From One to(o) Many

The Use of Forensic DNA Phenotyping in the Criminal Justice System

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Abstract *Forensic DNA phenotyping (FDP) refers to a set of techniques that aim to derive probabilistic information about certain externally visible characteristics of suspects, such as eye, skin, and hair color, from biological samples. In forensic science, this technology is most commonly used to predict the appearance of an unknown suspect in criminal investigations. In this chapter, we examine the artistic exhibition Probably Chelsea and a real criminal case in Canada as platforms for discussing how, despite narratives claiming that FDP enables a fine-grained approach that might lead to the identification of a suspect, in practice this technology creates a coarse-grained context that casts suspicion on an entire population group.*

1. Introduction

In 2017, the exhibition *Probably Chelsea* premiered at the Fridman Gallery in New York City. Upon entering the space, visitors saw *thirty different portraits*, varying in skin and eye color, as well as facial morphology (figure 1). Despite the very subtle resemblances among them, what they had in common was that they were all created based on the analysis of *one person's DNA*, through a technology known as DNA phenotyping. In the words of the artist, Heather Dewey-Hagborg: "when you enter … the faces will greet you in a way and invite you in, and hopefully invite you into thinking deeply about genetics and your own identity. I hope that you walk up to these faces and identify with one of them. That there will be a face that you connect to and are drawn into, and that leads you to think, 'that could be my DNA and how many different people are there in my DNA, as well?'"[2]

1 Both authors have contributed equally to this chapter.

2 https://www.youtube.com/watch?v=A-EhRw11JiQ (accessed 4 December 2023).

Figure 1: Exhibition Probably Chelsea by Heather Dewey-Hagborg

Source: https://deweyhagborg.com/projects/probably-chelsea.

In this chapter, we focus on the forensic application of DNA phenotyping, the technology used by Heather Dewey-Hagborg to create the exhibition *Probably Chelsea*. DNA phenotyping aims to derive probabilistic information from biological samples about certain externally visible characteristics, such as eye, skin, and hair color. In forensic science, this technology is most commonly used to predict the appearance of an unknown suspect in criminal investigations.

We take inspiration from the concepts of granularity (Bowker and Star 1999) and enchanted determinism (Campolo and Crawford 2020) to address forensic DNA phenotyping (FDP). Along with the artistic intervention *Probably Chelsea*, we analyze and explore a criminal case in Canada as a platform for discussing how, despite narratives claiming that FDP enables a fine-grained approach that might lead to the identification of a suspect, in practice this technology creates a coarse-grained context that casts suspicion on an entire population group.

This chapter therefore contributes to the body of literature that critically examines FDP (Queirós 2021; Hopman 2021; Granja and Machado 2020; Wienroth 2018b; M'charek 2008; 2020) by presenting both real and fictional cases as platforms for problematizing various issues related to the practical application of FDP technology in criminal investigations. The chapter begins with a brief exploration of some of the visual technologies mobilized in the criminal justice system, followed by a description of the scientific and social controversies that frame FDP. We then explain how our analytical framework is able to provide new insights into the use of FDP in the criminal justice system. Next, we explore the artistic collaboration between Heather Dewey-Hagborg and Chelsea Manning, which culminated in the exhibition *Probably Chelsea*. This case outlines how FDP ignores the complexities that might exist between inferring sex from genetics and transposing it to appearance. We then move on to explore the case of the Edmonton Police Service, where the company Parabon Nanolabs produced a DNA-generated portrait that led

to a strong community backlash, pointing out the racist implications of this technology. The final section of the chapter summarizes our reflections.

2. Visual Technologies in the Criminal Justice System

Visual technologies have a long history in the criminal justice system. The quest to categorize "criminal types" and/or identify unknown individuals, such as a suspect or a victim, is replete with attempts employing a variety of techniques, ranging from the more established and routine to those that are currently considered state of the art. The most common techniques used to target the facial image of suspects and/or criminalized populations include photographs, composite images (also known as sketches or composite facial drawings), CCTV footage, facial recognition software, and—the focus of this chapter—FDP. In this section, we focus only on photographs and composite images (sketches), because of their direct (dis)connections with FDP, thereby deliberately leaving out the controversies surrounding CCTV and facial recognition (Introna and Wood 2002; Williams 2020).

