause great harm to humans, is a morally bad artifact as it was designed and made to cause great pain.

van de Poel and Kroes (2014) give two contrasting examples of sea dikes and knives to argue that artifacts embody the value they were designed to contribute to. Designed as flood protection devices, sea dikes are artificial walls, built onshore to prevent low-lying areas from flooding. Sea dikes embody the value of safety by preventing harm by design. A normal knife is designed for cutting. The value of the knife however is not as clear cut as the example of the sea dike as is conditioned to how it is used; is it used to prepare food, is it used for survival or to cause harm? The final value of the normal knife, therefore, lies in the way it is used, rather than its design. These two examples give us a contrasting picture of design intentions and how design influences value. Sea dikes are designed for safety and they commit to the value of safety by protecting people in low-lying areas from floods. Knives *can* contribute to the value of health, but they aren't purposefully designed for health and so they do not embody that value. Therefore, according to van de Poel and Kroes (2014), the physical characteristics and the extrinsic property of an object determines its value. An artifact can only embody a value if it was intentionally designed to. This notion is what Michael Klenk (2021) calls 'the Intentional History Account of Value Embedding (IHAVE)'. IHAVE implies that intrinsic features such as the physical structure of an artifact do not determine its value, but the designer's intention when creating the artifact does. Thus, an artifact's intentional history determines its embedded value.

Similarly, Carl Mitcham (2014, 19) attributes a moral agency to artifacts by citing Bruno Latour, (1991) who says that "nothing lies outside of network relations" and there is no difference between the agency of a human, an animal, or an artifact. Society is defined by the interaction between the animate and the inanimate. The co-production of an artifact is possible through the interaction of designers, engineers, inventors, and inanimate objects within a network. Therefore, artifacts engage with culture with the intention it was created for but go on to change these intentions in an unintended way (Mitcham, 2014).

Mitcham (2014, 25) also refers to Hannah Arendt's *The Human Condition* (1958) written roughly four decades earlier than Latour where she writes on the historical transformations in the twentieth century by proposing three types of human activity: labor, work, and action. Labor, she writes, refers to the repetitive bodily behaviors akin to an animal; waking up, eating food, growing up, tending to one's body, and then going back to sleep. Individuality barely exists in labor and labor is the one thing species require to survive. Work creates material things that cannot be found in nature. Work creates individuality in the way things are made, not only in materials such as furniture, clothing, or art but also in the form of language, traditions, and culture. She notes the conditioned nature of humans as everything they create through 'work' becomes a condition of themselves. The human world consists of things humans create but those things are also conditioned by their makers (Arendt, 1958). In the topic of embedding values onto artifacts, the artifacts are in constant interaction with their human makers. Action, the last of the human activities Arendt writes about, creates a new kind of making by establishing a unique type of human artifact that is laws and politics. Thus, humans create a social network of artifacts that goes on to influence us back. Hence, artifacts and people cannot be investigated as separate entities but together inside a co-evolution of humans and machinery. The value of artifacts, therefore, resides in their interaction with the human actant as shown in Figure 1.

Figure 1. *The framework of the embodied value of artifacts.*



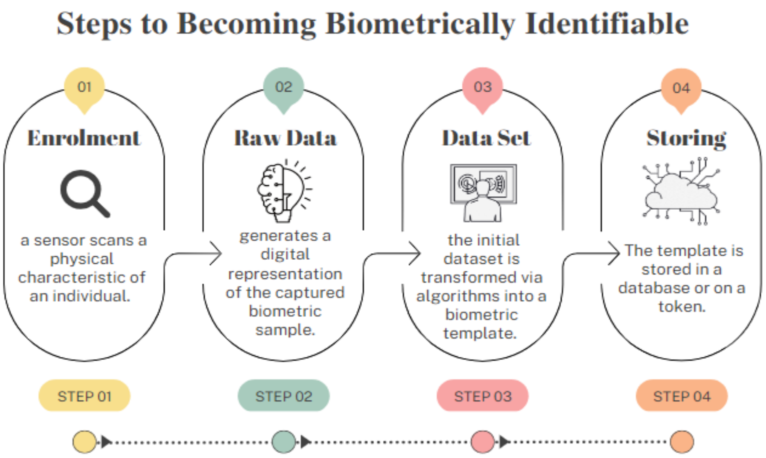
In this paper, we will adopt the view that technologies are value-laden and the value-ladenness is not relevant to the intentional characteristics of the materials used, although the material's characteristics in a way inspire us and help us shape our design, we in return shape the material in accord with our values. Therefore, *we* shape technology and technical artifacts, however, we are also shaped by them in return. In order to understand how this is applicable to biometric technologies, we will focus on what kind of values are assigned to biometric technologies and how they produce ethical issues.

