# License Plate Readers in the Netherlands

## Effectiveness, Best Practices and Privacy Issues

Bart Custers PhD MSc LLB

Ministry of Security and Justice, The Netherlands
Leiden University, The Netherlands

Government of the Netherlands

Ministry of Security and Justice

Universiteit Leiden

# Contents of this workshop

Part I: Presentation

- Introduction to License Plate Readers (LPR)

- Effectiveness

- Best Practices

- Privacy Issues

Part II: Q&As from the audience
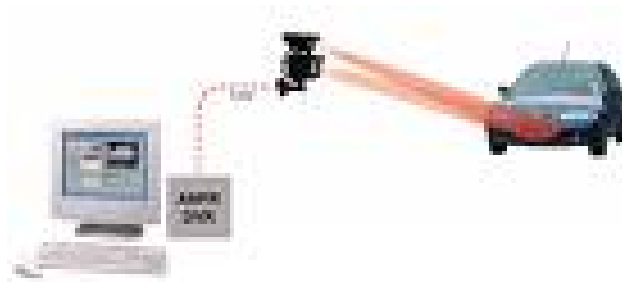
Part III: Discussing and comparing experiences

- Hypotheses derived from our research results

Government of the Netherlands

Universiteit Leiden

# Introduction to LPR

Automatic License Plate Readers (ALPR or LPR)

In Europe: ANPR



## Situation in the Netherlands:

- Almost 2x area of New Jersey, 16 mln people, 8mln cars
- Transition from 25 police regions to a National Police
- 78 mobile cameras and 119 fixed cameras (only police, border police, tax revenue service, etc. not included)
- Use for law enforcement, limited use for criminal investigation and very limited use for prosecution
- Very limited data storage: only in criminal investigation of concrete cases. No data storage for intelligence.
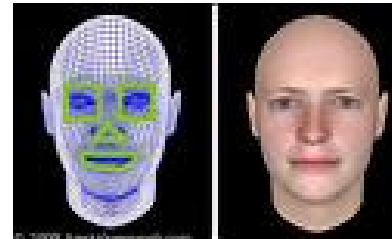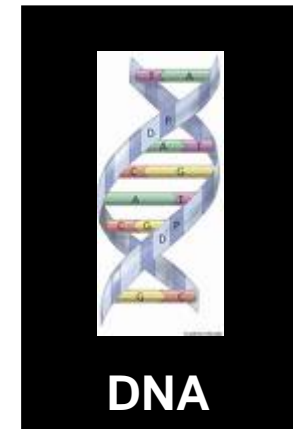
# Technology in Policing
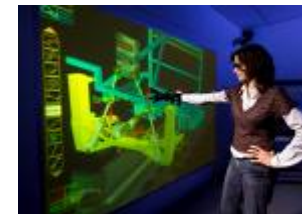

Fingerprints


RFID


Face Recognition


DNA


LPR


Tapping


Virtual reality


Camera surveillance

| Targets | | |
|---|---|---|
| Crime | down | -25 % |
| Solving crime | up | +15 % |


Network analyses

4

# costs / Reliability

**Relatively expensive**

- Artificial intelligence
- Aggression models
- Nanotechnology
- MRI-scans
- Face recognition
- Virtual reality
- Data mining
- Forensic anthropology
- Biological sensors
- Pathology
- Image processing
- Profiling
- Lab-on-a-chip
- Magneto-encefalography
- Domotics
- Networkanalyses
- Toxicology
- CCTV
- Traffic accident research
- Document research
- Statistics
- Serology
- Finger arteries
- Cryptography
- Spectroscopy
- Impact forensics
- Databases
- Iris/retinascan
- Access to data storage devices
- DNA

**Relatively cheap**

- Polygraphs
- Alarm systems
- Digital signatures
- Crowd control
- Social tagging
- Weapons
- Steganography
- PETs
- ALPR
- Groupware
- Titration
- Dossier building
- Tapping
- Wristbands
- Kneelock
- Chromatography
- Fire research
- Narrowcasting
- Filtering
- Handgeometry
- Alcohol analyses
- Fingerprints
- RFID
- Voice recognition
- Handwritings
- Citizen participation
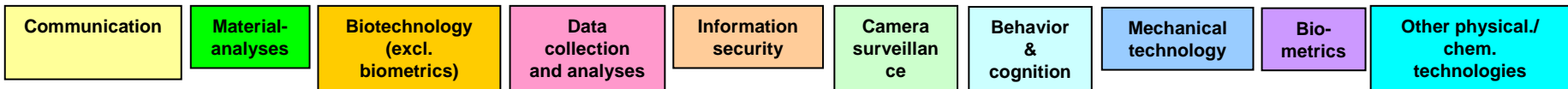
*Note: placement of the technologies in this figure is only indicative*