The increasing professionalization of police work in the 1880s and 1890s was associated with the institution of the photographic archive (Sekula 1986, 17). However, the use of photography in criminal justice has been at the center of many long-standing controversies. The use of photographs is prominently associated with the work of Alphonse Bertillon, who aimed to create a system of criminal identification that brought together anthropometric descriptions and measurements, photographs, and, when appropriate, records of unusual features such as tattoos and scars—the "portrait parlé" (Machado and Prainsack 2012; Burney and Pemberton 2013; Sekula 1986). Such records were intended as technologies of identification, to be kept as police files; such practices continue to this day, albeit in a different form (Miranda and Machado 2018; Nieves Delgado 2020).

Photographs of deviant bodies were also used in studies that considered criminality to be a physical manifestation of the body (Lombroso 1876), with particular links to the eugenic movement, most notably through the work of Sir Francis Galton. In the late 1870s, Galton used photography to compile the "typical" characteristics of "criminals" in order to categorize individuals into "criminal types" (Hopman and M'charek 2020). In particular, Galton layered multiple photographic negatives of portraits to make composite portraits. In his words:

> The photographic process … enables us to obtain with mechanical precision a generalized picture; one that represents no man in particular, but portrays an imaginary figure possessing the average features of any given group of men. These ideal faces have a surprising air of reality. Nobody who glanced at one of them for the first time, would doubt its being the likeness of a living person, yet, as I have said, it is no such thing; it is the portrait of a type and not of an individual. (Galton 1879, 132–133)

As posed by Allan Sekula, "Bertillon's nominalist system of identification and Galton's essentialist system of typology constitute not only the two poles of positivist attempts to regulate social deviance by means of photography, but also the two poles of these at-

tempts to regulate the semantic traffic in photographs" (Sekula 1986, 55). Despite their significant differences, both systems show how the image of suspected and criminalized populations is a focal point of interest, either for identification or categorization purposes.

In addition to photography, another visual technology commonly used in the criminal justice system is composite images, also known as sketches or composite facial drawings. These are facial representations of a criminal suspect created through an interview process in which a forensic artist combines personal expertise with the descriptions of eyewitnesses, to produce an image of the individual, usually a suspect (Bleumink, Jong, and Plájás 2021; Taylor 2000; Hopman and Bleumink 2023; Plájás 2023). Its first documented use in police investigations dates back to 1881 in the United Kingdom where, as part of a murder investigation, a caricature of a suspect was drawn and distributed to the public in the form of a police wanted poster (Taylor 2000). Whether sketches are by hand or created with the assistance of computer and software-based systems, their use has become an established and routine forensic practice (Bleumink, Jong, and Plájás 2021; Hopman and Bleumink 2023) within law enforcement agencies around the world. This technology is seen as particularly valuable in cases where the police have no significant leads other than the eyewitness's description of the suspect.

Because the creation of sketch images depends in part on human testimony and memory, forensic artists rely on a variety of techniques to produce the final image. The use of descriptive categories, reference images, and standardized photographic databases of different population groups is common practice among forensic artists producing sketches (Bleumink, Jong, and Plájás 2021; Taylor 2000; Nieves Delgado 2020; Plájás 2023). This allows forensic artists not only to narrow down the broader conception of the suspect within a smaller population group, but also to focus on the more specific characteristics and traits of that same population (Bleumink, Jong, and Plájás 2021). As noted by Ildikó Plájás, "For the facial composite to fulfill its purpose, that is, to lead the investigators to an individual, it needs to help narrow down larger population groups into smaller ones" (Plájás 2023, 942). Thus, although the primary goal of a sketch image is to reunite information to identify the suspect through this performative (re)construction of their externally visible features, the final image aims to translate a fine balance between generic and specific representations of their face. This means that when a sketch image is released to the public, it must simultaneously enable the public to recognize and identify the suspect's distinctive features and to interpret the ambiguity that was left in the less detailed ones. As Bleumink et al. note:

> When the composite drawing is too generic, criminal officers, who have to trace every single lead, face the risk of receiving too many leads pointing to a range of different individuals. As such, the composite loses its function. This is where circulating a composite representing a minority population, or an "uncommon" face, becomes more informative than a composite that resembles someone from the majority population in a specific area. (2021, 20–21)

Despite the continuing relevance of photographs and sketch images to the criminal justice system, both techniques have significant drawbacks. In the context of a criminal

investigation, photographs allow only for the inclusion/exclusion of certain previously identified and photographed individuals. Sketch images rely heavily on eyewitness and victim testimonies, which are based on memory and recollections of the criminal event, often considered to be fallible, subject to emotional fluctuations and fading memory, and therefore inaccurate. On this basis, the increasing relevance of science within policing has opened the door to the development and use of other visual technologies, anchored in what is seen as a more "robust" science, namely forensic genetics, perceived by several stakeholders as a "truth machine" (Lynch et al. 2008). FDP therefore emerges as another visual technology entering the criminal justice toolkit. However, as noted by Roos Hopman, despite its innovative potential some of its processes are reminiscent of previous techniques: "facial renditions produced through FDP make adjacent practices from different places and times. In the application of contemporary technologies to phenotypic data, nineteenth-century statistical averaging techniques as well as physical anthropological measuring and data-collection practices resurface" (2021, 4).

