

# Lies, damned lies, & *legal truths*

– making and breaking  
legal conviction

CWI

Richard D. Gill  
Mathematical Institute  
Leiden University



*[gill@math.leidenuniv.nl](mailto:gill@math.leidenuniv.nl)*

*<http://www.math.leidenuniv.nl/~gill>*

*@gill1109 on Twitter*

# Science versus Justice

- scientific community – creative thinking
- legal community – bureaucratic thinking

For an establishment like a national legal system,

Learning represents the possibility of  
**failure**  
and must thus be avoided if possible

Stolen from:

Robert Strandh: The psychology of learning,

<http://dept-info.labri.u-bordeaux.fr/~strandh/Essays/psychology.html>

# Dramatis Personae



# Dramatis Personae

17 judges: Fokkens, Fokkema, Fokking...

The Derksen family



Dr

ae

17 judges: Fok



# 2001: JKZ, the Hague

- 4 Sept: baby Amber dies unexpectedly overnight; death recorded as natural
- 5 Sept: nurse goes to chief paediatrician with “bad feeling”: *Lucia was on duty again ...*
- Excel spreadsheet statistics: no coincidence
- 5 Sept: Amber’s death becomes unnatural
- 5–14 Sept: 30+ incidents & deaths at JKZ and RKZ attributed to Lucia; gossip; ...
- 14 Sept: press conference; newspaper report; 5 deaths and 5 suspicious incidents reported to police

# 2003: the Hague Lower court



- Lucia pleads innocent
- and gets life sentence for 4 murders + 2 attempts at JKZ, RKZ, Leienburg
- Statistics essential: “1 in 342 million”
- No medical proof
- Both defence and prosecution appeal

Elffers: “Your honour, it was not chance. The rest is up to you.”



# 2004: the Hague Upper court

- Lucia gets life sentence + TBR for 7 murders + 3 attempts
- Medical proof that Amber died of digoxine administered by Lucia; motive: compulsion
- No statistics
- Chain argument
- Defence appeals (*novum* – mislaid Strasbourg lab finding “no digoxine”)

TBR = *ter beschikking rechter* = permanent detention in psychiatric care

# 2004: the Hague Upper court

- Lucia gets life sentence + TBR for 7 murders + 3 attempts
- Medical proof that Amber died of digoxine administered by Lucia; motive: compulsion
- No statistics
- Chain argument
- Defence appeals (*novum* – mislaid Strasbourg lab finding “no digoxine”)

TBR = *ter beschikking rechter* = permanent detention in psychiatric care

# 2006: the Hague Supreme court

- Conviction is upheld except that TBR is ruled illegal (\*)
- Upper court (a new one) complies
- Lucia suffers a stroke

(\*) No relevant psychiatric disorder + non-guilty plea

# Meanwhile ...

- Medical doctor Metta de Noo (*née* Derksen), sister-in-law of JKZ chief paediatrician Arda Derksen (*née* Lubsen) becomes uneasy
- The Derksen family is split; “committee Lucia de B.” formed
- Philosopher Ton Derksen publishes *Lucia de B: reconstruction of a miscarriage of justice*
- Peter Grunwald reads it and makes me read it too
- 2006: Derksen submits to CEAS: Committee for Evaluation of Closed Cases
- Growing media interest



2007

# Report of the CEAS

- Prosecution of case was tainted by tunnel-vision from early start
- “Experts” were chosen from small circle around JKZ, later advised police, later advised courts
- Experts disagree on cause of death of Amber
- Case should be reopened

2008

# The supreme court

- Advocate-General sees no *novum* in CEAS report
- However, he charges a multi-disciplinary medical investigation into death of Amber
- Lucia's sentence is temporarily suspended
- Conclusion: Amber's death could as well have been natural (exhaustion); he proposes the case be reopened
- Supreme Court: there is a *novum* (key expert of original trial states he agrees with new findings!); case is reopened

# 2009: the last act?

- Prosecution proposes major *forensic-criminalistic* investigation (vs. defence's *theoretical-scientific*) on lines proposed by independent company IFS
- The court decides to continue A.G.'s multidisciplinary medical line of investigation into cases of Amber, Achraf, Achmad only



- A professional statistician has *still never been heard*
- The only persons with a generalist medical overview of the whole case (Arda Derksen, Metta de Noo) *have still never been heard*



# The role of statistics

- Statistics initiated the case
- Statistics central to 2003 conviction
- 2004: “*no statistical probability calculation*”;  
“*all deaths and incidents shown by incontrovertible  
medical-scientific evidence to be unnatural*”
- ... yet from publication of Derksen’s book,  
statisticians at the heart of public movement to  
reopen case: why?



17 judges can't be  
wrong!

They don't  
have the full  
dossier!

