Digital Forensics - Behind the Scenes

By

David-Olivier Jaquet-Chiffelle

Presented At

The Digital Forensic Research Conference

DFRWS 2015 EU Dublin, Ireland (Mar 23rd- 26th)

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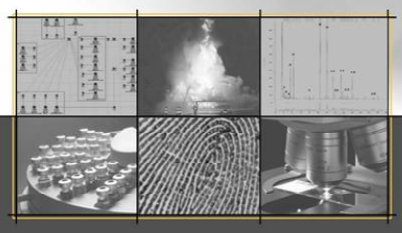
Digital Forensics: behind the scenes

David-Olivier JAQUET-CHIFFELLE
Full professor
ESC, University of Lausanne



R. A. Reiss

DFRWS 2015
March 25th, 2015

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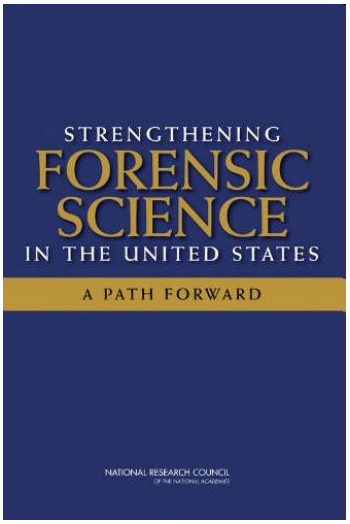
Forensic science on trial



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Forensic science on trial

> Brandon Mayfield

- > Attorney near Portland, Oregon, USA
- > Wrongly arrested because of an erroneous fingerprint identification
- > Wrongly charged with the 2004 terrorist train bombing in Madrid

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Forensic science on trial

> Forensic science becomes vulnerable to several kinds of attacks and critisisms

> The trustworthiness of forensic science is now questioned
- > How « scientific » is forensic science ?
- > How reliable are the underlying technologies ?
- > Are expert certifications trustworthy ?

> How can we
- > strengthen forensic science ?
- > reinforce the identity of forensic science ?

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General trend

> To standardize methods and procedures

> To accredit labs and certify experts

> To partition forensic science into silos and make it a patchwork of technical disciplines

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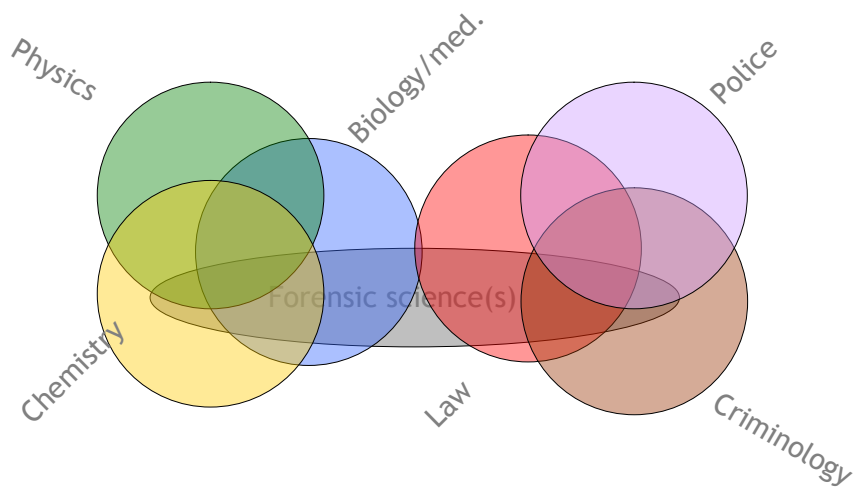
Forensic science(s)



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Duplication of the world of traces

> The digital domain

- > goes beyond a new discipline
- > creates a duplication of the world of traces

Analog domain	Digital domain
Film photography	Digital pictures
Handwritten signature	Digital signature
Safe	Crypto-algorithms
Paper files	Databases
(Snail) mail	E-mail

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The « real » world

« Real »	Analog
Physical	Most traditional traces
Virtual	e.g. testimony

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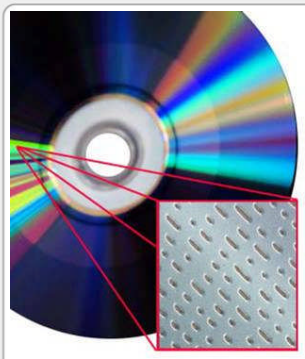
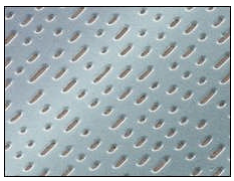
Digital traces



