THE NEXT MUGSHOT

Designing the next identity enrolment facility for the Dutch National Police

Master Thesis
Alexandros Vangelis Pliakis

TUDelft POLITIE

Master Thesis by
Alexandros Vangelis Pliakis

December 2019

Integrated Product Design

Delft University of Technology

In collaboration with
The Dutch National Police

Supervisory Team
Chair: Prof. ir. J. van Erp (Jeroen)

Mentor: ir. M.F. Bakker (Martien)

Company Mentor: ir. I. Salters (Ivo)

THE NEXT MUGSHOT

Designing the next identity enrolment facility for the Dutch National Police

Preface

A project for the Police, cool! That is the most common response I get when explaining my graduation project. And indeed, it was cool.

One of the most memorable moments was while attending a 112-shift at the Delft Police department. With sirens on, going 80km/h through the neighbourhood, we were driving towards an accident on the A13. It made me realise the versatility of the places and experiences that this discipline brings. A discipline that a successful graduation project will make me part of for the many coming years.

This project has offered me the opportunity improve the safety and thus the wellbeing of people in the Netherlands. That would be impossible without some people.

Firstly, I would like to thank my supervisory team. Thank you, Ivo, for showing me all the ins and outs of the Police and guiding me project- and design-wise as well. Our meetings always resulted in another week of energy and motivation. Martien, thank you for great in-depth project coaching and all the philosophical metaphorical discussions about design. Jeroen, thank you for always making time to provide feedback when it was needed. Without your feedback I would have not explored the interaction paths of design that added another dimension to this project.

My thanks go out to the Dutch National Police, who, as a client, provided (more than) the necessary tools for a successful project. More gratitude goes out to particular people. Jacinta, for our weekly coffee brainstorm moments. Marius, for setting up the project and facilitating a place at the Police. Thank you at the rest of the team, for always providing the information that I needed.

Finally, I would like to thank the participants of the creative session and all friends who helped me with brainstorming, creation of visuals and reviewing. You know who you are!
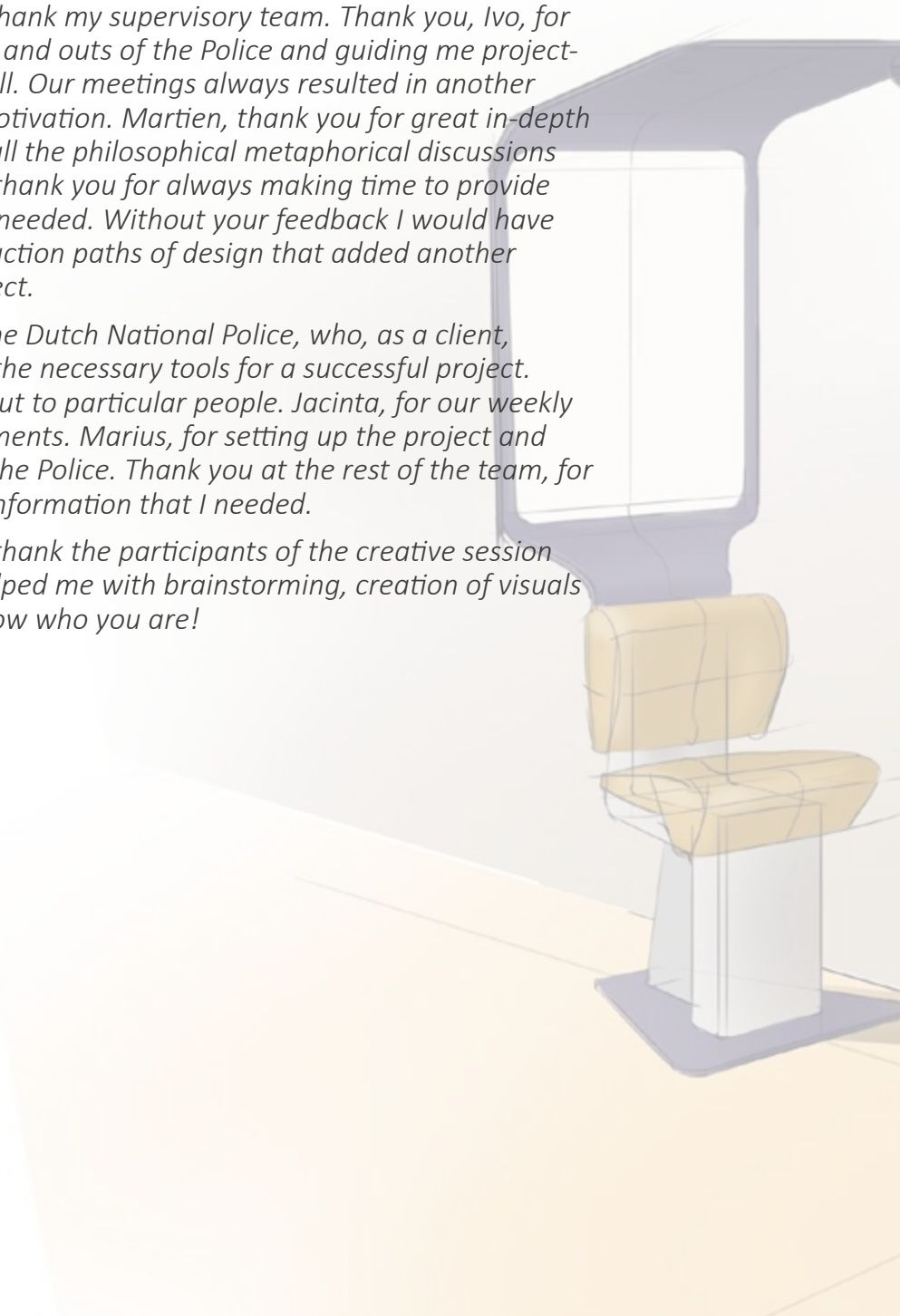
Abstract

Pushed by technology and international regulations the world of identities is rapidly changing. Among others, the Dutch government is obliged to keep up. In line with these developments, a special facility for execution of identification processes for crime and migration purposes was nationally commissioned in 2015, called the ''Basisvoorziening Identiteitsvaststelling''. Among others, this facility is used by the Dutch National Police to execute identification processes on migrants, aliens, suspects, convicts and witnesses.

Throughout the years the appliance has become out-dated. Expensive defects and poor user experiences have caused the Police to initiate the development of a new design.

Research unveiled that the Police is placed in a difficult position by relying highly on a product which functionality depends on numerous (uncontrollable) factors. The envisioned product requires be more flexible and future proof.

Additionally, it was concluded that standardisation of a new enrolment facility for all identity related governmental agencies is feasible and desired. The Police was focused to design for: they set the highest requirements and have the most difficult users.

Technology research provided that future identification will involve more biometric technologies and that a stationary enrolment facility will remain necessary for the coming decade.

Using the Vision in Product Design method the current product and context were evaluated. A new user interaction journey was developed to provide a foundation for future development. The participant and the product were envisioned to become more involved in the process. It was chosen to create an unjudged experience for the participant. For the operator, the feeling of police workmanship should be emphasised.

This led to the design goal: "Design the next identity enrolment facility for the Dutch National Police". In order to improve the current situation, the following goals are formulated:

- Improving the user interaction;
- Inducing flexibility by:
  - reducing dependency;
  - implementing futureproofing;
  - enabling versatile employability;
  - anticipating identity technology.

This initiated the ideation process. Through iterative prototyping, sketching and brainstorming a concept was designed. Eventually, an argumentation is provided on how the Main Appliance for Identification ('MAID') meets the design goals.

Eventually, recommendations and unused ideas are provided for the client for future development.

Definitions

Basisvoorziening Identiteitsvaststelling
The facility used by the Police and KMar to execute identification processes on migrants, aliens, suspects, convicts and witnesses.

Biometrics
The technological term for body measurements and calculations

Centrum voor Biometrie (Centre for Biometrics)
Part of the Police that is the national contact point for biometric related subject.

Chain
A collective of governmental agencies that pursue one or more common objectives (Noraonline, 2018).

Criminal justice chain
A chain that pursues the execution of crime related legislation

Dienst Justitiële Inrichtingen (Custodial Institutions Agency)
Member of the Ministry of Justice & Security that is responsible for all convicted detainees in the Netherlands.

Enrolment/registration
The process of storing someone's identity.

Identification
The process of finding a registered identity by measuring someone's properties to match with registered properties (1 on N)

Identity
The collective set of distinct personal and physical features, data and qualities that enable a person to be definitively identified from others (ICAO-a, 2015).

Identity processes
Processes that are related to either enrolment, identification or verification of a person.

Koninklijke Marechaussee (Royal Netherlands Marechaussee)
Member of the Ministry of Defence that is responsible for (inter)national safety of the Netherlands. For this project mostly involved around border control.

Migration chain
A chain that pursues the execution of migration related legislation

National Politie (Dutch National Police)
Member of the Ministry of Justice & Security that guards the safety of people in the Netherlands.

police (uncapitalised)
A collective term for police on the street/law enforcement/cops

Protocol Identiteitsvaststelling in de strafrechtketen (Protocol Identification in the Criminal Justice chain)
The protocol that describes how the WIVVG should be put to practice.

Verification
The process of finding out whether a property matches an assumed identity (1 on 1)

Wet Identiteitsvaststelling Verdachten, Veroordeelden en Getuigen (Law for Identification of Suspects, Convicts and Witnesses)
The law that defines identification in the criminal justice chain.

Table of Contents

Introduction

Project introduction

With the European migrant crisis, increasing presence of terrorism and awareness of privacy, the governmental management of identities of individuals is now more important than ever. Consequently, the identity technology industry is taking big steps. This has caused identity management to become more secure and increasingly internationally regulated. Consequently, governments are pushed to constantly redefine their laws on identification.

This counts for the Netherlands as well. In 2010, the WIVVG[1] was commissioned and the Dutch Aliens Act was modified in 2013. Both to implement new processes and the use of biometrics in identity registration (Eerstekamer, 2019). In order to facilitate the new processes, new identification facilities were nationally commissioned in 2015 (Rijksoverheid-a, 2019).

This so-called 'Basisvoorziening Identiteitsvaststelling', is the facility that is used to execute identification processes on migrants, aliens, suspects, convicts and witnesses. It

is operated nationally by the Dutch Police and the Royal Netherlands Marechaussee.

Identification data is stored in the underlying (European) registers and systems and communicated with numerous governmental agencies. Participants are being enrolled, identified or verified based on an ID-document, fingerprints and a portrait photo.

With the commissioning of the BVID, the government has taken big steps towards a future with more technologically advanced identity management. It has improved the link between criminal and alien data, nationally as well as internationally. Yet, throughout the years the product has become out-dated and needs to be redesigned.

---

1. Wet Identiteitsvaststelling Verdachten, Veroordeelden en Getuigen (WIVVG) (Law on Suspects, Convicts and Witnesses)

Fig.1: The BVID

Problem Identification

The problem is that the Police is highly relying on one product which functionality depends on numerous (uncontrollable) factors. One small defect or error can disable a whole police station from executing the arrest procedure. Since police stations are often limited to one BVID, the inability to use the appliance can cause queues of suspects. Moreover, the current functional and practical design has resulted in poor experiences, which leaves opportunities for improvements on user interaction.

This all results in an inflexible, fragile and error-prone product. The Police's IT department is therefore struggling with expensive defects and maintenance of the BVID.

Next to this problem, there are opportunities to utilize as well.

The types and quality of biometric technologies continue to grow, and the police envisions a future with even more biometric and mobile applications of the BVID. Additionally, nationalisation of governmental processes allows for involvement more stakeholders in the commissioning of the next appliance. The current product was not designed to be adaptive to such changes.

These reasons underline that the BVID needs to be redesigned to become more flexible and adaptive to future technologies and new use applications. In that way, the Police can maintain to work on the highest quality and keep up with their main goal: making the Netherlands safer.

The Dutch Police IT department has therefore approached the Delft University of Technology to research the current problems and possibilities and to design the next BVID.

Design Challenge

The design challenge, as rephrased after the research, is

formulated as below. The initial design challenge can be found in Appendix A.

Design the next identity enrolment facility for the Dutch National Police.

Fig. 2: Identity enrolment at the Dutch National Police

Project Approach

The project is divided in two parts. The first part of the project focuses on the generation of a solution space and definition of what is envisioned (Chapters: Research & Define). The second part uses the defined tools to develop a concept for the envisioned context (Chapters: Develop & Deliver).

Below, the chapters are briefly explained and a report guide is provided.

Research
Firstly, a brief explanation on identity is given to get the reader acquainted with the subject.

- What is identity?
- How is identity connected to governments?
- What role does technology play in identity?

Next, to acquire a clear image of the design context and in search for a possible broader market, the Dutch governmental identity-construct was researched, asking the main question:

- Is it feasible and desirable to design a solution for multiple governmental partners?

Afterwards, the Dutch Police is researched with a top-down approach from organisational level to the interaction with the BVID. Next to that, the technological field of identity was researched, to answer the following question:

- How will identification change in the coming years and what does that mean for this project?

The research was substantiated by the following methods: desk research, user research, field research, stakeholder interviews and company visits.

Define
A 'Vision in Product Design' (Hekkert & Dijk, 2009) approach is taken to define the context and tools that enable to start developing. Here you will find:

- Rephrasing of the initial assignment
- The scope definition with envisioned context (where, what, who, when)
- The design brief with a summary and design goal (why & how)

Develop
Starting off, a new interaction is developed do design for. Next, a summary of the development phase is given to present the explored idea space, resulting in one concept (Develop). This was one by though iterative ideation and conceptualisation phases, by means of (digital) sketching, prototyping, creative sessions, stakeholder concept evaluation and computer aided modelling.

Deliver
Then, the elaborated concept is presented. Focus is put on the argumentation and implementation of the concept. Eventually, recommendations are listed for the client.

RESEARCH — DEFINE — DEVELOP — DELIVER — RECOMMENDATIONS
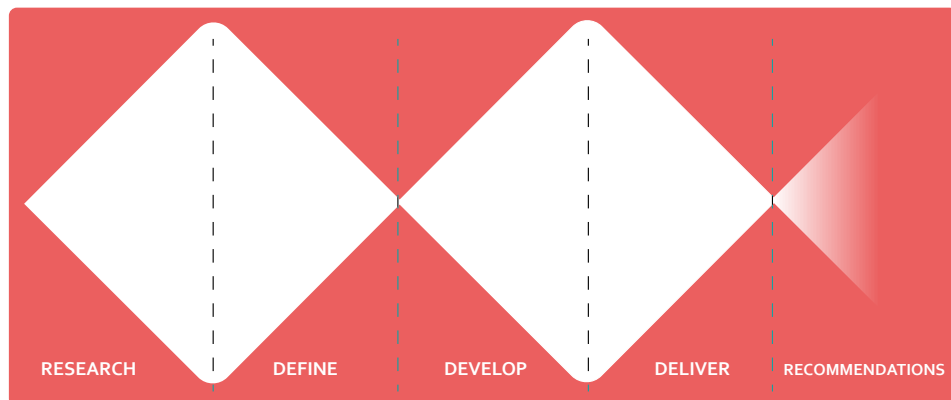
Fig.3: Visual overview of project

Report guide

Goal of the report
The purpose of the report is to document the design process of this graduation project. Also, I want to educate uninformed readers and to shape a basis to enable designers to continue with this project.

Abbreviations
The report contains numerous governmental terms and abbreviations. For simplicity reasons, all Dutch terms will be translated to English only the first time of use. Thereafter, its Dutch abbreviation is used. For instance:

Koninklijke Marechaussee (KMar) (Royal Netherlands Marechaussee).

A list of most frequently used terms can be found in section "Definitions" on page 6.

Conclusions & Takeaways
For a fast read-through, paragraphs are often concluded with key Takeaways (repeated succinct information) and/ or concluded with design decisions & conclusions (new information synthesized from that section).

Enjoy reading!

RESEARCH

RESEARCH

In this first section, identity is discussed from a global explanation to the governmental applications in Dutch society. First a brief explanation on identity is given to get the reader acquainted with the subject.

Questions that will be answered are:
- What is identity?
- How is identity connected to governments?
- What role does technology play in identity?

Next, to acquire a clear image of the design context and in search for a possible broader market, the Dutch governmental identity-construct was researched, asking the main question:
- Is it feasible and desired to design a solution for multiple governmental partners?

Afterwards, the Dutch National Police is researched with a top-down approach from organisational level to the interaction with the BVID. The product is being analysed on functional and interaction level.

Lastly, the technological field of identity is researched, to answer the following question:
- How will identification change in the coming years and what are the consequences for this project?

1. AN INTRODUCTION ON IDENTITY

Fig.4: Identity control

An Introduction on identity

Defining identity

Identity can be an extremely deep and complex term. The subject has been discussed throughout history by multiple sociologists, psychologists and philosophers. One can quickly drown in subjects as the self-concept, group identities, mental models or the actual gender identity.

On the other hand, you can talk about the less abstract sense of it. For instance, people might talk about the identity of an object, gender-identity or even identity of a situation.

For this project, the definition of the International Civil Aviation Organization[1] is most accurate:

The collective set of distinct personal and physical features, data and qualities that enable a person to be definitively identified from others (ICAO-a, 2015).

The governmental role

Governments around the world take responsibility over identities of their citizens. This 'civil registration' has reached a point where almost all countries in the world keep track of their citizens' birth dates, names, addresses, marriages and deaths. A short analogy will help understand why this happens (Fig.5).

---

1. The International Civil Aviation Organization (ICAO) is an agency that collaborates with the 193 UN member states to reach consensus on international civil aviation standards. Included are standards around identities that count for all UN member states (ICAO-b, 2019).
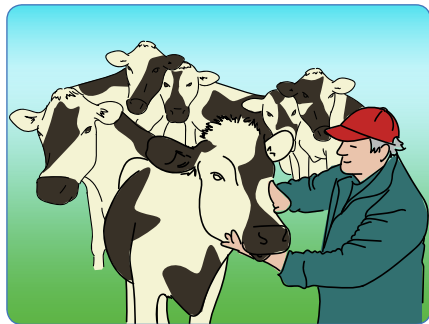
A farmer, Peter, wants to start a farm and buys 10 cows. The first couple of weeks go by and the Peter starts to bound with the cows. He can recognise the cows and has given them names. This way he keeps track of which cow is fed and milked when.

The business starts to grow and Peter buys 90 more cows. Due to their similar looks, the cows get mixed up and Peter loses track of the whole feeding and milking process.
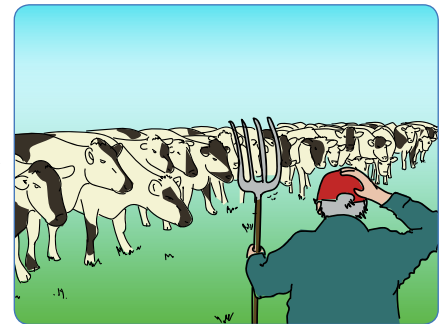
Being a smart farmer, Peter comes up with a system to identify each cow. He attaches a unique tag to each of them and creates a database to keep track of all numbers, feeding and milking programmes. Now, every time Peter buys more cows, he tags them and updates his system.

Slowly but steadily the farm begins to grow and the number of cows increases. Cows are born, get sick, die or get stolen. Some cows start to become aggressive and others might show bad production.

Next to that, some cows lose their tag and others realise they can get additional food by stealing tags.

The variety of required treatment in the hurdle of cows starts to grow and an extensive database becomes more and more important. Peter continuously needs to re-evaluate his system and come up with new methods and ideas to maintain a secure and accurate database.

Fig.5: An analogy on governmental identity management.

Yes, we are all numbered cows. Think of the farm as a country, the farmer as its government and the cows as its citizens. In order to function properly, governments need to know who lives in their country. They have therefore come up with systems to keep track of their population. Sadly, that is not the only reason for governmental identity registration.

Valuable possession

Identity theft,-selling and-falsification have always been a thing. Letting someone else identify as you, can be come out very favourable. For instance, wealthy criminals are paying beggars to serve jail time in their place.

Without registered identities you would have to trust people on their word, and how could one know that you are who you say you are?

An identity is a valuable property that not many people know they own. It is due to this fact, that governments cannot risk having identities particularly or privately organised.

Identity protection

In order to protect peoples' identities, governments and companies constantly innovating the principle of an identity. Laws are pushed by new technologies that enable the amount and required quality of identity properties to increase.

One of these properties is becoming increasingly relevant: biometrics[1]. We all have unique physical properties that can be registered and scanned. For instance, if we return to the farm analogy, Peter could have used the unique spot pattern of his cows as an identification method. Human examples are fingerprints and irises.

With this trend, identities become increasingly bound and unique to their owners and individuals become easier to identify. Hence, identities become harder to steal or replicate.

---

1. An example is the recent commissioning of biometric identification of travellers in Thailand (Thailand-business-news, 2019)

Causes for identity registration

To keep up with their population, many governments in the world utilize laws on obligation of identification. They describe the requirement to be in possession of a valid identity card and to produce this on demand when requested by authorities. Those who are unable to identify or who do not meet the requirements to do so, are in violation with the law.

Next to that, crime and migration cause particular people to be of more interest to keep track of than others. With other words: many countries maintain a parallel criminal and migrant database.

And this is where things start to get interesting for this project.

Fig.6: Snippet from a strip: with correct identification a UFO would be a IFO.

Takeaways
- Identity is the collective set of distinct personal and physical features, data and qualities that enable a person to be definitively identified from others.
- Countries keep track of their population by maintaining identity databases
- Most governments keep track of a parallel criminal and migrant database
- Pushed by technology, governments innovate the principle of an identity, making biometrics become more and more relevant

2. IDENTITY IN THE NETHERLANDS

Although the project was initiated by the Police, it seems that identity enrolment plays a broader role than just for criminals. How about 'normal citizens' or immigrants?

The question arises:

- Is it feasible and desired to design a solution for multiple governmental partners?

To answer this question a top-down approach is taken to sketch a rough[1] overview of the Dutch governmental identity context. Regarding this subject, the Netherlands is relatively advanced on legislation, communication and technological level. The country therefore plays a representative role in the world (Meijden, 2019). This makes the Netherlands a suitable context for this research.

The following research questions are answered:

- Laws: What is lawfully established?

Once that is defined, an in-depth approach is taken on the relevant laws:

- Stakeholders: Who is concerned with the execution of this law?
- People: To whom does this apply?
- Enrolment: When and how are their identities enrolled?
- Data: What happens with their data?

---

1. The time that is required to research this subject thoroughly would exceed multiple graduation projects. For further reading I would advise to consult a recent publication on Dutch identification: (Willemsen, 2019).

2.1. Legislation & Policy

So, what is lawfully established?

A short background on legislation
To define all rules around a governmental process, legislation has been established. Policy is concerned with how legislation should be put to practice. Governmental agencies have been appointed to execute legislation and policy. In order to guide the more complex processes, protocols have been established. They define guidelines, stakeholders, tasks, methods and workflows.

2.1.1. The identity–construct

The government is categorised in multiple ministries of which each takes responsibility for a particular portfolio. Each portfolio is executed by various governmental agencies. A collective of agencies that pursue one or more common objectives is called a chain (Noraonline, 2018). Parties within a chain are often linked by legislation and policy.

In the Dutch government we can find various partners that are concerned with identity related processes. They can be linked through either civil registration, criminal law (the criminal justice chain) and migration (the migration chain).

The identity management within these chains, is defined by law:

1. For everyone: Wet op de Identificatieplicht (Wet ID) (Law on Obligation of Identification)
2. Related to crime: Wet Identiteitsvaststelling Verdachten, Veroordeelden en Getuigen (WIVVG) (The Law for Identification of Suspects, Convicts and Witnesses)
3. Related to migration: Vreemdelingenwet 2000 (The Alien Act)

Although the target group and causes for enrolment vary among the laws, all partners are somehow nationally connected and share many of the same methods, databases and workflows[1]. For example: during identification of a suspect (criminal law), it is check if they have the right to stay in the Netherlands (migration law).

Due to this fact we can define a new national identity related chain: the Dutch identity-construct (Fig.7).

_____

1. This will be elaborated further on in this chapter.
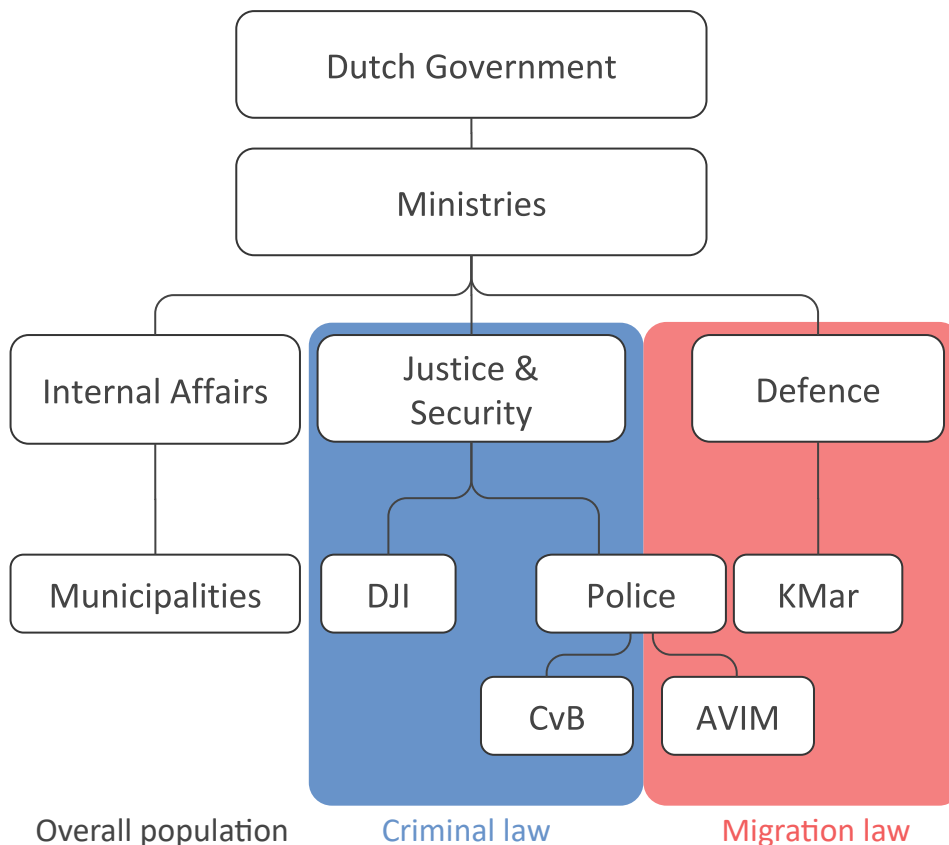
Fig.7: Organisational chart of the identity construct, with most important stakeholders

2.1.2. Identification processes

When a person comes in contact with the government, they want to know who they are. This can be done in various ways. We can define the processes around identity management as follows:

- Enrolment/registration: the process of storing someone's identity.
- Identification: the process of finding a registered identity by measuring someone's properties to match with registered properties (1 on N)
- Verification: The process of finding out whether a property matches an assumed identity (1 on 1)

The collective term 'identity processes' will be used to refer to the above-mentioned terms.

Now that it is defined what is lawfully established, we can dive into the identity-construct. The next three chapters elaborate the various identity laws.

2.1.3. Takeaways

- Legislation: laws around a subject
- Policy: define methods and guidelines to execute the law correctly
- Protocols: process focused guidelines for correct execution of the law
- Dutch identity processes can be linked through civil registration, criminal law and migration law.
- The identity-construct is a collective of governmental agencies that concerned with identification processes.
- Identification is required when someone comes in contact with the government. Enrolment is done when they are not able to identify.
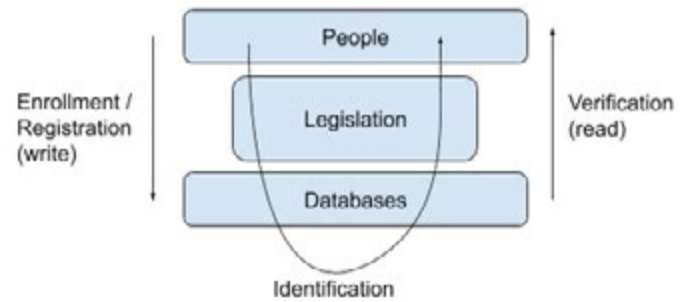
Fig.8: Enrolment, identification and verification visualised
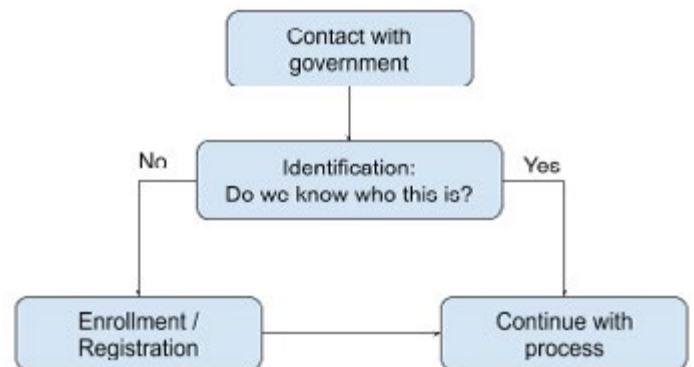
Fig.9: Flowchart of a first identification

2.2. Obligation of Identification

2.2.1. Legislation
The 'Wet op de Identificatieplicht' describes that all Dutch citizens from the age of 14 are obliged to own a valid ID (Overheid-a, 2017). ID-documents contain a unique set of properties, such as personal data a facial photo or fingerprints.

2.2.2. Stakeholders
It is the citizens' own responsibility to comply with the law. Obtaining and keeping up to date of personal data is organised by municipalities. The police responsible for controlling citizens on their identity but can only do so in suspicion of a violation of the law.

2.2.3. Enrolment
The main entry point for identities is the municipality. Enrolment usually happens at birth or at the request of a new ID-document. A (new) document requires personal data and a facial photo. In addition to this, passports require fingerprints as well.

A printed colour facial photo must be provided by the applicant of the document (Rijksoverheid-b, 2019). The photo must meet a strict set of requirements (Rijksoverheid-c, 2019). People usually make these photos at professional photographers or individually at photo booths. The photo is then scanned and stored in a database.

A fingerprint can be registered at the municipality's desks. After this, the print is stored for a maximum of four weeks for production of the document. After issue, the print is solely stored on the chip of corresponding passport.

2.2.4. Storage of data
Photos and personal data are nationally stored in the Basisregistratie Personen (BRP) (Personal Records Database), which the Rijksdienst voor Identiteitsgegevens (RViG) takes responsibility for.

2.2.5. Takeaways

Law	Law on Obligation of Identification
Stakeholders	Municipalities, Police & RViG
People	All Dutch citizens above 14 years old
Enrolment	Through various inputs, at municipalities. Reasons: birth, turn 14 or request new ID-document
Data Storage	Personal data, photo (and fingerprint for passports) in the BRP

2.3. Criminal Justice Chain

2.3.1. Legislation

The 'Wetboek van Strafvordering' (SV) (Code of Criminal Procedure) describes laws about identity registration of for the criminal justice chain.

In October 2010, the new WIVVG (Overheid-b, 2010) was commissioned (justid-a, 2019). A group of chain partners[1] has drawn up a protocol for the implementation of the law in practice: Protocol Identiteitsvaststelling in de strafrechtketen (PIS) (Protocol Identification in the Criminal Justice chain) (J&V, 2015).

This protocol describes five procedures on verification and identification. In most cases, a procedure needs to be followed where biometric data of the suspect play an important role.

- Procedure 1 describes the most basic identification through an EEGG[2] ID-document.
- Procedure 2-4 describe biometric verification, identification and enrolment workflows
- Procedure 5 is executed when further investigation is required.

When procedure 1 fails, procedure 3 is executed

2.3.2. Stakeholders

The following partners play an important role within this protocol[3] (J&V, 2015):

- Nationale Politie (Police)(Dutch National Police);
- Koninklijke Marechaussee (KMar) (Royal Netherlands Marechaussee);
- Dienst Justitiële Inrichtingen (DJI) (Custodial Institutions Agency).

A full list of enrolling, identifying and verifying partners in the criminal justice chain can be found in Appendix K.

---

1. The group is named the CIS: 'Coordinatiegroep Informatievoorziening Strafrechtketen': a collective of governmental agencies in which parties are represented who are concerned with identification in the criminal justice chain.
2. Elaborated in section 4.2
3. Unlike all other connected partners, the ones listed here both enrol, identify and verify. They are also the ones that stand directly in contact with citizens.

The Dutch National Police

The Police is responsible for identity control and the enrolment of suspects. Being part of the Police, the Centrum voor Biometrie (CvB) is the national contact point for biometric related subject. That way, the Police is also closely involved with the definition of new laws.

With the implementation of the WIVVG, the Police and KMar have developed and commissioned the BVID (J&V, 2015): a product that encompasses all required means for identity registration and verification. Use data (Fig.10) shows that 90% of the time, this product is used for the criminal justice chain (SR-processes). Other use data provides that 90% of those processes is executed by the Police.