**Reliability** — Prone to errors — Very accurate

## Legend

- Communication
- Material-analyses
- Biotechnology (excl. biometrics)
- Data collection and analyses
- Information security
- Camera surveillance
- Behavior & cognition
- Mechanical technology
- Bio-metrics
- Other physical./ chem. technologies

# Research on effectiveness

No effectiveness concepts available…

- When does something work?

    What is the goal: prevention, criminal investigation, prosecution or sentencing?

- How to determine whether something works?

    To what extent is a goal reached?

- How to prove this is not due to other factors?

…let alone effectiveness reports of particular technologies, in this case LPR.

Some clues in UK research: Driving Crime Down (ACPO/UK Home Office) 2004

# Research Results on Effectiveness (1)

- LPR is a reliable instrument
  - Cameras: 90-94% reliable recognition
    (lower during fog or rain)
  - Matches: estimated 100% correct matches
  - No research on reliability of reference lists or other police data
    - no conclusive data on false positives and false negatives
    - in a 3-month pilot, 200 out of 225 stops resulted in fines, arrests, etc.

# Research Results on Effectiveness (2)

- LPR is very useful for crime prevention
  - Secure Lane: cargo theft reduced from 74 incidents to 4 in one year.
  - Indications for elasticity ('waterbed effects')
    - Drivers choose different routes to avoid LPR cameras
    - Theft of vehicles or license plates before committing a crime

# Research Results on Effectiveness (3)

- LPR is very useful in law enforcement
  - Collecting fines
  - Driving without insurance/vehicle registration/etc.
  - Crowd control during large events (hooligans, etc.)

Condition:        Ensure direct follow-up

# Research Results on Effectiveness (4)

- LPR is very useful in criminal investigation
  - Finding and arresting suspects
  - Excluding suspects
  - Tracing stolen vehicles

- LPR has limited use in (so far) as evidence in prosecution and sentencing
  - So far only 4 cases in court
  - Due to decision of the Dutch Data Protection Authority, there is limited data storage. LPR Act to create a legal basis is in preparation.

# Effectiveness of profiling

- Movie on profiling

- Individual profiling…
    - Where was this individual at time x?
    - Is this individual moving towards an event?
    - Is this individual showing strange behavior?
- … or aggregated profiling
    - License plates from country C
    - Vehicles that cross the border 3x in one hour
    - Vehicles from rental agency A
    - Vehicles that stop at every parking on a stretch of highway

convoy analysis:

which vehicles travel with suspicious vehicle V?

Profile for cargo theft
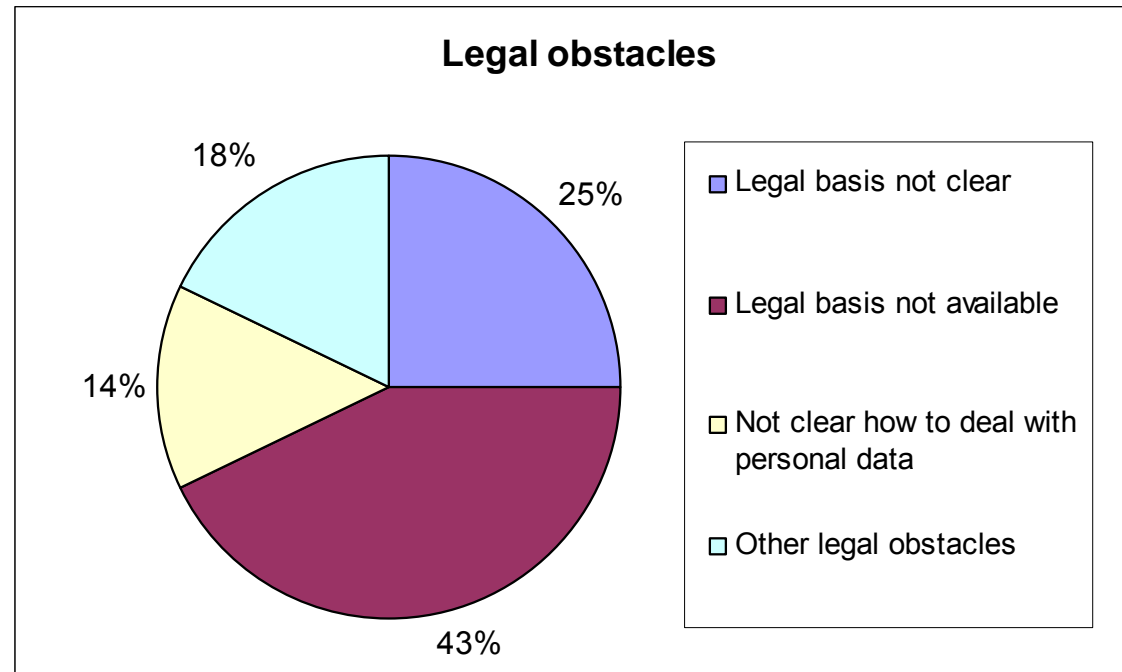
# Best Practices: Survey + Interviews