3. Forensic DNA Phenotyping

The ability to match a DNA profile collected at a crime scene to a specific individual ushered in a new paradigm in forensic science that has been expanding ever since. In the early 2000s, technologies such as forensic DNA phenotyping (FDP) began to be developed, expanding the field's potential to contribute to criminal justice. Forensic DNA phenotyping refers to a set of techniques that aim to derive probabilistic information about certain externally visible characteristics of suspects—such as eye, skin, and hair color—from biological samples. FDP is generally paired with biogeographical ancestry (BGA) inference, which provides probabilistic information about a person's genetic ancestry as being of African American, Southern European, or Northern European geographic-genetic origin. That is, although BGA does not analyze phenotypic traits, it still informs the prediction of externally visible characteristics (Hopman 2021; Koops and Schellekens 2008, 211; M'charek 2020).

In the field of forensic science, FDP is primarily designed to assist in criminal cases where a *one-to-one* logic (comparison of DNA profiles) is not possible (Kayser and de Knijff 2011; Børsting and Morling 2015; Kayser 2015). Aiming to assist police investigations in the decision-making process, FDP uses probabilistic representations that reveal a set of variable biological characteristics shared by certain population groups to which the suspect may belong. It thus operates in a *one-to-many* logic where the population is (dis)aggregated into different configurations of groups of individuals based on certain criteria (a specific eye color, skin color, biogeographical ancestry group, etc.). FDP thereby shifts the locus of police investigation from *one* (the suspect) to *many* (a collective population).

FDP has been presented by its proponents as a technology characterized by scientific and technological progress. Drawing on the scientific legitimacy of DNA (Lynch et al. 2008), FDP is wrapped in an aura of progress, objectivity, immutability, impartiality, and reliability. It has therefore been presented as "the production of a 'biological witness' from crime scene DNA" (Walsh and Kayser 2016, 417). "In essence," Kayser writes, "FDP outcomes can serve as 'biological witness,' and may potentially provide even more accu-

rate information than human eyewitnesses do, who are known to be unreliable" (Kayser 2015, 34).

Despite such overly optimist promises associated with FDP, this technology is still characterized by several controversies and complex politics of legitimation and contestation (Granja and Machado 2020), both within and beyond the scientific community of forensic genetics.[3] Despite ongoing controversies regarding the accuracy of the technology (Sharma et al. 2019; Lipphardt 2018), currently, the application of FDP tends to focus on predicting pigmentation characteristics, such as eye, hair, and skin color and biogeographic ancestry (Kayser 2015; Kayser and Schneider 2009; Kayser et al. 2023). Given the complexity in understanding the genetic-based settings that result in the physical expression of other characteristics—such as the variation of face shapes, body weight/structure, hair loss, baldness and hair morphology—scientific research concerned with these predictions is still underdeveloped (Kayser 2015). Some publications have presented results using genetic kits and computer software for the application of FDP. Although they aim to allow the accuracy of this technology to be assessed, they have proved to be inconsistent and unsatisfactory (Sharma et al. 2019).

On the one hand, social scientists have played a crucial role in debating FDP controversies by questioning the conceptual ambiguity associated with the concept of origin and its interrelations with racial categories. Contributions in this domain criticize how FDP is able to legitimize the notion that race is a category of differentiation with genetic validity (Vailly 2017; Queirós 2021). On the other hand, social sciences also emphasize the potential of FDP to reproduce stigmatization and reinforce criminalization. By increasing the visibility of racial or ethnic differences, FDP holds the potential to affect disproportionately population groups already vulnerable to the action of the criminal justice system, such as racial and ethnic minorities (Toom et al. 2016; Queirós 2021; Hopman 2020; Hopman and M'charek 2020; Duster 2008; Ossorio 2006; Skinner 2018; M'charek 2013; Bartram, Plümecke, and Schultz 2022).