An elaborate explanation on identification at the Police is provided in chapter section 3.
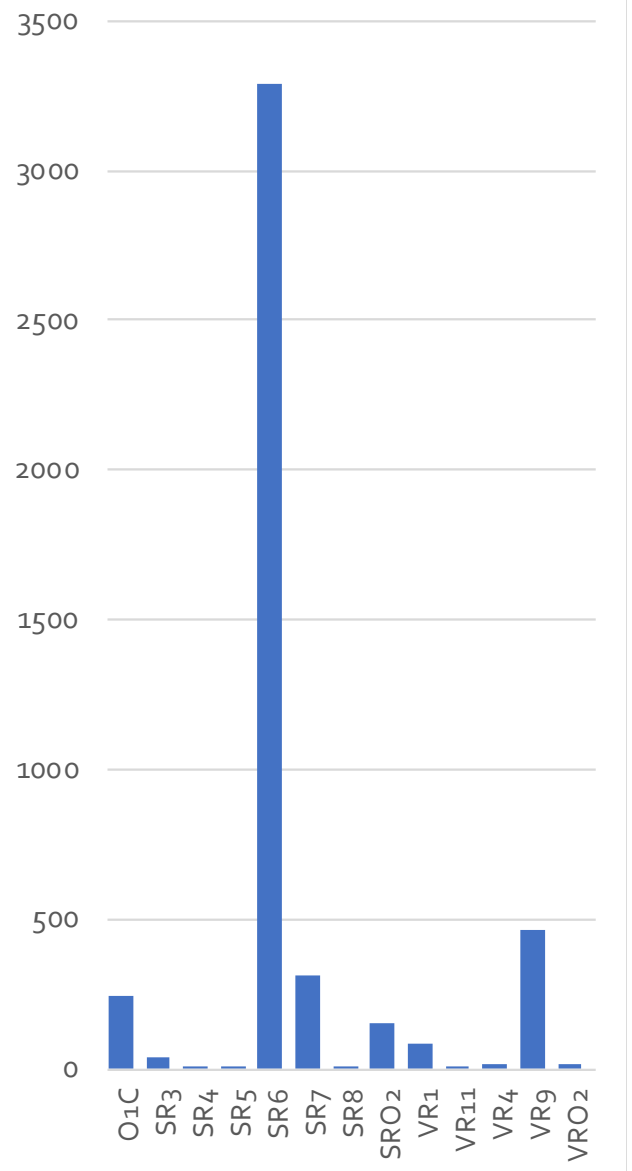

Fig.10: BVID use data from February 2018 (Appendix Y)

Koninklijke Marechaussee

The KMar takes responsibility for border control and is thus more connected to the migration chain. A part of the KMar is the Expertisecentrum Identiteitsfraude en Documenten (ECID). It is the national contact point for ID-document related questions.

Dienst Justitiële Inrichtingen

Although the DJI is a key-stakeholder in the criminal justice chain, they still maintain their own identity databases and methods. To research the opportunity of identity-construct broad implementation, the DJI was researched more thoroughly.

The DJI is responsible for all convicted detainees in the Netherlands. They manage 'their' identities separately, but similarly as the rest of the identity-construct. They re-enrol detainees at arrival and store identity data in an internal database.

The DJI started with biometric identity registration in 2008, which the 'Basisvoorziening Biometrie' (BVB) (Basic Facility Biometrics) was commissioned for. This appliance basically functions the same as the BVID. Back then, it was not feasible to establish product-standardisation with the rest of the identity-construct. Main reasons were (DJI, 2019):

- a lack of development time;
- authorisation restraints;
- communication problems with other databases.

The agency is currently developing the BVB 3.0 and is looking for integration of more biometrics and more collaboration with partners[1]. The DJI is aiming to use advanced verification technologies for internal purposes as well: i.e. medicine provision and room access.

2.3.3. Target group

The initiation of enrolment/identification of a person takes place when they come in contact with the criminal justice chain for the first time. That is, in most cases: being suspected of a crime. Suspects are thus the main target group in the criminal justice chain.

VRIS'er

During an identification, the right of residence of a suspect might be doubted. Only in such cases the operator might consult European databases like EU-VIS[2] (Europa-a, 2019)

---

1. Detainees and their visitors often take part of larger criminal networks. Therefore, they make for a very interesting target group for investigation purposes. They often receive requests from forensic investigation for recent photos of a particular detainee (DJI, 2019).
2. The Visa Information System (VIS) allows particular European

and EURODAC[3] (Europa-b, 2019). This might lead to a case of a 'Vreemdeling In de Strafrechtketen' (Vris'er) (Alien in the Criminal Justice Chain). This forms the link between the criminal- and migration chain.

2.3.4. Enrolment

People in the criminal justice chain are enrolled with the BVID, mostly at police stations. The PIS states that a newly registered identity consists of:

1. The suspect's own statement
2. ID-document
3. Biometric data: Facial photo & 10 (rolled) fingerprints

If the suspect is detained for investigative purposes (explained in section 3.2.1), additional measurements may be ordered in the interest of the investigation SV section 61a (Appendix L). Such measures may include:

- taking photographs and making video recordings;
- taking measurements and prints of palms, feet, toes, ears and shoes.

2.3.5. Storage of data

In case of a new enrolment, an identity is numbered (Strafrechtketennummer (SKN)) and an 'ID-record'[4] is created. This file holds data that is collected during the enrolment. The number is the key to link data through databases.

The ID-record is stored in the SKDB (Strafrechtketendatabank). It holds all personal data and photos of criminals. Fingerprints are stored in the HAVANK[5] and VVI[6] databases (justid-b, 2019).

Recent developments show that these databases will be fused together increasingly in the near future (Riemen, 2019).

---

countries (Schengen States) to exchange visa data.

3. The EURODAC regulation establishes an EU asylum fingerprint database.

4. Not to be confused with a criminal record (strafblad). That is a summary of all one's criminal activities. The ID state is just a momentary registration of one's identity.

5. HAVANK: Het Automatische Vinger Afdrukken Systeem Nederlandse Kollektie is a database that holds all finger-, footprints and crime scene traces. Since the automation (2006-2010), storage of new (finger-) prints has shifted from ink to digital.

6. VVI: The Voorziening voor Verificatie en Identificatie is the database that is used for fingerprint verification by the Police.

2.3.6. Takeaways

Law	Law for Identification of Suspects, Convicts and Witnesses
Partners	National Police and Royal Military Police
People	Suspects, convicts and witnesses
Enrolment	With BVID or mobile ID-suitcase in case of VH-crime or unable to identify
Data Storage	Personal data, ID-document, Photo, 10 rolled fingerprints and possible other biometrics, stored in multiple databases

2.4. Migration Chain

2.3.7. Legislation

In 2013, the Vreemdelingenwet 2000 (Alien Act) (Overheid-c, 2019) was changed to add biometrics as an identification method and to comply with European law on aliens (Eerstekamer, 2019). The Protocol Identification & Labelling (PIL) describes the method for identification and verification in asylum, border control and supervision within the migration chain.

2.3.8. Stakeholders

The most prominent registering & identifying partners are:

- Police:
  - Vreemdelingenpolitie (AVIM[1])
  - Zeehavenpolitie (ZHP) (Sea Harbour Police)
- KMar

A full list of executive partners can be found in Appendix M.

2.3.9. Enrolment

The enrolment of a person only takes place at the start of those processes, in which the person comes into contact with the migration chain for the first time. Examples are the application for asylum or request for visa. A full list of processes can be found in Appendix M.

---

1. AVIM stands for Afdeling Vreemdelingenpolitie, Identificatie en Mensenhandel (Deparment of Aliens Police, Identification and Human Trafficking)

Request for asylum

The most common cause for enrolment is the application for asylum. After admission by the IND, refugees and asylum seekers are being registered by the AVIM. They are enrolled by registering ten rolled fingerprints, a facial photo and an ID-document. Again, the BVID is used in execution of this process. Use data from Fig.10 points out that 10% of the time, this product is used for migration related processes (VR-processes).

Border control

The KMar and Zeehavenpolitie take responsibility for border control. They register aliens at Dutch airports and harbours. In preparation for immigration to the Netherlands, KMar and AVIM has recently started registering at international airports as well (Athens, Rome and Ankara) (VreemdelingenVisie, 2017). Registration across the border is done with mobile ID-suitcases.

2.3.10. Storage of data

During registration, foreigners receive a 'vreemdelingennummer' (v-nummer) (alien-number). The v-number, their document, personal data and biometrics are then stored in the BVV (Basisvoorziening Vreemdelingen).

2.4.1. Takeaways

Law	Vreemdelingenwet 2000
Partners	Police (AVIM, ZHP) and Royal Military Police
People	Asylum seekers, (illegal) foreigners
Enrolment	With BVID or mobile ID suitcases
Data Storage	Personal data, Photo, 10 rolled fingerprints in BVV

Fig.11: Police officers talking with a inhabitant of the asylum-seeker centre in Echt, Netherlands

2.5. Conclusion

We can now reflect on the initially stated question: Is it feasible and desired to design a solution for even more governmental partners?

It is feasible and desired? Yes:

- There is already one connected identity-construct, yet it is only not utilised that way;
- Throughout the identity-construct we see the same requirements for enrolment (document, fingers, face, personal data). It is envisioned that the requirements of biometric data originate from the alien and criminal chain and slowly shift towards the civil law;
- Enrolment and identification in the criminal- and migration chain are already done with the same product;
- We observe that standardisation in the identity-construct is already initiated (use of BVID and database structure);
- We can already see various other identity systems at municipalities and the DJI. For verification, an even higher variety of methods is used;
- It seems that identities become more digital and increasingly biometrically registered;
- There lies a huge opportunity in collaboration with the DJI;
- Standardising enrolment and verification methods will increase speed and hit chances (section 4.3.2).

Is it feasible as a graduation project done by one person? Most likely not. However, we can reach the whole chain if we focus the highest requirement: suspect enrolment by the Police:

- The Police is the most prominent identifying partner in the criminal- and migration chain;
- Suspect enrolment is the most common process in the criminal justice chain (section 2.3.2);
- Demands on types and quantity of criminal identities are the highest in the identity-construct (section 3.1.4);
- Suspects form the most difficult target group (section 3.4.2).

Concluding, it can be stated that a product that suits the Police, should work for any connected agency.

3. IDENTIFICATION AT THE DUTCH NATIONAL POLICE

In this section we narrow down from an overall Police organisational approach, to one specific identification process.

- What is the Dutch National Police?
- Where does identification come to play?
- What people/stakeholders are involved?
- What product is used to do that?
- How is that product used?

3.1. Organisation

Until 2013 the Police consisted of 25 individual regional corps. During the reorganisation that happened in that year, the police became the 'Dutch National Police': one national organisation. This did not go without any issues (NRC, 2019), but the nationalisation has opened opportunities (like this project) as well. The modern organisational structure of the Dutch National Police can be found in Fig.13.
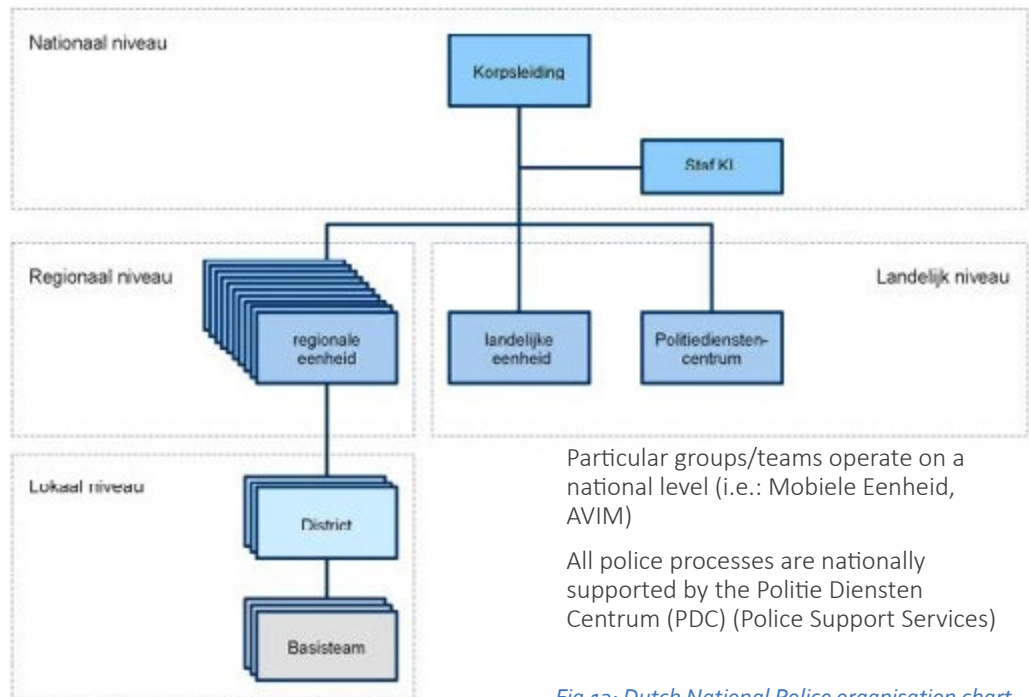
Regional units manage on a level of provinces and the larger cities. It is subdivided into districts that in turn consist of various 'basic teams'. Districts and basic teams are more commonly known as Police stations.

Particular groups/teams operate on a national level (i.e.: Mobiele Eenheid, AVIM)

All police processes are nationally supported by the Politie Diensten Centrum (PDC) (Police Support Services)

Fig.13: Dutch National Police organisation chart

3.1.1. Company goal, pillars and vision

The Police main goal is "make the Netherlands safer". This is substantiated by their pillars[1], the goals that are most applicable for this project are defined here.

Starting off, in their mission they state to be always watchful and helpful. The organisation describes reliability, connectedness and honesty are three of their core values. They envision a result-orientation approach, collaboration with citizens, sharing of information, feedback and transparency.

A full overview of the Police's pillars can be found in Appendix N).

3.1.2. Company technology trends

Research has uncovered some trends that are interesting for this project. They are elaborated below.

Becoming increasingly digitally connect with citizens
The Police is working on a vision around digital connectivity[2]. The vision formulates action points on implementation of more digital and mobile processes. It describes that the Police wants to focus more on transparency and privacy. Next to that it formulates that interaction and innovation with the citizen as one of their key focus points.

Implementation of mobility
In 2013, a programme was commissioned that prioritises modernisation of information appliances[3] (Politie-a, 2017).

Ever since, the Police has worked on mobility in their processes. Examples are:

- The implementation of the MEOS-app (Mobile more Effective on the Street application in 2015, which combines many on-the-street processes in one application.
- The commissioning of a mobile identification appliance 'GRABBA'. Recently new versions have been put to practice for testing[4].

The Dutch Police stands internationally at the forefront of working with mobile solutions that came about under this programme (Politie-b, 2017). They believe that mobility is the future and are convinced to implement it in more and more processes in the near future (Meijden, 2019).

3.1.3. Takeaways

Police goal: Making the Netherlands safer, through:

- Reliability, connectedness and honesty;
- Result-orientation, transparency, feedback;
- Collaboration, interaction and innovation with the citizen.

Interesting company trends:

- Digital connectedness with the citizen;
- Integration of mobility in processes.

---

1. A full description of their pillars can be found in Appendix A.
2. The document is not published yet and thus confidential.

3. Bijgesteld Aanvalsprogramma
4. Based on a discussion with a colleague at the Police IT Department.

3.1.4. Police identity-organisation chart

Fig.14 provides an overview of the police organisations that are connected to identification processes. From left to right:

- 90% of all criminal justice chain registrations happen at police stations. Together with the 'arrestanten complexen' (arrested complexes), this is where most of the BVID's are located.
- The Zeehavenpolitie (ZHP) and Vreemdelingenpolitie (AVIM) take responsibility for identity processes in the migration chain.
- The Landelijk Team Forensische Opsporing (LTFO) (National Team Forensic Investigation) is concerned crime scene investigation. They store traces and are occupied with identification people involved in crimes.
- The Centrum voor Biometrie (CvB) is involved with research on technological level and legal innovations.
- The Politie Diensten Centrum ICT (PDC ICT) makes sure everything keeps working and is occupied with the digital development.

Due to their important role in the identity construct, the CvB was visited. Unlike the others, this partner has not been discussed yet. Elaboration is provided below.

Centrum voor Biometrie

This partner is the national governmental contact-point for biometrics. They are a loyal customer of identity databases for purposes of investigation. The agency is responsible for HAVANK, which is the database that holds all recorded fingerprints and traces since the beginning of registration in the Netherlands. It is aimed that this becomes the national biometrics database in the future (Riemen, 2019). Regarding data on suspects, for them only one rule counts: the more, the merrier (Kraus, 2019).

The CvB plays an important role in defining the types and requirements of biometrics. Substantiated by technological developments, they are also narrowly involved in the (international) development of new laws and protocols.
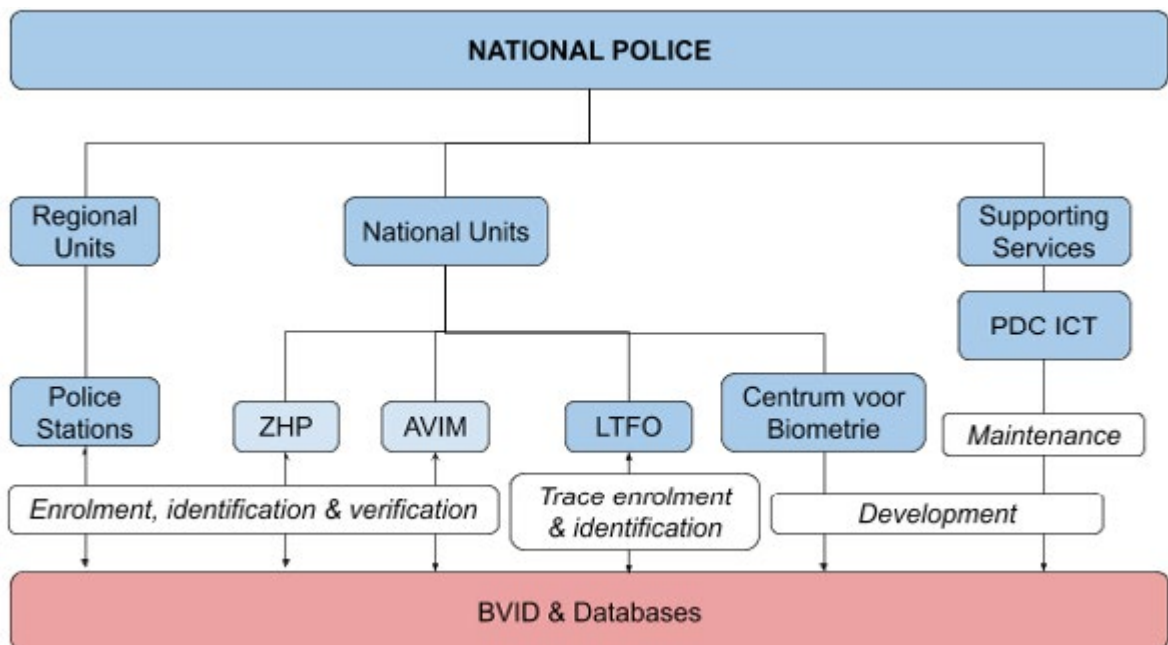

Fig.14: Organisational structure of identity related Police organisations

3.2. Identification Processes

In the organisational structure of the Police, we can point out various sub-organisations that are concerned with identity management. To find out more about them we answer the following questions:

- What initiates a identity processes?
- How is that organised?
- How is that executed?

3.2.1. Cause for identity examination

Within Police processes, most common cause[1] for identification is when a person is suspected of a crime. In case that the person in question is unable to identify or is suspected of a temporary custody, that person is taken into custody. Then we are talking about an arrest, which initiates a more elaborate process: identity examination ('identiteits-onderzoek').

Voorlopige Hechtenis (Temporary Custody)
If someone is suspected of a harsh crime[2], an order for Temporary Custody (Voorlopige Hechtenis(VH)) is given. In police-jargon, such crimes are referred to as a 'VH-feit' (VH-fact). In suspicion of a VH-crime, the suspect in question is directly arrested.

An explanatory overview is given in figure Fig.15.

---

1. There are other causes for identification, but they are so infrequent that they won't be addressed in this project.
2. Wetboek van Strafvordering, Section 67.1

3.2.2. The arrest

As mentioned earlier, the identification process is a part of an arrest. Everything that happens before and after and arrest is described here.

Holding vs. arrest
An arrest (arrestatie/aanhouding) is often confused with a holding (staandehouding). The difference is clarified by the following quote:

"An officer's "brief and cursory" holding and questioning someone is a detention. An example is a cop stopping someone who is behaving suspiciously in order to ask a few questions. The suspect isn't free to leave, but he also isn't under arrest. [...] An arrest, on the other hand, involves the police taking someone into custody through a more significant restraint on movement. The quintessential example involves the use of handcuffs and an advisement that the suspect is under arrest (NOLO, 2019)."

Arrest Process
Once a person is unable to identify or in cast of a VH-fact, the arrest is initiated. The following steps are taken:

1. Transportation to the police station

2. A body examination is executed

3. Identity examination

4. Initiation of prosecution:

   o Hearing of the assistant public prosecutor (Hulp-Officier van Justitie)

   o Temporary custody of maximum 9 hours

Fig.17 provides a graphical overview of the process.

Fig.15: Flowchart of how identification takes place
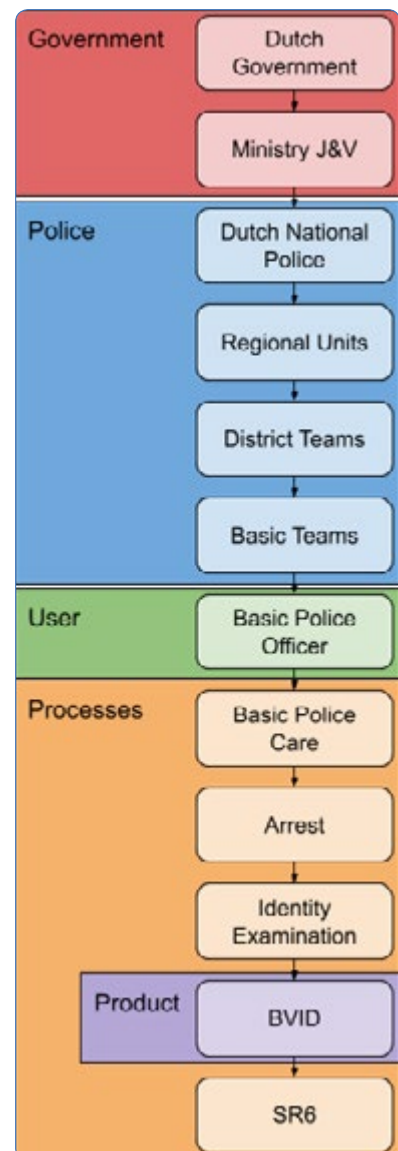
Fig.16: Graphical representation of how the BVID is linked to the government, and everything in between

3.2.3. Identity examination

Identity examination is thus a primary part of an arrest. How this is executed depends on the situation, but at all times, the BVID is the facilitating product.

After booting up and logging in, the operator is presented with various workflows for various situations. The most elaborate and frequently executed workflow is the enrolment of a new suspect (Laar, 2019). This workflow facilitates the execution of procedure 3 & 4 of the PIS:

- Document scanning
- Fingerprint enrolment (repeat until good quality)
  - 4 left & 4 right
  - Two thumbs
  - 10x individually rolled fingerprints
- Taking a facial photo (usually three photos are taken after which the best is chosen)
- Complement personal data

3.2.4. Takeaways

Within the Police, the following organisations are concerned with identification in the criminal justice chain:

- District teams & Basic Teams
- Landelijk Team Forensische Opsporing (forensic investigation)
- Centrum voor Biometrie
- Politie Diensten Centrum ICT

Processes:

- The most common cause for identification is an arrest.
- Among other steps, identity examination is a part of the arrest process.
- The BVID is the primary product regarding identification at the Police.
- Suspect enrolment is the most common executed identity process.
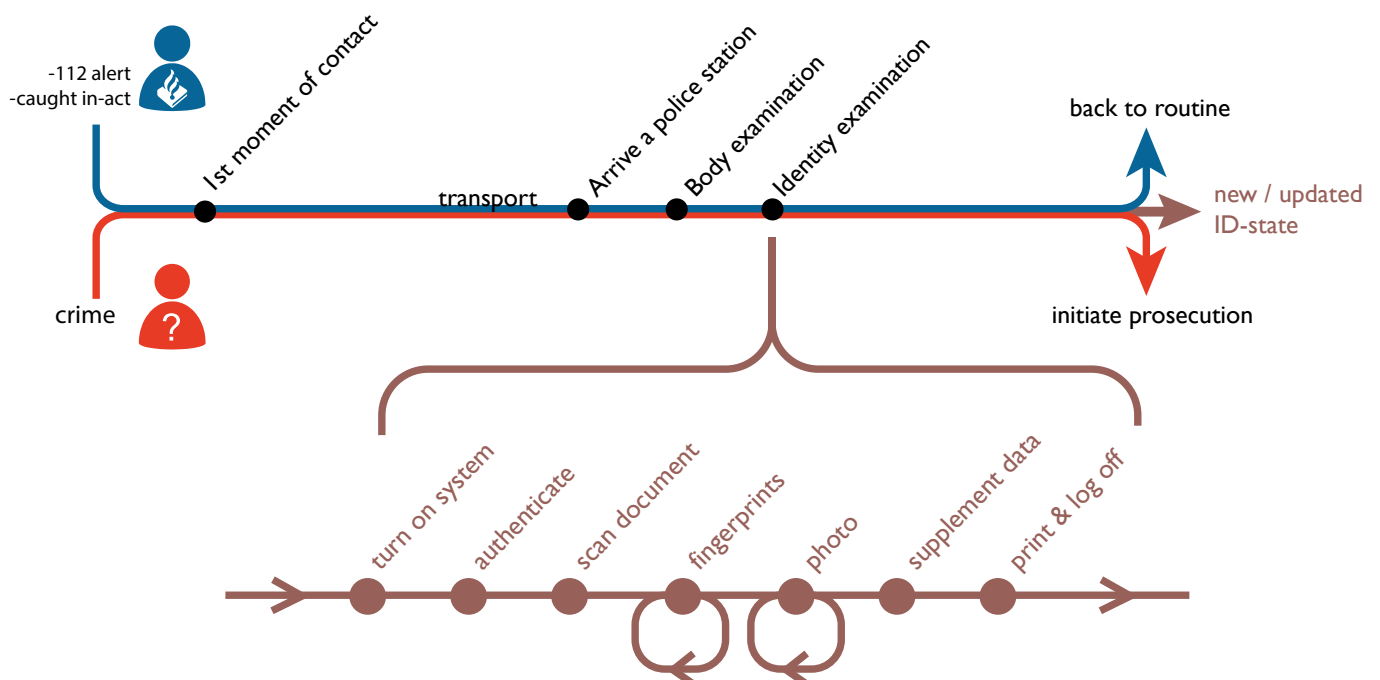
Fig.17: A chronological flowchart of an arrest.
Identification is enlarged.

Fig.19: Enrolment of a suspect

Fig.18: BVID batch setup at AVIM Rotterdam. Note
the amount of instruction A4's hanging

Identification at the Dutch National Police

3.3. Product Analysis: BVID

An explanation of the BVID is provided by answering the following questions:

- Why was the product needed?
- What is it and how does it work?
- Where can we find it and what are the effects of this environment?
- How and why did the product change over the years?

3.3.1. History

The commissioning of WIVVG in 2010 caused the Police to put up a team of 20 developers and chain partners to develop a biometric identity enrolment facility. It took roughly 7 years before the product was nationally commission, because of the following reasons (Meijden, 2019):

- Digital development (accounts, databases, authorisations, partner & European connections, application design) & testing
- Product development
- Development of protocols and legal changes
- Implementation of identity rooms in all police offices

For production of the concept, an aluminium- and furniture manufacturer was contacted. A list of requirements[1] and rough sketch of the concept formed the starting points for production. Product and software development were outsourced at first but has been acquired in-house ever since (Meijden, 2019).

The successful pilot in 2010 lead to the national implementation of 450 appliances in 2015 (Rijksoverheid-a, 2019). Every police station appointed a specific room that had to be rearranged, painted and renovated to meet the strict requirements of the new appliance.

Consequently, the Police commissioned the 'Programma voor Identificatie in de Strafrechtketen' (Progis[2]) (Program for Identification in the Criminal Justice chain) to guide the implementation of the protocol and the BVID in the right direction.

The portable BVID
A mobile version of the BVID has been commissioned for remote applications:

- The Police uses it for backup in case of a defect BVID and for training at the Police Academy. It functions as well to pilot new components for future BVID implementation.
- The KMar uses it for identification across the border, before migrants take their flight to the Netherlands

In collaboration with an identity products specialised agency, a lot of development is going on around this ID-suitcase. The demand has been rising since their implementation in 2015: recently 20 new suitcases have been ordered for the KMar.

---

2. It is for this reason that the BVID is being referred to by officers as the 'Progis zuil'. Executing an identification process is more commonly known as 'zuilen' or 'Progissen'.

---

1. For this project, this list was only used for inspiration and therefore not included in the report.

Fig.20: The mobile identification suitcase of the Police and the KMar

3.3.2. Functionality

Below, functionality of the BVID is described based on its components.

Two modules
The BVID can be split up in the parts: the participant module (Fig.21 left) and the operator module (Fig.21 right).

Fingerprint scanner
The fingerprint scanner is mounted close to the participant for enrolment of flat and rolled fingerprints. The arm towards it directly defines the participant's minimum distance to the camera.

Camera
A DSLR camera is used to make the facial photo. Two external flashes are mounted to overrule the environmental lights.

Document scanner
The document scanner reads out all necessary data for authentication. At places where foreigners are registered, and additional A4 scanner is added for specific documents.

Computer
A regular desktop computer is used for calculating power and connection to the internet. In order to communicate with the PC, all components are connected to a central USB hub.

Desk
The desk provides a workspace for the officer. In most places it is also used as a quick dump spot for i.e. documents and cleaning items.

Panes
Two panes are mounted to provide good circumstances for a facial photo. The back-pane functions as background. It is prone to a minimum distance to prevent cast shadows of the participants head. The top pane covers context light and reflections.

Height adjustment poles
Both modules are provided with linear actuators, to customize the working height to its users. From the participant's side, connections run through this pole towards the computer.

Migration related components
To scan alien documents, an A4 scanner can often be found at migration related locations. Also, signature pad can be found there.

3.3.3. Operation

The system is operated by executing various workflows that apply to different types of identity examinations. The application provides processes for enrolment, verification or document examination for both Criminal law and Migration law.
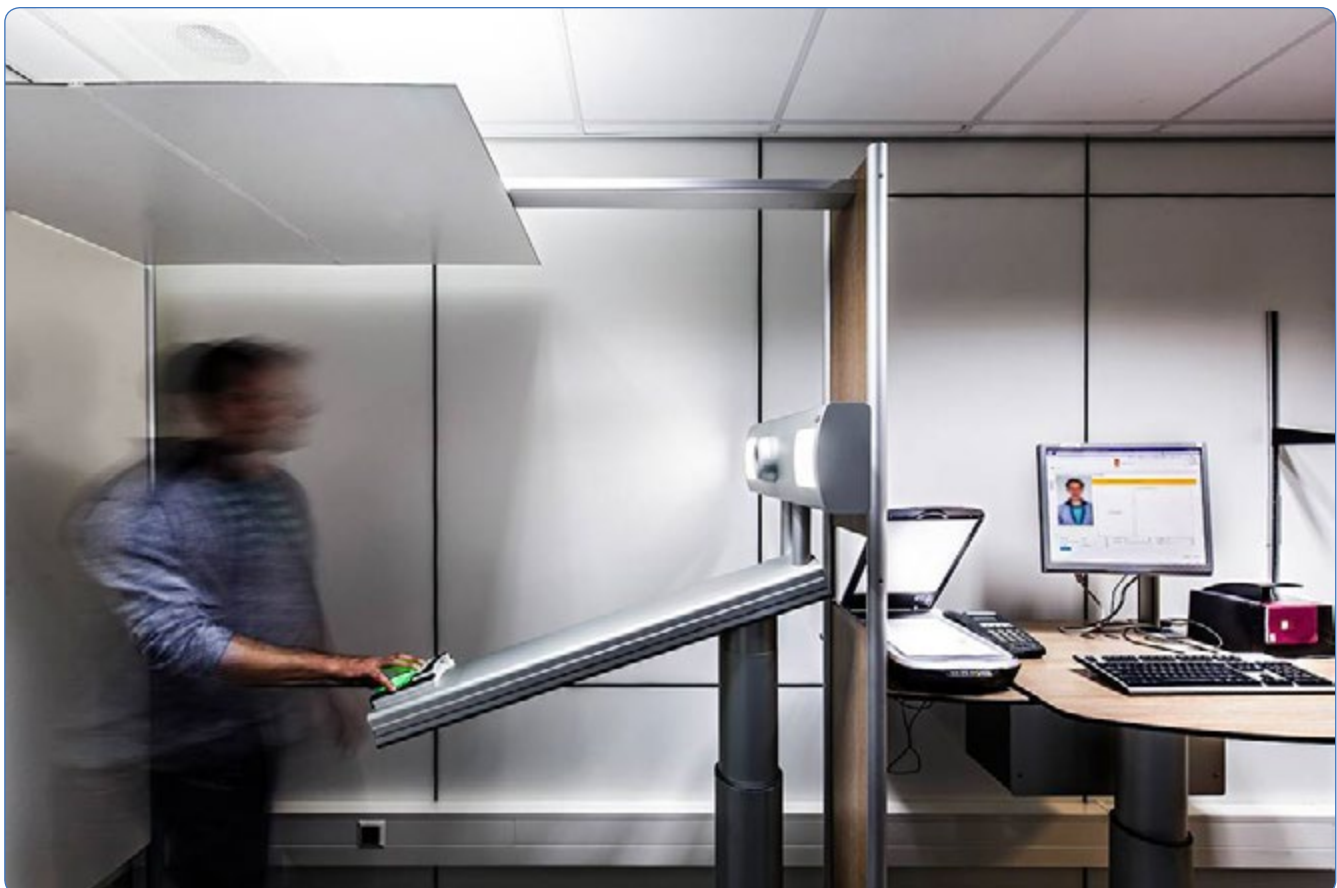

Fig.21: Side-view of the BVID

3.3.4. Product Environment

Distribution in the Netherlands
A total of around 450 BVIDs are commissioned at multiple places throughout the Netherlands. Every Police station has at least one BVID commissioned, varying from 1 at most police stations to around three in the larger ones. The AVIM also operates a couple of them for migration purposes. Lastly, the KMar uses BVID's at each of their brigades.