> **Material**

physical digital traces



> **Abstract**

virtual digital traces

0 1

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The real world

« Real »	Analog	Digital
Physical	Most traditional traces	e.g. holes at the surface of a DVD
Virtual	e.g. testimony	Most traces in the information society

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New perspective

> Digital traces

> offer
> > a new perspective

> require
> > to extend the traditional paradigms
> > by integrating the virtual one

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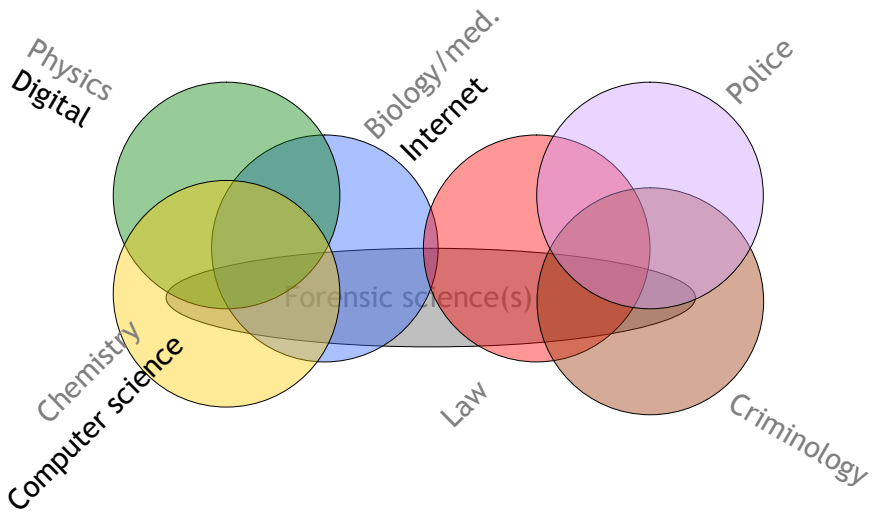
Forensic science(s)



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Digital traces

- Risk
  - To isolate the digital paradigm
  - To create a new science of
    - "digital" traces and identities
  - i.e., to split a core domain of forensic science

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A strategy to reinforce forensic science

- Accreditations and certifications ?
  - might be adequate for some technologies or laboratories, not for a science
- Forensic science should not be confined to a patchwork
  - of technologies
  - of other sciences applied to forensic issues
  - of forensic science providers

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A strategy to reinforce forensic science

> A true forensic science is needed with

- > a stronger scientific approach,
- > a broader vision and
- > a common unifying language

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Forensic science: wikipedia definition

> Forensic science is the scientific method of gathering and examining information about the past which is then used in a court of law

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Lausanne school of forensic science

> Forensic science should not be confined to "court of law" requirements only

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Role of forensic science

> Forensic science aims at
  > Bringing admissible evidence to a court of law

> But it also aims at
  > Participating in the decision process in the investigation
    > Formulation of hypotheses, choices
  > Finding ways to disable or discourage criminal activities
    > Botnet shutdown
    > Rise the required criminal effort for some key actions
  > Detecting, e.g. through their modus operandi,
    > Series of criminal activities
    > Criminal networks and their structures

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Stolen credit card credentials

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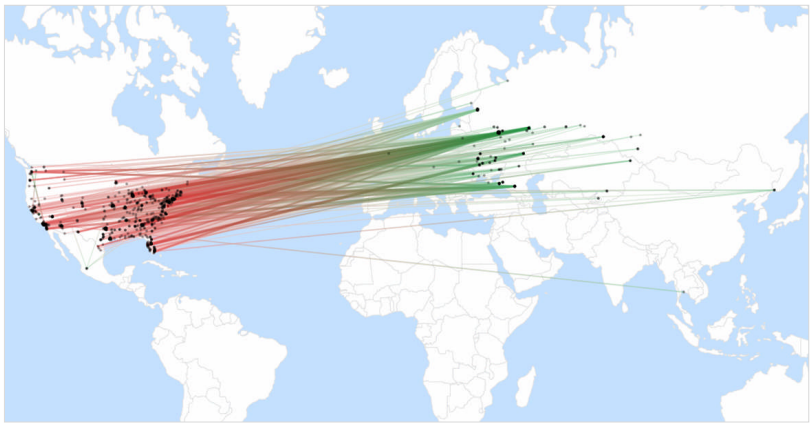
Extent of the problem



- 1 label supplier
- 1767 labels
- Declared value : **US $ 275'328**
- 23 weeks of activities

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Lausanne school of forensic science

> Forensic science should not be confined to "court of law" requirements only

> The trace is the fundamental object of study in forensic science

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The trace: a traditional definition