# The public debate

- Slowly, the media change sides Nature!
- Petition for reopening the case to minister; candle-light demonstration at prison; newspaper full page advert; ...
- The legal establishment digs in its heels Nobel laureate!
- Intellectuals, artists, scientists become involved
- The medical establishment keeps silent Undermining the  
foundations of the state!
- Politicians keep silent
- Public opinion and academic opinion are won for Lucia
- Key figures in legal establishment are won for Lucia



# De zaak Lucia de B. moet zo spoedig mogelijk worden heropend

[www.luciadeb.nl](http://www.luciadeb.nl)

[www.ipetitions.com/petition/lucia](http://www.ipetitions.com/petition/lucia)

Lucia de Berk is tot levenslang veroordeeld voor zeven moorden en drie moordpogingen. De sterfgevallen konden volgens de deskundigen afzonderlijk bezien allemaal een natuurlijk dood zijn geweest en waren ook eerst als zodanig opgegeven. Dat Lucia ‘zo vaak’ aanwezig was bij een sterfgeval vond het ziekenhuis verdacht. Er is *geen* getuige, *geen* bewijs, *geen* bekentenis; *wel* beeldvorming door angst en achterklap. Volgens het hof is slechts één ‘moord’ wettig en overtuigend bewezen, de rest volgt via de schakelconstructie. Het zou bij deze ene ‘moord’ om een digoxinevergiftiging gaan. Volgens toonaangevende experts echter is digoxinevergiftiging uitgesloten. De *Commissie Evaluatie Afgesloten Strafzaken* stelt dat als het gerechtshof dat had geweten, vrijspraak voor alle 10 gevallen had kunnen volgen. Haar rapport concludeert ook dat er sprake is geweest van: onvolledigheid en fouten bij het statistisch onderzoek; onvolledigheid bij het geven van medische informatie; coaching van politie door het ziekenhuis; onjuistheden bij de testmethodes van de digoxine; keuze van deskundigen op basis van persoonlijke bekendheid en niet op basis van deskundigheid; het niet open staan voor alternatieve scenario’s. De commissie spreekt van *onderbuikgevoel*. Toch is heropening nog niet aan de orde: er zal eerst nog wéér een onderzoek plaatsvinden. Lucia zit deze Kerst voor het zevende jaar in de gevangenis.

...nde), Maggie Dorey, prof Ann Dring, Keith Duineveld, Tamara N. van Duyvenvoorde, Carole Edrich, Shirley (al), prof Bradley Efron a, Thomas Elbers, dr Jong Enschede, Ana van Tijmen Euser, Hester J. Fabius, prof. Jiqian gzhou Canton Province jn Februari (schrijfster – euren, C. Ford, Maarten (Stanford Univ.), dr ir prof Ursula Gather ara van de Geer (ETH Gelder, drs Marten van errits, J.M. Gerrits, Paola Richard Gill (KNAW – W. Gobius du Sart, Amy ooch, Emely de Graaf, ziosi, Tim Groeneboom v.), Marco Greco, prof nk de Groot, mr B.W. de dr Peter Grünwald, dr prof Mathisca de Gunst an Haaften, Ash Haeger, happen), Robert Haines, A. Klein Haneveld, prof tie voor Toxicologisch rijver – bioloog), Cees stiek in de sociale wet.), e Helsdingen, drs n, Arjan Hertsenberg, Els ? van den Heuvel, René nd, Wendy Hinke, Marty Hoare, An Hoedemaker, n, dr Willem-Jan van ever oude en Oosterse geven, prof W.Th.F. den Susan Holmes (Stanford natuurkunde – KNAW), Han Hoogeveen, Anja Sacha Hubert, Mark l. wetenschappen), Julie Jaeger (Univ. Ålborg),

Annika Döring, J. Driver, Johan Dubbelo Dubbers, R. van Dulr Steve Dzincielewski, Ire Edrich, Phil Edwards, (Stanford Univ.), prof L.H. Elbers, prof Chris Es, dr A.J. van Es, Et Eymers, Frans Faa Fang (biostatistics – Ph China), Dave Fargher, filosoof – columnist – ju Fornerod, Mieke Francis E.H. Furnée, M. van (Univ. Dortmund), Adria Zürich), dr ir Maurits Gelderen, prof Edward Gerritsen, Rein Gerritsen voorz. VVS-OR), Ed C Godliman, Dick Goedh Paula Grassart, Kevi (WiiJay), prof P. Groene Patrick Groenen (statist Groot, dr Karin Gr C.A. Grünwald-Schindl, (biostatistiek), dr Madal Steven Hagers, prof Oll Rob Hak, mr Sjako ten Johannes Harleman (Pathologie), Ruud Harm Hazenberg, Hans van H S.H. Heisterkamp (A.P.J. Hendriks, Willem Heskes, Peter de Heu Hiddingh, Denise Hijde, Hirst, Michael Hirst, Jan B. Hoeksma, Jetty Hoeve, Nelly van der talen), prof Jan P. Hoger Hollander (KNAW Univ.), dr J.D. Holtzer Susan Hoogeland, dr Ad Hooijmans, prof Willem Hughes, G. Hulscher, J Ingham, Ada Ipenburg, prof Peter Jagers (v)

# FOKKE & SUKKE

HEBBEN DE OPEN BRIEF NATUURLIJK OOK ONDERTEKEND

WIJ DENKEN NAMEDIJK DAT MAARTEN 'T HART NET ZOVEEL VERSTAND VAN STRAFRECHT HEEFT...