Identity rooms
To function properly, the room a BVID is placed in line with the strict sterile requirements[1]. Therefore, throughout the years, the Police has been transforming rooms into dedicated identity rooms. Lighting and wall colour are standardised, reflections caused by windows and walls are eliminated and unnecessary objects are removed from the rooms.

The placement of the BVID itself depends on the officer's safety as well. The officer should be closest to an exit and remain out of direct reach of the suspect while operating the computer. Also, it is aimed for that loose objects are out of the suspect's reach during enrolment (Appendix R).

Additionally, the officer's module is placed as such, that the display is out of the suspect's line of sight. This is due to the confidential information that is being shown on the screen.

3.3.5. Life cycle

In order to design a product that fits the current context, the life cycle of the BVID was analysed.

Development
Currently, most development is done on digital level. Examples are: developing the application, updating devices and digital user experience. It is done by a team of software developers, testers and a UX designer at the Police IT Department in Odijk.

On product level, development is done like the rest of the police: very responsive to problems. Repetitive defects or component upgrades are the main cause for design alterations. They are being handled by the Functioneel Beheer (Business Information Management) team in Odijk.

1. Mostly caused by the requirements for facial photography and the presence of (potential) criminals

There is no on-going (proactive) product development on a stationary enrolment facility.

Production, distribution and placement
Production of the facility is done by an aluminium and furniture specialised manufacturer. They are as well responsible placement of new facilities for larger maintenance.

Monitoring
All maintenance incidents are being recorded nationally. The data is currently used as a backlog, but not analysed for development.

In May 2018 was the Police started to monitor the usage as well. This gives insight on location, lead times and login frequencies. We can therefore analyse for instance the amount of asylum seeker registrations in Ter Apel, migrant registrations at Schiphol by the KMar or the average registration time of suspect in Delft. The data is currently being analysed mainly to evaluate the impact of digital developments. The goal is to use this data more pro-actively for development as well.

Updates and versions
Throughout the years the product has undergone small upgrades, refurbishments and updates. The causes form interesting improvement points for the next design. Examples are:

- The release and implementation of new versions components
  - The camera has been changed 4 times
  - The mount hole on the camera new model was replaced
- Changing the orientation of the fingerprint sensor.
- The implementation of new modules necessitates an upgrade to USB 3.0, having to replace all USB-hubs

End of life and refurbishments
In an interview, the BVID was described as a composition of multiple sub-products (LO, 2019). It is therefore only declared as end-of-life when it must undergo too many repairs or upgrades. In such a case, the manufacturer replaces the BVID with a new one and refurbish all old components.
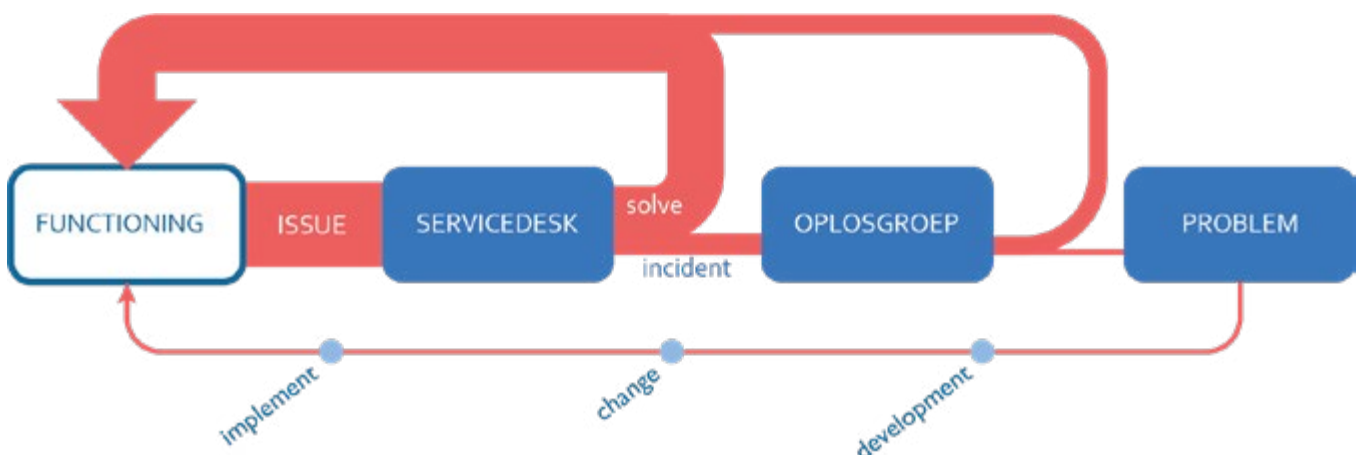

Fig.22: Standard maintenance procedure and estimate flow of incident numbers (red line thickness)

3.3.6. Maintenance & Prio1's

One of the motives for this project was the high number of priority-1 incidents (Prio1's) that were caused by the BVID. An analysis has been conducted to identify the consequences for this project.

- What is a priority-1 incident?
- What causes the BVID priority-1 incidents?
- What can we do about it?

Standard maintenance procedure
So, what is a priority-1 incident? Whenever an issue occurs, employees reach out to the Service Desk, who filter out most of the troubles. If they are unable to solve the issue, it becomes an 'incident'. Incidents are handled by the 'oplosgroep' (resolving group) and picked up by the 'Lokale Ondersteuning' (the Police internal technical maintenance department). Larger incidents are handled as 'problem', which initiates a new development process[1].

A Priority-1 is an incident type, that makes it unable to execute a primary police process because of a defect. An incident is granted such a priority when it meets the following criteria:

1. A primary process cannot be executed
2. The functionality is directly needed
3. It is not locally resolvable
4. There are no fall-back options

Only few processes at the police are prone to priority-1 notifications. Their urge usually results in high costs, which is the reason why these incidents are being monitored strictly. An arrest is one of those primary processes and identification is a mandatory step in that process. Due to the time limitation of the detainment of a suspect, the inability of identification is handled a priority-1 situation, making the BVID a critical product.

Ownership
Another cause for defects is that no one is assigned at police stations to take the responsibility over the BVID: it doesn't have an owner (LO, 2019). The absence of a local BVID expert is assumed to cause for a lack of maintenance and available knowledge.

BVID incidents
Now the next question can be addressed: What causes the BVID priority-1 incidents? Data from January 2018 to June 2019 provides us with statistics on all incidents that are related to the BVID. From the 5340 reported BVID incidents, 166 became a Priority 1 incident.

All these Prio1's have been analysed to find the causes. Due to inadequate or lacking documentation it was unable to define the cause of 66% of the incidents. Although it was sometimes possible to find what the incident was related to, there was no specific cause to work with.

It seems that this is related to the fact that technical support receives little to no education on the BVID. Maintenance on the BVID falls right in the same package of tasks as the repair of a printer or a door lock.

Fig.23: Incident cause spread (January 2018 to June 2019)
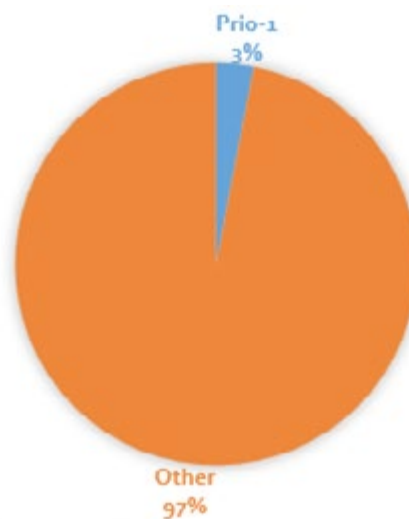
Fig.24: BVID incident distribution (January 2018 to June 2019)

Conclusion
It seems that at a maintenance level, the Police handles a complex product like this as a printer. When incidents are handled that way by untrained people, inadequate work is almost guaranteed.

Concluding, there is insufficient monitoring of the causes of defects to formulate design improvements on. Also, many causes are related to digital systems, which exceeds the scope of this project. The reduction of priority 1 notification is not directly linked to the reduction of defects, but also by reducing the dependency on the product. Solving the known causes won't be the key to improving the BVID. But it can be strived for to anticipate Prio1's, by keeping the priority-1 criteria in mind when designing the next concept.

---

1. An example: during this project, new document scanners were commissioned nationally. An error in the license caused for many priority-1 notifications. A small development cycle resolved the issue after a couple of days.
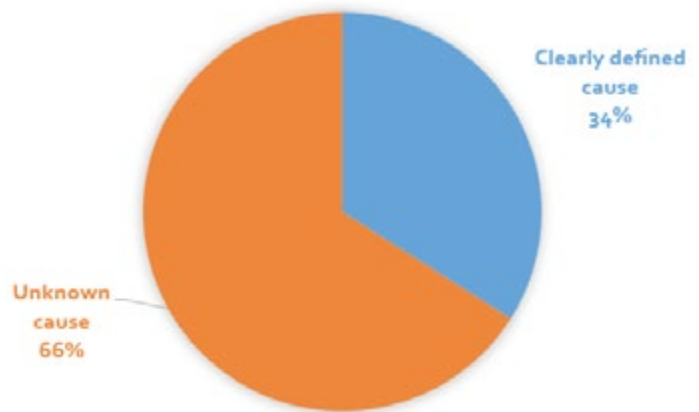
3.4. The Users

This section shines light on the users of the BVID: who are they and what do they do?

3.4.1. The operator: police officer

To define who operates the BVID, a definition is provided by law:

> "The civil servants, referred in section 141, and the police officers, referred to in section 3(1)(b) of the Police Act 1993 [...], who are also special investigating officers as referred in section 142, shall establish the identity of the arrested suspect in the manner referred to in section 27a(1, first and second sentence)."

Fig.25: Wetboek van Strafvordering Section 55c: definition of the operator

Though this gives still too little insight on who the operator is. To determine who we need to focus, we can define our most frequent operator by analysing the BVID use data. In section 2.3.2, we concluded that 90% of the criminal justice chain processes is done by the Police, at police stations. Suspect enrolment is a part of the arrest process, which a basic police officer (basis politieagent) takes responsibility for. This makes the officer our key operator.

It is the officer's main job to perform 24/7 'basic police care' (basispolitiezorg) (Politie-c, 2019). That includes:

- Daily police supervision: the presence of the police on the street prevents offenses and crimes.
- Prevention: tips to prevent burglaries, for example.
- Traffic: Alcohol controls, traffic accident investigation and advising the municipality on traffic measures (for example, on adjusting speed).
- Investigation and forensic investigation: for example, detectives investigate theft and burglary, while a forensic expert investigates DNA traces.
- First aid assistance
- Enforcement of laws and regulations in the field of weapons and ammunition and closing times of catering establishments and shops.

Anyone who wants to become an officer needs to pass the Police Academy[1] (Politie-d, 2019). Based on the strict admission requirements, a police officer must meet the following criteria (Politie-e, 2019):

- An age of 18+
- A Dutch nationality and speak Dutch fluently
- VMBO, HBO or WO educated
- Being mentally stable and no psychological issues in the past
- High endurance and physically fit
- Clear eyesight and independent of routine medical attention

Usage statistics
Based on use data from 2018, it was concluded that (Broekhuis, 2019):

---

1. The academy provides all kinds of educational programs for officers to specialize in.

- 35.000 people are authorised to use the BVID, of which roughly 10.000 never logged in
- Those who log in, do so 1.4 times a month on average
- Around 15% is responsible for half of all registrations, they log in more than twice a month
- 58% logs in less than once a month

Trend: Acceptance of digitalisation
Whereas the younger, more digitally advanced generation of officers increases, the older traditional generation shrinks in numbers. This results in the overall increase of acceptance of processes that involve digital systems (Appendix J).

Nine years ago, usage of the BVID became a part of the Police Academy programme. Meaning that everyone who has been working for less than 6 years for the Police, accepts 'Progissen' as a standard step in the arrest (Appendix J). For the older generation it is often still experienced as an extra step and a barrier to overcome. They like to 'leave it to the youth'(Appendix H).

Takeaways
- Officers must switch rapidly from a diverse set of tasks, that each require precision and very much attention.
- A large portion of the users must find out the functionality every time of use. Use is more and more accepted among officers.

Fig.26: Police officer

3.4.2. The participant: the suspect

The participant of the BVID is in most cases a suspect. Law provides the following:

Demographics
By law, everyone above the age of 12 is prosecutable. Since everyone can violate the law, theoretically speaking, everyone above the age of 12 can become a suspect and

> "Before prosecution has been initiated, a person shall be regarded as a suspect when a reasonable suspicion that he is guilty of having committed a criminal offence can be derived from the facts or the circumstances."

Fig.27: Wetboek van Strafvordering, Section 26.1: the definition of a suspect.

thus a participant of the BVID. Statistics show that most suspects age from 25-45 years. Roughly 80 is male (CBS, 2019).

Recidivists
A convict who re-offends the law is called a 'recidivist'. They are thus familiar with the BVID. Although they are already registered, recidivists are still brought to the BVID for identification. Some convicts are so familiar with this process, that they have to describe to the officer how the system works (Appendix J). Around 50% of the participants is familiar to the Police (Laar, 2019), and thus with the BVID.

Mental state
Contrary to any other identifiable person in the identity-construct, a suspect has no personal benefit from being enrolled. In most cases, cooperation would even work in their disadvantage and is by law, not even obligated.

A suspect's mental state can vary enormously. They can be under the influence of alcohol/drugs, have a very

aggressive attitude due to a fight on the street or become drowsy during night-time hours. With such mental states, there is a maximum after which the Police declares the participant unable to cooperate with. The investigation process is then extended until the participant is cooled down or rested.

Usage statistics
In 2018, 158.890 suspects were registered in the Netherlands. Over time we see an steady decrease of registrations: the number is halved since 2005 (CBS, 2019).

There is no individual use data like that of the officer, but it was concluded that 50% of the participants have used the BVID before.

Ethics
I'd like to point out that our participant is not (yet) a criminal. In judicial terms, a name 'offender' or 'convict' (in common language: criminal) is given only after persecution. As stated above, it is hard to say how many suspects 'become' criminals. But, at the moment of identification only one rule counts: innocent until proven guilty, and that is how the participant must be treated.
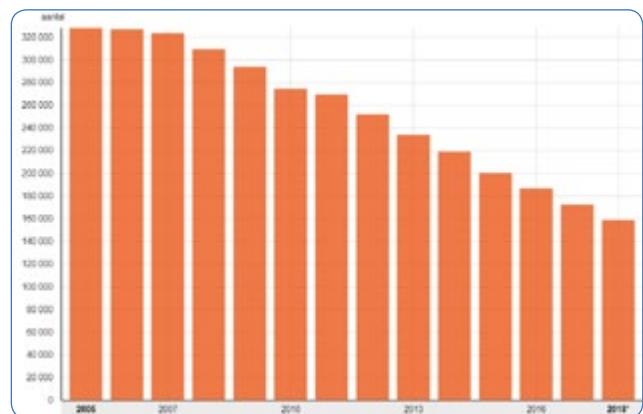

Fig.29: Yearly total of registered suspects in the Netherlands (CBS, 2019).

Fig.28: Officers and possibly a suspect

3.5. Interaction with the BVID

So, now that it is clear who the users are, how do their interact with the BVID?

3.5.1. Interaction between the users

To evaluate the interaction, we analyse the most common use workflow of an BVID (Fig.30).

Currently, the interaction takes place mostly as visualised in Fig.31: the participant takes on a passive object-like role that follows instructions. Interaction with the product has a large sense of one-way traffic: everything goes 'via' the operator, they say what to do and not to do.

If we split up the identity registration process for both users, we can determine the phases of use (Fig.32). This visual forms the basis to describe the individual interactions.

It must be noted that the bound between the users is initiated on the street already. The relationship can thus be of many natures when the identification process is initiated: hostile or kind. Still, violence and aggression during identification are very rare (Appendix T) and in case of a very aggressive participant, they let them cool down for a while. So, the prior built up bound will be regarded for now.

Information on the experience of the users was acquired through interviews, observations and personal communication with stakeholders (Appendix J, Appendix H). With the insights, a value proposition canvas (Appendix W) could be filled in to elicit the following gains and pains.

Main bottlenecks for both users can be found in Fig.32.

Fig.30: The workflow of a suspect enrolment (view page 29 for enlarged version)

Fig.31: Current interaction between operator, product & suspect

3.5.2. Operator interaction

At the BVID, the operator's main job of the operator is to execute the identity registration process.

Gains
- Delivering justice
- Making the Netherlands safer
- Acquire job satisfaction
- Finding an important match

Pains
- Being forced to follow a strict procedure
- Being in danger of an aggressive suspect
- Losing status by:
  ◦ Portraying incompetence in executing your work
  ◦ Being held back by defects
- Losing time
- Experience high dependency on something you have no power over
- Being taken out of the police workflow
- Lack knowledge on the status of the BVID during arrival

Furthermore, a user test conducted by Zahra Broekhuis concluded the following user desires (Broekhuis, 2019):

- Reduce the required external instructions
- Facilitate a simple and quick process
- Underline the importance of identification

3.5.3. Participant interaction

During the process, the participant's main task is to provide biometrics.

Gains
As mentioned before (section 3.4.2), the suspect currently does not gain anything from being registered. We can thus try to implement more gains, to increase the motivation of the participant to collaborate. We can define certain possible gains:

- A feeling of being treated righteously
- Being provided with positive feedback on cooperation

Pains
- Not being provided with information or feedback
- Not being in control
- The feeling of being deprived of something
- Being ordered and demanded
- Losing time

Being uninformed about the status (on/off/defect/occupied) of the BVID

Finding out how everything works or having to be assisted by an expert

Being constantly occupied with instructing both the participant and the BVID

During the photo, the operator must provide multiple instructions on the place, posture and facial expression of the participant.

| Arrival | Setup | Biometrics | Conclusion |

IDENTIFICATION FACILITY

turn on system · authenticate · scan document

assist & instruct

supplement data · print & log off

fingerprints   photo

It is unclear hat is going to happen and how long it will take

Participant must wait multiple times

Uncertainty on where to stand

Plays a passive role throughout the entire enrolment

Various repetitive moments of instructions cause for confusion and impatience

Does not know what is going to happen with their data

There is no clear beginning or ending of the process & Participant is uninformed about the goal, the progress and the result of the enrolment

Fig.32: Current interaction journey of a suspect enrolment visualised for both users. The proximity of each line with the product represents the intensity of the interaction.

3.5.4. Conclusion

The current usage is fully relying on the officer's knowledgeability. It is an administrative complex task that doesn't suit the rest of the police's duties. The participant plays a passive objective role and has no clue what is going on.

To improve the design, the user journey should be redesigned, by addressing the observed pains and underlining the gains. The participant should be actively involved in the process, while being guided through clear and concise tasks. Their collaboration should be stimulated by the feeling of being respected. They should be provided with clear feedback on how their contribution accelerates the process.

Furthermore, the identification process should blend in better with the rest of the police duties. The operator should experience a collaborative creation process, assisted by his right hand: the facility.

The product should take a pro-active, transparent and guiding role towards both users. It should be prepared and provide knowledge to the operator. It should be welcoming, patient and unjudging towards the participant.

4. IDENTITY TECHNOLOGY

The anticipation technological developments is one of the most determining factors for designing a future-proof product in this sector (section 5.1). Regarding identity, we are dealing with a rapidly changing industry. Because of this, it is important to know where we are and what will happen. That way, scenarios can be sketched to proof that the delivered design is in fact future-proof.

To do so, we look at the following questions:
- How will identities be registered & verified in the coming years?
- What role will biometrics play?
- What will become of ID-documents?

Eventually, we draw a conclusion for this project:
- Where and how will enrolment/verification take place on the short and long term?
- To what extent is automation or self-enrolment possible to our situation?
- What technological opportunities can we utilize?

4.1. Developments in Identity

In chapter section 1 identity is described as follows:

The collective set of distinct personal and physical features, data and qualities that enable a person to be definitively identified from others.

Although this definition is timeless, the interpretation of "personal and physical features, data and qualities" is changing. We take a short look at developments on private and national level.

Trends on governmental level
Looking at the national developments, a shift can be observed towards identities with more biometrics (Appendix I). The Aadhaar-programme in India is responsible for the biometric enrolment of already 1.248 billion identities since 2016 (AADHAAR, 2019). In countries like Thailand and the USA, travellers have become obliged in the last decade to enrol ten fingerprints and a photo at arrival and departure (DHS, 2007) (Thailand-business-news, 2019).

To find out more about trends in civil registration in the Netherlands, a governmental agency was visited. Due to confidentiality, results can not be named here.

Private Sector ID applications
We can learn from this sector what is technologically feasible and desired, when there are fewer legal limitations. In the private sector, identity enrolment technologies are way easier to implement, because people consent voluntarily with registration of biometrics. This makes enrolment in this sector more advanced. For instance, since 2009, Schiphol travellers with a Privium membership can pass the border by iris verification (Schiphol, 2019).

Private sector identity applications make for an interesting source of information to define the feasibility and viability of identity technologies.

Conclusion
It can be concluded that both on governmental and private level, the definition of these personal features is moving from a documented list of personal details to a digital set of data[1]. Pushed by technology, this data is becoming more and more related to biometrics. Developments in this industry enable identities to become increasingly inseparable from the person carrying them.

---

1. This was confirmed during an interview with Idemia at the ID Week in London (IDWeek, 2019)

4.2. Identity Documents

Throughout the world there are countless variations of ID-documents. In the Netherlands, the following documents qualify as valid IDs (Wet op de Identificatieplicht, Section 1) (Overheid-a, 2017):

- ID card
- Residence permit
- Passport
- Driver's licence

To qualify as valid, ID-documents must be 'EEGG' (as defined in the PIS):

- Echt (genuine)
- Eigen (property to the identifiable person)
- Geldig (valid: not out-dated)
- Gekwalificeerd (qualified in that particular situation)

Just like a human identity, an identity document contains a distinct set of unique properties (or: authenticity features). On one hand, this is required to uniquify a document and connect it inseparable to a human identity. On the other hand, to counteract document falsification.

Since travel documents need to apply globally , developments in this sector go slow. An example: since 1980 countries began to issue passports with a machine readable zone (MRZ, Fig.35). It took around 30 years to implement this globally (Appendix B).

Fig.35: Dutch Passport, MRZ in red

4.2.1. Future of ID-documents

Fingerprint in ID cards
In February 2019, Europe has agreed to implement fingerprints, next to passports, on ID cards as well. The law describes additional guidelines that standardise ID card look and shape throughout Europe (AD, 2019).

Biometric passports
More and more countries are shifting from traditional passports to biometric- or E-passports. This passport has an embedded chip that contains biometric information of the passport holder. In 2008, 60 countries were issuing them (Findbiometrics, 2019). The number is more than doubled by 2017 (Gemalto, 2019).

> **The First Passport**
> One of the earliest known references to paperwork that served in a role similar to that of a passport is found in the Hebrew Bible. Nehemiah 2:7–9, dating from approximately 450 BC, states that Nehemiah, an official serving King Artaxerxes I of Persia, asked permission to travel to Judea; the king granted leave and gave him a letter "to the governors beyond the river" requesting safe passage for him as he travelled through their lands.

Fig.34: The first passport

Fig.36: Dutch biometric passport, recognisable by the RFID logo on the cover

Digital ID
More technologically developed governments are starting to implement digital ID applications in their processes and this will keep increasing (IDWeek, 2019). The concept of a digital ID is that a person can identify digitally without the use of a document but with a virtual ID. An example is the Dutch 'DigiD'.

One of the ideas is that people will be able to provide only the required identity information, based on that situation. For instance, a bouncer only needs to know whether you are 18+, not your date of birth.

A growth in integration of the digital ID with smartphone apps is envisioned as well (Gemalto, 2019).

Will we stop using physical documents any time soon? No, that would mean that every country in the world would need to work with a, probably technologically advanced, alternative to identify a person[1]. We cannot expect that for at least the coming 20 years. Next to that, people will always want to have a feeling of physical ownership on their own ID and the widespread ID-document industry will not vaporise at once[2].

Takeaways
ID-documents will not disappear for at least the coming 15 years, but we can expect an increase of virtual- and digital ID applications and smartphone integration in more technologically developed countries.

---

1. Wow, a kind of identity enrolment appliance would come in handy here!
2. Conclusion of an interview with an Idemia employee at Identity Week London (IDWeek, 2019).

4.3. Biometrics

Biometrics is the technological term for body measurements and calculations. Examples extend from autographs to heart rhythm to the pore pattern on your fingertip. Since many parts of the human body provide unique characteristics, biometrics are a perfect fit for identity enrolment. Therefore we dive deeper into this field.

First a brief overview is given on the history, function and governmental application. Next we zoom in on the various types of biometrics that are more relevant for this project.

4.3.1. The first ID-record

In Dutch history we can find biometric enrolment for the first time in the end of the 19th century. Though the goal was not identification, but eugenics. In eugenics it is believed that a person's good/bad character is genetically defined. This resulted in studies where scientists measured of body parts of convicts and suspects (Eggens, 2005). An example can be found in Fig.38.

4.3.2. How biometric identification works

The capturing and storing of biometric information from an individual is called enrolment. A template is created that functions as reference material for future verification. Theoretically, a one-time qualitative enrolment should suffice for long term identification and verification.

During verification, the scanned biometric is compared to the stored template (1 on 1). Identification is thus a comparison of a known template to stored templates (1 on N). A successful match is called a hit. The factors that determine the hit chances are described below (Kraus, 2019).

Quantity: Increase the types of templates
The identification of a person is based on a combination of characteristics. By enrolling a higher variety of characteristics, the number of known variables in the equation will reduce, making the sum easier to solve.

An example: 400 fingerprints were found in a shop where a robbery had taken place. A witness subscribed the thief to have a light skin tone and blonde hair. A combination of these characteristics will narrow down the suspects

drastically.

Quality: Increase the amount of data in the template
When the stored template contains data of high quality, the certainty of a match will increase. Enrolment methods must therefore meet requirements higher than verification methods. Consequently, enrolment context and devices must live up to stricter standards as well.

Scanning overlap: Increase the homogeneity of data in the template
Various scanners register data differently. Enrolling biometrics with different devices will increase the variety of stored data, resulting varying stored templates for the same biometric. Consequently, data acquired during verification, must be comparable to a larger set, increasing the operation time. Additionally, the verification data must comply with all enrolled templates.

For example: Patrick's fingerprint is enrolled by the police during, but afterwards another print is taken with a different device at the DJI. Two weeks later the LTFO (forensic investigation) finds a trace at a crime scene. They now must search both the Police's template type, as well as the DJI's.

If registered data is more homogeneous, the range of the dataset that needs to be matched with decreases and verification becomes simpler and faster.

Conclusion
A standardisation of enrolment and verification methods will increase hit chances and reduce operation time.
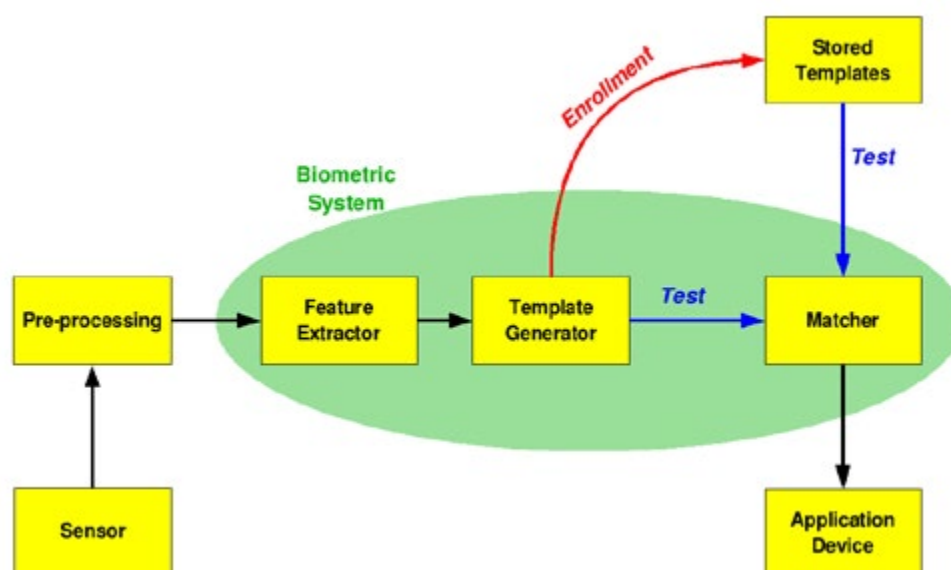

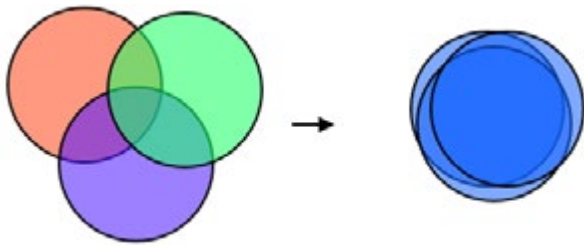*Fig.37: Schematic overview of a biometric enrolment*

Fig.39: The goal is to shift from templates obtained by multiple enrolment devices (left) to similar devices. This results is more data overlap and leaves only enrolment context and execution as a variable factor.

Fig.38: An example of a 'signalementen-kaart' (1896). It registers a convict in the same manner as we see today. A holder for the head facilitated the correct 'enrolment of the face'. This might actually be the first BVID!

4.3.3. Government & identity application

One biometric suits specific goals better than the other. It is therefore that governments select biometrics on particular criteria. The likelihood of Dutch governmental adoption of a biometric in identity is defined by the following criteria (CentrumBiometrie, 2018):

- Universalness: does everyone have it?
- Uniqueness: does the biometric differ from each person?
- Permanence: does it remain the same over time?[1]
- Enrolability: the ease of registering the biometric
- Performance for use: to what extent is this biometric usable for an intended purpose?
- Acceptance: is it socially and legally accepted to work with this biometric?
- Robustness: how resistant is enrolment to small errors?

Enrolability and performance for use are the two factors that can be influenced by technology the most. Consequently, technological developments enable new biometrics to be commissioned. A rough sketch of steps taken to implement a biometric for governmental purposes is given below (Kraus, 2019).

1. A new technology is invented
2. The private market adopts the technology
3. Once proven, the technology reaches its maturity stage
4. The government can start implementing the technology in its processes
5. Enrolment and verification methods of the technology are commissioned in a stationary controlled environment
6. Verification starts to steer towards mobile solutions
7. Eventually portable enrolment will be possible
8. The technology is overtaken by a better alternative and dies out

---

1. For instance: fingerprints come in handy during crime scene investigation, but are (still) unidentifiable through security cameras.

Fig.41: Optical fingerprint scanning at the BVID

4.3.4. Types of biometrics

In this section we zoom in on the various types of biometrics that are more relevant for this project. A distinction is made on the types that are already commissioned, legally accepted or promising for future applications. This all counts for the Netherlands. The questions that are being asked:

- How is the biometric currently enrolled?
- What are the next steps on the short and long term?

4.3.4.1. Commissioned biometrics

Enrolment of the following biometrics are a part of the current Dutch identification procedures.

Fingerprint
Fingerprints lend their uniqueness to the papillary line- and pore-pattern on fingers. Registering rolled fingerprints is currently a standard part of identity enrolment in the criminal justice and migration chain. Until 2010 this was done by ink prints. From then on fingerprints are registered digitally, through optical scanning (Fig.41).

