Statistics beyond Physics - Misused in Public ?

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Misuse of statistics

From Wikipedia, the free encyclopedia

A **misuse of statistics** occurs when a statistical argument asserts a falsehood. In some cases, the misuse may be accidental. In others, it is purposeful and for the gain of the perpetrator. When the statistical reason involved is false or misapplied, this constitutes a **statistical fallacy**.

The false statistics trap can be quite damaging to the quest for knowledge. For example, in medical science, correcting a falsehood may take decades and cost lives.

Misuses can be easy to fall into. Professional scientists, even mathematicians and professional statisticians, can be fooled by even some simple methods, even if they are careful to check everything. Scientists have been known to fool themselves with statistics due to lack of knowledge of probability theory and lack of standardization of their tests.

Types of misuse [edit]

Discarding unfavorable data [edit]

In product quality control terms all a company has to do to promote a neutral (useless) product is to find or conduct, for example, 40 studies with a confidence level of 95%. If the product is really useless, this would on average produce one study showing the product was beneficial, one study showing it was harmful and thirty-eight inconclusive studies (38 is 95% of 40). This tactic becomes more effective the more

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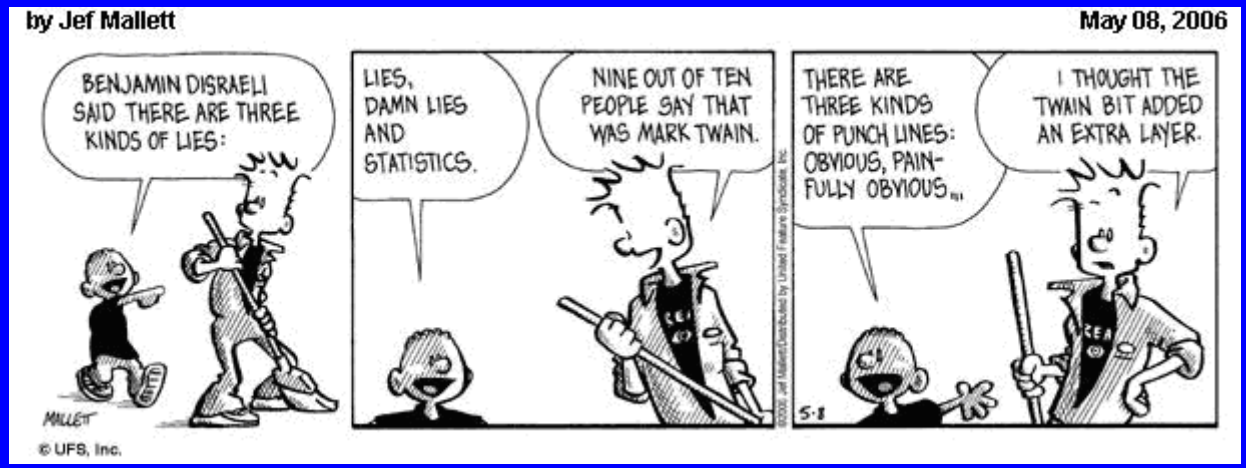
„There are three kinds of lies:

Lies, damned lies, and statistics“

attributed by Mark TWAIN to the 19th Century British Prime Minister
Benjamin DISRAELI (1804-1881)



**„Ich glaube nur der Statistik, die ich selbst gefälscht habe.
(Do not trust any statistics you did not fake yourself.)“**

attributed by ... to the 20th Century British Prime Minister
Winston CHURCHILL (1874-1965)

Trivial methods of misuse:

Falsification of data sets,
e.g. election in GDR (7 May 1989), exposed by engaged citizens' group ---> peaceful revolution

The „correlation – causality“ problem;