...ALS VAN AFVALLEN.



RGVT

# FOKKE & SUKKE

VOELEN DAT AAN HUN WATER

DE KANS DAT VRIJWEL ALLE  
HOOGLERAREN STATISTIEK HET  
EENS ZIJN

...IS NATUURLIJK  
HEEL ERG KLEIN.



RGvT

# FOKKE & SUKKE

MOESTEN DE NOODTOESTAND WEL UITROEPEN

DIE LEDEN VAN HET  
HOOGGERECHTSHOF...

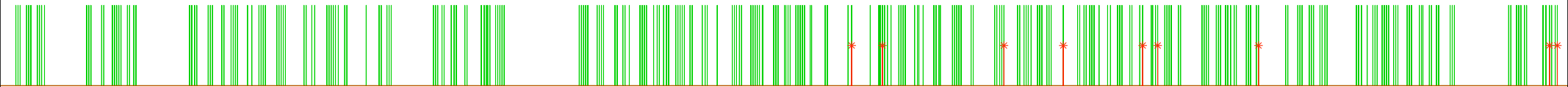
...SNAPTEN *NIETS*  
VAN STATISTISCH  
BEWIJS.



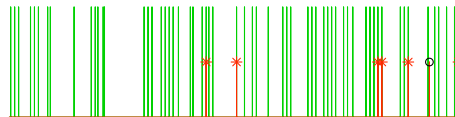
RGvT

# Statistics: the data

JKZ: Sept '99 – Sept '01



RKZ: Aug '97 – Nov '97



LEIJENBURG ?

PEN. SCHEVENINGEN ?

# Elffers' data

Shifts	with incident	without incident	Total
with Lucia	9	133	142
without L.	0	887	887
Total	9	1020	1029

JKZ (2nd year only)

Shifts	with incident	without incident	Total
with Lucia	6	52	58
without L.	9	272	281
Total	15	324	339

RKZ-42

Shifts	with incident	without incident	Total
with Lucia	1	0	1
without L.	4	361	365
Total	5	361	366

RKZ-41



# Elffers' 1 in 342 million

- Three Fisher exact tests
- JKZ: *post-hoc* correction by Bonferroni: 26 nurses
- Multiplication of three  $p$ -values
- Elffers emphasized that correlation  $\neq$  causation
- *By way of example, perhaps:*
  - Lucia is a bad nurse (but not a murderer)
  - Lucia has more difficult shifts
  - Lucia has more night shifts
  - Someone is trying to set Lucia up

# Statistics out, from 2004?

- The incidents at JKZ occurred in a short period in a ward where usually nothing happened
- Lucia was present every time
- A natural cause was ruled out, medically, in every case

# The legal concept of irrefutable medical-scientific proof of unnatural death

- If the precise time of a death from complex causes can't be predicted, the (time of) death is *inexplicable*
- An *inexplicable* death is a *suspicious* death if Lucia is present, and hence perhaps *unnatural*
- For every case separately, a majority of medical experts thought the death was natural; but always one could be found who thought it unnatural!
- In two cases, only one expert thought it was unusual; why? *Only* because Lucia was there!

# Elffers' lesson on correlation comes in handy

- Chain proof: we have a lying murderess who was present at medically inexplicable events
- She cannot explain her presence:  
Elffers' escape clauses are ruled out, by herself

Judge: “*Mrs de Berk: were you a bad nurse?*”

Lucia: “No, your honour, my superiors and colleagues ...”

Judge: “*Mrs de Berk: did you work more difficult shifts than your colleagues?*”

Lucia: “No your honour, we shared all the work fairly ...”