The first next step is capacitance scanning[1]. The technology is more compact and less influenced by environmental lights.

An envisioned next step is touchless scanning of fingerprints. The CvB is already experimenting with the use of touchless scanning (Fig.40)

Looking further ahead, latent fingerprint photography is believed to become a feasible technology (Kraus, 2019). With this method, fingerprints are stored by analysing high quality photos. This enables fingerprint recognition and enrolment on a distance. A hacker proved the feasibility of this technology already back in 2014, by faking Angela Merkel's fingerprints using this method (theGuardian, 2014).

---

1. The Police IT department will soon start testing three new fingerprint scanner, that all make use of capacitance scanning. The ID-suitcases are already equipped with one.

Fig.40: An example of touchless fingerprint scanning: Morpho-wave by Idemia.

Face

Facial photos have always been the most common human verification method. Currently, suspects' face is registered using photography. In some cases, a second photo is registered from the side.

For the next step, one of the greatest desires of the CvB is to be able to request a 3D facial image. That way, a suspect can be compared to CCTV images and photos from various corners. For this project there are two interesting methods to register a 3D facial image:

- Spatial photography: video-record multiple images to generate a 3d image (Fig.43).
- Make one photo from multiple angles with multiple cameras. Example: Intel RealSense (Fig.44).

Desired facial data extends from ear to ear and forehead to throat. A full 3D head model is thus not necessary.

Identifying someone by automated face recognition is not believed to be implemented in governmental processes in the future. Compared to irises and fingerprints, faces do not score very well on permanence and uniqueness and are therefore an unreliable identification method.

4.3.4.2. Legally accepted biometrics

Conform SV Section 61a (Appendix L), governmental enrolment of the following biometrics are already legally accepted. Yet, they are not a part of the standard identity processes. Will they become though?

Hand geometry
The shape of a hand can be an identifying characteristic as well. Currently, hand palms are still registered by using ink prints, but other countries have already standardised the it nationally. The CvB beliefs to be able to identify 30% of 350.000 the unidentified traces with the use of hand geometry biometrics.

Ear & Foot
These biometrics are unique by their geometry. The technology is only used for very specific investigation purposes (Kraus, 2019). They can be enrolled in a same way as hand

Bodily Measurements
The sizes of body parts are not unique enough for identification but can add up to existing evidence to identify a person. A promising technology to do this is 'human pose estimation': it enables the live capture of measurements of body parts.

Fig.43: The application called 'FYuse' uses spatial photography to render a 3D image.

Fig.44: Intel's RealSense uses a combination of camera's and an infra-red grid projection to capute a 3D image. The compact design (20 x 6 cm) proves how small these camera's can be.

Fig.42: Parts of the body are identified though human pose estimation.

4.3.4.3. Future Biometrics

Enrolment of the following biometrics are assumed to be promising for the future (Kraus, 2019), but not yet allowed by law.

Hand palm veins
Every palm has a unique blood-vein pattern. As veins run under the skin rather than on the surface, vein scanning is considerably more permanent and resistant to fraud than fingerprint recognition (Kraus, 2019). Blood veins are scanned using infrared photography.

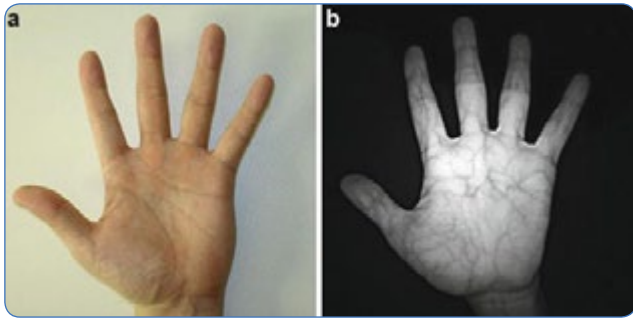It is envisioned that on-a-distance scanning is the next step for this technology.

Fig.45: Hand palm vein scanning

Iris
Irises are unique because of the fibre pattern in the retina. Both police and the CvB describe it as one of the most promising technologies for identification and verification. Also, the DJI desires to make use of verification by irises in the future (DJI, 2019).

This biometric scores high on permanence (an iris remains the same over time) and enrolability (it is fast and easy to capture). That is why it is believed that iris will overtake fingerprints for identification and verification purposes. The only drawback is that irises do not function great for investigation purposes (no one leaves their iris on a crime scene).

Currently most common high quality iris enrolment is done with close up photography. Though, with the increase of camera quality, capturing an iris on regular portrait-photo distances become more and more doable (IDWeek, 2019).

Fig.46: Examples of current all-in-one solutions (IDWeek, 2019).

4.3.5. Enrolment & verification product trends

All-in-one self-enrolment solutions
It was observed that many of the competing identity enrolment facilities provide all-in-one solutions. Both mobile and stationary facilities are equipped with a rigid set of defined components, leaving little to no room for customization. Examples can be found in Fig.46.

Portability
The reduction of sensor weight and size increases the portability of biometric scanners and products. Consequently, verification steers into increasingly more mobile solution, followed by enrolment.

Both at the ID Week in London and during visit at a Dutch identity product-design company, a lot of development was observed in portability and mobility (Appendix I & Appendix F)

Integration of the smartphone
Nowadays it is not out of the ordinary to carry a computer, fingerprint sensor, multiple (infrared) camera's and an iris scanner in your pockets. Our smartphones make for a great identification devices.

Next to that, the quality of and existing sensors continues to increase. Among others, this allows for mobile fingerprint photography, document scanning and facial recognition.

The increase of smartphone computing power has now allowed for mobile phones to function as a PC by attaching an external screen (Fig.48).

Component geometry compatibility
The market shows more and more products that focus geometric compatibility. Here, the device is designed with a more generative shape to enable easier integration with larger more elaborate products. Examples can be found below.

Fig.47: Chameleon-D, example of a compact portable identity enrolment device

Fig.48: Smartphone as desktop operating system: Samsung Desktop Experience (DeX)
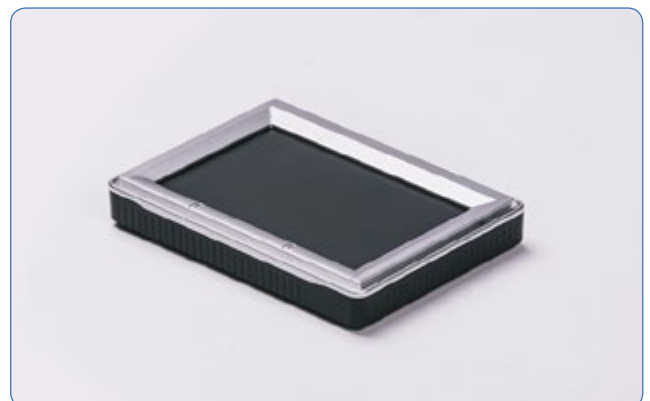

Fig.49: PENTA Scanner block

Fig.50: Integrated Biometrics Five-0

4.4. Conclusion

Where and how will enrolment/verification take place on the short and long term?
- Will the next BVID still be a stationary solution in a controlled environment?
- Does technology enable full mobile enrolment?

It is believed that technology will keep pushing governments to innovate identification. That means that new technologies will continue to be added in the future, that all need to walk the implementation path as defined in section 4.3.3. Verification is already done mobile and will become even more so. Eventually mobile enrolment will follow as well, but not for the coming decade.

A stationary controlled environment will thus remain a requirement for the long-term future.

To what extent is automation or self-enrolment possible to our situation?
Technology will enable enrolment to become easier, steering towards automation possibilities, but not for the near future. As new biometric technologies will be commissioned on the short term, enrolment will remain a delicate and sensitive process with high standards. Since we have a difficult, unfamiliar and unwilling participant, this process will continue to require assistance, making automation and self-enrolment impossible for our situation.

What technological opportunities can we utilize?
The current identity market is saturated with developments around portable verification, mobile enrolment, live enrolment and automated enrolment. Yet, most products and concepts deliver all-in-one solutions that offer little to no room for customisation and flexibility.

Additionally, due to the large focus on live enrolment and automation, little development is going on in assisted enrolment. This opens the opportunity to develop a customizable assisted enrolment facility.

DEFINE

DEFINE

In this chapter we reflect on the conclusions drawn in the research phase and frame what that will mean for this project.

Next, in line with the 'Vision in Product Design'-approach, the new context is defined in the design brief.

- The scope definition with envisioned context (where, what, who, when)
- The design brief with a summary and design goal (why & how)

5. Project Re-definition

In this section we re-evaluate how we are going to answer to the initial design brief. Conclusions from the research phase are synthesized to form new insight and decisions.

Eventually the design brief is formulated, summarizing all conclusions in one place to sketch a clear project goal.

5.1. Reliability through Flexibility

As formulated in the initial assignment (Fig.51), the Police wants a concept that they can rely on. We can describe this reliability as a consistent performance when needed under any the situation, now and in the future.

A closely related and maybe more adequate term for this project is flexibility: the product's ability to remain functional under varying circumstances (Dietz, Albani, & Barjis, 2008)[1]. Translated to the current situation of the BVID we can observe many relations:

Research has shown that the product is prone to a rigid experience (use inflexibility) and is not ready for the future (time bound inflexibility). Also, the opportunity for identity-chain-broad implementation was discovered: use-context flexibility. This all narrows down to the desire for more flexibility.

We can create a more flexible product by anticipating the earlier mentioned changes in circumstances. Summarized:

Induce flexibility by anticipating varying circumstances

The circumstances are all the factors that may influence the product's performance: functionality, work environment and time. They are addressed below.

5.1.1. Anticipate a change in functional circumstances
For a proper executing of an arrest, the police are fully relying on the BVID. The problem is that, in our case, this functionality alone already depends on numerous factors. In case of a change in these circumstances (i.e.: the participant breaks the fingerprint scanner, or a database

---

1. Dietz describes that process flexibility can be seen as the ability to deal with both foreseen and unforeseen changes.

> **Graduation assignment**
>
> Analyse the current root causes of the failures that disable the usage of the identification facility. Design, together with the various stakeholders, promising concepts that can lead to a highly reliable appliance for identification. Integrate a minimum set of interchangeable components for the purpose of establishing the identity of an individual based on biometric characteristics.

Fig.51: A snippet from the advertisement of this project, defining the graduation assignment.

doesn't function), the dependency on the product is experienced most critically. In the current situation, the police are then confronted with a problem, because:

1. A primary process cannot be executed: the product is not operable;
2. The functionality is directly needed;
3. It is not locally resolvable;
4. There are no fall-back options.

We can thus reduce the experience of dependency by reducing the probability of the steps above occurring. In response to each step, we frame the following goals:

- Reduce the number of factors that the products functionality depends on;
- Reduce the likelihood that the product is labelled as 'not operable';
- Plan use in advance and anticipate defects earlier;
- Improve local resolvability;
- Implement more fall-back options.

5.1.2. Anticipating future changes: Futureproofing

Next to this, we need to anticipate the changes that the future is going to bring as well: implement futureproofing. Futureproofing is the process of anticipating the future and developing methods of minimizing the effects of shocks and stresses of future events (Wikipedia, 2019). In other words, being prepared for these future factors, would result in futureproofing. To define what this means for this project, we define our factors and our future below.

Future

We can define 'our' future as a period between the short term (from now until implementation of the product) and long term (the period in which the product is functional).

So, when do we want to commission the product? The initial brief states 2022 but looking at the development of the previous product (7 years), that would be too soon. Still, we can reduce the development time, since we are designing in an already established context: we design the next version, not something completely new. If there are no legal changes required for the commissioning of the next concept[1], 2025 would be a good estimation.

For the long term we can only design for as far as an educated guess may go. We have to keep in mind that identity technologies will continue to evolve as rapidly and the legislation will continue to be pushed by it. Also,

1. Changing legislation is a time-consuming and extensive process that would add many years to the implementation of the product (Laar, 2019).

private sector ID application give good insight on what is already possible and how long the government 'delayed' to adopt them. A product that would function at least 10 years is therefore a good estimation.

Factors

So, what factors determine the future requirements of this product? We can find the fundamental requirements of this product in legislation. So, long term requirements originate from developments in legislation. In the identity sector, legal changes are mostly caused by utilizing opportunities of new technologies (i.e. digitalisation of fingerprints). This makes the anticipation of identity technology the key-factor for futureproofing.

From a business point of view, a future-proof product must fit a company on the long term as well. In order to provide structure throughout time, the Police's has set pillars, visions and missions (section 4.3.5). These will be used as a guide to provide business futureproofing.

As for the operating context, we defined the opportunity of identity-construct-broad commissioning. Utilizing this opportunity would mean that the product needs to be adaptable to more contexts in the future: versatile employability. Conclusively the following goal can be stated:

Achieve futureproofing by enabling versatile employability and anticipating identity technology from 2025 until 2035.
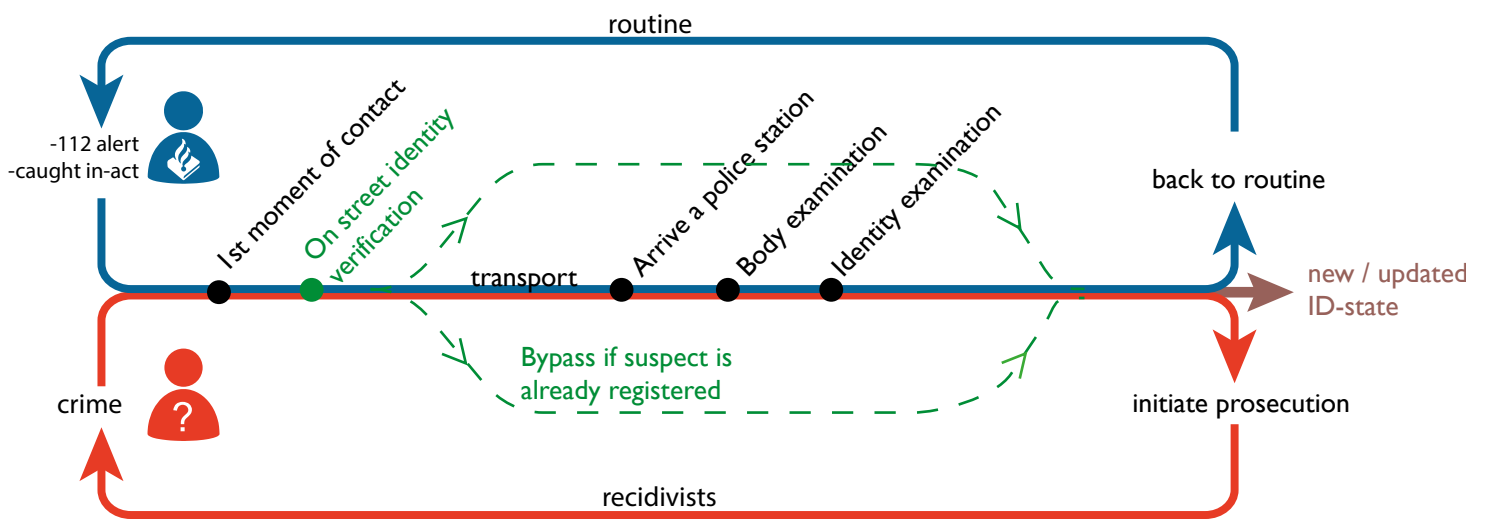

Fig.52: Envisioned process context with newly added earlier verification (green).
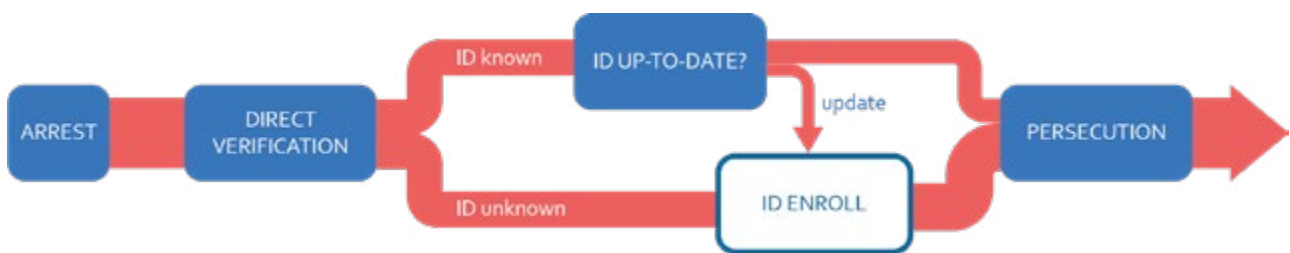

Fig.53: Envisioned process context with newly added earlier verification (green).

5.2. Envisioned Context

The identity product-service layer
Research has made clear that partners in the identity-construct use different products for identification processes (section 2.5). To improve identification, we want to standardise these processes and devices nationally (section 4.4).

To facilitate this, I want to propose something new. A new governmental identification context is envisioned, where one connected product-service family facilitates biometric identification for the whole identity-construct. All enrolment, verification, communication with databases and collaboration of partners goes through this new product-service layer (Fig.54).

This layer shall consist of various services and multiple identification devices: stationary as well as mobile. In line with the initial assignment we shall focus on the stationary mother of this family.

Next to its focus on high quality, this station/kiosk is envisioned to function as the local identification brain and as a mothership of the local swarm of identity products as well.

5.2.1. Designing for the new context by focusing the police

It is concluded that enrolment in the criminal justice chain is bound to the highest requirements and the most difficult target group (section 2.5). Therefore, the envisioned product will be designed for suspect enrolment for the Dutch National Police. Eventually it should be tested if the product would function for the whole identity-construct: versatile employability.

Since were focusing the Police, the envisioned product will, just like the BVID, be a facilitator for the identity examination during an arrest. Since it is expected that mobile verification will to be implemented nationally on the short term, a slightly altered arrest journey is sketched, where the new product already plays a role on the street (Fig.52).

During the first mobile verification it will be determined if an individual is known to the Police. When unknown or in case of an out-of-date ID-record, the individual needs to be (re-)enrolled. The envisioned product knows who is coming and can setup a customized process prior to arriving. With this implementation, it is believed to reduce the use by roughly 40% (50% is enrolled already (recidivists: section 3.4.2),-%10 because some recidivist identities might need an update).

Additionally, mobile devices will be able to communicate with surrounding ID appliances to check availability and defects.
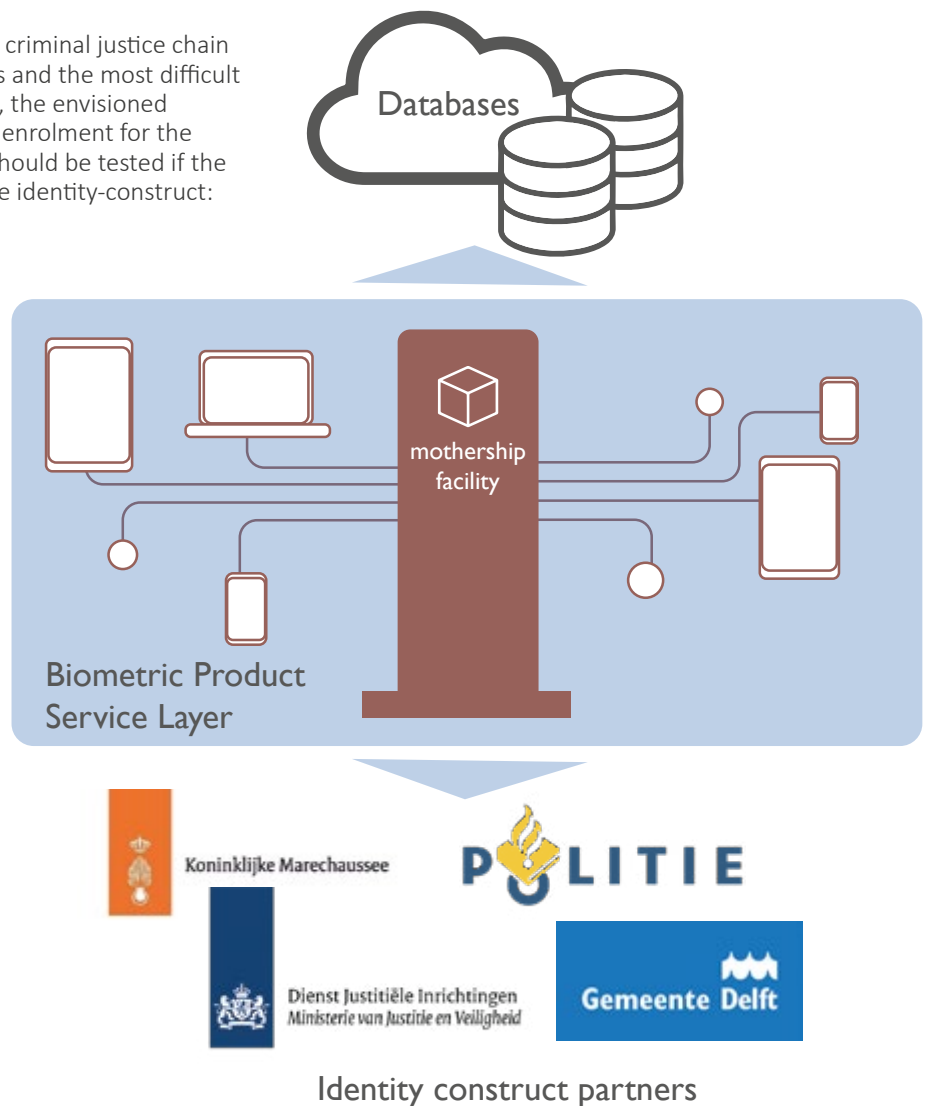

Identity construct partners

Fig.54: The envisioned identity product-service layer

6. Design Brief

This section provides an outline of all decisions, goals, requirements and deliverables set for this project.

6.1. Recap

The Dutch Police contacted the Delft University of Technology to design a new BVID. The opportunity was observed that one standardised identity enrolment facility for the whole identity-construct is desired and feasible, but not for this project. It was chosen to target the Dutch Police, since they have the highest requirements.

Based on the evaluation of the current product, a new user journey was sketched to provide a foundation for future development. Technology research provided basis for what future identity management will bring us.

This leads us to the design goal.

6.2. Focused Context

So, what are the borders of our design scope? This is done by answering the 'WWWWWH' (Tassoul, 2009). First the What, Who, When and Where is defined. Then, the Why and How are formulated as the design goal.

6.2.1. What?

So, what are we going to design? It is concluded that a stationary controlled environment for high quality enrolment will remain a requirement in the future (section 4.4): the mother of the family.

We will therefore design the identity mothership station/ kiosk of the Dutch identity-construct. What is should do is defined in the list of requirements.

6.2.2. Who?

The existing interaction describes two users: an operator and a participant (section 3.5). It is concluded that, for the next appliance, this will remain the same:

One participant
Biometrics are inseparably connected to the participant, so the presence of a participant will always be required.

One operator
The following reasons underline that an operator we remain required:

- During an arrest, suspects are never left alone outside of their cell;
- Suspects have no benefit to be registered and are not obliged to cooperate (section 3.4.2: mental state);
- The high variety of mental states and attitudes suspects can have;
- Enrolment will remain a delicate process;
- An enrolment process consists of many steps and can

go wrong in many ways.
Technically speaking, automation should be possible, but only with cooperating, willing and sober users.

6.2.3. When?

Envisioned is implementation in 2025, futureproofing until at least 2035 (section 5.1).

6.2.4. Where?

Product placement is defined on three levels.

Organisational level:
Target the whole identity-construct by focusing the Police (section 2.5)

Process level:
Playing the main role in the identity investigation process.

Physical level (product environment):
In identity rooms at Police Stations: a controlled environment is required (section 4.4) and identity rooms have been appointed already in all Police stations (section 3.3.4). So, the location of use will remain the same.

6.3. Design Goal

6.3.1. Why are we doing this?

In the end, the goal is to pursue the main goal of the Police: making the Netherlands safer. To make a country safer, legislation and law enforcement have been established. Our goal is to improve the way the law is executed, by providing a vision and a product that improves identity processes of the Dutch identity-construct.

6.3.2. How are we going to do this?

So, what does 'improve' mean in our case? We will do this by providing a conceptual design of a product that answers to the main concerns and designing a new interaction. In summary we will focus on:

- Designing a user interaction based on the pains and gains as defined in section 3.5
- Increasing the product's flexibility by:
  - Reducing dependency by reducing the probability of a priority 1 occurring
  - Implementing futureproofing
  - Enabling versatile employability within the police organisation and the identity-construct
- Providing handles for the company for implementation and further development of the concept

6.4. List of Requirements

Here, the total list of requirements can be found. Few requirements that were defined in the develop phase are included as well.

1. Futureproofing

The product should...

  1.1. be in line with the Dutch National Police's vision as defined in section 3.1.1

  1.2. adapt to and implement the use of smartphones

  1.3. provide possibility to implement the promising technologies as defined in section 4.3.4

  1.4. reduce dependency in a manner as described in section 5.1.1

  1.5. address the main causes for dependency as defined in section 5.1.1

2. Interaction

The product should...

  2.1. emphasize the feeling of police-workmanship for the operator

  2.2. create an unjudged experience for the participant

  2.3. play an pro-active role in the bond between the users and the execution of the process

  2.4. facilitate the envisioned user journey as defined in section 7.5

  2.5. aesthetically evoke an experience as defined in section 7.5

3. Users

The product should...

  3.1. provide a separate interface for both users

  3.2. communicate a result of the process

  3.3. provide use-guidance for both users

  3.4. require no more than 4 hours of training for operators that are familiar with the BVID

  3.5. provide a connection to the internet

  3.6. provide a common progress indicator

4. Operator's module

The operator's module should...

  4.1. be usable by operators as defined in section 3.4.1

  4.2. provide the ability for the operator to intervene at all times

  4.3. be operable without the operator having to hold anything in their hands during use

  4.4. not form any kind of physical barrier between the users

  4.5. be re-arrangable in a manner that the operator is closest to an exit (mirrorability)

  4.6. facilitate the operator's product qualities

  4.7. keep the operator and their components out of the participants direct reach during use

  4.8. facilitate the scanning of a document

  4.9. facilitate the process of a document examination

  4.10. provide means to input text

5. Participant's module

The participant's module should...

  5.1. be usable by the following special users:

    5.1.1.　foreigners and migrants

    5.1.2.　non native Dutch speakers

    5.1.3.　participants in wheel chairs

    5.1.4.　participants under light influence of alcohol or drugs

  5.2. be usable by people with body measurements from the P5 Dutch woman (20-60 years old) to the P95 Dutch man (20 to 30 years old)

  5.3. facilitate the participant's product qualities

  5.4. occupy the participant with tasks solely related to their biometric scanning

  5.5. provide a dedicated place for the participant throughout the whole process

  5.6. provide compensation for environmental background and lights

  5.7. provide a seating

  5.8. be used in a seated position

5.9. provide use feedback

5.10. facilitate taking photographs and making video recordings;

5.11. facilitate taking measurements and prints of palms, feet, toes, ears and shoes.

5.12. provide automated height adjustment of the display and camera to the participant's length

5.13. provide a distinct background that eliminates cast shadow

6. Maintenance
The product should...

6.1. diagnose defects and provide simple maintenance guidance

6.2. provide ease of replacing critical components

6.3. allow for basic do-it-yourself maintenance (like a reset button)

7. Functionality
The product should...

7.1. withstand human lean- and hit-forces

7.2. be 24/7 operable (or provide direct solution when not so)

7.3. prevent itself from being flipped over easily

7.4. not require any kind of attachment to the building

7.5. portable and movable within police stations

7.6. fit through doors in police stations

7.7. allow for customizable lay-out of components

6.5. Nice to haves

In addition there are some focus points that should be strived for.

Function
It is favourable if the product would...

• facilitate the process as fast as possible
• be as much in line as possible with current laws
• not require more education than the current product
• minimize officer's instructions
• minimize physical officer- suspect interaction
• minimize participant physical product interaction

Aesthetics
It is favourable if the product would...

• be least inviting for unintendeddo-it-yourself maintenance
• avoid caging and enclosure-like shapes around the participant
• have one uniform expression
• be limited in context-dependency
• be usable by most people in the Netherlands over the age of 14
• stimulate the participant obedience

DEVELOP

DEVELOP

The development phase has been captured to present the explored ideation space. Firstly, an interaction is designed to form a basis for all design decision. Next, the breadth of the explored ideation space is presented, resulting in 4 mock-ups. These form the basis of the next phase: conceptualisation. After multiple iterations, this chapter concludes with the final concept.

7. INTERACTION

So how are we going to implement our users in the described context and how do we want them to experience the product?

As a starting point, a new interaction vision is sketched.

Next, conclusions from section 3.5 are taken to come up with statements. These describe the desired experiences.

The statements are then synthesized and illustrated by analogies. The analogies, the statements and the current pains & gains form the basis to re-evaluate the current journey. A new user journey is then designed that resembles the new interaction.

7.1. Vision

Concluding from the current interaction, it is envisioned to involve the product and the participant more actively in the process. We want to transition from the existing interaction (Fig.56) towards an interaction that involved the participant and product more and focuses on their interaction as well. The interaction triangle as proposed by Zahra forms a great basis for this (Fig.57) (Broekhuis, 2019).

Fig.56: Current interaction

7.5.1. Operator interaction

The identification process should blend in better with the rest of the police duties (section 3.5.2). The operator should experience a collaborative creation process, assisted by his right hand: the facility.

It seems that the BVID does not underline any of the gains it could create. Additionally, the formulated pains counteract the role of a police officer in many ways.

We therefore formulate the following statement:

"I want to emphasize the feeling of police-workmanship."

Fig.57: Envisioned interaction triangle

7.5.2. Participant interaction

The participant should be actively involved in the process, while being guided through clear and concise tasks. Their collaboration should be stimulated by the feeling of being respected. They should be provided with clear feedback on how their contribution accelerates the process.

The formulated pains underline an already judging, convicted experience. But, as defined in section 3.4.2: Ethics, the participant is innocent until proven guilty.

To relieve gains and to involve the participant more, it would be interesting to take the opposite approach: negating a criminal experience. We therefore state the following:

"I want to create an unjudged experience."

Will this loosen strings too much for a possible criminal? No, it is believed that the authority and dominance largely depend on the operators attitude, not the product (Appendix R). The product can therefore be stripped of all dominance, leaving the required authority to the operator.
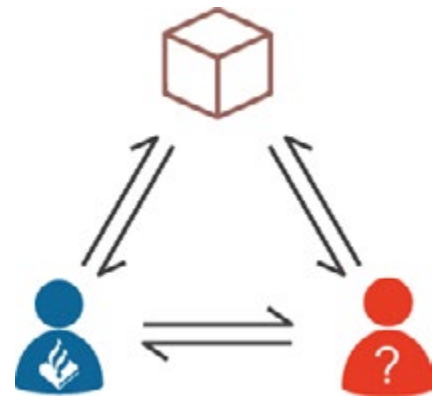
7.5.3. Product role

Providing guidance

As concluded in section 3.5.1, the relationship between the users can be of hostile nature. Verbal instructions and physical guidance will not positively affect this and could even cause dangerous situations. Another reason to shift guiding tasks from the officer towards the product. In addition, this will increase the participant's feeling of responsibility and independence, reducing the judged experience.

Product vision

The product should therefore take a pro-active, transparent and guiding role towards both users, facilitating a mutual behavioural change in their bond. It should be prepared for- and provide knowledge to the operator. It should be welcoming, patient and un-judging towards the participant.

"I want the product to play a pro-active role in the bond between the users and the execution of the process."

7.2. Analogy: the Dog

I want the beginning of the journey to be experienced:

Like entering a friend's house and being welcomed by their friendly dog

Two friends decide to have dinner after work and drive towards one of their houses. The owner unlocks the front door and they encounter his dog, who had been preparing for this moment the whole day. They enter the house and the dog curiously starts sniffing the stranger. They get to know each other and the dog quickly opens up to the friend, guiding the stranger where he wants to be petted.

In here, the dog owner symbolises the operator; the friend symbolises the participant and the dog symbolises the product.

7.2.1. Analogy qualities

Dog owner experiences:
- preparedness / readiness of the dog;
- ownership;
- dominance;
- feeling at home.

Experiences of the friend:
- being welcomed in someone's territory;
- becoming part of an existing bound;
- interaction / usability when bounding with the dog;
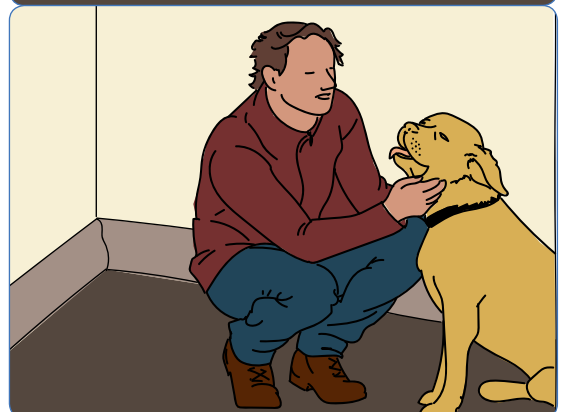- guidance by the dog.