In addition to academic research and police interest in FDP, the development of this technology has been characterized by a fetishization of the new (Brown and Michael 2003) and has therefore attracted considerable interest from for-profit forensic providers. In January 2015, a private company based in the United States, Parabon Nanolabs, launched Snapshot. Snapshot is a tool that allegedly enables the prediction of the appearance, including face morphology, of an unknown individual. Its commercialization is directly targeted at criminal investigations and its development has received directed funding from the Department of Defense.[4] Snapshot differentiates itself from other existing products on the market by providing a DNA-based portrait of an individual, typically a suspect.

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3 Within the scope of this article the expression "community of forensic genetics" or "scientific community of forensic genetics" is used to refer to what Simon Cole calls "forensic genetic scientists," that is, individuals working on criminal cases and that are employed by a forensic laboratory, and "research scientists," which represent individuals employed by universities whose primary professional occupation is scientific controlled laboratory research with applications in forensic science (Cole 2013).

4 https://media.defense.gov/2022/Nov/23/2003120778/-1/-1/0/PARABON_STORY.PDF (accessed February 16, 2023).

Owing to its overly optimistic promises, Snapshot has received wide attention from high-impact media outlets, such as *National Geographic* and *The New York Times* (Greenwood 2016; Pollack 2015; Southall 2017) and significant interest from police departments across the world. According to the Parabon website, "Snapshot has been used by hundreds of law enforcement agencies around the world to help generate leads, narrow their suspect pools, and solve human remains cases, in both active and decades-old investigations." This claim is followed by a list of cases allegedly solved using Snapshot.[5]

However, Snapshot has received considerable backlash from several members of the forensic genetics' scientific community (Wienroth 2018a). Forensic geneticists involved in academic research dedicated to the development of the FDP describe the impossibility of assessing the scientific robustness of the services offered, thus raising questions of validation and transparency, and more broadly, of scientific ethics and responsibility (Granja and Machado 2020). Despite the ongoing controversies surrounding Snapshot, Parabon NanoLabs has irrevocably linked the use of FDP technology to the possibility of creating a DNA-based portrait.

4. Analytical Lens

Framing FDP as part of the technolegal worlds of forensic genetics (Toom, Wienroth, and M'charek 2023), in this chapter we draw inspiration from the concepts of granularity (Bowker and Star 1999) and enchanted determinism (Campolo and Crawford 2020). On the one hand, Bowker and Star's seminal work on classifications and classification systems as powerful technologies (1999, 319) helps us to understand how the fine-grained aspect of granularity (referring to specificity) is repeatedly mobilized to refer to the informational potential of DNA, which is seen as the ultimate identifier (Lynch et al. 2008). As described earlier, such a narrative is recurrently adopted by proponents and supporters of FDP who invoke DNA uniqueness to argue for the technology's fine-grained approach, especially when comparing FDP to other visual technologies. On the other hand, the coarser component of granularity captures how FDP ends up categorizing broad groups that share the same particular trait(s) or characteristic(s). In other words, although the technology uses DNA as a fine-grained source of information, in practice its operationalization and results reveal a coarse-grained approach, as there are multiple ways of translating its results. As Bowker and Star also point out, "all information systems are necessarily suffused with ethical and political values […] These systems are active creators of categories in the world as well as simulators of existing categories" (Bowker and Star 1999, 321). Applied to the case of FDP, this sheds light on how this technology makes use of both old and (re)new(ed) scientific practices and classification systems that are embedded in complex configurations of scientific and cultural frameworks. In practice, it has the power to (re)create dynamics of collectivization of suspicion towards certain population groups (Queirós 2021; Hopman 2021).

The concept of enchanted determinism is proposed by Campolo and Crawford (2020) within the context of artificial intelligence. It refers to "a discourse that presents deep

5 https://snapshot.parabon-nanolabs.com/phenotyping (accessed February 16, 2023).