Apart from what is technologically available, we asked for police needs:

- Good and bad experiences
- Legal/technological/organizational obstacles
- Success stories and evaluations

Methods: survey and interviews

# Best Practices: Legal

Survey results:

**Legal obstacles**



- 25% — Legal basis not clear
- 43% — Legal basis not available
- 14% — Not clear how to deal with personal data
- 18% — Other legal obstacles
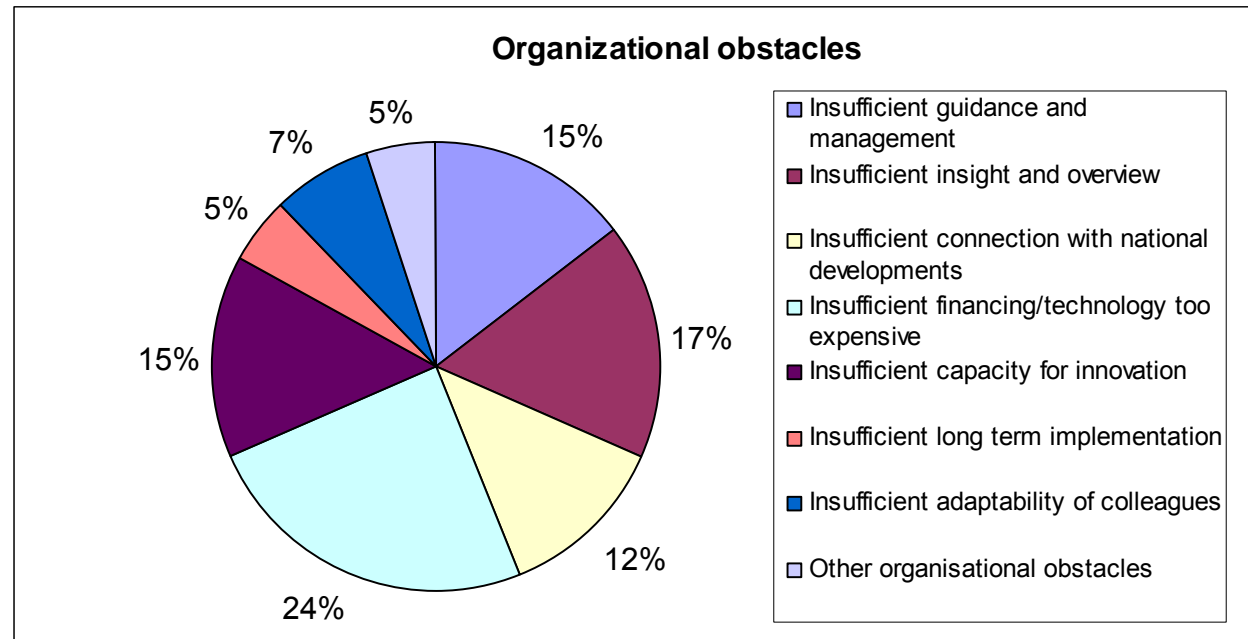
- LPR act in preparation
- Practical guidelines for LPR use
- Use of anonymous profiles is not restricted by data protection law
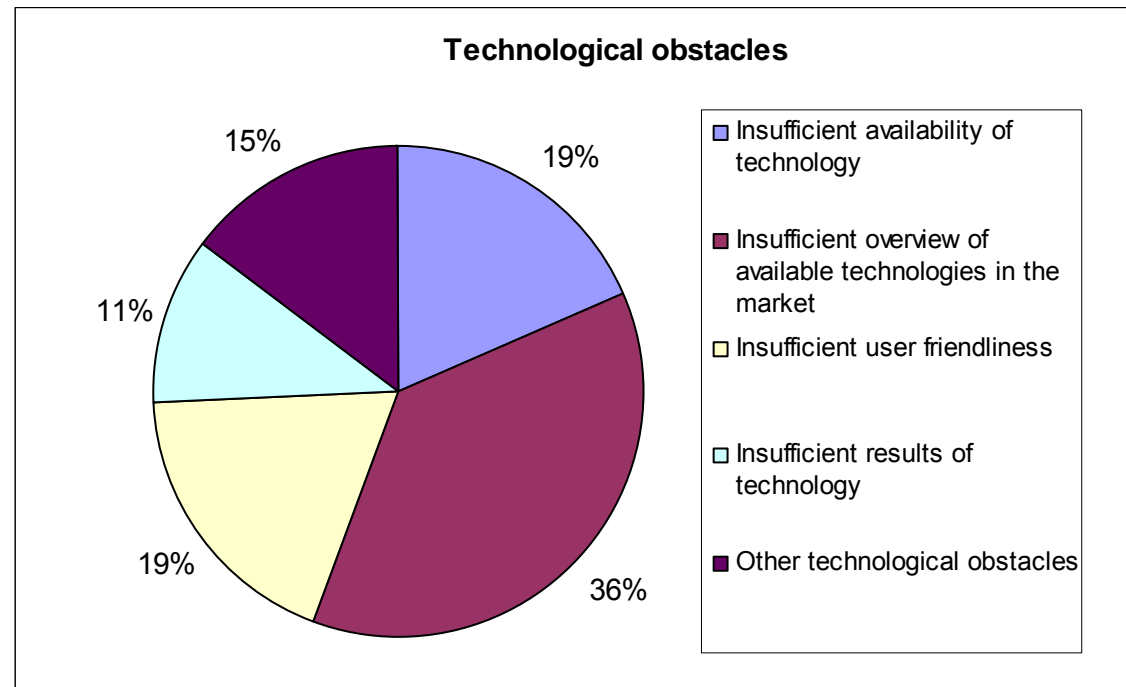
# Best Practices: Organizational