Fig.58: The dog analogy

7.3. Analogy: Cooking a Meal

I want the second half of the journey to be experienced:

Like a parent and child cooking

While cooking, father calls his daughter and asks her to cut the tomatoes. The father hands over the necessary tools to perform the task and explains briefly what needs to be done. The daughter takes her responsibility seriously and starts cutting the tomatoes. Once finished, the daughter returns the tomatoes to dad and together they finish the meal. Once the food is served, they proudly observe the meal they cooked together.

In this analogy, the father symbolises the operator, the child symbolises the participant and the tools symbolise the product. Eventually, the cooked meal symbolises the result of the enrolment.

7.2.2. Analogy qualities

Experiences of the father:
- remaining the knowledgeable;
- being in charge.

Experiences of the child:
- Respect and transparency by being provided with feedback;
- Respect by being given a portion of the responsibility by the in-charge figure;
- Clarity by a clear start and end of the responsibility;
- Clarity by executing a concrete small task with clear tools;
- Having contributed to the whole.

The bound between the characters provides some interesting interactions as well:
- Father remains ready to intervene when necessary;
- Collaborative creation;
- Collective result appreciation.

Fig.59: The cooking a meal analogy

7.4. New User Journey

With the existing journey (Fig.60), the analogies and intended interaction statements in mind, the use of the product can be re-evaluated. We are now able to determine how the interaction should develop through time. In other words: a new user experience journey was designed.

Based on the qualities from the analogies, the steps have been redefined:

1. Both users arrive in the identity room and see the product
2. The operator offers a seat to the participant and authenticates and scans the document. Meanwhile the participant has time to get acquainted to the product and is informed by the product about the process.
3. A transfer moment is implemented to facilitate a clear transmission of the responsibility. It also bounds the
4. Now the main task for the participant starts: enrolling biometrics. Guided by the product, the participant is informed on the tasks and progress. Cooperation is stimulated by providing feedback on the progress.
5. Once finished, the participant transfers the responsibility back to the operator.
6. The users collectively appreciate the result and a clear conclusion is communicated by the product.
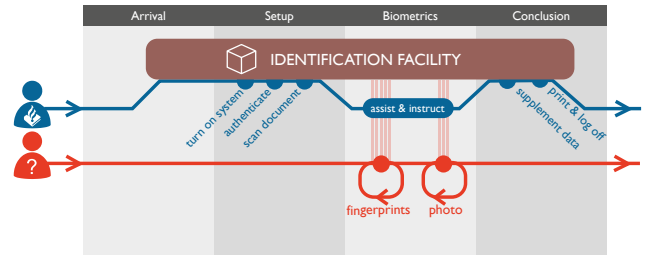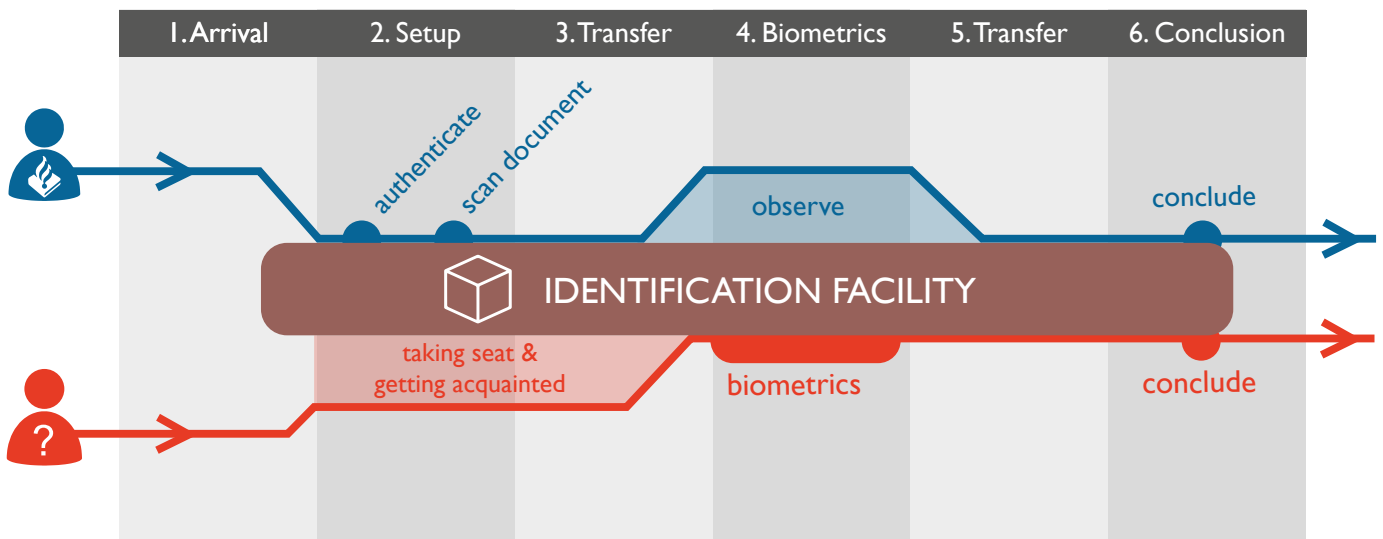

Fig.61: Current interaction journey, elaborated in Fig.32

Fig.60: From old to new interaction journey. The proximity of the interaction line with the product describes the 'amount of interaction' of the specified user with the facility.

7.4.1. Establishing an early connection: on the street verification

Now we can also implement the opportunity defined in section 5.2.1 and the goal defined in section 5.1.1.

Steps in the earlier process:

1. Officer establishes communication with the product to identify the suspect.
2. Officer is updated if product is ready for use. Product prepares for who is coming and the customized workflow is initiated.
3. Arrest: The arrest is initiated.

Fig.62: Envisioned mobile journey

7.5. Product Qualities & Summarized New User Journey

Product qualities for the operator and the participant have been defined based on the analogies and a brainstorm on the statements (Appendix P & Appendix U). Appendix V provides an overview of the sources of and setup of the qualities. The qualities have been spread out over the phases as can be found in Fig.63.

Furthermore, the following aesthetic qualities are desired to be experienced by the participant. As they describe the product's look and feel, they are not bound to a specific phase.

- Simple;
- Humble, light;
- Friendly / accepting;
- Kind, warm;
- Un-intrusive;
- Un-submissive;
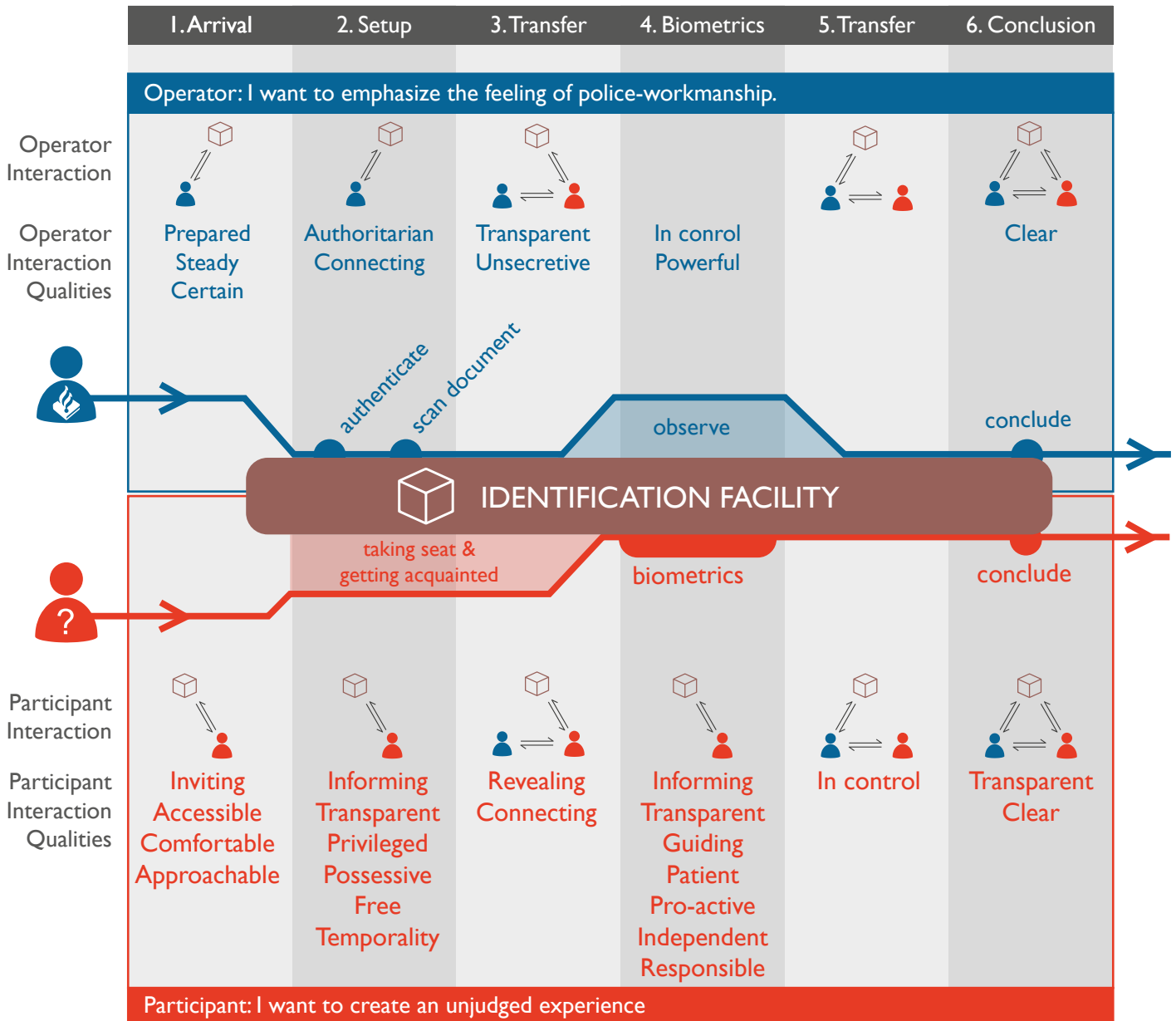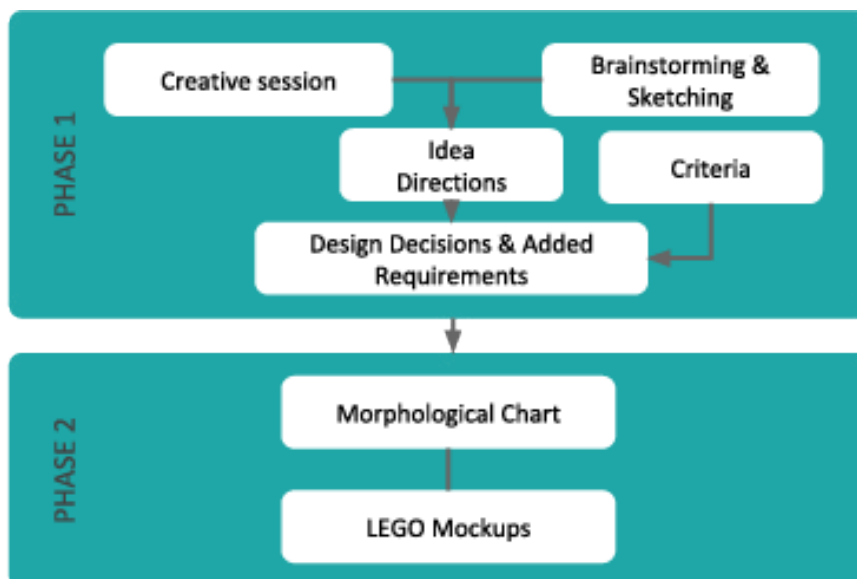- Unifying;

Fig.63: Summarized envisioned interaction journey

8. IDEATION

A summary of the ideation phase is presented in this chapter. The ideation is divided in two phases. A visual overview of the process is presented in below.

8.1. Idea Phase 1

8.1.1. Criteria

To value the ideas and to test concepts throughout the development phase, criteria were set up.

As a starting point, a brainstorm was held at the Police IT Department (Fig.64). Together with criteria from the interaction statements and the design goal, this resulted in the following list:

Criteria	The extent to which the concept...
Versatile employability	is applicable for different use-cases, partners and situations
Futureproofing	can respond to future factors
User connectedness	facilitates and stimulates a connection between the users
Simplicity / minimalism	expresses simplicity
Escalation resistance	remains functional and guarantees the operator's safety under escalating situations
Unjudgedness	undermines participants' criminal experience
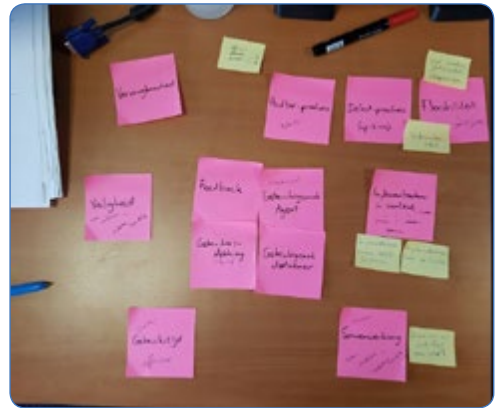
Fig.64: Criteria brainstorm

8.1.2. Creative Session

To kick-off the ideation phase and come up with the first directions, a creative session was held. The design challenge of this project was stripped from all stakeholders, laws and context factors to leave the session participants with a simple challenge:

How to transfer biometric data from a person into a database?

The participants were challenged to come up with a prototyped solution in half an hour with groups of 2. The participants were provided with How-Tos (Tassoul, 2009) and prototype material. The set-up, execution and results can be found in Appendix O.

Fig.65: Photos from the creative session

8.1.3. Idea directions

Through sketching and brainstorming first directions came to life:

The first direction is based on a product that the participants would Travel Through Together, walking along the necessary steps to execute together.

The next idea is to have a Single Unit with Two States. So, one product that encompasses all functionality, but can switch between an operator-state and a user-state. Switching between the states could be done either mechanically or digitally.

The last direction describes the use of One Unit with Two Sides, one for each user.
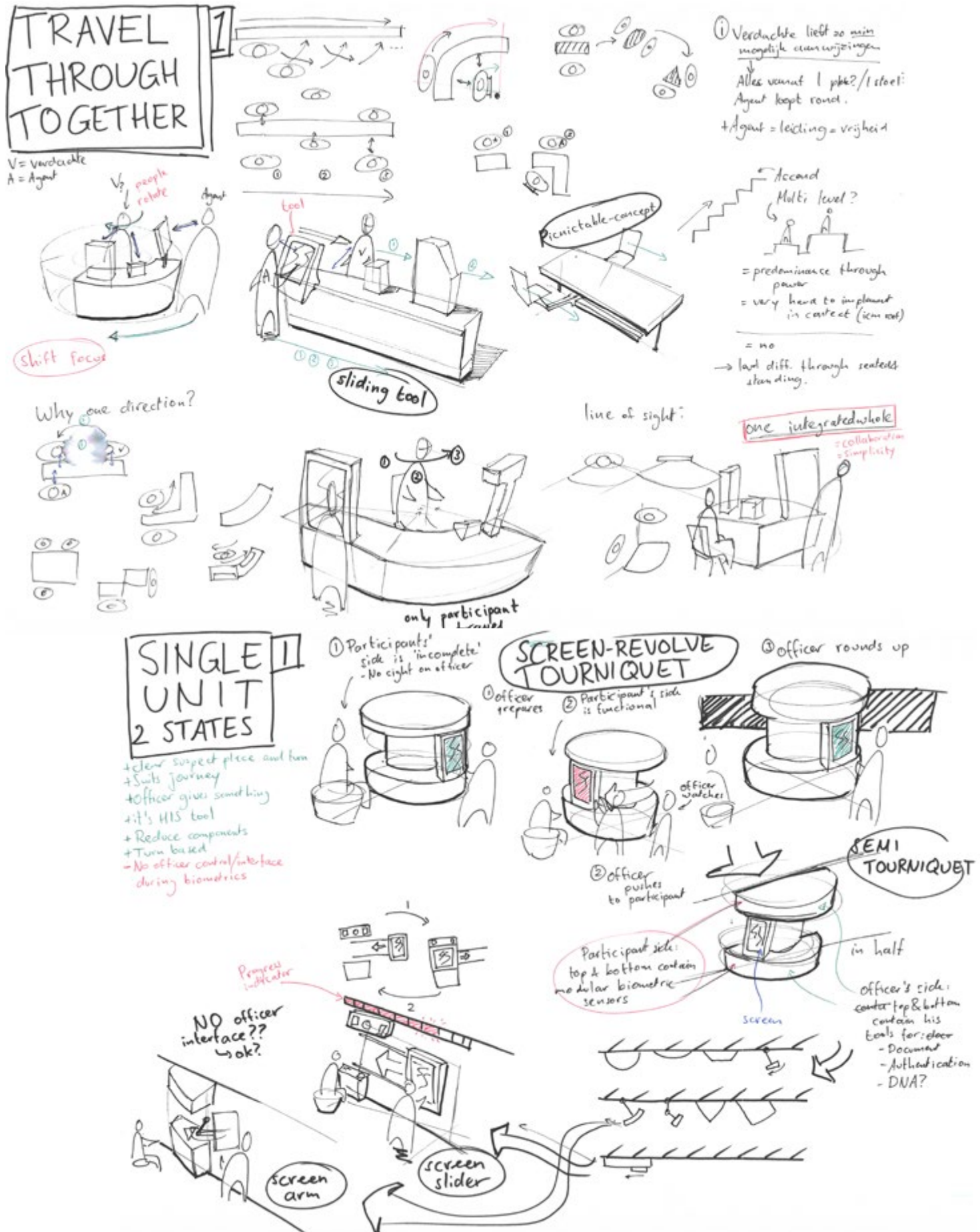
1 UNIT 2 SIDES / 2 STATES | 1

integrated whole
too defined

idea: semi seated
→ bar krak
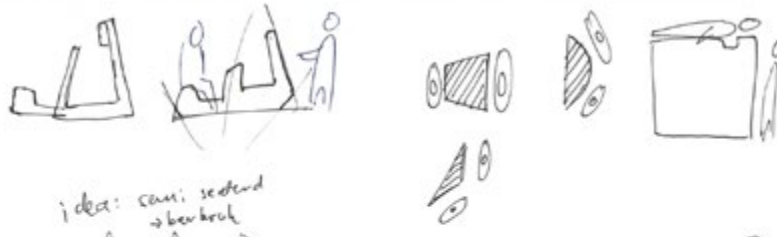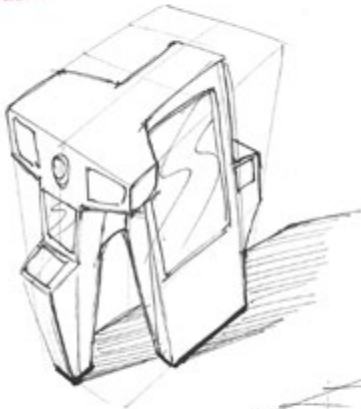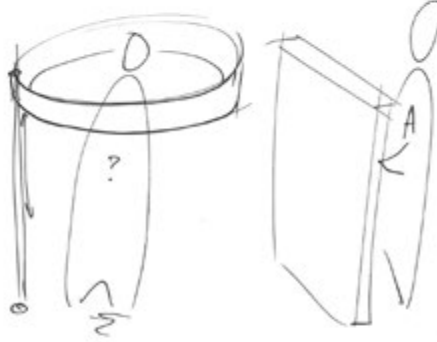
OFFICER'S Tool:
- Mobile?
- Digital tool
- Carry-on

draaibank = tool

🔧 = tool

= toolkit

|T.F.M...| = toolrack

tafel v. chirurg
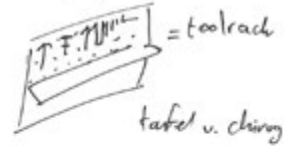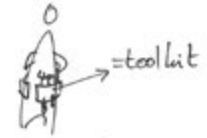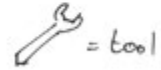
WALL UNIT

instructor — leerling
dirigent — koor
chirurg — patient

minder modulair

Modulair

OMEGA WALL

Single unit, 2 states | 3

Both interface need

equal

Make suspect upper smaller?

What if officer prepares suspect setup?
→ clear initiation of process
→ shift of responsibility

suspect's

① Prepare

- open klappen
- omdraaien
- aanzetten
- aanschuiven
- doordruwen
- doordraaien

②

③ monitoring

interacting

②

①

A

?

?

②

①

Revolving vertical

Mechanical switch

Standing or seated?
Modularity?
→ futureproofuse

afterwards.

8.1.4. New requirements

The creative sessions, a lot of brainstorming and the first idea directions lead to the definition of the first design decisions and development of new requirements.

Added requirements
- The operator should be able to intervene, at any time during use
  - The operator's hands should always remain free
  - The product should not create a physical barrier between the users
- Participant should only be occupied with biometric enrolment
- Participant remains at a dedicated place throughout the whole process
- Allow for separate scanning of each biometric

8.1.5. Design decisions

Transitioning from a workstation to a kiosk: arrive, scan, go
- Facilitate a feeling of agility
- Prepare the product for an even faster future

Operator touch screen
To answer to Req. 4.3 and Req. 4.9, it is chosen to provide the operator with a display for input and feedback A touch screen was chosen for the following reasons:

- Opens possibilities for mobile integration
- Substantiates a fast and quick registration
- Removes loose parts like a mouse and keyboard
- Leaves the hands of the operator free during use (loose hands)

Centralized biometrics
Since the participant should remain in one place (Req. 5.5) and with an eye on space efficiency, it is only logical to place all scanners compactly and close to the participant.

Common progress indicator
Underlining the user connection (Req. 5.9) and feedback, it was chosen to provide both users with a common progress indicator. It is still to be defined if this is done manually/ digitally and with one or multiple indicators.

Avoid 'caging' and enclosure of the participant by the product

Suspect components
Enrolment of some biometrics has been defined by law (Req. 5.10 & Req. 5.11). To generate ideas, this phase of development they will be clustered in the following groups:

- Head components (face, iris ad ear);
- Hand components (fingerprint; hand-palm);
- Foot components (footprint).

Operator components
- Touch screen;
- Document scanner (documents will remain for the coming decade, section 4.2);
- Phone holder (integration of mobility in processes, section 3.1.2).

A timeless base with interchangeable modules
Implemented components are likely to change in the near future (section 4.4) and the Police has no control over the geometry of off-the-shelf devices (section 3.3.5: updates & Versions). Though, we must be able to adapt to these changes, without high costs and large refurbishments.

It was therefore decided to go with a timeless base-frame, that will function as a kind of rack onto which different components can be placed.

To eliminate the dependency of off-the-shelf device geometry and connections, adaptors could be designed to bridge the differences between these devices and the base.

Fig.66: Modularity: the idea of a device adapter part (below) that can be mounted on a modularity strip (middle) and how the component groups would function (below)

8.2. Idea Phase 2

8.2.1. Morphological chart

The above-defined design decisions functioned as starting points for the next ideation step.

Additional promising directions and ideas were extracted from the ideation sketches and clustered in groups.

A morphological chart was then constructed from these ingredients.

8.2.2. Four concepts

To come up with promising concepts, unique paths were chosen through the chart with matching 'concept-ingredients'. Multiple LEGO models were prototyped of the chosen directions. These initiated the conceptualisation phase
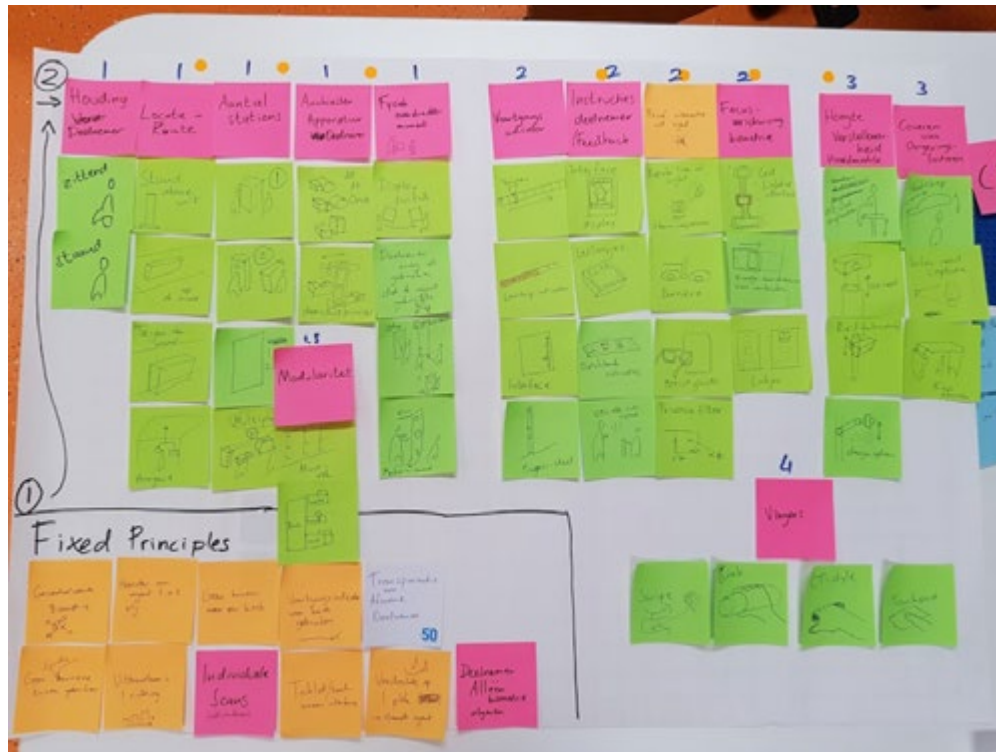
Fig.67: The morphological chart was the key-step to the conceptualisation phase

Fig.68: Four LEGO prototypes

Ideation

9. CONCEPTUALISATION

This section shines light on the process that the concepts have gone through. Based on 2 evaluation moments with relevant stakeholders, three concept phases were ran through. The graphic below provides a visual overview of the conceptualisation phase.

PHASE 1
- 4 Concepts
- Concept evaluation 1
- Stakeholder preferences and concerns
- Design Decisions

PHASE 2
- Ergonomics
- Structural model
- Embodiment Concepts
- Concept eval. 2
- 1 Concept
- Design Decisions

PHASE 3
- Seating Ideation
- Base Ideation
- Color Study
- Final Concept
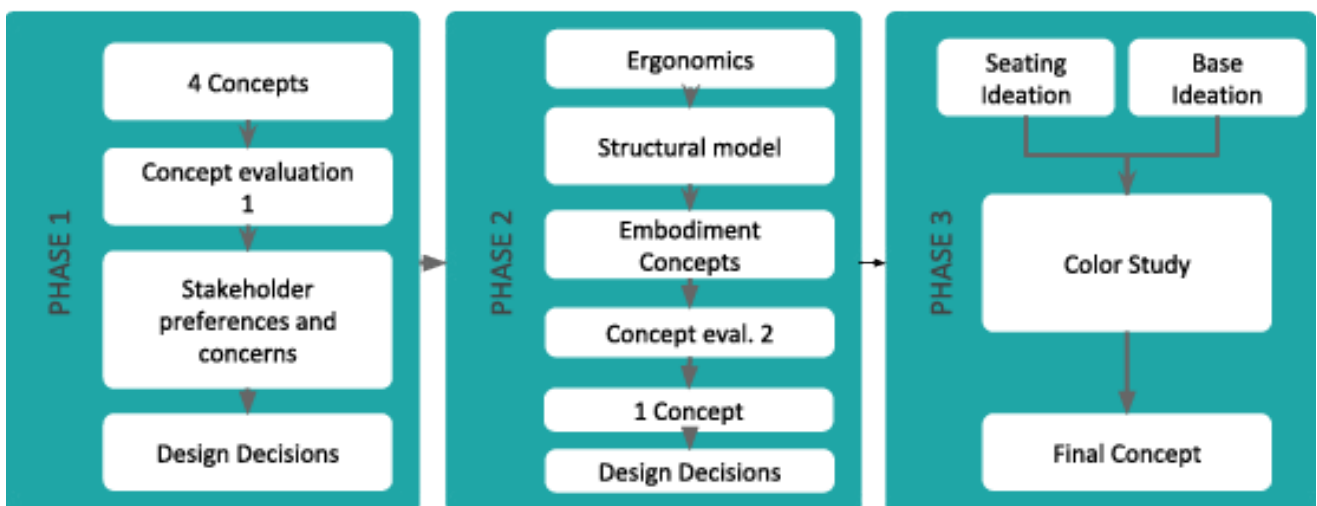
9.1. Concept Phase 1

Without losing creativity but with a reasonable eye on feasibility, four of the LEGO prototypes were chosen for further elaboration. Four posters were created to communicate the key-strengths of the concepts

9.1.1. Concept evaluation 1

To determine the value of the first concepts and to define promising ideas and directions, three concept evaluation sessions were held with important stakeholders (Police, KMar and CvB). The concepts were evaluated on feasibility, viability and desirability as well. The session plan and results can be found in Appendix R.

The concepts and corresponding evaluation are presented on the next pages. Enlarged posters can be found in Appendix Q.
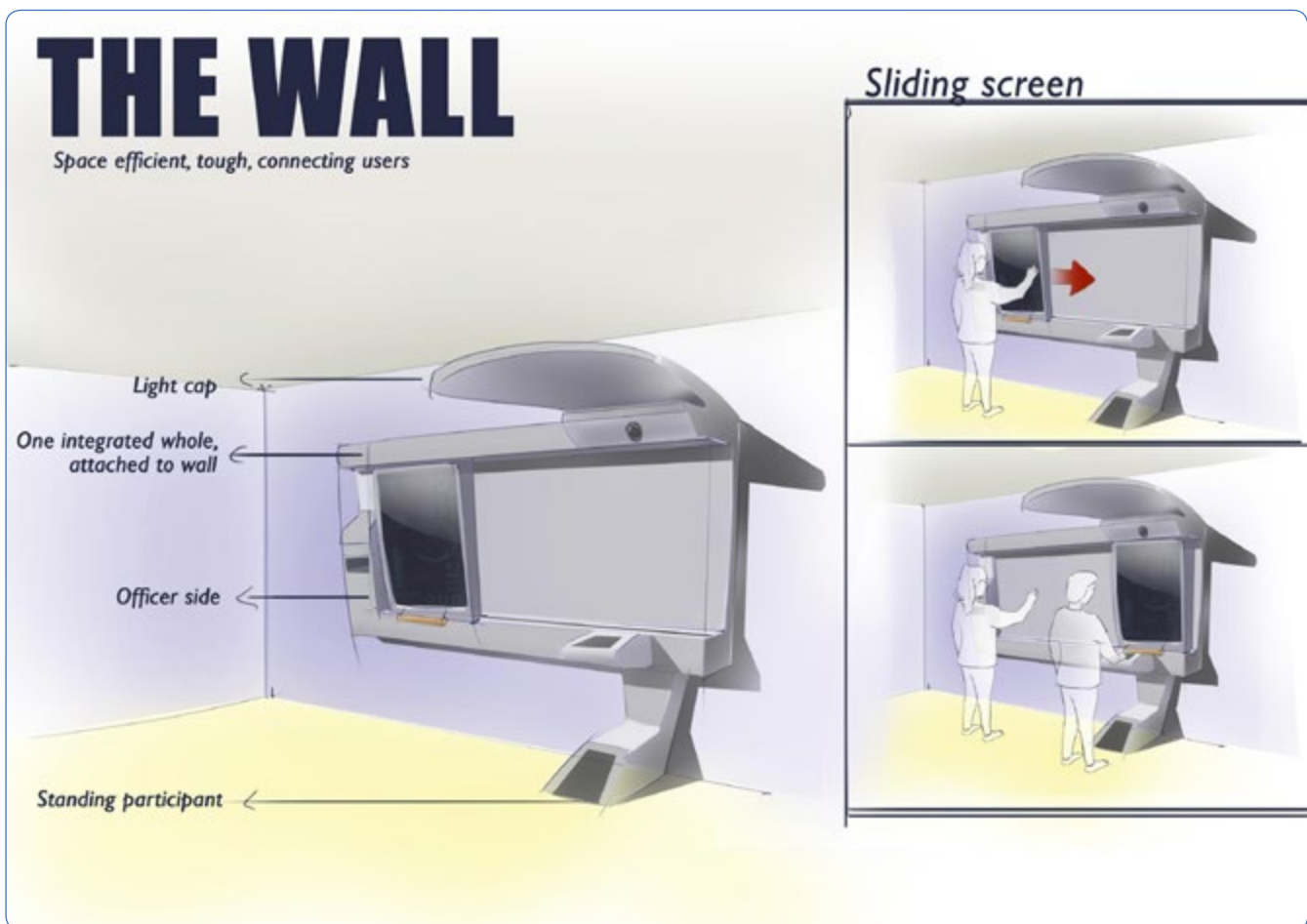
Appreciated by the stakeholders:
- Looks very robust and compact;
- Space efficient due to the use of a wall;
- Very versatile employable.