learning techniques as magical, outside the scope of present scientific knowledge, yet also deterministic, in that deep learning systems can nonetheless detect patterns that give unprecedented access to people's identities, emotions and social character" (2020, 3). A *translation* of the concept (Callon 1986; Latour 1986; 1992) into the context of the FDP allows a particularly fruitful perspective on the role of Parabon. Although Parabon bases its service on some of the FDP's predictions (e.g., eye, hair, and skin color), the scientific community of forensic genetics consider its current promise to be outside the scope of current scientific knowledge, as several doubts remain about the scientific validity of inferring facial morphology from DNA (Granja and Machado 2020; Wienroth 2018a). In addition, even more important for the purposes of this chapter is to understand how the discourse of enchanted determinism has crucial social implications: "[it] values the technical 'accuracy' of predicting social identities over a deeper contextual knowledge of how those predictions are made, their limitations, or the impacts those predictions have in the world (Campolo and Crawford 2020, 12). Considering this, in the remainder of this chapter we explore how the concept of enchanted determinism is particularly useful for exploring how Parabon services, particularly Snapshot, are fraught with political and social risks. We examine, in other words, how Snapshot's claims of high levels of accuracy and objectivity, when applied in real criminal cases, raise complex issues of responsibility and liability with unfolding implications in terms of individual and, more importantly, collective suspicion, discrimination, and criminalization.

5. Case Studies

5.1 Probably Chelsea

In 2010, Chelsea Manning, a former US Army soldier was sentenced to thirty-five years in prison for leaking classified and sensitive military and diplomatic documents to WikiLeaks. While in prison, Manning openly identified as a trans woman. Placed in solitary confinement on several occasions during her imprisonment, Manning was subject to a strict visiting policy and was not allowed to be photographed.

Heather Dewey-Hagborg is an "artist and biohacker interested in art as research and technological critique."[6] One of her best-known projects is *Stranger Visions* (2012–2013), in which she used a technology known as DNA phenotyping to produce 3D-printed facial sculptures from the analysis of genetic material (hair, cigarette butts, chewed gum) collected from public places. In 2015, Heather Dewey-Hagborg received an email from *Paper* magazine asking if she would be interested in making a 3D facial sculpture of Chelsea Manning based on her DNA, as she was not able to receive visits or be photographed at the time. This led to an exchange of letters between Chelsea Manning and Heather Dewey-Hagborg, and eventually to Chelsea Manning sending the artist a letter containing her biological samples (cheek swabs and hair clippings). Based on this data, in 2015, the artist created *Radical Love*, a project featuring two life-size 3D-printed models of Chelsea Manning's face, based on her DNA. The project premiered at the World Economic Forum in

6 https://deweyhagborg.com/bio (accessed February 22, 2023).

January 2016. In light of Manning's transgender identity, one of the 3D DNA-based facial sculptures was intended to represent Manning's face as gender-neutral. The other was rendered as a woman. The project is described by the artist as "an homage to and exploration of gender identity stereotypes in forensic DNA phenotyping."[7] But the collaboration between Chelsea Manning and Heather Dewey-Hagborg did not end there. In 2015, the two of them created a graphic short story entitled "Suppressed Images." And two years later, after Manning's sentence was commuted by President Barack Obama, the artist premiered the exhibition *Probably Chelsea* (introduced above). This collection comprised thirty different possible 3D-printed facial sculptures of Chelsea Manning, each generated through DNA phenotyping technology. At the exhibition, the sculptures were strategically placed at diverse heights to create the illusion of a crowd as visitors entered the space. Sculptures varied in their skin and eye color and morphology, while bearing an almost imperceptible resemblance to each other. According to Dewey-Hagborg, "genomic data can tell a multitude of different stories about who and what you are. Probably Chelsea shows just how many ways your DNA can be interpreted as data, and how subjective the act of reading DNA really is."[8]

Chelsea Manning's case brings into focus a topic that up until this point has remained underexplored in the body of literature exploring FDP. Skin and eye color have received significant attention in the literature on FDP due to their relation to the notion of race (Hopman and M'charek 2020; M'charek 2008; Queirós 2021; Bartram, Plümecke, and Schultz 2022). However, this artistic interpretation of DNA phenotyping technology also foregrounds how gender performance influences individuals' appearance in ways that cannot be disclosed by DNA. Given how bodies are socially situated and contingent upon gender performance (Butler 1993), it is crucial to bring into the discussion the differences between sex and gender identity. That is, despite the fact that sex can be inferred from DNA (and such information can be useful for forensic purposes), the leap from there to creating images of what a suspect might look like involves a set of assumptions and stereotypes that completely ignore gender performativity. Chelsea Manning's case therefore shows how the diversity and plurality of gender performance, which might be mutable, changing not only across time but also space, do not find translation into genetic readings of the human body. Consequently, this poses additional challenges to the application of FDP technology as a means of generating information about the externally visible characteristics of individuals.