2. Moral Issues in Biometric Technologies

Often referred to as the "next big thing" biometric technologies are used to identify living beings using biological traits by matching 'live' parts of the body with previously recorded data. In other words, creating static biological samples from otherwise dynamic physical and mental identity. A unique aspect of the technology is that it requires an intimate relationship with people to collect and record bodily data. Today, biometric identification refers to the automatic identification of individuals based solely on their physical or behavioral characteristics. (Jain et al., 2000). As the technology relies on *people*, biometric technology advocates often rely on the notion; bodies do not lie (Martin and Whitley, 2013).

For biometric systems to generate a digital representation of a person as seen in Figure 2, a reference image such as a scan of their face, eye retina, or fingertips is used. This 'raw' biometric data is then processed by algorithms to become a biometric template, a data set. This template is stored in data or a token such as a chip with identifying information of the person like the name or a visa number. By storing information on the cloud and biological information derived from biometric systems can in theory be accessible from all over the internet (Bussmann, 2020).

Figure 2. *The steps to becoming biometrically identifiable in a biometric system.*



Throughout this process, some information is lost, filtered, and changed and new information is created. Therefore, the system does not result in a binary yes or no but rather it simply gives a comparison score of similarity. Then we can regard the process of biometric recognition as informatization of the body that might leave room for deviation. These deviations as Kloppenburg and van der Ploeg (2020) point out might seem minor with an error rate of 0.1% supposedly giving a perfect result, however in a high-stake area such as border control, this 0.1% can refer to a large number of people.

Increasingly, biometric technologies are becoming more common due to a rapid decline in technology costs, especially in the military and security industries. This has been faced by criticism from human rights advocates and social scientists on the basis of; how can we ensure the accuracy and security of these systems, as well as ensure that their accessibility is fair. The United States National Research Council notes the uncertainty biometrics bring as individuals may not be recognized in the system due to physical traits or having traits that lack distinctiveness for the system to operate (Pato and Millet, 2010, p. 89).

Furthermore, as biometric systems suppose physical properties as being unchangeable and unquestionable forms of data, a certain identity-producing role is given to the system which means reducing identities to a code. The ‘whole person’ therefore with a situated sense of self and history then becomes a simple singular sign, such as a fingerprint.

Biometric technologies are helpful and important with regard to security and safety implementations. Face recognition technologies are widely used by governments to determine suspects. “[B]iometric facial recognition is a form of AI that involves the automated extraction, digitization and comparison of the distribution of facial features to the spatial and geometric features to identify individuals” (Smith and Miller 2022, 168). Smith and Miller state that in early 2020 governments of the United Kingdom, the U.S.A., and Australia implemented technology developed by a private company to determine suspects by searching billions of social media images through face recognition systems (Smith and Miller 2022, 167). However, as part of biometric technologies face recognition should be applied in a way not to violate human rights to individual privacy, autonomy, democracy, and democratic accountability. According to Smith and Miller, they are the basic principles and they should be valued in liberal democracies (Smith and Miller 2022, 167).