Survey results:



**Organizational obstacles**

- 5%
- 7%
- 5%
- 15%
- 24%
- 12%
- 17%
- 15%

Legend:
- Insufficient guidance and management
- Insufficient insight and overview
- Insufficient connection with national developments
- Insufficient financing/technology too expensive
- Insufficient capacity for innovation
- Insufficient long term implementation
- Insufficient adaptability of colleagues
- Other organisational obstacles

- Practical guidelines for LPR use
- National Back Office for reference lists
- Priority in policing: more focus on criminal investigation, less on collecting taxes and fines
- Camera plans

# Best Practices: Technological

Survey results:



**Technological obstacles**

- 19% Insufficient availability of technology
- 36% Insufficient overview of available technologies in the market
- 19% Insufficient user friendliness
- 11% Insufficient results of technology
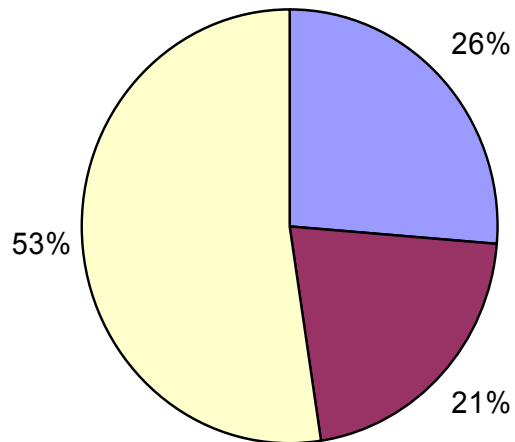- 15% Other technological obstacles

- Standards for camera specifications
- Standards for reference lists
- National availability of LPR equipment