> Mark, sign or object, **the trace** is

> an apparent sign
(not always visible to the naked eye) that is

> the vestige
> > of a presence or
> > of an action
at the location where this action took place

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The trace: a traditional definition

> The location where the action took place is often relevant
  > for traditional traces
  > in the physical world

  but not really for digital ones (cloud computing)

> The concept of traces should be extended to events with
  > no action and
  > no specific presence

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The trace: my revisited definition

> A **trace** is a modification
  > subsequently observable,
  > resulting from an event

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The trace: my revisited definition

> The modification can be
  > an adjunction
  > a suppression
  > a transformation

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Forensic science

Forensic science
> studies **traces**
  > Detection, observation and sampling
  > Identification, individualization and authentication of the source
  > Determination of the probative value

> as well as possible **links** between traces
  > Case study
  > Discovery of a series
  > Understanding networks and phenomena

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Potential impact of digital forensics

> The border between
  > the physical world and
  > the virtual one

  becomes fuzzy in our modern Information Society

> Challenges related to digital evidence give an opportunity
  > to soften traditional barriers between forensic disciplines and
  > to strengthen forensic science itself

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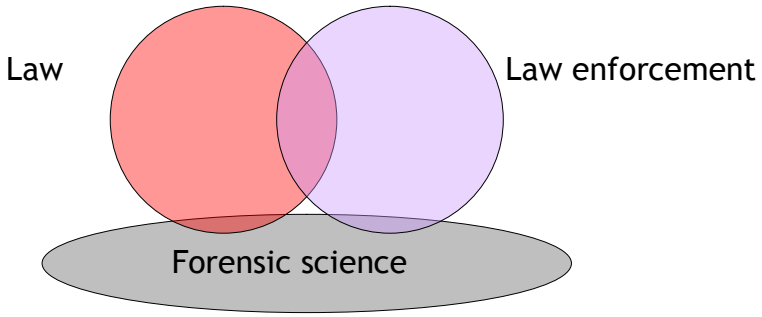
Forensic science



A science in its own right

A science to support, in particular, the fight against crime

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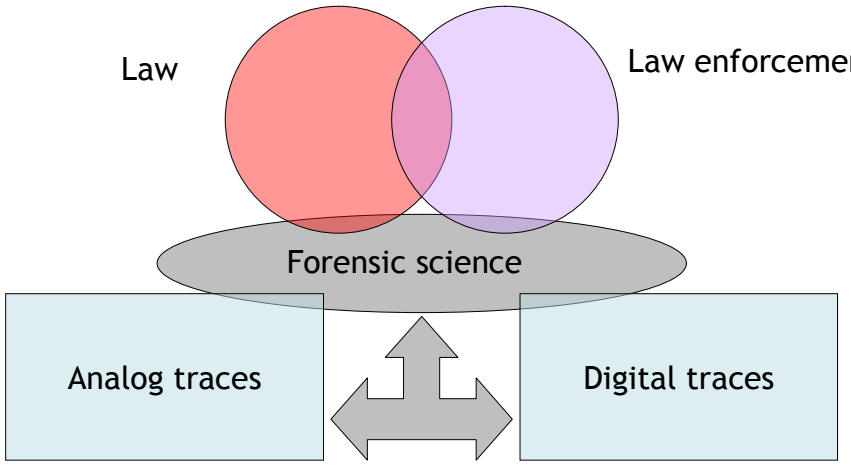
Forensic science



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> Forensic science should not be confined to "court of law" requirements only

> The trace is the fundamental object to be studied in forensic science

> Extending our own domains of expertise to promote cross-disciplinary approaches seems necessary to handle complex criminal activities

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Illegal drugs markets: Criminal activities

> Combined approach

physical world ⟷ Internet

> Optimisation of the ratio gain/risk
  > Cost reduction
  > Scalability
  > Minimization of the risks related to physical contacts/meetings

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Illegal drugs markets: Forensic activities

> Regular snapshots of illegal marketplaces in the Darknet
> Analysis of specialized forums
> Ordering of illegal drugs samples

> Chemical analysis and profiling of received substances
> Analysis of the packaging, etc.