One of the problems pointed out by Smith and Miller is that face recognition systems can be incorporated with "the closed circuit television systems that already exist in public and private spaces to identify people in real-time (Smith et al. 2018) (Quoted by Smith and Miller 2022, 168). This may create many privacy violations. As it is extracted from the BBC's news by Smith and Miller, in China social credit system was founded on biometric surveillance system and the facial recognition system via CCTV enables authorities to determine minor crimes or misdemeanors like crossing a street on a red light or wearing pajamas in public (Extracted by Smith and Miller 2022, 168). There is also a reward system that depends on this surveillance.

The ethical problems created by using biometric technologies are usually summarized as privacy violation, the loss of autonomy, and social exclusion (Smith, M., & Miller, 2022), (Cooper, I., & Yon, J. 2019), (North-Samardzic, A. 2020).

Smith and Miller clearly express their worries about privacy issues. In brief, they say that we as human beings have a right to privacy with regard to the possession of information, including biometric information. Therefore, surveillance systems like CCTV that can recognize faces and track the movements of individuals and record their facial images without getting their consent is problematic. Besides, the right to autonomy includes the right to control the private realm in the sense of excluding organizations' access to private data (Smith and Miller 2022, 171-172). They also underline that the right to develop projects without being surveilled is also extremely important (Smith and Miller 2022, 172).

With biometric technologies becoming more common, questions arise. Can these technologies lead to discriminatory or racist objectification? If these issues were to occur, would they be occurring on purpose?

Biometrics also have the potential to create unfavorable conditions for minorities. It has in the past. One of the early efforts in using the body as a source of identifiable data is The *Carnet Anthropométrique* which was a compulsory administrative document issued in France in 1912 to monitor the movements of nomadic bohemians and Romani peoples (Lyon, 2008). The document relied on 'racial indicators', suggesting that nomads and Romanis could be distinguished by their criminal otherness and were not worthy of legitimate citizenship. Around the same time in the USA, the General Allotment Act of 1887 was implemented on native lands. This act allowed for the regulation of tribal territories within the States. To regulate, fingerprinting or as it was known at the time "dactyloscopy" was used to distinguish between specific members of groups; black or brown bodies or the Chinese community. The practice of using fingerprints to distinguish race was later imported to Bengal where white officials used fingerprints to differentiate whites from their Indian subjects (Lyon, 2008). Cole (2001, p. 139) suggests that dactyloscopy was viewed at the time as a technology that could be applied to masses to create "others"- immigrants, people of color, women- and these "others" could then be tied to a web of state-sponsored identification.

Biometric data preserved by governments and companies may harm individuals and may cause segregation. These data may be used justifiably for security and safety reasons, however, when they are used by authorities and companies without taking the public's consent, it may create ethical problems. Even when a consent is taken, it creates problems, because what we call the consent may not be informed consent or informed enough consent. For it to be an informed consent, a user of technology or the relevant person should know all the details of the use and the consequences that are produced by them. Usually, in technology use, this does not happen. We rarely read all articles in digital consent forms and rarely become aware of the consequences of our approval. This is what Winner (1986) calls "technological somnambulism."

Besides, another ethical problem created by biometric technologies is the exclusion of certain group of people. This problem of social exclusion is pointed out by Cooper & Yon;

> A study in the UK found that approximately 0.62% of people could not register with any biometric system. The data look small, but multiplied by the total population of the UK made it huge (62,000). At least for now, biometric acquisition devices are not capable of handling individuals other than normal values, and some individuals are not able to be identified and thus excluded. Especially when these systems are linked to social welfare, these unidentifiable individuals are likely to be excluded from social welfare, leading to injustice (Cooper & Yon 2019, 67).

According to Cooper and Yon, mentally retarded, disabled, elderly, homeless, and people belonging to certain races are in the group to be affected (Cooper & Yon 2019, 67).

3. What Kind of Biases May Involve in Biometric Technologies?

Biometric technologies may imply biases and discriminate unfairly against historically disadvantaged groups. These biases can affect already unfair distributions of liberal goods such as rights, wealth, opportunities, education, and healthcare.