# Success Stories and Evaluations
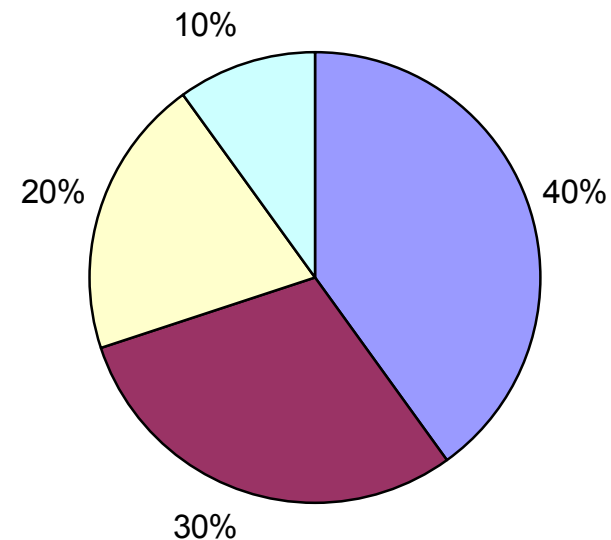
## Survey results

### Success Stories

26%

53%

21%

- no clear success stories
- yes, clear success stories, but I cannot/want not share
- yes, clear success stories, please contact me

### Evaluations

10%

20%

40%

30%

- No evaluations of effectiveness
- Yes, evaluations after pilots
- Yes, evaluations after pilots and periodically after implementation
- Unknown

# Privacy Issues

- New LPR Act: data storage during 4 weeks for *all* LPR data (for criminal investigation)
- Parliament requests a Privacy Impact Assessment (PIA) before accepting this Act
- No format available, though very helpful is:

  LPR Privacy Impact Assessment of IACP (USA) 2009.

- Two goals for a PIA:
  - Abstract: reproducible approach
  - Concrete: privacy risks of our LPR Act

# Research methods

Systematical approach, to reach completeness:
- Process approach
  - Analyzing the process for data collection and use
  - Determining specific risks in every stage of this process
- Stakeholder approach
  - Determining all relevant stakeholders
  - Determining specific risks for every stakeholder

Methods:
- Literature research (mainly UK and US)
- Interviews with stakeholders
- Workshop for validation of the results

# Risks

Definition of a risk:

**Risk = Probability x Impact**

Size of a risk:

| | Very likely | Very unlikely |
|---|---|---|
| **Large impact** | **Large risk** | **Potentially large risk** |
| **Small impact** | **Potentially large risk** | **Small risk** |

# Results: risks

| | Risk | Risk description | Probabil. | Impact |
|---|---|---|---|---|
| Step 1: collection | 1.1 | Incorrect or incomplete data | Medium | Medium |
| | 1.2 | Insufficient transparency (collection) | Medium | Small |
| | 1.3 | Non-equal treatment | Small | Small |
| | 1.4 | Elasticity ('waterbed effect') | Medium | Large |
| | 1.5 | More theft of license plates and vehicles | Large | Large |
| | 1.6 | Identity fraud | Small | Large |
| | 1.7 | Chilling effects | Small | Medium |
| Step 2: Storage | 2.1 | External security (hacking and leaking) | Small | Large |
| | 2.2 | Data overload | Small | Small |
| Step 3: Consulting and using the data | 3.1 | Privacy violations | Large | Small |
| | 3.2 | Function creep/détournement de pouvoir | Large | Large |
| | 3.3 | Internal security (unauthorized employees) | Large | Large |
| | 3.4 | Insufficient transparency (data use and rights) | Large | Small |
| | 3.5 | Interpretation errors/presumption of innocence | Small | Large |
| Step 4: Deletion | 4.1 | No timely deletion of data | Medium | Medium |

20

| | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 | 1.7 | 2.1 | 2.2 | 3.1 | 3.2 | 3.3 | 3.4 | 3.5 | 4.1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sunset provisions and periodical evaluations | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| Evidence-based approach | | | | | | | | | X | | X | | | | X |
| Limited type of crimes | | | | | | | X | | | X | X | | | | |
| Limited data retention | | | | | | | | | X | X | X | | | | |
| Selective deployment | | | X | X | X | | X | | X | | X | | | | X |
| Turning cameras off | Not applicable | | | | | | | | | | | | | | |
| Random locations | | | X | X | | | | | | | | | | | |
| Breach notification | | | | | | | | | X | | X | | | | |
| Security against hacking and leaking | | | | | | X | | | X | X | | | | | |
| Internal authorization rules (need to know) | | | | | | | | | | X | | X | | | |
| Criminalization of hacking | | | | | | | | | X | | X | | | | |
| Legal (personal data) protection | X | X | | | | | | X | X | X | X | | X | | |
| Clear legal basis for LPR | | X | X | | | | | | | X | X | | X | | X |
| Transparency and rectification (where possible) | X | X | | | | X | | | | | | | X | X | X |
| Human factor in decision chain | | | | | | X | | | | | | | | X | |
| Adequate camera plan | X | | X | X | X | | | | | | | | | | |
| Providing information | | X | | | | | X | | | | | | | | |
| Independent supervision | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |

# Results: remaining risks

| Risk | Risk description | Probability after measures | Impact after measures |
|------|-----------------|---------------------------|----------------------|
| 1.1 | Incorrect or incomplete data | Small | Small |
| 1.2 | Insufficient transparency (collection) | Small | Small |
| 1.3 | Non-equal treatment | Small | Small |
| 1.4 | Elasticity ('waterbed effect') | Medium | Medium |
| 1.5 | More theft of license plates and vehicles | Medium | Medium |
| 1.6 | Identity fraud | Small | Small |
| 1.7 | Chilling effects | Small | Small |
| 2.1 | External security (hacking and leaking) | Small | Medium |
| 2.2 | Data overload | Small | Small |
| 3.1 | Privacy violations | Small | Small |
| 3.2 | Function creep/détournement de pouvoir | Small | Small |
| 3.3 | Internal security (unauthorized employees) | Medium | Medium |
| 3.4 | Insufficient transparency (data use and rights) | Medium | Small |
| 3.5 | Interpretation errors/presumption of innocence | Small | Medium |
| 4.1 | No timely deletion of data | Small | Small |

# Conclusions & recommendations

- LPR is a useful tool...
  - For law enforcement: ensure direct follow-up
  - For criminal investigation: ensure data storage
- ...though we do not always know exactly how useful
  - Improve registration and evaluation of the results
- To avoid privacy issues:
  - Ensure a clear legal basis
  - Use anonymous profiles
  - Perform privacy impact assessments
- Share best practices
  - Guidelines and standards for cameras and reference lists

Show movie on anonymity
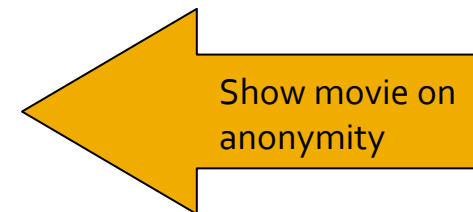
# Questions?　　　Next: discussion
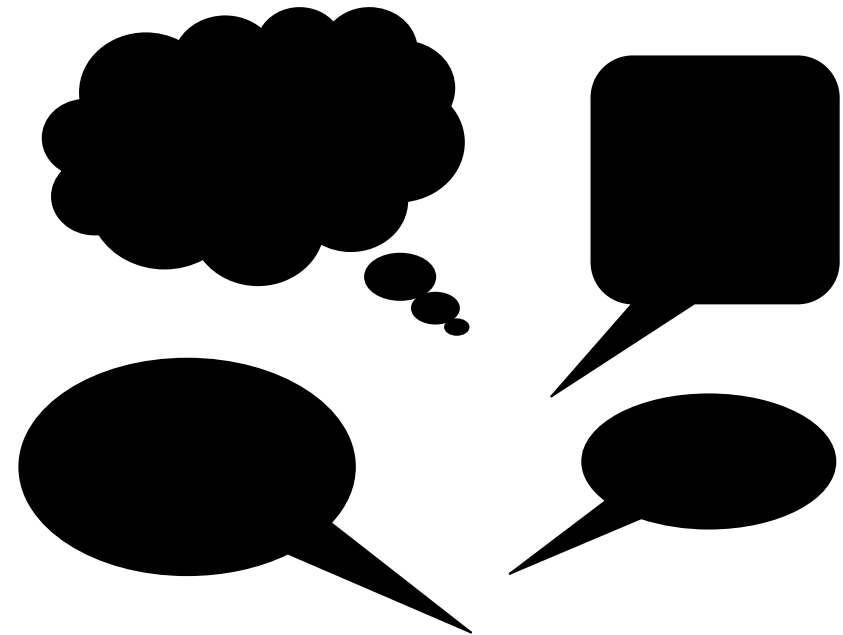
Thank you for your attention!

Or contact me later: b.custers@minjus.nl

# Hypotheses for discussion - 1

1. Data storage

   LPR data should be stored indefinitely, in order to have unlimited time to investigate and to be able to solve cold cases.