FDP technology has been presented by its advocates and supporters as a tool that is capable of providing law enforcement with a fine-grained approach and specific information of intelligence value about the appearance of criminal suspects, particularly in the absence of additional clues or eyewitnesses. The case of *Probably Chelsea* shows that not only do the results of DNA phenotyping not provide definitive answers—thus contradicting the imagery of unity and singularity associated with DNA—but they are also open to different interpretations, thereby outlining a coarse-grained translation outside forensic laboratories (Bowker and Star 1999). As shown by the artist, too many and different faces can be drawn from the same DNA sample analysis.

7 https://deweyhagborg.com/_archived/chelsea/ (accessed February 22, 2023).

8 https://deweyhagborg.com/projects/probably-chelsea (accessed February 22, 2023).

5.2 The Edmonton Police Service Case

On 10 March 2019, a Black female in her mid-20s was walking home at dawn in the city of Edmonton in Alberta, Canada. On her way, she passed a bus stop where several people were waiting, including an unknown male. The bus arrived, picked up the people waiting, and left. The unknown man did not enter the bus. He followed the young female as she continued walking home, eventually dragging her to a field and sexually assaulted her. During the attack, the victim lost consciousness. She was left alone, seriously injured, wearing only a t-shirt in 27-degree Celsius weather. When she regained consciousness, she walked towards a street where a resident saw her and called the police. According to the Edmonton Police Service, the victim specifically described the suspect as a 162-cm Black man with an accent, wearing bulky winter clothes and a black toque that covered most of his face. The police collected the DNA of the suspect through a rape kit but it did not match any of the profiles stored in forensic DNA databases. With no eyewitnesses or CCTV footage and after all traditional investigative options had been exhausted, the case went cold.

Three and a half years later, the Edmonton Police Service decided to contract Parabon to use their Snapshot service in this case. Although they had never used this technology, the decision was perceived as a "last resort," as declared by Colleen Maynes, a detective in the Edmonton Police Service Sexual Assault Section, and Enyinnah Okere, chief operations officer for the Community Safety and Well-Being Bureau of Edmonton Police Service (Okere 2022; Edmonton Police Service 2022).

Hoping to generate new leads on the suspect's identity, on 4 October 2022 the Edmonton Police Service released a statement on their website and social media along with the the DNA-generated portrait that Parabon had produced. Confirming the description given by the victim, the DNA-based portrait presented the suspect as a Black man with African ancestry, adding new information about his brown/black eyes and black hair. In the statement issued to accompany the disclosure of the DNA-generated portrait, the police mentioned some of Snapshot's limitations. For example, Parabon uses a default—not DNA-based data—age of twenty-five and body mass index of twenty-two in their predictions (Edmonton Police Service 2022). The Edmonton Police Service thus outlined how "the suspect may be older, [or] may have a different body composition," but also "may have facial hair or a different hairstyle than depicted in the photo" (ibid.). The statement ended with a brief acknowledgment of the potential effects the release of the DNA-based portrait could generate in the Black community of Edmonton:

> Following consultation with community stakeholders, the EPS [Edmonton Police Service] is aware of the impact this release may have on a marginalized community. Due to the severity of the occurrence, the need to advocate for a victim of a violent sexual assault and in consideration of the public safety interest, investigators believe the release of this image based on DNA evidence is required in order to further the investigation. As always, any leads generated from the release of a composite image would require further investigative steps. (Edmonton Police Service 2022)

Notwithstanding the alerts on the limitations of the DNA-generated portrait and the mentioning of the potential discriminatory effects on the Black community, the release of that DNA-based portrait triggered an unprecedented backlash. Shortly after the disclosure of this "new" information, reactions deriving from different groups quickly arrived. Nine Edmonton-based Black community activist groups addressed a letter to the Edmonton Police Commission chairman calling for an end to the police use of FDP technology. They argued that information produced by Parabon and its subsequent release to the public further stigmatized and criminalized racialized groups within the Edmonton community (Issawi 2022).

The release of the portrait also inflamed social media. Haruun Ali, a community activist, while juxtaposing a picture of himself with the one released by the police, stated: "You can take any random Black man that you know, put him next to it and to be frank, it will probably look similar to them. … This is modern-day racial profiling."[9] Adam Rutherford, a geneticist, was one of those linked to science who had an active voice in this controversy. Reposting the tweet that police had made disseminating the DNA-generated portrait, Rutherford addressed reliability and accuracy issues related to the work of Parabon. In his own words: "You can't make facial profiles or accurate pigmentation predictions from DNA, and this is dangerous snake oil."[10] Finally, Doug King, professor of justice studies at Mount Royal University, also addressed issues related to the idea of accuracy that Snapshot's DNA-based portrait conveys and the risks of racial profiling:

> "We see the composite picture and then we automatically assume it's an accurate composite picture. … By putting a composite together, we fix it in people's minds that this is what the person is supposed to look like. So, you have to guard against that because then the issue becomes, 'I see someone who looks like that—my next-door neighbor.' And it turns out it has nothing to do with that person" (Gibson 2022).