# More sharp legal thinking

## A.G. to supreme court

- Just because Amber died of exhaustion on Sept 4, it doesn't mean that she otherwise wouldn't have died of digoxine poisoning
- Just because there were similar clusters of events at JKZ in earlier and later years, doesn't mean that every one of the deaths in "Lucia's cluster" are natural

# The newest data

Shifts	with incident	without incident	Total
with Lucia	7	135	142
without L.	4	883	887
Total	11	1017	1029

JKZ (2nd year only)

Shifts	with incident	without incident	Total
with Lucia	5	53	58
without L.	10	271	281
Total	15	324	339

RKZ-42

Shifts	with incident	without incident	Total
with Lucia	1	2	3
without L.	4	359	363
Total	5	361	366

RKZ-41

## Old data

## New data

, , JKZ

	Incident	Normal
Lucia	9	133
Others	0	887

, , JKZ

	Incident	Normal
Lucia	7	135
Others	4	883

, , RKZ41

	Incident	Normal
Lucia	1	0
Others	4	361

, , RKZ41

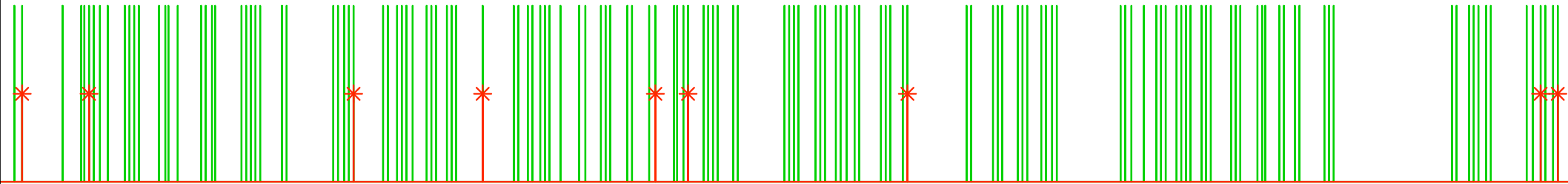
	Incident	Normal
Lucia	1	2
Others	4	359

, , RKZ42

	Incident	Normal
Lucia	6	52
Others	9	272

, , RKZ42

	Incident	Normal
Lucia	5	53
Others	10	271



- Three children represent  $7=2+2+3$  of the now 11 incidents (one illegal euthanasia removed)
- Two incidents actually occurred in the shift *after* Lucia's
- At least two incidents outside of Lucia's shifts are missing (they weren't *suspicious* incidents)



# The newest $p$ -values

- Cochran-Mantel-Haenszel test  
JKZ; RKZ-41, -42; & Elffers' post-hoc correction  
1 in 916
- Ultimate stratification  
11 *days* at JKZ with both incident & Lucia on duty  
1 in 25
- Gamma(1) heterogeneity over Poisson intensity  
JKZ, RKZ pooled  
1 in 25

# & what about ... ?

- *Post-hoc* problem
- Data selection problem
- Information from outside Lucia period;  
total number(s) of incidents.  
[Elffers analyses distribution of incidents *between* nurses,  
*within* period]

# Approaches

- Significance testing
- Grand Bayesian synthesis
- Bare likelihood ratio

# Approaches

- ~~Significance testing~~
- Grand Bayesian synthesis
- Bare likelihood ratio

# Approaches

- ~~Significance testing~~
- ~~Grand Bayesian synthesis~~
- Bare likelihood ratio

# Approaches

- ~~Significance testing~~
- ~~Grand Bayesian synthesis~~
- ~~Bare likelihood ratio~~

# Likelihood ratio

- What is the hypothesis of the prosecution?
- What is the hypothesis of the defence?

# The basic empirical research is still missing

- Events are strongly clustered
- Shifts fall in regular patterns
- Variation between nurses  
[a nurses' actions can *define* when/what is an incident]
- Differently qualified nurses do get different shifts
- A hospital ward is in a non-constant environment  
[winter/summer, changing admissions/discharge policy, opening/closing other wards]
- Multiple incidents concerning same patient



- Hidden confounders cause heterogeneity between nurses, between days
- $\text{var}(X) = E(\text{var}(X|Y)) + \text{var}(E(X|Y))$
- *Independent Uniform* random rare events:  
variance  $\approx$  mean
- Unmeasured heterogeneity:  
variance  $\gg$  mean

The basic empirical  
research is still missing

As long as it remains so, statistics must be kept out of such cases

# Lessons

- Many reforms are being made
- Science and Justice are talking together
- Still: the gut reaction of the system is: *create rules, checklists, registers*
- We want honest cops, upright magistrates, intelligent and knowledgeable lawyers, wise judges who weigh all the evidence and use their common sense and intellect and humanity
- We want the system to admit mistakes so that it can learn from them

# Three kinds of lies: *lies, damned lies, and legal truths*

CWI



For an establishment like a national legal system,  
learning represents  
the possibility of failure &  
must thus be avoided if possible



- S.E. Fienberg & D.H. Kaye (1991), Legal and statistical aspects of some mysterious clusters. *J. R. Stat. Soc. (A)* **154**, 61–74
- B.C. Yorker et al. (2006), Serial Murder by Healthcare Professionals. *J. Forensic Sci.* **51**, 1362–1371
- K. Ramsland (2008), *Inside the Minds of Healthcare Serial Killers*, Times-Warner ...
- R.D. Gill et al. (bis), to appear ...