Concerns:
- Sliding screen is believed to be a critical failure point;
- Reduction of the safety of the officer since they cannot keep eyes on the participant;
- Lack of camera adjustability;
- Participants' position is difficult to define;
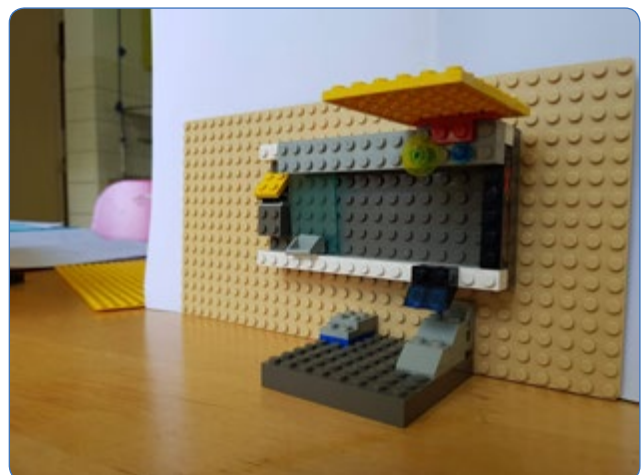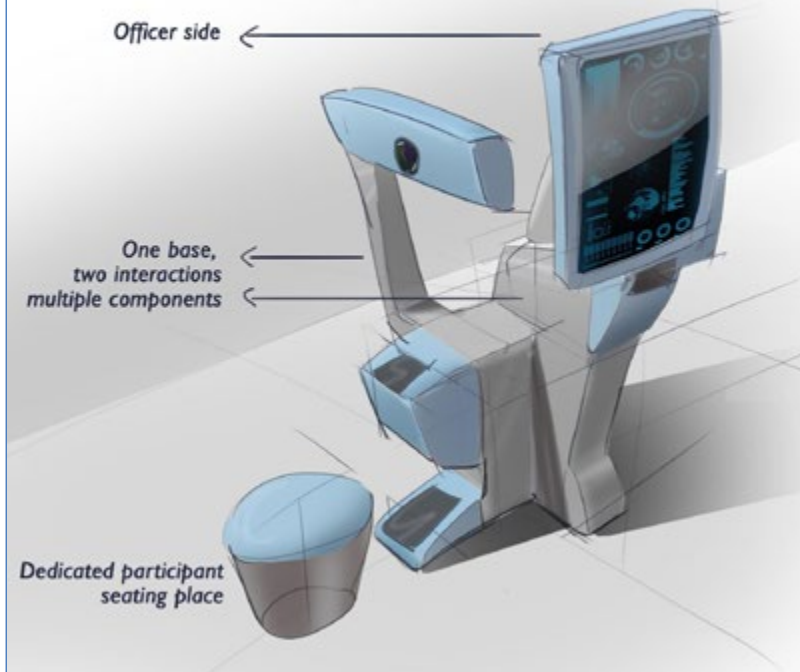- Hard to fit more than one in a single room

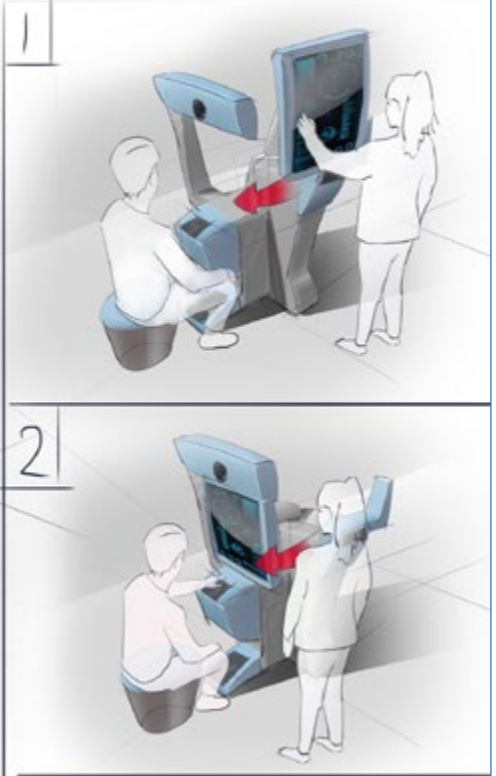*Fig.70: Poster & LEGO prototype of The Wall*

PLACE & GO

One integrated unit, compact, stand alone

Officer side ←

One base,
two interactions
multiple components ←

Dedicated participant
seating place

Rotating Screen

1

2

Appreciated by the stakeholders:
- Touchscreen is appreciated;
- A screen for the participant;
- Seated participant.

Concerns:
- No attention is given to coping with context factors for photography;
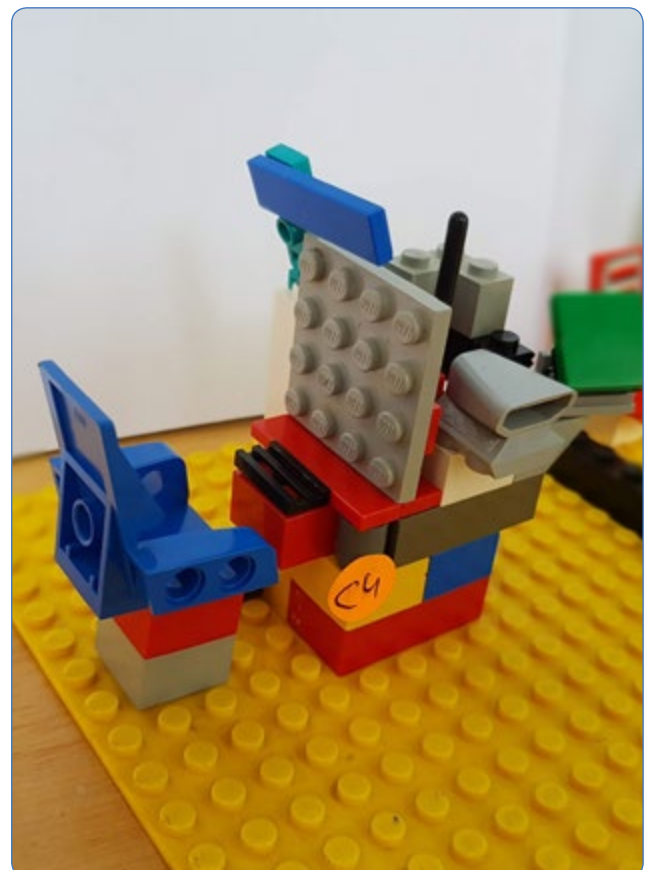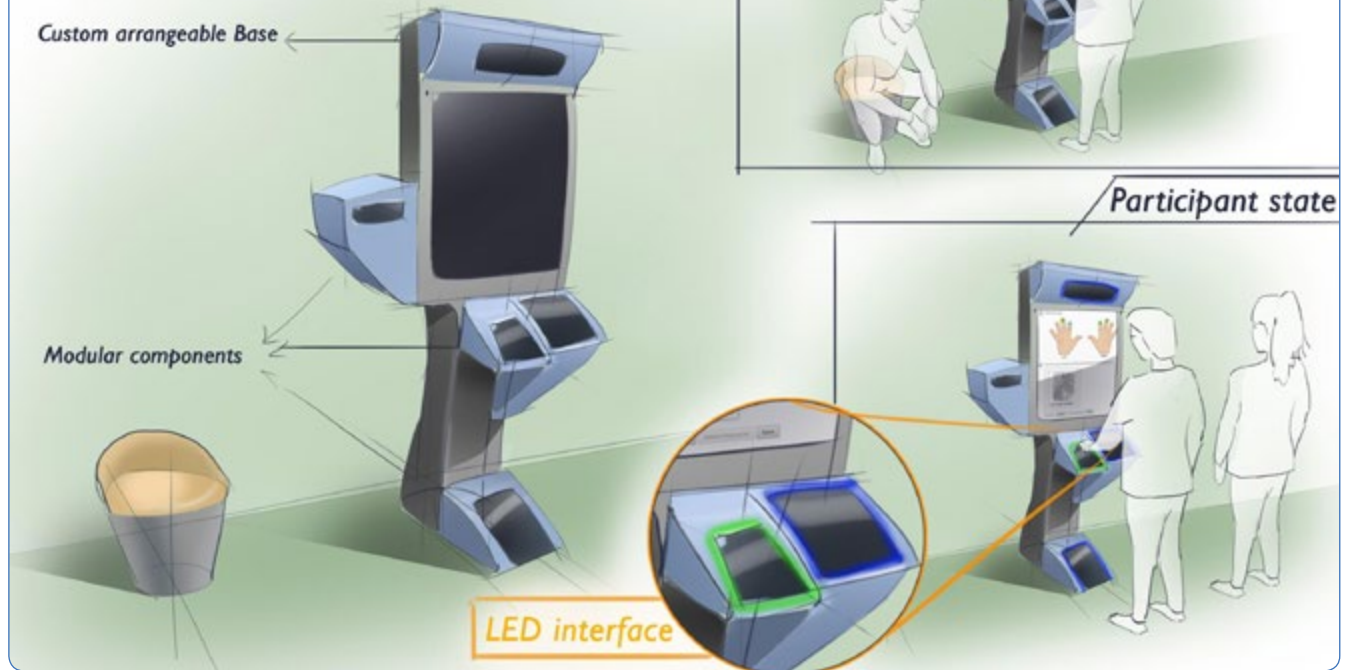- The rotating mechanism is believed to only cause problems.

Fig.71: Poster & LEGO prototype of Place & Go

Appreciated by the stakeholders:
- Very portable;
- Compact and agile feel;
- LED interface was appreciated.

Concerns:
- The participants' position during use is not appreciated. It feels childish and they have no clear task;
- Misses a solid base;
- Adjustability of the camera is a point of attention.

Fig.72: Poster & LEGO prototype of State Switch

Conceptualisation

TWO TOWERS

Customizable, flexible, split interaction

Custom arrangeable Base

Participant base with interface

Dedicated participant seating place

Officer's Base

1. Setup

2. Reveal

3. Enrollment

Appreciated by the stakeholders
- The flexibility that is enabled by the separate unit is appreciated;
- Idea: to integrate the participant's module with the wall

Concerns
- A connector might be needed between the modules: extra component and not nice to have;
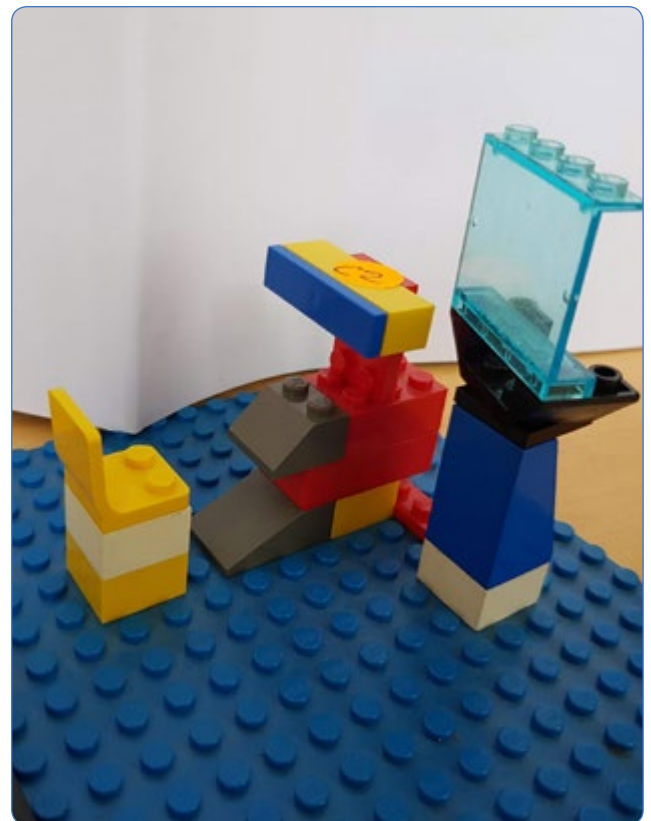- Having two loose units results is less space efficient

Fig.73: Poster & LEGO prototype of Two Towers

9.1.2. Design decisions

Based on the feedback acquired during the evaluation sessions and with the criteria (section 8.1.1) in mind, the following decisions made:

Participant display
Similarly to the operator, we will add a screen for the participant as well, for the following reasons:

- It is in line with the envisioned guiding role of the product. The interface can take over instructions of the operator and provide feedback on the execution of steps and overall progress.
- A participant interface could provide instructions in all languages. This is beneficial for the migration chain as well.

Seated participant
Based on the following arguments it was chosen to have a seated participant:

- It facilitates a feeling of being welcomed, enabling the operator to 'provide a seat for their customer'. It also opens the possibility for more unjudging design element.
- A seating provides a dedicated place & position for the participant during the entire process of enrolment, depriving them directly of that uncertainty.
- A seating automatically aligns the participant correctly to the camera.
- Although we stated that authority is mostly caused by the operator's nature, a seating provides an additional authoritarian difference in the relationship between the users. Due to the overall welcoming experience, it is assumed that the authoritarian gab will be experienced mostly unconsciously by the suspect.
- In case of an escalating situation, the seated position causes a standard tactical disadvantage against the officer. It as well provides a spot to but pushed against

A seated participant might make it harder for the operator to assist during fingerprint enrolment[1]. It is assumed though that the instructions provided by the display of the participant will partly cover this reduction.

Physical transfer moment, but no rotating display mechanism
The rotating display was assumed to be one of the key ideas for the transfer moment, but it has been taken out due to feasibility reasons.

- Assuming a seated participant and a standing operator, there will always be an eye-level difference. A rotating display would, in that case, need to move in height as well.
- Regarding overall robustness and weight of the intended display, the facilitating mechanism would become rather big.
- The display is one of the key components that the

product relies on. This idea would make the product fully dependable on one relatively complex mechanism.

One integrated whole, but separated interfaces
Having two loose units will result in a user disconnection by default. Next to that the 'single unit' and compact concepts were appreciated. Due to privacy and hygiene reasons, the operator should have their own separate interface.

The integration of two user interaction points in one facility reduces the possibility to vary in setup. This is a challenge for the next phase.

No use of wall: stand alone
The 'Wall' concept was greatly appreciated in terms of space efficiency and simplicity. Though it was chosen to avoid the requirement of a wall for the following reasons:

- Increase dependency on uncontrollable context factors.
- Drastically reduce versatile employability and placement flexibility
- We can state that, whatever the concept will be, it will contain a certain amount of weight. This gives us another dependency that we are not sure to cover strong walls.
- Police station buildings are not owned by the police. Having to construct a device on the wall will have an impact on the real estate.

'Mirrorability'
During one of the evaluations the desire came up for a concept where the operator's side could be place on either side of the participant. With an eye on the employability criteria, the mirrorability is listed as a new requirement.
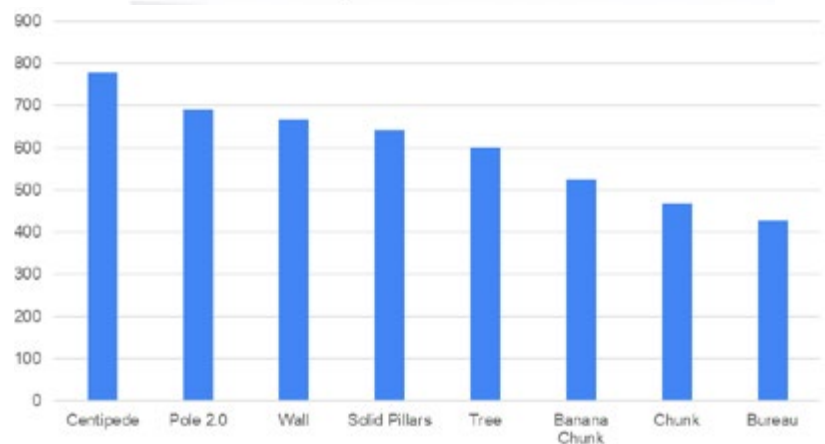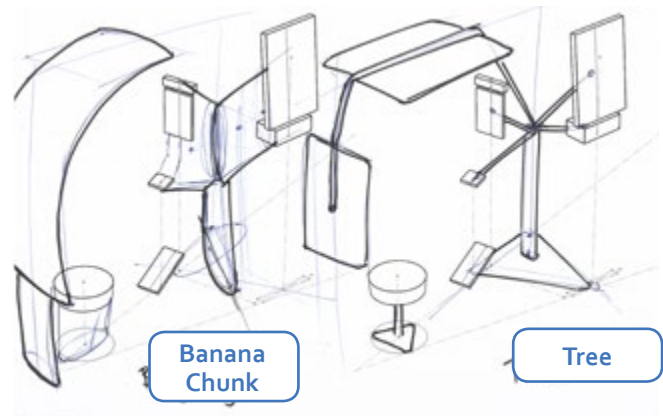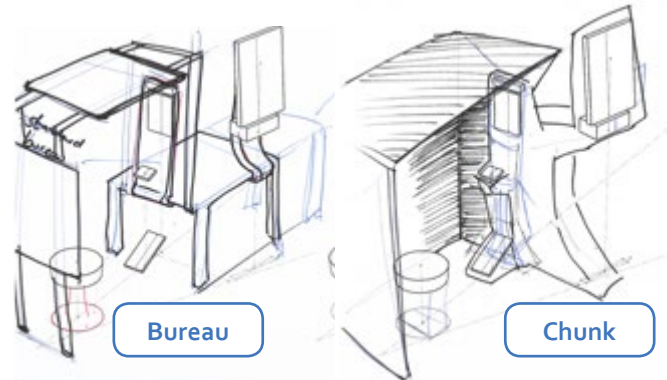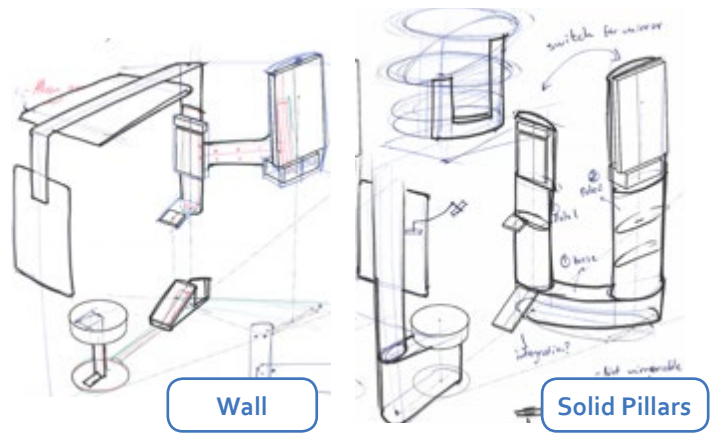
---

1. Stated during Concept Evaluation 1 (Appendix R)

9.2. Concept Phase 2

New requirements and design decisions laid the foundation for a transition towards one concept. The goal of this phase it present one concept to the client. Results from the second evaluation suited to steer the concept for a last time in the correct direction.

9.2.1. Ergonomics & Structural model

With the new principles, defined components and human measurements in mind, a structural model (Muller, 1997) was designed. In line with the suspects' most common age range, the P95 Man 20-30 years (DINED, 2004) was used for maximum values. For minimal values the P5 woman 30-60 years (DINED, 2004) was used[1].

Some dimensions play a critical role in the structural setup and are therefore elaborated below.

Participant grab radius
To address Req. 4.7, the maximum grab radius of the P95 participant was calculated. The operator and their components should remain out of this radius when the participant is seated. The radius was calculated as follows:

Maximum participant grab radius =
[standing reach length] + [shoulder width / 2] +
[upper body length / 2] = 1300mm

Head module height adjustability
In line with Req. 5.2, the participant camera and interface need to be adjustable in height. For the bottom level we take the seated eye height of the P5 woman.

The upper maximum is defined by a possible future lay out. Namely, next step in facial photography could be a 3D capture with multiple cameras from different angles (section 4.3.4: Face). This causes the requirement that cameras might be placed below the screen as well, setting the required eye height on centre of the screen. Concluding, the upper maximum adjustability is the seated eye height of the P95 man added by half of the screen height. So:

Head module adjustability range =
[P95 man, seated eye height] + (screen height / 2) -
[P5 woman, seated eye height] = 845mm

Chair height
In line with the intended experience of agility (Fig.63) and a correct posture for the photo, an active seating position should be stimulated. Therefore, the height of the seating was chosen to be slightly above average:

Seating height = ([P60 man, seating height] + [P60
woman, seating height]) / 2 = 475mm

Orientation of fingerprint sensor
The past has proven that the fingerprint scanner should be oriented parallel to the stretched hand (section 4.3.5: updates & versions). This should be considered for the next design.

---

1. The P-values might suffer from the 'P5-P95-syndrome' (Dirken, 2004-2008). It has be noted that these P-values are being used for an early conceptualisation step. For the final product this must be re-evaluated: can we allow 220cm tall men to have a slightly bad posture on their picture?

Fig.74: Structural model

Fig.75: Grab-radius (above)
Ergonomic seating setup (below)

9.2.2. Embodiment concepts

Using the structural model as an under layer, 8 new concepts were developed. A weighted criteria method was chosen to evaluate the concepts (Fig.76). The embodiment concepts are presented on this page.

Wall

Solid Pillars

Centipede

Bureau

Chunk

Banana Chunk

Tree

Pole 2.0

Criteria	Value	Solid Pillars		Chunk		Centipede		Bureau		Tree		Banana Chunk		Pole 2.0		Wall	
Versatile employability	17	8	136	3	51	9	153	4	68	8	136	3	51	9	153	2	34
Future proofness	20	5	100	4	80	9	180	6	120	8	160	3	60	8	160	8	160
Unity & user connectedness	17	6	102	4	68	7	119	2	34	7	119	5	85	7	119	7	119
Simplicity / minimalism	12	4	48	2	24	6	72	7	84	6	72	6	72	9	108	8	96
Escalation resistant	18	8	144	10	180	7	126	4	72	1	18	8	144	3	54	9	162
Unjudged-ness	16	7	112	4	64	8	128	3	48	6	96	7	112	6	96	6	96
Total	100		642		467		778		426		601		524		690		667

Fig.76: Weighted criteria result

9.2.3. Concept 1.0

Through some synthesis of the concepts, the lasts steps were taken towards the first version of the final concept. More iterations were done mostly on the base, the seating is still left mostly unattended.
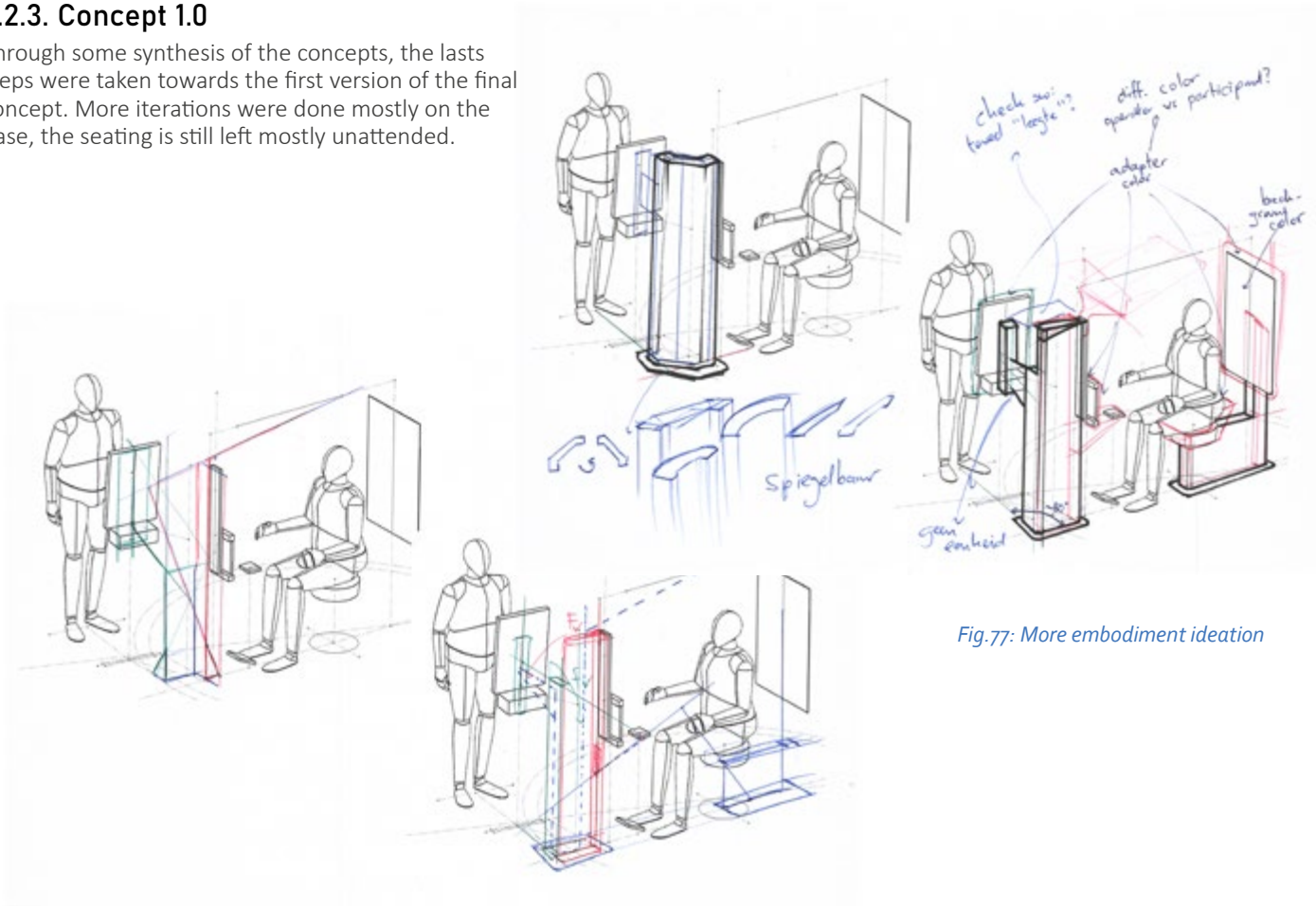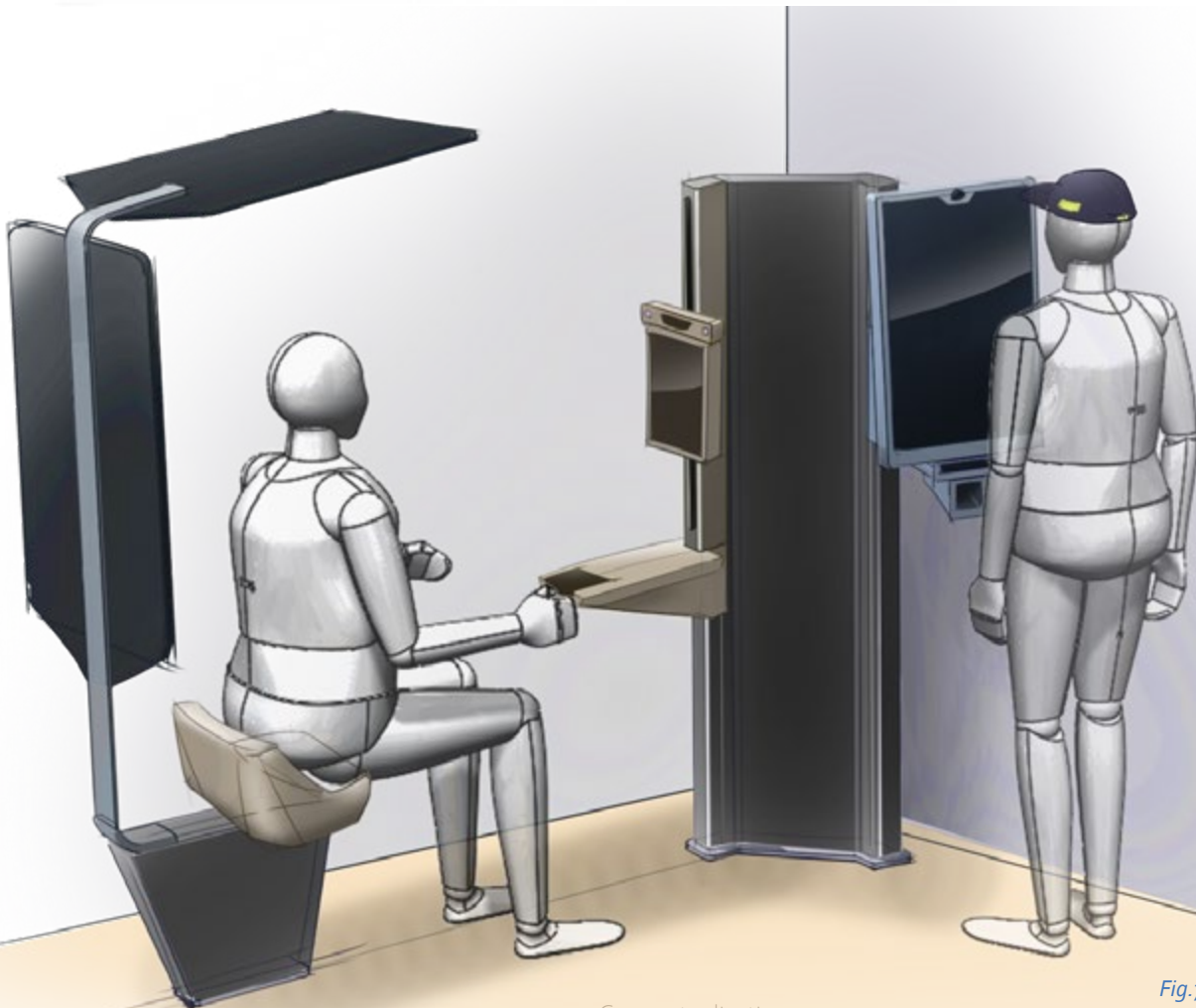
9.2.4. Concept evaluation 2

Concept 1.0 was evaluated with the Police (setup and results can be found in Appendix T). During the evaluation session, the concept and its function were presented and attendants were asked to collectively answer questions based on the criteria. Results from these evaluation forms the basis for the final design alteration. They are listed below.

Overall conclusion
Positive remarks were given on the overall product architecture and user placement. Compactness, the sense of plug 'n play ("you can put it everywhere") and the integration of the smartphone were greatly appreciated. Most concerns were around the seating, the base and the

Criteria	Value
Multi-purposeness	5
Future-proofness	7
Unity & user connectedness	7
Simplicity / minimalism	2
Escalation resistant	N/A
Unjudgedness	N/A

Fig.79: Scores per criteria based on the interview questions

overall aesthetics.

Seating concerns
The following concerns are listed regarding the design of the seating:

- Does not communicate in form language with the base;
- Does not express simplicity;
- Fragile and unstable look;
- Lacks foundation.

Base improvement points
The evaluations resulted in some improvement points the base as well. New ideas were developed based on the following concerns:

- Instability;
- The overall dull and rigid look;
- The top of the base (right) misses a kind of aesthetic closure.

Aesthetics
Additional feedback was provided on the colouring and aesthetics. This concept still lacks a welcoming sense and a feeling of simplicity. This is an aspect that shall be put extra attention to in the next phase.

9.3. Concept Phase 3

With the feedback, a last conceptualisation phase was initiated. The seating and base were redesigned and aesthetics study was conducted.

9.3.1. Seating ideation

Early concepts looked like toilets. Square seating and less integration of the backplate eliminated this effect!
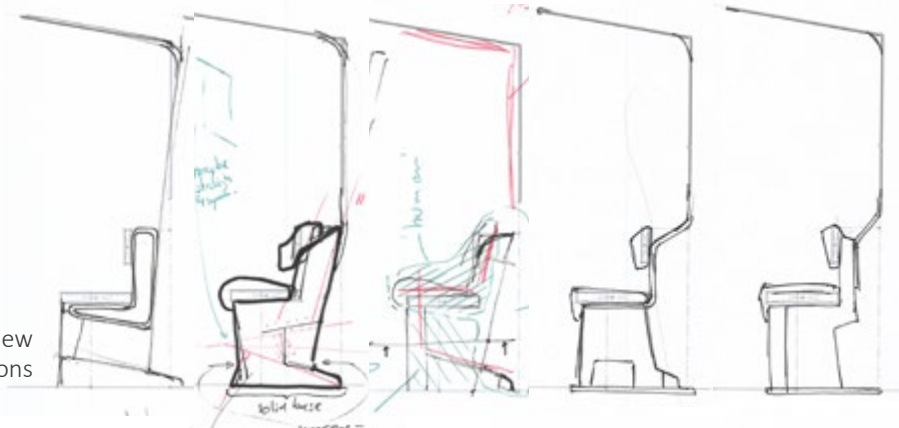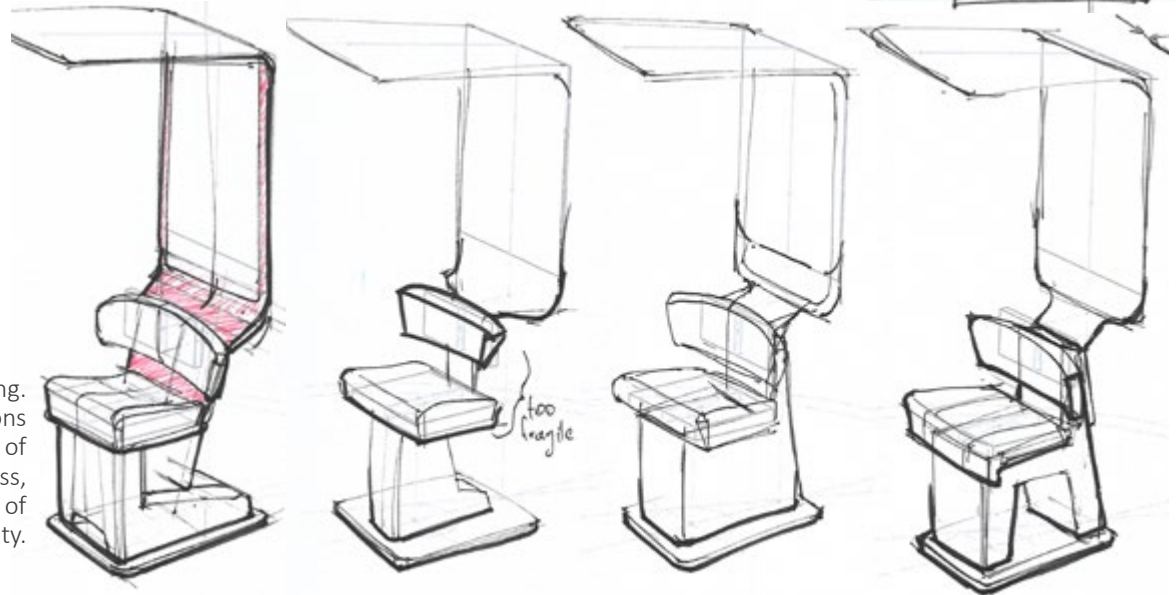
A lot of side-view iterations

10 degree angle
The first concept that started to look nice!