In the face of myriad accusations of racism from Black community groups, activists, and scientists dismissing Parabon's work as irresponsible science, a statement of apology was issued by the Edmonton Police Service just forty-eight hours after releasing the DNA-generated portrait. This was signed by Chief Okere, who is responsible for overseeing the Sexual Assault Crimes Team and is himself a member of the Black community. The statement announced the immediate removal of the DNA-generated portrait from the police website and social networks:

> We were not and are not oblivious to the legitimate questions raised about the suitability of this type of technology. The potential that a visual profile can provide far too broad a characterization from within a racialized community and in this case, Edmonton's Black community, was not something I adequately considered. There is an important need to balance the potential investigative value of a practice with the all too real risks and unintended consequences to marginalized communities. … I prioritized the investigation—which in this case involved the pursuit of justice for the victim, herself

9 https://twitter.com/HaruunYEG/status/1583622302528606209 (accessed February 20, 2023).

10 https://twitter.com/adamrutherford/status/1577556029499355136 (accessed February 20, 2023).

> a member of a racialized community, over the potential harm to the Black community. This was not an acceptable trade-off and I apologize for this. (Okere, 2022)

Finally, not ruling out future uses of Parabon's Snapshot service or of FDP, despite protests in the media calling for a ban of this technology, Okere also indicated the police will review their internal and consultative processes to prevent a controversy like this from happening again (ibid.). Up to the date of writing this article, the criminal case remains unresolved.

This case is a clear example of the potential effects that Parabon's use of FDP technology brings. From one DNA sample, Parabon produces *one* portrait image, one face. And while that face, at first glance, conveys the same fine-grained idea of unity and singularity as DNA, that imagery vanishes, as the case so well demonstrates, with the acknowledgment of its breadth within society. The portrait created through DNA has a coarse-grained (Bowker and Star 1999) translation outside the forensic laboratory. In simple words, despite the illusion of an individual genetically based portrait, it produces a broad and stereotyped generic face from which *too many* faces can be drawn.

In addition, the Edmonton Police case also constitutes an exemplary case of the potential for overinvestment in innovative DNA technologies by police forces and, simultaneously, on the effects of disinformation on what type of data the application of specific technologies can bring to the case under investigation. Given that the police already had a description from the victim of the suspect as a Black man, it is unclear what the purpose of the DNA-based portrait was. In this case, promises of accuracy surpassed the possible social and political consequences: "accuracy measures ascribe to them a power of social prediction and categorization without assessing the underlying social and political risks, hidden behind counter-intuitive properties or uninterpretable mechanisms" (Campolo and Crawford 2020, 12).

We therefore argue that the Edmonton police case is an example of the enchanted determinism (Campolo and Crawford 2020) effect of the Parabon representation of FDP. At the heart of this case is the promise, promoted by Parabon, to provide a DNA-based portrait. Attracted by the alleged technical accuracy of predicting social identities, in this case the social identity of the criminal suspect, the police ended up disregarding: (i) the deeper contextual knowledge of how these predictions are made, which in this case refers to the black-box knowledge of Parabon's product, protected by commercial logics of secrecy and patent control (Wienroth 2018a; Granja and Machado 2020); (ii) Parabon's limitations, namely the possibility of producing a DNA-generated portrait, which is highly contested by most members of the forensic genetics community directly working with FDP—something that, as previously noted, was also voiced by geneticist Adam Rutherford when he commented on the case; and (iii) more importantly in this particular case, the impact that these predictions have in the world by focusing on a racialized and highly stigmatized community, as the community backlash so well demonstrates.

In addition to the aforementioned impacts on racialized communities, Snapshot's results affect not only the company's public image and scientific credibility, but also the perceived validity, scientific credibility, and precision associated with FDP in the context of forensic science applications. The controversy surrounding the Edmonton Police Service has sparked movements advocating for a ban on using FDP technology. This ban

targets not only Parabon as a forensic services provider or this particular service, Snapshot, but calls for a complete prohibition on the use of this technology.