Bias in the most general term means to be slant, it can either have neutral content such as a customer being biased not to purchase a damaged good. It can also show significant moral meaning such as a customer refusing to buy goods from a minority. It has been demonstrated that bias in biometric systems discriminates against certain communities and populations (Mehrabi et al., 2021). This notion is highly worrisome as biometric systems can not only act unfairly upon their discriminatory biases but can also create new inequalities.

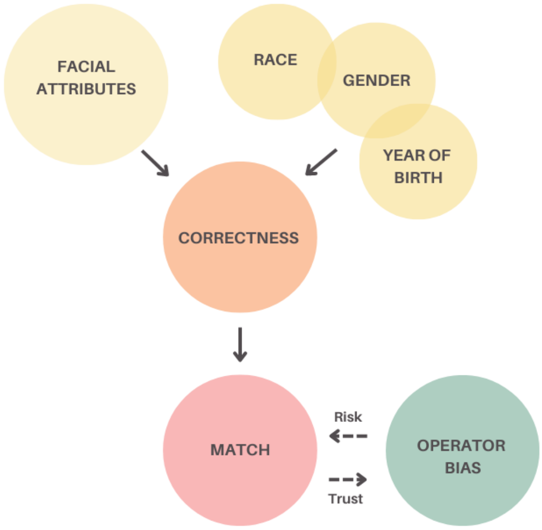
One of the earliest studies to explore the types of biases that can be found within computer systems, Friedman and Nissenbaum (1996) separate biases in these systems into three distinct categories as seen in Table 1. These are; preexisting, technical, and emergent biases.

Table 1. *The categories of bias according to Friedman and Nissenbaum (1996).*

Pre Existing Bias	Technical Bias	Emergent Bias
Arise from: -Social Institutions -Social practices and attitude	Arise from -Technical Constraints -Technical Considerations	Arise from: -Context of use -Changing societal knowledge -Population -Cultural values
Individual Bias Comes from the input of individuals, including the designer, engineer, scientist or the commissioner.	**Computer Tools Bias** Comes from limitations in technology such as available hardware, software, and capacity.	**New Societal Knowledge Bias** Comes from the new knowledge in society being unable or insufficiently incorporate into the already existing design of the system.
Societal Bias Comes from culture, organizations, and people.	**Decontextualized Algorithms Bias** Comes from using an unfair algorithm.	**The mismatch between Users and System Design Bias** Comes from the users of the system being different than the assumed target demographic.
	Random Number Generation Comes from imperfections or the misuse of random number generation.	**Different Expertise Bias** Comes from people using the system differently than with the assumed knowledge base it'd be used with.
	Formalization of Human Constructs Bias Comes from human constructs like; Judgements, discourse, and Intuitions that cannot be found within computers.	**Different Values Bias** Comes from a system being used by people with different values than how it was assumed during the design process.

Kenneth et al., (2020) suggest that biometrics in terms of facial recognition systems can be 'biased' based on a year of birth, gender, race, and facial attributes as seen in Figure 3. A 'correctness' indicates the bias inherent in the face recognition system, while the 'match' presents whether the positive or the negative prediction matches the operator's bias that is embedded within the system.

Figure 3. A causal network of biases for facial recognition (Kenneth et al.,2020).



Studies show that in biometric systems, female, racialized, queered, disabled, and younger (18-30) faces are more difficult to recognize (Buolamwini and Gebru, 2018, Magnet, 2011). This phenomenon puts these demographic groups at a significant disadvantage. As an example of the phenomenon, Beauty.AI was a face analysis system that aimed to identify the most beautiful contestants based on given factors including facial symmetry, wrinkles, and skin health. There were roughly 6000 entries from more than 100 countries however out of 44 winners only one had dark skin with the majority of the winners being white. The Chief Science Officer of the system pointed out that there could be a lot of reasons as to why the system had a bias toward white people, but the most significant problem was that the data set used to establish the given factors did not include enough diversity (Khalil et al., 2020). Although the designers did not specifically code light skin as ideal beauty, the system itself generated that conclusion from the available data.