The angles and curves evoke kindness

Still pretty bulky, but it is starting to come

The first final seating. Still too bulky. Iterations show a reduction of experienced mass, while keeping a sense of stability.

9.3.2. Base ideation

Aesthetic closure
New ideas to develop an aesthetic closure of the top of the base

Stability
Stability was addressed by developing 5 concepts and testing them through a small brainstorm with an employee of maintenance support

Concept 2.0 version 1
The final design with all new directions synthesised in one

9.4. Colour Study

Now that the structure, components and basic shapes of the concept have been defined, there is room for a study on aesthetics.

Color groups

For clear communication, components were clustered in colour-groups based on functionality and 'ownership'. Next, qualities from the interaction journey were assigned to the colour group. Based on the qualities and the aesthetics study in Appendix X, colour characteristics were chosen. Eventually a colour study was conducted to determine the right tint. In order to not spoil the concept here already, the renders are be found "10.2. Colour Study" on page 92.

Component group	Aesthetical function	Product quality	Colour character
Floorplates	Boundary of the product	Clear, stable, confident, conclusive	Contrasting with the floor, darker
Embodiment	Reducing the presence of the product	Approachable, Inviting	Warm, light, calm
Participant components & seating	Clustering, invite to use and communicate ownership	Accessible	Warm
Operator components	Clustering, invite to use and communicate ownership	[no aesthetics qualities were defined for the operator]	Differentiating with participant and base. Calm, professional
Caps	Boundary of the product	Clear, stable, conclusive	Contrasting with the walls & roof. Similar colour as floor plates

Fig.80: Colour groups

9.4.1. Concept 2.0

With the feedback from the second evaluation and the implementation of new ideas, a next concept was developed.

Design Decisions

This concept was presented to the initial client and the supervisory team. The provided feedback resulted in some small design alterations.

- A quick win was observed to reduce production costs: make the floorplates identical.
- For aesthetic purposes, a cap was placed on the base, though it has no functionality. It was decided to leave it out for now.

Fig.81: Concept-sketch of concept 2.0

DELIVER

DELIVER

This chapter presents the final concept that is delivered. Firstly, the concept's functionality is explained and elaborated on detailed level: what is it and does it do? Next, an argumentation is given on why this concept 'solves' this project. Then we shine light on the next steps: how could this be implemented and what are the next development steps? To conclude, an overview of recommendations is given to provide the Police promising directions and advices, that could be elaborated in the future.

10. CONCEPT EXPLANATION

So, here it is, the 'Main Appliance for Identification (MAID)'. But what is it and what does it do?

10.1. Functionality & Components

The concept consists of two parts: a seating and a base. The base consists of two separate interaction points (Req. 3.1): one for the operator and one for the participant.

Size can be found in Fig.82. Estimated weights are 80 kg (base) and 50 kg (seating).

Fig.82: Side-, rear- and top- view

1800 mm

1900 mm

550 mm

630 mm

600 mm
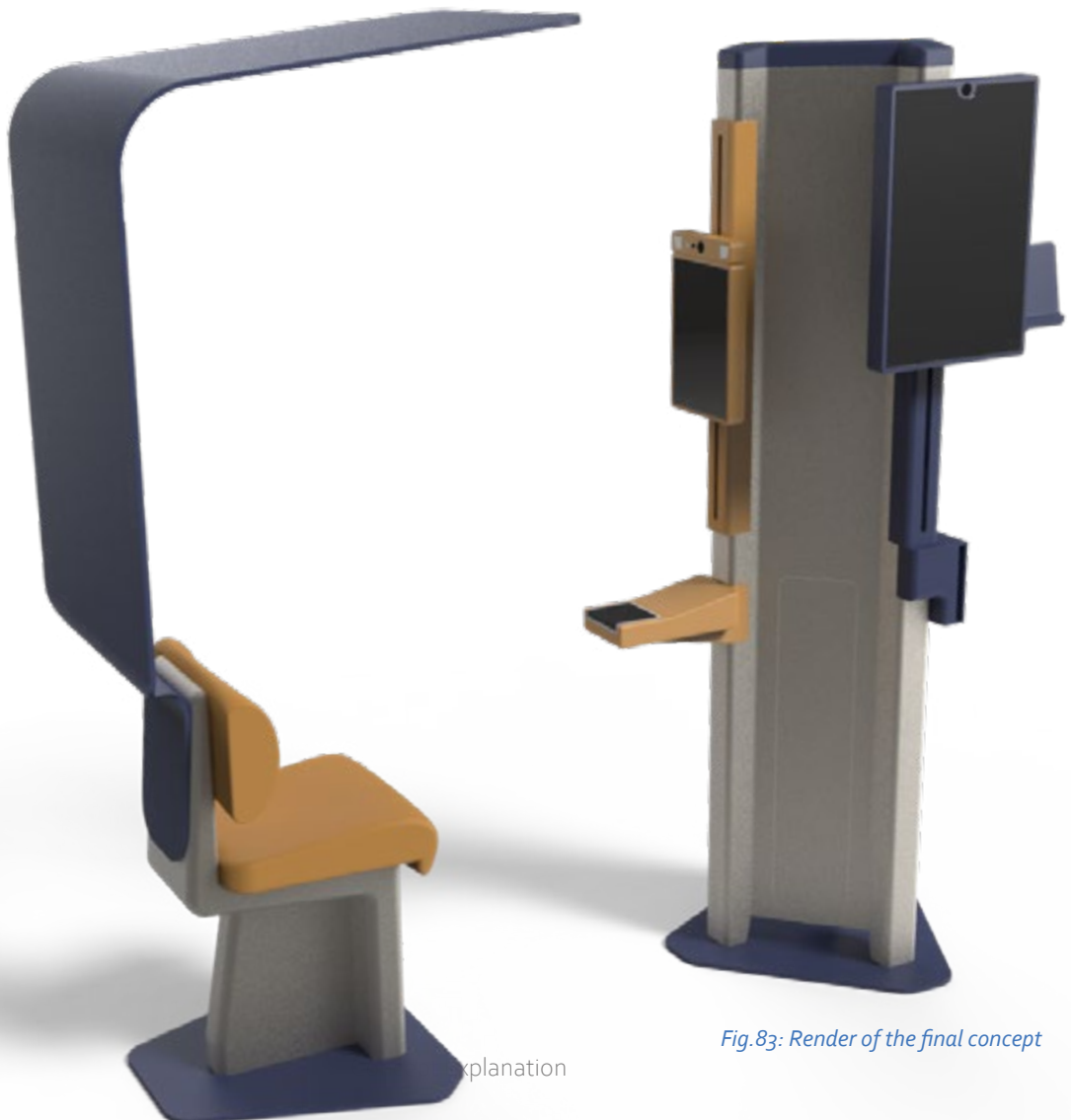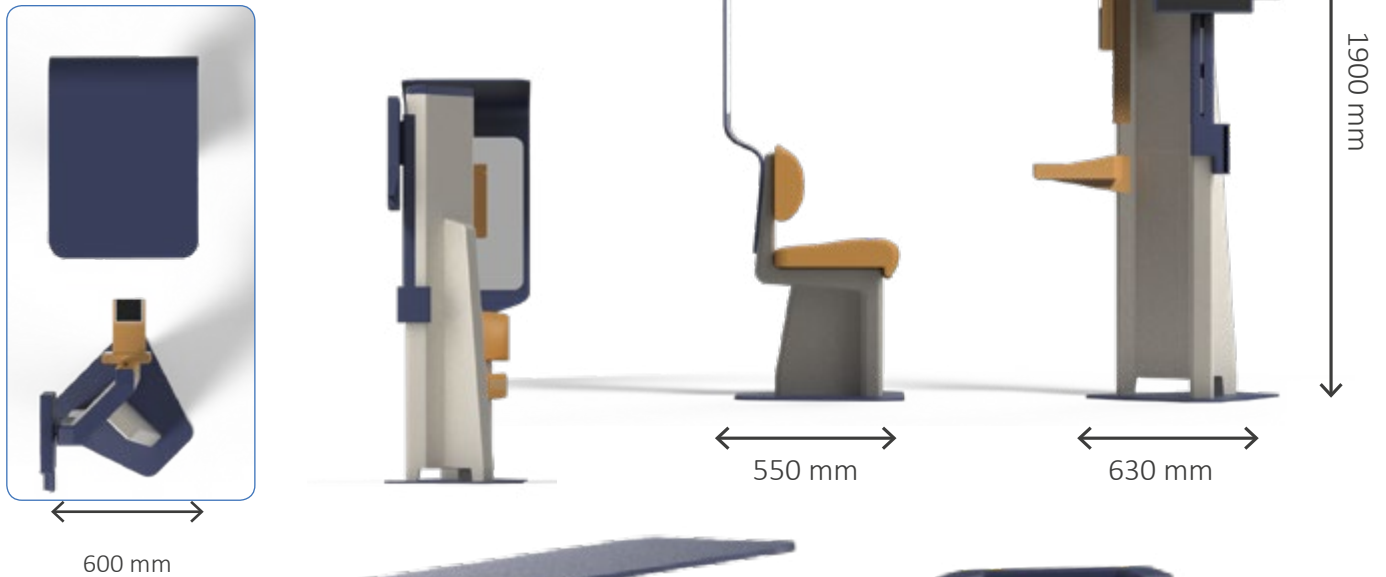
Fig.83: Render of the final concept

explanation

10.1.1. Exploded view of the base

The plate metal embodiment covers up all structural elements and internal electronics

The base cap provides a functional and aesthetic closure of the base

The modularity strips provide both sides with the possibility for customization of components

The plate steel base frame provides all strength and stiffness for the product. It provides slots to hang the modules on, a foundation for the electronics and attachment points for the baseplate.

A small camera functions for facial recognition verification. Additionally it can capture the environment during registration and will help to auto adjust the product's camera setting to the environment.

The touchscreen enables the operator to interact with the product in a hands-free way (Req. 4.3). Additionally it enables the product to communicate with the operator.

The linear rail enables the automated height adjustability for the necessary components for both users

The fingerprint sensor is placed in a compatibility module for future-proofness and easy replacement.

Fingerprint scanner

Document scanner

The display enables for feedback and instructions for the participant during use.

Participant's camera functions for facial photography, human pose estimation

A phone holder enables for operator's authorisation with mobile phone

The maintenance cap provides possibility for more elaborate maintenance

The foot and floorplate provide the base with stability and weight

Concept Explanation

10.1.2. Exploded view of the seating

The cap around the participant functions simultaneously as a back background and as a protection to environmental lights, reflections and shadows

An EL plate is placed in the background of the participant to cope with cast shadows and to provide photos with one distinct plain background colour

Backrest and seat

The seating frame is designed to provide weight, strength and stiffness to the seating

An identical floorplate is placed underneath the seating to provide stability and weight

10.2. Colour Study

As promised in section 9.4.1, the colour study.

Conclusion

The 6 colour lay outs below were found to be the most promising. It was chosen to go with blue and orange since they are most in line with the experiences as described in Fig.80 . These colour represent the Police best as well.

11. CONCEPT ARGUMENTATION

The main question answered in this chapter is: how does it solve this project? To substantiate why this concept meets the demands, a reflection is given based on the criteria. Eventually implementation is discussed.

11.1. Proofing Futureproofing

11.1.1. Modules

One of the uncontrollable dependency factors is the geometry of off-the-shelf devices. To eliminate this dependency, adapters have been designed that provide compatibility between the off-the-shelf devices and the product. This grants the Police with more freedom of choice and prepares for future versions of existing components.

Now, whenever a new component is required, only the adapter needs to be changed, not the whole product.

11.1.2. Incorporate company vision and trends

The product encompasses the Police's envisioned mission (Req. 1.1).

The base connects the interfaces of both users, connecting the citizen with the officer. By providing feedback on the process, the user experiences transparency and honesty. Eventually the users can appreciate a result, underlining the Police's result-oriented approach.

Additionally, the phone holder and the touchscreen open the door for implementation of more mobility related solutions.

Fig.85: Integration of smartphone
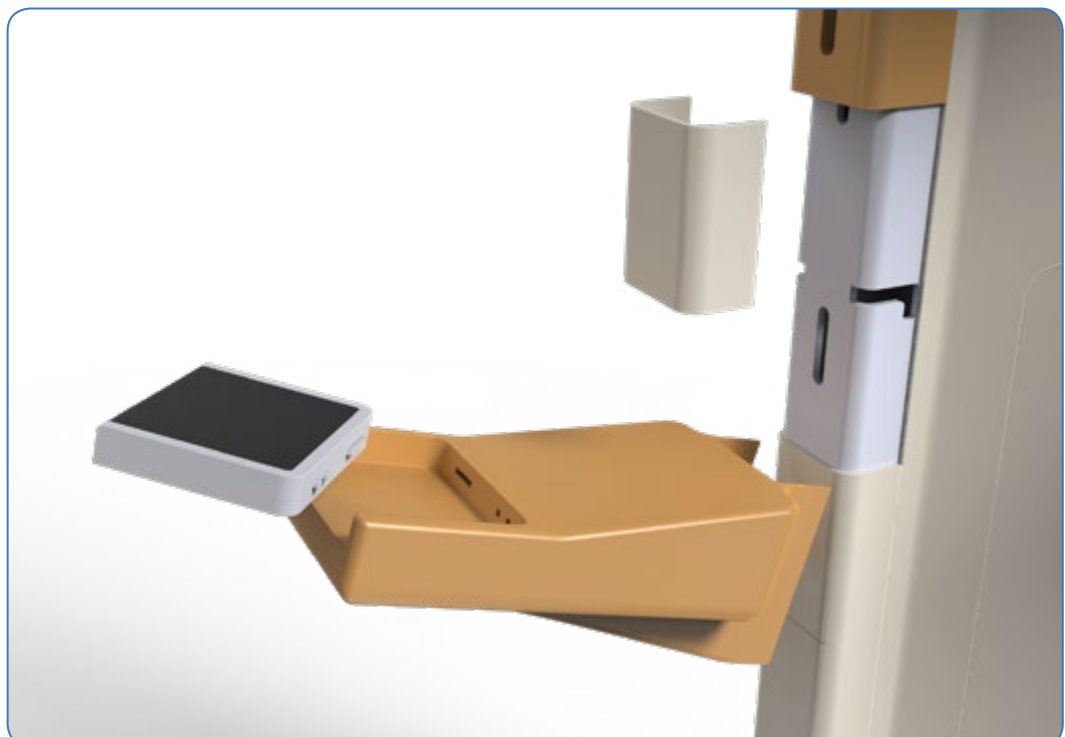
Fig.86: Adaptors for compatibility

Concept Argumentation

11.1.3. Implementation of new technologies

The product provides the possibility for implementation of new biometric technologies. With the modules, the product can be arranged in various ways, but the base remains.

Implementation phase 1

The MAID is set-up as its initial design. The base of and the frame of the seating will remain there for a longer period of time
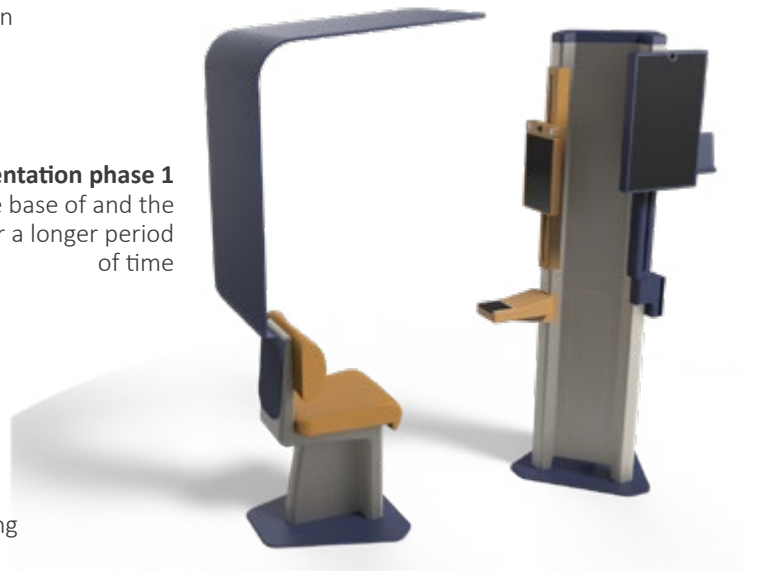
Implementation phase 2

- Future hotography might enable to cope surrounding light and reflection, eliminating the top cap.
- 3D image capturing is made possible by multi-angle photography.
- Hand palm and fingerprint are scanned at once.
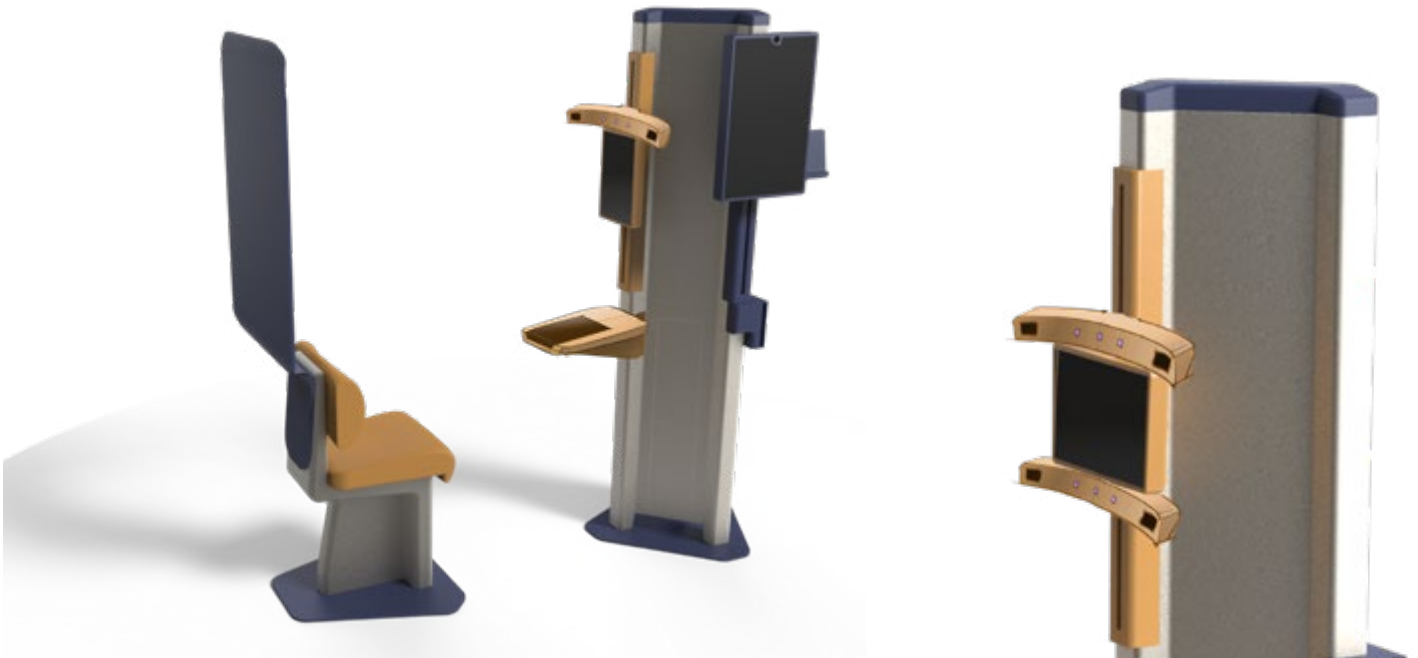
Implementation phase 3

- The operator's input and display is fully transitioned to their smartphone
- 4 camera's are place for even faster 3D capture and to eliminate the environmental background
- Fingerprint and handpalm are fully touchless and instantaneous with touchless scanning

11.2. Versatile Employability

To what extent is the product usable for police applications and more partners in the identity-construct?

11.2.1. Police applications

Mirrorability for set-up flexibility
To deal with the variety of identity rooms, the base has been designed to enable the users' interfaces to be interchangeable (Req. 4.5) (Fig.87).

Improved portability
The concept is designed as such, to fit through doors, allowing for easy transportation.

To enable easy replacement (Req. 7.5), the foot of the base can be removed easily the reduce weight and the space underneath the base allows for the use of a hand truck. Furthermore, the concept does not require any kind of fixation to the building.
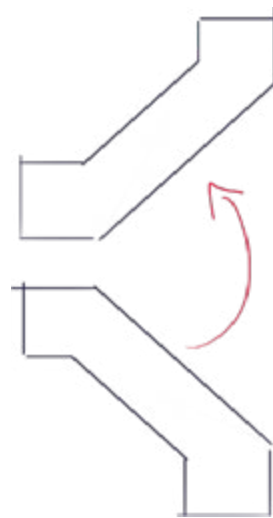
Fig.88: Mirrored setup

Fig.87: Bare frame for custom layout and mirrorability

Concept Argumentation

11.2.2. Identity construct applications

Instructions in migrant's native language
The concept applies for migration chain purposes as well.

With the new display, the participant can now be provided with instructions in their native language. Eliminating the possible language barrier between the users

Fits the statement as well. You want to be welcomed in a new country, not feel judged.

Batch set-up voor AVIM
Refugee registration must deal with long queues. To improve lead time, the new concept allows for a batch setup. This enables the AVIM to enrol multiple refugees at the time.

Customizable module appearance
The modules provide the option to customize the product to the partner's preference. For instance, the municipality of Delft can have light blue fingerprint scanners, with their logo on it.

DJI
The DJI could commission the exact same lay out as the police, but for the purpose of keeping enrolled data up to date.

Municipalities
This concept encompasses all functionalities required for identity enrolment at municipalities. It eliminates the necessity of having to go to a photographer and risking the photo to be rejected. Furthermore, the homogenisation of photo quality and characteristics can boost the implementation of facial recognition. This way, all required steps for application can be taken at once in one place.
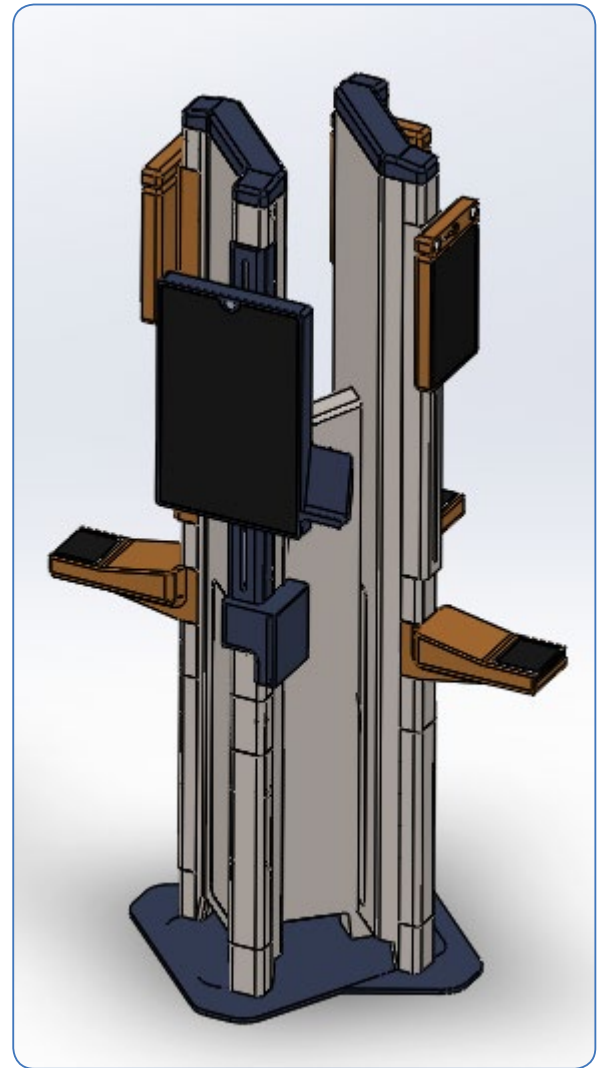
Fig.89: Batch setup by integrating another base

Advanced lay out for investigation purposes
Some biometrics like the ear of footprint are only rarely requested. For these purposes, the product can be equipped in an setup (Fig.90) to be commissioned only at few dedicated places in the Netherlands.

Fig.90: Advanced lay out for investigation purposes

11.3. Reducing Dependency

In section 5.1.1 it was stated that the goal is to reduce dependency by reducing the probability of a priority 1 occurring. The assessment of the sub-goals is described below.

Reduce the number of factors that the product's functionality depends on
- With the guiding role of the new concept, the required knowledge of the operator is reduced.
- The illuminated background will cope with cast shadows
- The adaptor modules make the MAID compatible with any device on the market. It can also adapt to new versions of already implemented devices.
- The seating eliminates possible wrong positioning and posture of the participant.
- Authentication with mobile phone will eliminate login issues.

Reduce the likelihood that the product is labelled as 'not operable'
The more often a product is used, the higher the number of defects. The implementation of an on-the-street verification moment will reduce the number of uses by 40% (section 5.2.1). Since the facility is used less frequently it will have less defects as well.

Additionally, we see an increase of digital acceptance among police officers. It is believed that the redesigned interaction will increase this even more. That way, users are becoming more knowledgeable about the product, reducing the likeliness that a simple malfunction will be labelled as a defect.

Plan use in advance and anticipate defects earlier
By implementing an earlier contact moment with the product, the operator can check on beforehand if the facility is ready for use. If not, they can fall-back to a different station.

Also, pro-active self-diagnostics of the MAID will notify of a defect when it occurs, not when it is directly needed. This eliminates the chance that a participant cannot be enrolled when arriving at the appliance.

Improve local resolvability
The following measures improved the ability to solved problems locally:

- The designed modules make it easy to replace component, enabling additional self-maintenance.
- By implementing self-diagnostics, the MAID can assist and guide local operators to handle simple defects. That way, operators become more knowledgeable, reducing the probability of calling for backup.

Increase fall-back options
The versatile employability is believed to increase the overall amount facilities in the Netherlands. This increases the overall presence of component modules as well. If one fingerprint module breaks down, a working one might be nearby. Image a fingerprint scanner breaking down at a police station, but being able to quickly borrow one from the municipality around the corner.

Additionally, the implementation of local back-up storage points becomes a more profitable and logical option.

11.4. Escalation Resistance

This section provides substantiation to why the concept is resistant to escalating situations.

Safety of the operator
In line with Req. 4.7, the product facilities a distinct distance between the users during use, keeping the operator and their components out of the direct reach of the participant.

Next there is no barrier between the users, this way the operator can intervene when necessary.
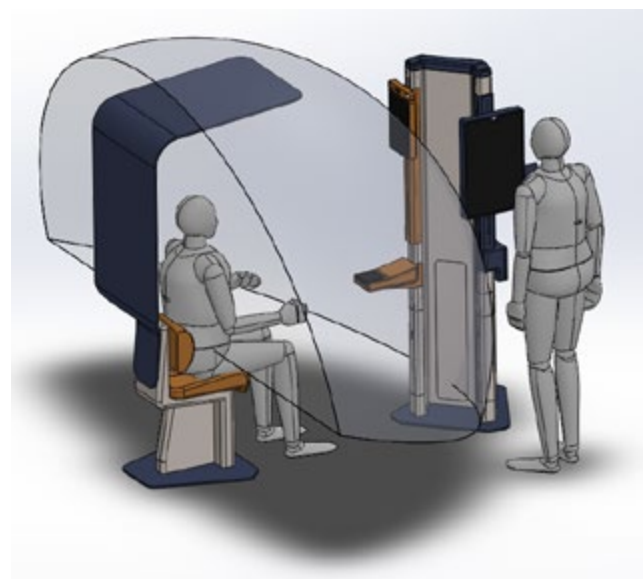
Stability
Both parts of the product are provided with weight, as such to move their centre of gravity close to the ground. Additionally the floorplates extend the product's tipping point.

There are no loose components and wires

To prevent injuries, all edges are rounded

The new cameras can record an enrolment process

Fig.91: During use, the operator and their components are out of direct reach of the participant.

11.5. Interaction

This section covers the last three criteria: simplicity, user connectedness and unjudgeness. Furthermore, a reflection is given on how the product answers to interaction: how do the envisioned product qualities return in the final concept?

To answer this question, use scenario is sketched to walk the journey step by step while providing details about the experience and the aesthetics.

1. Arrival
During arrival the operator offers a seat to the participant. The MAID has already prepared the mandatory steps and ready for use since it knew who was coming.

- The slight opening of the cap give an approachable and inviting sense
- The display is turned on, evoking a feeling of preparedness and accessibility for both users
- The seating is designed to look warm and comfortable.
- To provide clarity, similar colour is chosen for all the participants' components

- The operator offers the participant a seat, resulting in a privileged, bounding and welcoming experience.
- The plate give a certain and steady sense to the product, convincing that it stands its ground.
- The space underneath the base provides a light sense to the product

Fig.92: Arrival

2. Setup

While the operator authorizes themselves, the participant has time to get acquainted with the product.

- The camera and display auto-adjust to the correct height.
- The participant is being informed about what is going to happen, resulting in a feeling of transparency.
- The participant is given their own spot and components, creating a possessive experience.
- The product recognises the officer, facilitating a feeling of being connected.
- An unconscious authoritarian difference is created by the seated position of the participant.
- The seating is slightly high for the average participant, resulting in an active posture and feeling of agility
- The rounded edges give a kind sense to the product

Fig.93: Set-up

Concept Argumentation
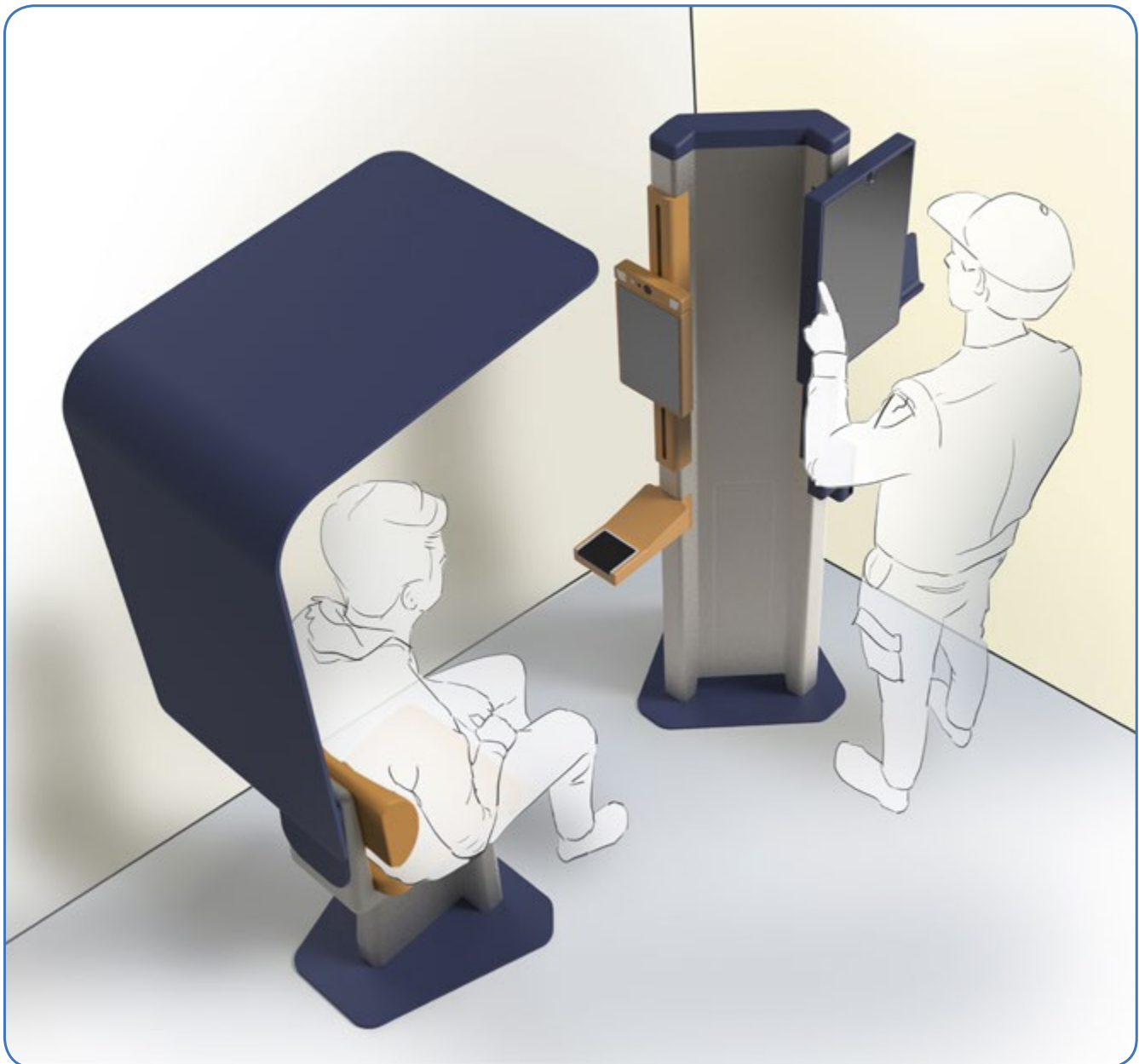
3. & 5. Transfer moments

When everything is set up, a clear moment of transfer is initiated where the responsibility of the process shifts from one user to another. The participant experiences trust and respect by being given a portion of the responsibility by the in-charge figure. This displays that the operator can be transparent and has nothing to hide. This results in a connecting experience between the users.