This case therefore raises complex questions about accountability. As noted by Campolo and Crawford (2020, 1): "Enchantment shields the creators of these systems from accountability while its deterministic, calculative power intensifies social processes of classification and control." Although the Edmonton Police Service issued a statement of apology and announced the immediate removal of Parabon's DNA-based portrait from the police website and social networks, as of the time of writing and to the best of our knowledge, the company responsible for producing such data not only keeps the suspect's DNA-based portrait on their website, which is still linked to (and, thus, identifies) the Edmonton Police Service,[11] but also has not taken a stand, thereby distancing themselves from ethical responsibility and legal liability (see Campolo and Crawford, 2020, 3).

6. Final Remarks

This chapter aims to contribute to the body of literature focusing on forensic genetics and their technolegal worlds (Toom, Wienroth, and M'charek 2023) by fostering new avenues of discussion related to the complexities associated with the use of FDP in the criminal justice system. It focuses on two publicly available cases: an artistic intervention by Heather Dewey-Hagborg and the criminal case of the Edmonton Police Service that made use of Parabon's Snapshot service. The chapter mobilizes such cases as platforms for discussing how FDP: (i) ends up materializing a coarse-grained approach; (ii) fails to capture the multiplicity of social categories, such as gender identity; (iii) holds the potential to reinforce stigmatization and criminalization of certain population groups.

The allure of producing an image of suspects has irrevocably marked the history of police work, as shown, for example, by the use of composite images proposed by Galton and, later, by sketches. In both cases, there is something appealing in supposedly creating a generalized image of the criminal suspect that does not necessarily represent an individual but characteristics shared by a group. As outlined by Galton, the goal is to create an image "that represents no man in particular, but portrays an imaginary figure possessing the average features of any given group of men. Nobody who glanced at [it] for the first time, would doubt its being the likeness of a living person, yet … it is the portrait of a type and not of an individual" (Galton 1879, 132–133). Such conceptualization shares remarkable similarities with the coarse-grained approach of FDP.

Although the proponents of FDP argue that this technology surpasses limitations of previous visual technologies, it ends up reproducing similarities by relying on broad classification systems to create "a materialized image of a suspect's likeness [that] is never final" (Bleumink, Jong, and Plájás 2021, 29). Therefore, despite claims of enabling a fine-grained approach due to the informational potential and specificity of DNA, the cases presented in this chapter show that FDP ultimately operates within and creates a coarse-grained context. On the one hand, the case of *Probably Chelsea* is particularly useful for showing how FDP ignores the complexities that might exist between inferring sex from

11 https://snapshot.parabon-nanolabs.com/posters (accessed February 27, 2023).

genetics and transposing it to appearance. On the other hand, the Edmonton Police case pinpoints how the production of a genetically based individual portrait as possessing inherent value to criminal investigations is illusory. Such a portrait fails to provide specific individualizing information about the suspect's unique physical appearance. Instead, it casts suspicion within a group of individuals who possess the same set of characteristics (M'charek and Wade 2020). Thus, rather than assisting the process of identifying the suspect, the portrait creates a broad and stereotyped generic face, from which *too many* faces can be derived.

At the same time, and similarly to earlier visual technologies, the DNA-based portrait reinforces a particular image of the suspect in people's minds. It appears to be authentic and conclusive, conveying the idea that "*this* is what the suspect looks like." This happens, as M'charek posits, because "the face—just like DNA—is associated with individuality" (2020, 1). But while the DNA-generated image appears to be authentic and conclusive, as both cases demonstrate, it paradoxically omits all the other *many* possible interpretations of genetic data that are not represented in that *one* portrait.

In addition to reproducing old patterns and contributing to the production and reification of stereotypes with crucial implications for the affected communities, the cases analyzed in this article also raise issues of liability, responsibility and accountability. The Edmonton Police case particularly illustrates how the use of products from for-profit forensic providers can affect the perceived validity, scientific credibility, and accuracy associated with FDP in the context of forensic science applications. Shielded by commercial logics of secrecy and patent control and anchored on accuracy promises, Parabon's service creates liminal spaces of accountability that distance it from ethical responsibility and legal liability (see Campolo and Crawford, 2020, 3). The case of FDP is therefore particularly useful for interrogating the regulatory norms, social values, and competing interests entailed in the technolegal worlds of forensic genetics (Toom, Wienroth, and M'charek 2023), considering its situated and broad legal, cultural, and political implications.

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