# Hypotheses for discussion - 1

1. Data storage

   LPR data should be stored indefinitely, in order to have unlimited time to investigate and to be able to solve cold cases.

<table>
<tr><td>

**Pros**

- More crime can be solved when more time is available

- Large amounts of data are easy to store nowadays

- Less of the valuable policing time required for securing data

</td><td>

**Cons**

- Most crime is either solved within 6-9 months or not solved at all

- Maintaining large databases costs a lot of time and money

- Risks of function creep and privacy violations increase

- Less time may encourage the police to work fast

</td></tr>
</table>

# Hypotheses for discussion - 2

2. Reference lists

   People who were convicted in the past for driving under influence should be put on LPR reference lists.

# Hypotheses for discussion - 2

2. Reference lists

   People who were convicted in the past for driving under influence should be put on LPR reference lists.

| Pros | Cons |
|------|------|
| ▪ A prior conviction or criminal record is the best indicator for future crime<br><br>▪ Such a targeted approach is much more effective than a random approach | ▪ This would result in 'once a criminal, always a criminal'. People should be able to make a new start in society<br><br>▪ Such close scrutiny may imply a punishment additional to a court's sentence |

# Hypotheses for discussion – 3

3. Discrimination

   To avoid discrimination, LPR cameras should be deployed at random locations, not in selected neighborhoods.

# Hypotheses for discussion – 3

3.  Discrimination

    To avoid discrimination, LPR cameras should be deployed in random locations, not in selected neighborhoods.

<u>Pros</u>

- Random locations are unpredictable: criminals have more difficulties to anticipate

- Adjusted behavior of criminals can also be detected

- Random locations may decrease discrimination

<u>Cons</u>

- A hot-spot approach is often more effective

- A non-targeted approach often means a larger burden on police capacity

# Hypotheses for discussion - 4

4. Cameras

   The police should not use their own network of cameras, but should have legal competences to claim any data from any (public or private) camera when necessary.

# Hypotheses for discussion - 4

4. Cameras

   The police should not use their own network of cameras, but should have legal competences to claim any data from any (public or private) camera when necessary.

| Pros | Cons |
|------|------|
| <u>Pros</u> | <u>Cons</u> |
| ▪ User cameras of others is cheaper | ▪ Others may not cooperate (even when mandatory) |
| ▪ The network of cameras of (all) others is more dense | ▪ Cameras of others may be in the wrong locations |
| ▪ Some parties may store data longer than the police | ▪ Cameras of others may not meet quality standards |
| | ▪ There may be a lack of overview on who has cameras |

# Hypotheses for discussion - 5

5. Privacy

   Use of LPR increases privacy, as only hits are stopped, while innocent vehicles can pass without any delay.

# Hypotheses for discussion - 5

5.  Privacy

    Use of LPR increases privacy, as only hits are stopped, while innocent vehicles can pass without any delay.

| Pros | Cons |
|------|------|
| <ul><li>Stopping all vehicles is indeed more limiting free movement</li><li>Having your license plate filmed may be less privacy invasive than a thorough search of your vehicle</li></ul> | <ul><li>Not all hits concern 'guilty' people and not all no-hits concern 'innocent' people</li><li>Once on a reference list, a person may be stopped many times</li></ul> |

# Hypotheses for discussion - 6

6. Cameras

   LPR only works with a dense network of cameras, otherwise people may easily avoid routes with cameras.

6.  Cameras

    LPR only works with a dense network of cameras, otherwise people may easily avoid routes with cameras.

| Pros | Cons |
|------|------|
| ▪ A dense network may provide more hits | ▪ A dense network is very expensive |
| ▪ A dense network may provide less opportunity for alternative routes | ▪ A dense network may generate an overload of data |
| | ▪ A dense network may create a Big Brother feeling |

# Hypotheses for discussion – 7

7.  Effectiveness

    If a particular LPR application is ineffective, it should not be used.

# Hypotheses for discussion – 7

7. Effectiveness

   If a particular LPR application is ineffective, it should not be used.

| Pros | Cons |
|---|---|
| ▪ Ineffective applications are a waste of time, money and effort | ▪ Initially ineffective experiments may provide useful knowledge on making applications effective |
| ▪ Use facts & figures, rather than intuition and belief | ▪ It is difficult to actually determine whether an application is (in)effective |

# Hypotheses for discussion – 8

8. Privacy

   Performing Privacy Impact Assessments is a waste of time.