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Digital traces

> allow a transversal and integrative approach

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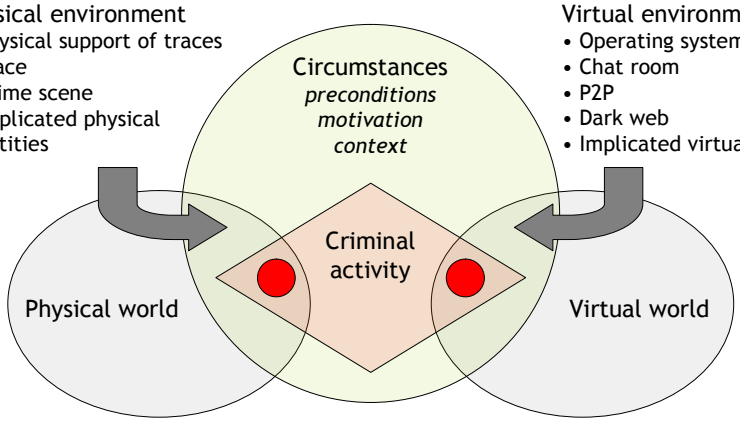
The global picture

Circumstances: Why ? When ? How often ?

Physical environment
- Physical support of traces
- Place
- Crime scene
- Implicated physical entities

Virtual environment
- Operating system
- Chat room
- P2P
- Dark web
- Implicated virtual entities



Traces: Where ? What ? Who ? How ?

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Contextual information

- **Minimizing** contextual information can
  - prevent some forms of cognitive bias
- **Eliminating** all contextual information is
  - a theoritical abstraction, irrelevant in practice
- **Using** contextual information can
  - help
    - to find the right questions
    - to get the relevant answers
  - allow to link valuable information

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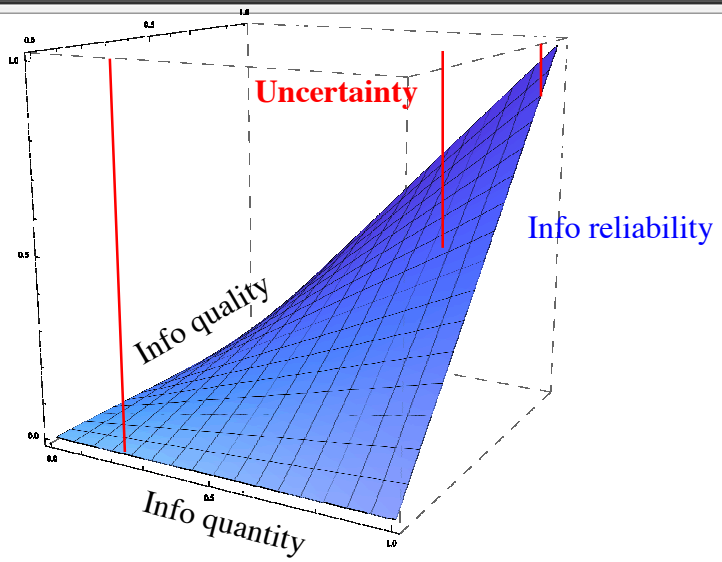
Information, context & confidence



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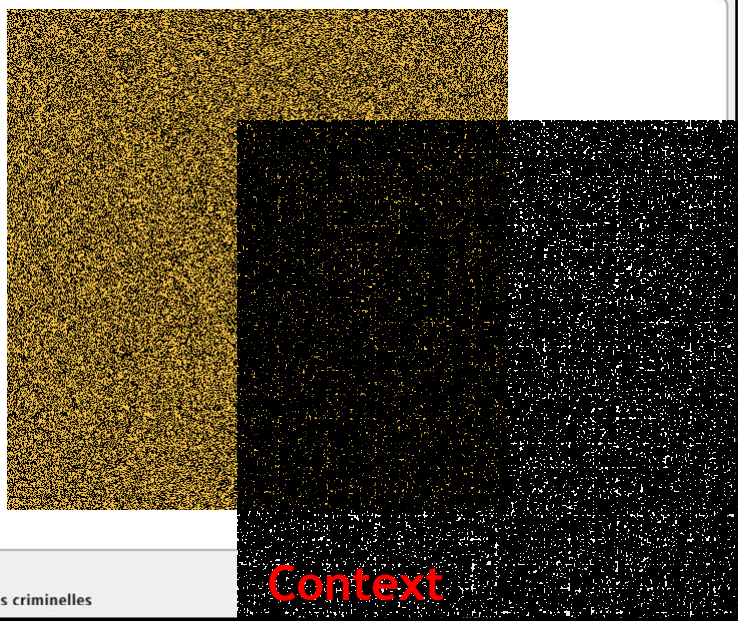
Digital traces and context



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Conclusion

> Forensics science is in the line of fire

> A true forensic science is needed with
- > a stronger scientific approach,
- > a broader vision and
- > a common unifying language

> The digital paradigm gives us a unique opportunity
- > to revisit traditional and fundamental concepts
- > to develop further a true forensic science
- > to strenghten the identity of forensic science itself

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Thank you for you attention