Another transfer moment takes place, but the participant is now in control over when they are ready. Responsibility is shifted back to the operator, providing a clear end of the participants task.
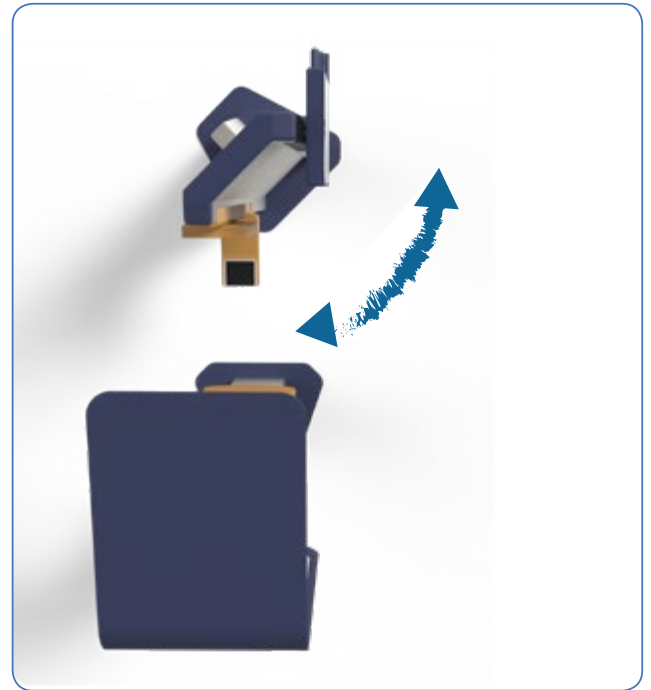
4. Biometrics

It is now up to the participant to enrol all necessary biometrics. They are provided with clear instructions, feedback and an indication of the progress in the process on the display.

During the use, the operator's interface keeps them in control

The display provides pro-active guidance for the participant and is transparent on the progress of the enrolment

The participant is provided with clear feedback on how their contribution accelerates the process. It gives a sense of responsibility and independence.

6. Conclusion
After enrolment, both users round up with a collective appreciation of the result.

- To emphasize the feeling of police workmanship, the officer could get a concluding overview of how they improved safety: stats about their registrations, matches of wanted criminals or what databases are filled. The other way around, the officer could check anytime in the system for results of 'their' registrations
- The product communicates a clear end to both users.

Fig.96: Conclusion

11.6. Implementation

The last questions that will be answered in this project is: how can we get it going? Well firstly, a lot still needs to happen, but I'll refer you to the recommendations for that. But, what can we say about implementation of the MAID in the context?

During development, attention was put to remain close to determining factors for implementation: legislation, organisation and workflow. There is therefore little to say, since the product fits all those factors.

Organisational adaptation
The product fits to the vision and mission of the police. It does not require any new users, roles or resources. I would though advise to develop a training programme for technical support and operators.

Legislation
There is nothing in the MAID that does not comply with the law. Moreover, this new design facilitates the law and is even ready for legal changes.

Workflow adaptation
The implementation of on-the-street verification will alter the current arrest workflow. A new procedure would have to be written to address this.

Concept Argumentation

12. RECOMMENDATIONS

During the project multiple interesting ideas came to mind and many waters were chosen to leave unexplored. To provides handles for further development, these research topics, directions, design ideas are listed in this chapter.

12.1. Picking up where I left off

Firstly, there are some open ends to the project that must be underlined.

Evaluate the concept with end users
Use renders of the existing concept in combination with a physical 1:1 carton board prototype of the concept. Execute user tests in the context with the police officers and suspects:

- Test if the experience is in line with the intended interaction;
- Assess the usability of the current concept with ISO/IEC 9126-4 usability score (effective, efficient, satisfactory).

Anticipate technological developments
The most determining factor for future proofing of a product in this segment is anticipating technology. Work closely with the CvB to be prepared for technological changes, threats and opportunities. Observing what happens in the private sector with ID applications can be of great interest.

A great way to do this, is by maintaining a technology roadmap. This was initially planned for this project as well, but eventually this was not yet necessary for this conceptual stage.

Evaluate the concept's performance on other workflows than just the suspect enrolment

Frame all dependency factors
A clear opportunity came to mind (too) late in this project. As initiated in section 5.1, I would like to advice to get a grip on all factor that the BVID (or the MAID) depends on. By keeping a close eye to them the Police might be able to respond to defects before they occur. Strive for less factors to be dependent on or reduce the dependency on the factor that are required for functionality.

Business case: cost & time reduction
Another next step is to assess the business case: how will this concept reduce the lead times and what how will it affect the costs? It is believed that the product is going to be more expensive, but its long life-span might compensate for this.

Also, the MAID should be compared to the BVID in term like size, weight and replacability etc. Sneak peak: the MAID takes up almost half of the volume.

12.2. Long-term Development

Next to the steps that are there are some recommendations for the longer term of development.

Outsource production to a qualified manufacturer
Outsource production of the product to a producer that is familiar with high end technological devices, not a furniture and aluminium-parts producer.

Assess sustainability
Now that the concept is clear, one of the first next steps would be to design the life cycle of the product. Questions must be answered like: what happens when components break down? How long will the base last?

Further in development, whenever parts, materials and components are defined, a life cycle assessment should be done, to define the environmental footprint of the product.

Furthermore, when a standardised enrolment facility is commissioned nationally, all the existing facilities will become unnecessary. What will happen to them? They could for instance be sold to less technologically developed countries, to boost their identification processes.

Improve maintenance and usage monitoring
In line with the conclusion from section 3.3.6, I would like to advice to start with more adequate maintenance monitoring. Asking the question: what was actually the cause for defect? To do this, provide better training for maintenance support or commission specialized support.

Next to that is was concluded that usage monitoring is already well on its way, though I'd like to advice to use this data more pro-actively. Analyse it to unveil usage trends, anticipate peak hours and monitor lead times. This way information can be gathered to define threads and improvement opportunities.

Set up a specialized design team
There are numerous competitors on the market who provide enrolment facilities for the rest of the world. So, I wondered, why should we do this ourselves? This is not a rhetorical question, but one that really should be discussed logically.

In the case that the Police wants to develop a product like this in-house, more design specialists in the field of identity should be acquired. Set up a team of designers and specialists from all disciplines (including CvB) and provide them the tools that are needed.

Don't see the appliance as a printer
In maintenance terms: do not consider the next concept as just another product that facilitates police work. It is a facility that is doing things that go far way beyond printing or making coffee. It should be observed as a technologically advanced appliance that needs specialized people and specialised support.

Outsource priority 1 incidents
In addition, I'd like to point out that defects and incidents are inevitable: so long as something is produced it can be broken down. Prio1's will remain, but they can be outsourced! Make sure that responsibility of the Prio-1 incidents is not of the Police: see the next concept as a service that could be delivered by a company: you are not buying the product, but 250.000 ID-records a year. The supplier is responsible for meeting that demand, but as well for dealing with the maintenance and up-time.

12.3. Users

Re-evaluate your user
Improve the definition of who your users are now and who you want them to be. Who uses the product is currently only defined by law. The Police should redefine how this translates to their processes.

Participant inclusiveness
People at the Dutch government have a strong urge for user inclusiveness. And since were talking national terms, that usually means: the product must be usable by everyone. For example: "But what if we have a disabled blind person from Pakistan?" "What if they only have 8 fingers?"

It is defined by law that the product must be usable by all Dutch citizens above the age of 14. I'd like to point out that you cannot generate interesting concepts for blind people in wheelchairs and drunk immigrants at the same time. I would like to advice to generate clarity on the spread of participants: define to what extent we are including which users and for whom you make exceptions.

Let officers do their work
In early years, identity registration was done by the 'arrestanten zorg': specialized people that take care of suspects at police stations. An officer only had to drop off the suspect and continue their work on the street.

My question to the company is: why do you want officers to execute this process in the first place?

- They are already responsible for almost everything that happens on the street (section 3.4.1)
- The complicated bureaucratically-like tasks do not align with any of the other tasks
- They only use the product every 1.5 months and not even for the same process
- The bound that is built up during the arrest can be regarded by handing the suspect to the 'new' operator, starting with a clean sheet.

12.4. Unused Ideas

Throughout the project, some interesting ideas came to mind that either exceeded the scope or were not elaborated due to the lack of time. They are presented here to provide potential starting points for future development.

The physical transfer moment
The moment of transfer as defined in the envisioned journey was not put enough attention to. The current concept provides possibility for a digital moment of transfer though, this should be elaborated more.

ID-handcuffs
From the first contact moment on the street until the identification on the Police station, it could be unclear who is who. Specially with larger groups of suspects the police might want to be able to quickly tag everyone on the street. Although it is still unknown who they are, people will not be confused anymore after the tag. This ID handcuff could have some kind of integration or communication with the stationary facility as well.

A local identity responsible
One of the causes of defects is the lack of attention that is given. Currently there is no one who takes end responsibility for the product (section 3.3.6:Ownership). Appointing one identity responsible per police station might be a great idea for the increase of local knowledge and the reduction of Prio1's.

LED lights as use cues
The LED interface idea was appreciated by the stakeholders, yet not implemented in the final concept. I would advise to explore this direction (Fig.99)

Fig.97: Welcoming Lights
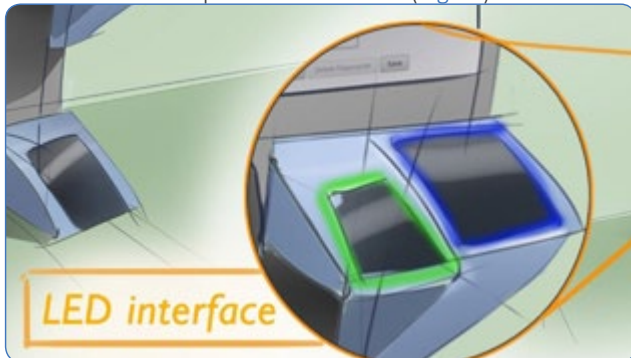
Fig.99: LED use cues

Welcoming lights
Fig.97 presents the idea of the implementation of spotlights. On the one hand, this idea is in line with the envisioned interaction: it resembles a welcoming and guiding experience for the participant. The evoked 'chiqueness' reduces the criminal experience as well. During the evaluation, the client agreed to this as well.

However, it does increase the complexity and reduces the context adaptability of the concept. Consequently, it was chosen to leave this for further development

Event-appliance & interchangeable modules
During the evaluation of the State Switch concept, the idea came up to use it as a kind of semi-mobile facility for, per example, events and festivals. Additionally, the component modules could be used for both the stationary and the event facility.
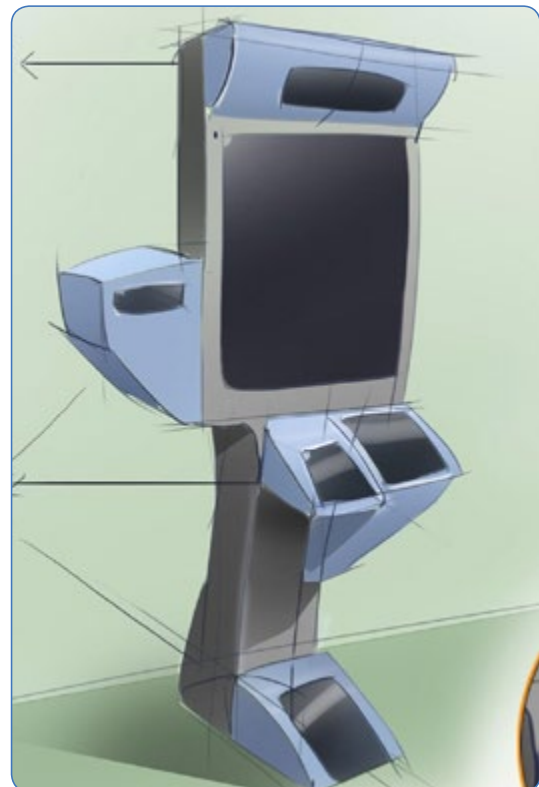

Fig.98: State Switch concept for event application

OUTRODUCTION

13. Personal reflection

13.1. Overall

The world of identities and governments, criminal law and Police is an extremely complex one. Influenced by rapidly changing biometric and identity technologies, this sector has been prone to many organisational and juristic changes in the last decade. Being a designer in this field you must deal with requirements from all angles: stakeholder with different agendas, legislation, (un-) willing users and complex technologies. Often you must ask yourself: where does my role as a designer stop and where do I stop designing? Where do I become the jurist, will I target privacy ethical issues, and should I interview refugees? You could say it was hard to 'identify' my own role sometimes.

Shortly: it is a very complex context to design in.

It is due to this reason that I am proud and unsatisfied at the same time.

The hardest challenge in this project was to keep my head above the water, or as Ivo would say: separating essentials and non-essentials. But how do you filter the essentials, before understanding the bigger picture? How do you know if a puzzle is finished when it doesn't have border pieces? To my opinion this has resulted in some rough edges and sometimes maybe wrong hasty conclusions. It is very unsatisfactory to not utilise opportunities and to leave problems unsolved. Yet, I think that this is necessary in this case: with only 5 months you sometimes need to cut off the edge of a piece to forcefully shape the border of the puzzle. Although this has brought some loose ends to the project, I can say that I could not have done more in the time I had.

That is why, on the other hand I am proud for having enabled myself to design in this 'very well established' governmental world of identities. Exploring this context has taught me so much. Not only about the context, but about myself as well. For instance, defining identity was not only a to-do for my project, but hit me personally as well. Being in a police car on emergency duty revealed to me how many experiences the field of design can bring.

13.2. Project process

The process of the project has had everything a graduation project needs. Ups, downs, weeks of struggling on one topic and then realising it could be left out as well, starting too late with writing the thesis, but also very relieving breakthroughs.

It is again underlined that a design project never follows its exact initial approach. Initially I though that graduation was a project that puts everything you know to one final test, not learning and applying new methods and project management.

With my initial IPD-only approach, this project would focus on reducing maintenance or increasing up-time, researching and integrating new technologies. Integrating a bit of DFI as well was a new experience and worth the time.

Report

On the one hand, it is nice to have everything in one place and to be able to give handles to the client. It is also great for personal reflection and to present what you have done as a student to the supervisory team.

On the other hand I think design and documenting do not hold hands as lovely as other technical disciplines do. To my opinion, documenting often counteracts the creativity: fingerspitzengefühl and creativity are difficult to substantiate.

Research

Explaining and documenting the world of identities into understandable matter was very hard to do. It was difficult and sometimes impossible to be succinct while remaining complete and correct. Whole studies have been conducted on what I was trying to explain in one paragraph.

An example of the earlier-mentioned rough edges is to my opinion the technology research. There is so much more to define, and you can't be superficial about it. It resulted to my opinion in many loose ends, but then again: for the project we only needed to have basic prediction of what components might be added.

Define

These few pages were definitely the most time intensive. Specially the translation from reliability to flexibility to well formulated design goal took a lot of effort. It was a realisation I had only after completing the first version of the report. A realisation I could not leave out. I think it offers great handles to actually frame the desire and problem of the Police.

Develop

If I had to point out one aspect that I am especially proud of, that would be the development process. I never did interaction design before and I have to say that I really struggled at first. But it has definitely paid off: coming up with something new by starting at the bottom: that what the user values. I think this has enriched my technical and practical mindset.

Next to the that, the conceptualisation process was so much fun. It took so many iterations to come the final concept. At one point I even asked my mother to send me a box of LEGO. Later, the LEGO prototypes became one of the decisive factors of the final concept. Funny to see that the building blocks for graduation were already in my hands when I was just a kid.

Deliver

Although digital rendering and CAD suited greatly for communication of all my ideas, it might evoke too much 'definitiveness' of the design for the conceptual phase that we are still in.

Overall, I really think the results live up to the assignment. Adding versatile employability in the identity construct and a suspect centred approach made me add something new. Something that has been seriously discussed as a next step. Something that will improve people's safety and thus their wellbeing. This is all fully in line with one of my initial personal goals (Appendix A), which I have therefore accomplished.

13.3. Epilogue

Next to that I would like say something about the current developments in this field.

Pushed by technology, we are steering towards a future where identities become increasingly inseparable from the human body. On the one hand this protects and uniquifies our identities, but at the same time it increases the value of what you always carry with you. When you go out at night, you cannot leave your iris at home. You, and even children, will always carry something of value. What makes this more dangerous, is that, to my opinion, that people are currently not aware enough of their privacy and value of identity. And with current developments I think this knowledge gab will only increase.

So long as the way we enrol identities is changing, so will the black market adapt. Imagine robbers carrying fingerprint scanners. We should keep anticipating identity crime by constant innovation.

Additionally, so long as governments keep forcing their (and foreign) citizens for biometric enrolment, there should be provided a balanced amount of education on the subject as well.

14. References

14.1. References

AADHAAR. (2019, December). AADHAAR Dashboard. Retrieved December 4, 2019, from https://uidai.gov.in/aadhaar_dashboard/index.php

AD. (2019, February 19). Europees akkoord over vingerafdruk op ID-kaart. Retrieved October 22, 2019, from https://www.ad.nl/buitenland/europees-akkoord-over-vingerafdruk-op-id-kaart~a07bfca9/

Boeijen, A. G., J. J., Zijlstra, J. J., & Schoor, R. S. (2013). Delft Design Guide. Amsterdam: BIS Publishers.

Broekhuis, Z. (2019, March). Identificatie bij de Politie: Het ontwerp van de interactie met een identiteitszuil in het kader van strafrecht.

CBS. (2019, March 28). Verdachten; delictgroep, geslacht, leeftijd en migratieachtergrond. Retrieved from Centraal Bureau Statistiek: https://opendata.cbs.nl/statline/#/CBS/nl/dataset/81947NED/barv?ts=1573566535480&fromstatweb=true

CentrumBiometrie. (2018, October 28). Presentatie workshop RvIG Klantendag 2018- Centrum voor biometrie (politie). Retrieved from https://www.rvig.nl/documenten/publicaties/2018/10/29/centrum-voor-biometrie-politie

DHS. (2007, August). US Visit Edu Traveler Brochure English. Retrieved from https://www.dhs.gov/xlibrary/assets/usvisit/usvisit_edu_traveler_brochure_english.pdf

Dietz, J. L., Albani, A., & Barjis, J. (2008). Advances in Enterprise Engineering I, p16. Springer-Verlag Berlin Heidelberg.

DINED. (2004). DINED / Anthropometry in design. Retrieved September 30, 2019, from https://dined.io.tudelft.nl/en

Dirken, H. (2004-2008). Productergonomie: ontwerpen voor gebruikers. In H. Dirken. Delft: VSSD.

DJI. (2019, May 16). Referred to is an interview at the Dienst Justitiële Inrichtingen. Setup and results can be found in Appendix E.

Eerstekamer. (2019). Gebruik biometrie bij identificatie vreemdelingen. Retrieved October 5, 2019, from https://www.eerstekamer.nl/wetsvoorstel/33192_gebruik_biometrie_bij

Eggens, A. (2005). Van daad tot vonnis: Door Drenten gepleegde criminaliteit voor en tijdens de Eerste Wereldoorlog. Retrieved from https://www.rug.nl/research/portal/files/33260856/h1.pdf

Europa-a. (2019). Migration and Home Affairs: Visa Information System (VIS). Retrieved October 30, 2019, from https://ec.europa.eu/home-affairs/what-we-do/policies/borders-and-visas/visa-information-system_en

Europa-b. (2019). Migration and Home Affairs: Identification of applicants (EURODAC). Retrieved October 30, 2019, from https://ec.europa.eu/home-affairs/what-we-do/policies/asylum/identification-of-applicants_en

Findbiometrics. (2019). Over 60+ countries now issuing ePassports. Retrieved November 1, 2019, from https://findbiometrics.com/archive/over-60-countries-now-issuing-epassports-2/

Gemalto. (2019, October 16). The electronic passport in 2019 and beyond. Retrieved December 4, 2019, from https://www.gemalto.com/govt/travel/electronic-passport-trends

Hekkert, P., & Dijk, M. v. (2009). Vision in Product Design. Amsterdam: BIS Publishers.

ICAO-a. (2015). Doc 9303, Machine Readable Travel Documents. Retrieved November 20, 2019, from https://www.icao.int/publications/Documents/9303_p1_cons_en.pdf

ICAO-b. (2019). About ICAO. Retrieved November 23, 2019, from https://www.icao.int/about-icao/Pages/default.aspx

IDWeek. (2019, June 11). Referred to are results from multiple interviews and discussions at the London ID Week 2019. Preparation and results can be found in Appendix I.

J&V. (2015). Identiteitsvaststelling in de strafrechtketen: Een inspectie-onderzoek naar de toepassing van de Wivvg. Inspectie Justitie & Veiligheid.

justid-a. (2019). Identiteitsvaststelling in de strafrechtsketen: Wet en Protocol. Retrieved October 21, 2019, from https://www.justid.nl/organisatie/MatchingAutoriteit/ma_wet_protocol.aspx

justid-b. (2019). SKDB en HAVANK/VVI. Retrieved September 30, 2019, from https://www.justid.nl/organisatie/MatchingAutoriteit/SKDBenHAVANKVVI.aspx

Kraus, B. (2019, May 9). Referred to is an interview at the Centrum voor Biometrie. Results can be found in Appendix C. Also is referred to the concept evaluation at CvB in Appendix S.

Laar, H. v. (2019, May 21). Referred to is an interview and presentation at the Politie ICT. Results can be found in Appendix G.

LO. (2019). This is a summary of various talks I had with a former employee of the 'Logistieke Ondersteuning'. It started off with a more extensive interview on priority 1 incidents, after which he became a fixed source of information on maintenance related questions.

Meijden, A. v. (2019, June 6). Interview can be found in Appendix D.

Muller, W. (1997). Vormgeven Ordening En Betekenisgeving. Utrecht: Lemna (bedankt voor deze details Martien ;)!).

NOLO. (2019). Arrest vs. Detention: How to Tell Whether You've Been Arrested or Detained. Retrieved November 4, 2019, from https://www.nolo.com/legal-encyclopedia/arrest-vs-detention-how-tell-whether-you-ve-been-arrested-simply-detained.html

Noraonline. (2018, March 20). Ketensturing/De wereld van ketens/Wat is een keten? Retrieved October 22, 2019, from https://www.noraonline.nl/wiki/Ketensturing/De_wereld_van_ketens/Wat_is_een_keten%3F

NRC. (2019, July 17). De vijf plagen van de politie. Retrieved from nrc.nl: https://www.nrc.nl/nieuws/2019/07/17/de-vijf-plagen-van-de-politie-a3967448

Overheid-a. (2017, March 1). Wet op de identificatieplicht. Retrieved October 21, 2019, from https://wetten.overheid.nl/1.0:c:BWBR0006297

Overheid-b. (2010, October 1). Wet identiteitsvaststelling verdachten, veroordeelden en getuigen. Retrieved 10 21, 2019, from https://wetten.overheid.nl/BWBR0026180/2010-10-01

Overheid-c. (2019, February 27). Vreemdelingenwet 2000. Retrieved October 10, 2019, from https://wetten.overheid.nl/BWBR0011823/2019-02-27

Politie-a. (2017, November 30). Aanvalsprogramma Informatievoorziening Politie: Eindrapportage.

Politie-b. (2017, November 1). Politie wint ICT-prijs. Retrieved from https://www.politie.nl/nieuws/2017/november/1/00-de-politie-wint-belangrijke-ict-prijs.html

Politie-c. (2019). Politietaken. Retrieved November 4, 2019, from https://www.politie.nl/themas/politietaken.html

Politie-d. (2019). Agent worden: zo werkt het. Retrieved November 4, 2019, from https://kombijde.politie.nl/agent-worden/zo-werkt-het/intro

Politie-e. (2019). Toelatingseisen: Wat vragen we van jou? Retrieved November 4, 2019, from https://kombijde.politie.nl/agent-worden/toelatingseisen/toelatingseisen?gclid=Cj0KCQjwr-_tBRCMARIsAN413WT3r8G-ymBHoblRSK-V-1LC9cTdITxWQUQ5rN-fOFHwy3IF9VUmsFQaAjLXEALw_wcB

Riemen, J. (2019, October 10). Presentation at Centrum voor Biometrie.

Rijksoverheid-a. (2019). Archief Rijksoverheid Nieuwsbrieven. Retrieved 4 10, 2019, from https://abonneren.rijksoverheid.nl/nieuwsbrieven/archief/artikel/55/1bcce598-eb49-41cf-ade9-43369d00b351/c1e52f02-cb78-43f6-9112-4cd8f18d10c7

Rijksoverheid-b. (2019). Hoe kan ik een paspoort of identiteitskaart aanvragen? Retrieved October 22, 2019, from https://www.rijksoverheid.nl/onderwerpen/paspoort-en-identiteitskaart/vraag-en-antwoord/waar-en-hoe-kan-ik-een-paspoort-of-identiteitskaart-aanvragen

Rijksoverheid-c. (2019). Eisen aan de pasfoto voor paspoort of ID-kaart. Retrieved October 22, 2019, from https://www.rijksoverheid.nl/onderwerpen/paspoort-en-identiteitskaart/eisen-pasfoto-paspoort-id-kaart

Schiphol. (2019). Keeping an eye on security: This is how the iris scan works. Retrieved December 4, 2019, from https://www.schiphol.nl/en/page/how-the-iris-scan-works/

Tassoul, M. (2009). Creative Facilitation. Delft: VSSD.

Thailand-business-news. (2019, May 15). Thailand to use Biometrics scan to identify travellers. Retrieved November 11, 2019, from https://www.thailand-business-news.com/tourism/72499-thailand-to-use-biometrics-scan-to-identify-travellers.html

theGuardian. (2014, December 30). Hacker fakes German minister's fingerprints using photos of her hands. Retrieved November 6, 2019, from https://www.theguardian.com/technology/2014/dec/30/hacker-fakes-german-ministers-fingerprints-using-photos-of-her-hands

VreemdelingenVisie. (2017). Het herplaatsen van asielzoekers is belangrijk werk. (H. Grimmius, Ed.)

Wikipedia. (2019). Future Proof. Retrieved October 31, 2019, from https://en.wikipedia.org/wiki/Future_proof

Willemsen, C. J. (2019). Identiteitsvaststelling van verdachten en ilegale vreemdelingen door opsporingsdiensten: Een toetsingskader voor de kwaliteit van het product, het proces en de organisatie.

14.2. Figure sources

Fig.1 Photo by RE_Klipsteen (https://twitter.com/re_klipsteen/status/497271065253801985)

Fig.5, Fig.58 & Fig.59 Illustrations made by Suzanne van Beek, thank you!

Fig.6 Snippet from comic 'Jack Kirby and D Bruce Berry Kamandi: the Last Boy on Earth' 32, page 7.

Fig.13 Graphic by Police (https://www.politie.nl/over-de-politie/organisatie---organisatie.html)

Fig.21 Photo by Paul Tolenaar (https://magazines.defensie.nl/kmarmagazine/2015/07/11_hoe_werkt_dat_eigenlijk_7-2015)

Fig.35 & Fig.36 Photo by Henriëtte Guest (https://www.rvig.nl/reisdocumenten/voorlichtingsmateriaal-reisdocumenten/rechtenvrije-fotos-reisdocumenten-model-2014)

Fig.38 Scan from Alle Drenten (http://scans.alledrenten.nl/m/?p=ZmlsZT0vVG9lZ2FuZ2VuLzAxMzcuMDEvMDEzNy4wMV8zMzkvTkwtQXNuREFfMDEzNy4wMV8zMzlfNDI3NkEuanAy&archive=0137.01&registry=339)

Fig.37 Illustration by Alessio Damato (https://commons.wikimedia.org/w/index.php?curid=2008641)

Fig.40 Photo by Idemia (https://www.idemia.com/morphowave-compact)

Fig.42 Photo by learnopcv.com (https://www.learnopencv.com/deep-learning-based-human-pose-estimation-using-opencv-cpp-python/)

Fig.43 Photo from https://petapixel.com/2014/12/17/fyuse-spatial-photo-app-lets-capture-share-world-3d/

Fig.44 Photo from https://www.intel.com/content/www/us/en/architecture-and-technology/realsense-overview.html

Fig.45 https://link.springer.com/referenceworkentry/10.1007%2F978-1-4899-7488-4_129

Fig.48 Photo byCoolblue.nl (https://www.coolblue.nl/en/advice/what-is-samsung-dex.html)

Fig.49 Photo by DESKO (https://www.desko.de/en/products/travel/for-integration/PENTA-OEM-Scanners.php)

Fig.50 Photo by Integrated Biometrics (https://integratedbiometrics.com/products/five-0/)

From Police photo repository
Fig.4 Photo by Mark van der Zouw

Fig.2 & Fig.11 Photos by Peter Monteny

Fig.12 Photo by Harro R. Meijnen

Fig.26 Photo by Ellis Vermeulen

Fig.28 Photo by Frans Vega

Fig.19, Fig.33, Fig.41 & Fig.55 Photos by Henk Rutten

14.3. Appendix: List of Contents

Appendices can be found in a separate document, the list of contents is placed here for referencing.

THE END

Pushed by technology and international regulations the world of identities is rapidly changing. Among others, the Dutch government is obliged to keep up with these developments. In line with these developments, a special facility to execute identification processes for crime and migration purposes was nationally commissioned in 2015, called the ''Basisvoorziening Identiteitsvaststelling''. Among others, this facility is used by the Dutch National Police to execute identification processes on migrants, aliens, suspects, convicts and witnesses.

Throughout the years the appliance has become out-dated. Expensive defects and poor user experiences have caused the Police to initiate the development of a new design.

Research unveiled that the Police is placed in a difficult position by relying highly on a product which functionality depends on numerous (uncontrollable) factors. The envisioned product requires be more flexible and future proof.

Additionally, it was concluded that standardisation of a new enrolment facility for all identity related governmental agencies is feasible and desired. The Police was focused to design for: they set the highest requirements and have the most difficult users.

Technology research provided that future identification will involve more biometric technologies and that a stationary enrolment facility will remain necessary for the coming decade.

Using the Vision in Product Design method the current product and context were evaluated. A new user interaction journey was developed to provide a foundation for future development. The participant and the product were envisioned to become more involved in the process. It was chosen to create an unjudged experience for the participant. For the operator, the feeling of police workmanship should be emphasised.

This led to the design goal: "Design the next identity enrolment facility for the Dutch National Police". In order to improve the current situation, the following goals are formulated:

- Improving the user interaction;
- Inducing flexibility by:
  - reducing dependency;
  - implementing futureproofing;
  - enabling versatile employability;
  - anticipating identity technology.

This initiated the ideation process. Through iterative prototyping, sketching and brainstorming a concept was designed. Eventually, an argumentation is provided on how the Main Appliance for Identification ('MAID') meets the design goals.

Eventually, recommendations and unused ideas are provided for the client for future development.

Designing the next identity enrolment facility for the Dutch National Police

Master Thesis
Alexandros Vangelis Pliakis

TUDelft P⚡LITIE