Browne (2015) and Magnet (2011) also note that systems are designed by people with biases who build their algorithms around whiteness, ableness, and maleness as default categories. These biases even affect lighting settings with the amount of light cast on the body impacting the visibility of a user getting recognized by a biometric machine (Wevers, 2018). Therefore, programmers directly shape algorithms. Dominant biases then, get installed within the 'black box' of the biometric systems of an algorithm.

Similarly, when Amazon's face recognition program, Amazon Rekognition ran a test program to assess its accuracy, it falsely matched the images of members of Congress in the US with dark skin with a database of mugshots, essentially falsely identifying them as criminals. The misidentification rates were at 40% which is disproportionately high as only 28 members of the congress were people of color equaling only 20% of the tested faces (Nkonde, 2019). The system's misidentification of people of color as convicted people shows discriminatory biases of program algorithms.

Biometric systems have a tendency to be biased toward fine skin (Wevers, 2018). Biometric devices can fail to recognize effaced fingertips which is often the result of age, manual labor, or the fine structure of the skin which is often seen in Asian women. The bias manifests more clearly against people without fingers or functional limbs. Wevers (2018) point out that invisibility that comes from the failure of recognition creates a new form of hypervisibility as misrecognition can get an individual under additional scrutiny, especially in situations where biometrics are used for security such as borders, airports, or applying for a passport, and misidentification can lead one to be mismarked as a potential threat.

4. Conclusion

As has been already stated, biometric technologies are not exempt from values. Biases and preferences in biometric technologies are the results of codifying implemented applications or programs and data analytics. This is related to the discussion raised earlier in the context of Pitt's article. Are we going to blame machines or human beings for discrimination? Who is responsible? Can we attribute agency and responsibility to machines? As has been discussed earlier, surveillance systems like CCTV can recognize faces and track the movements of individuals and record their facial images without getting their consent. This is automatically done by machines and it is called "pervasive computing" or "ubiquitous computing" by Tavani (Tavani 2016, 320).

It is better to turn back to Winner's discussion about the relation between artifacts and politics to evaluate this. Winner is critical of technological politics from the perspective of democratic politics. Although the title of one of his books is *Autonomous Technology* and therefore, sometimes he has been criticized for defending technological determinism, he is not the advocate of technological determinism; neither is he the defender of social constructivism. He thinks that in the aura of technological societies we live in, we voluntarily give ourselves in technology, which he defines with the concept of "technological somnambulism" (Winner 2010).

Winner also underlines that there are two ways in which artifacts have political characteristics. In the first one, a design, an invention, or an application is adapted to solve a problem in a certain community. The second one, on the other hand, which is called "inherently political technologies" by Winner is closely attuned to a certain type of political relationships (Winner 1980, 123). The first one has flexibility, in other words, it is possible for the artifact to be redesigned by social groups with amendments, however, the second one does not have that kind of flexibility, Winner gives the nuclear plant as an example to this. The question to be asked here is in which category biometric technologies can be put in? When we consider the big data and the Internet of Things, biometric data and technologies are the part of the big data, and it is usually more difficult to control large technical systems than controlling individual artifacts. As has been said earlier, because of the ubiquitous computing, it may become more difficult to control biased operation of data analytics. Smith & Miller also point out this issue by underlining the significance of ethical research; "While current literature on the subject notes that the 'displacement of agency from humans to machines, raises ethical questions about mediated social sorting and discrimination'(Marciano 2019; 134), it is more often focused on sociological analysis of the issues and there is a gap in applied ethical analysis that can provide a foundation for law and policy solutions" (Smith and Miller 2022, 168). Therefore, we need to focus on the ethical aspects of technologies for them to be the basis of judicial regulations. As Winner says, "Because choices tend to become strongly fixed in material equipment, economic investment, and social habit so that the original flexibility vanishes when initial commitments are made" (Winner 1980, 127-128) and once they are founded, they endure for a long time. Hence, responsible innovation is also necessary for biometric technologies.

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