Storks deliver babies

R. MATTHEWS (2000): Storks deliver babies

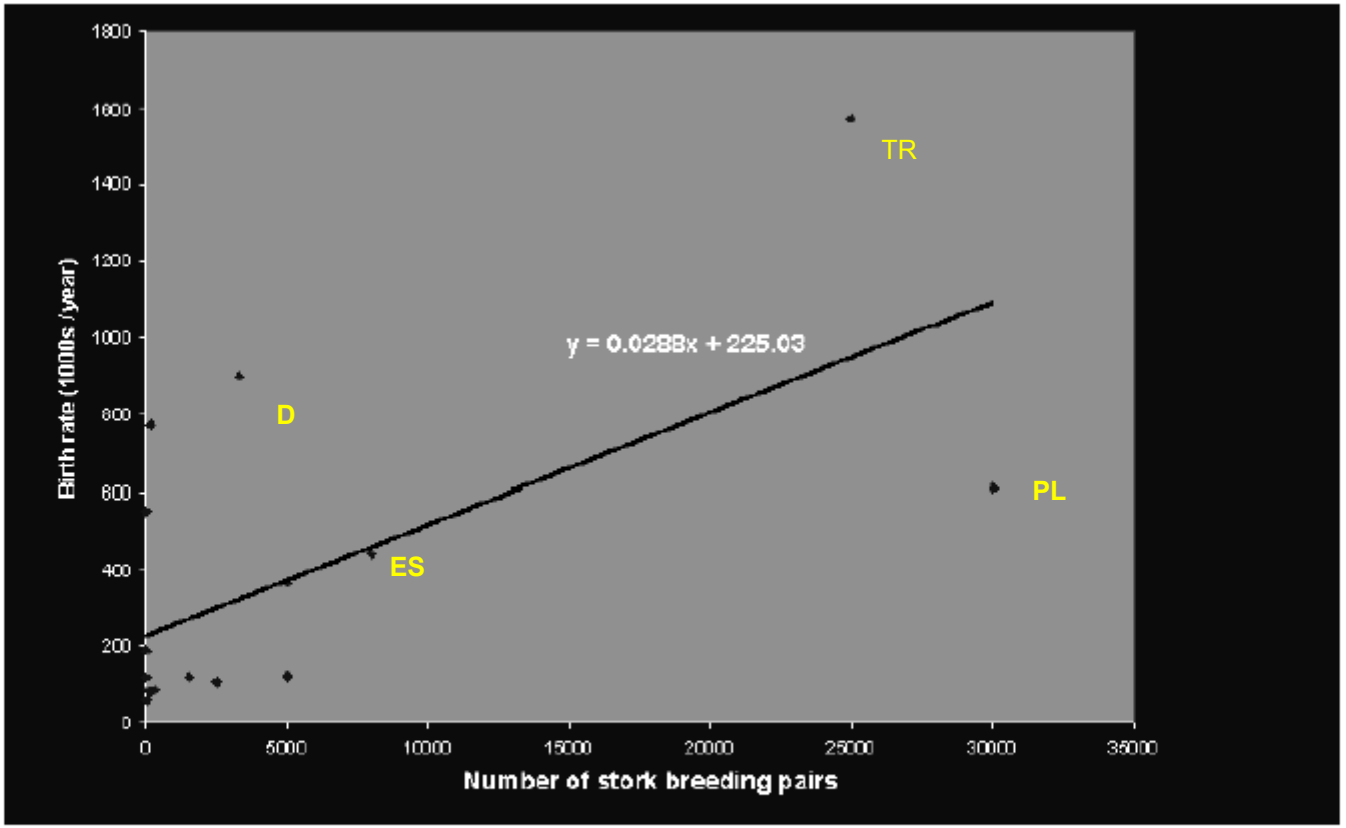


Fig 1. How the number of human births varies with stork populations in 17 European countries.

T. HÖFER, H. PRZYREMBEL, S. VERLEGER
New evidence for the Theory of the Stork
***Paediatric and Perinatal Epidemiology 2004,* 18, 88-92**

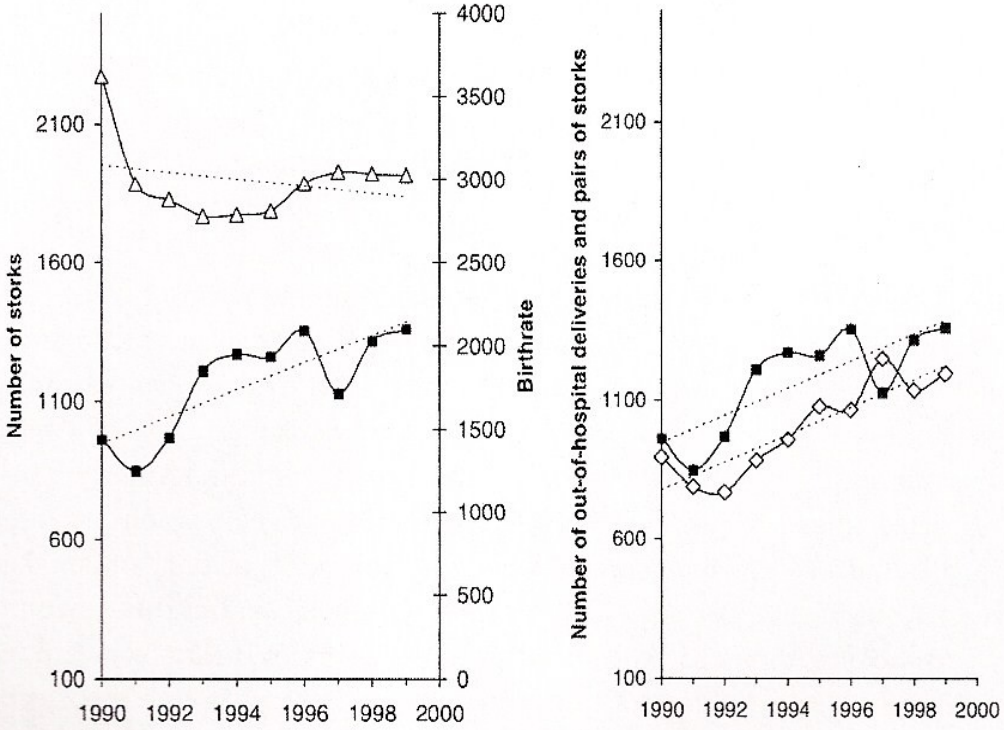


Figure 2. Storks in Brandenburg and the birthrates in Berlin, Germany (1990–99). Open triangles show number of clinical deliveries per year in Berlin. Open diamonds show number of out-of-hospital deliveries per year in Berlin. Number of pairs of storks are shown as full squares. Dotted lines represent linear regression trend ($y = mx + b$). For the convenience of the readers, two figures are presented. Left graph shows clinical deliveries against pairs of storks using two scalings, right graph shows numbers of out-of-hospital deliveries and pairs of storks both on the same scale. In both figures, data are from the years 1990–2000.

Outline:

1. Introduction: Statistics beyond physics
2. Criteria of identification
   - 2.1 Local criterium
3. Confidence region
4. Statistics of rare events
5. Summary

1. Introduction

Statistics - part of physics (exact sciences):

Physicists are familiar with basic concepts:

ensemble, - averaging, error bar,
equilibrium, ergodicity,
self-averaging, mean value and variance,
central limit theorem, statistics of rare events,
… …

Misuse of statistics in public:

sometimes (often?) by violation of
basic concepts

2. Criteria of identification

ensemble ⇨ population

statistical unit ⇨ event, symptom, …

Criteria of identification for statistical units:

temporal
local
factual

In population (crime, economic, …) statistics these criteria are weakened

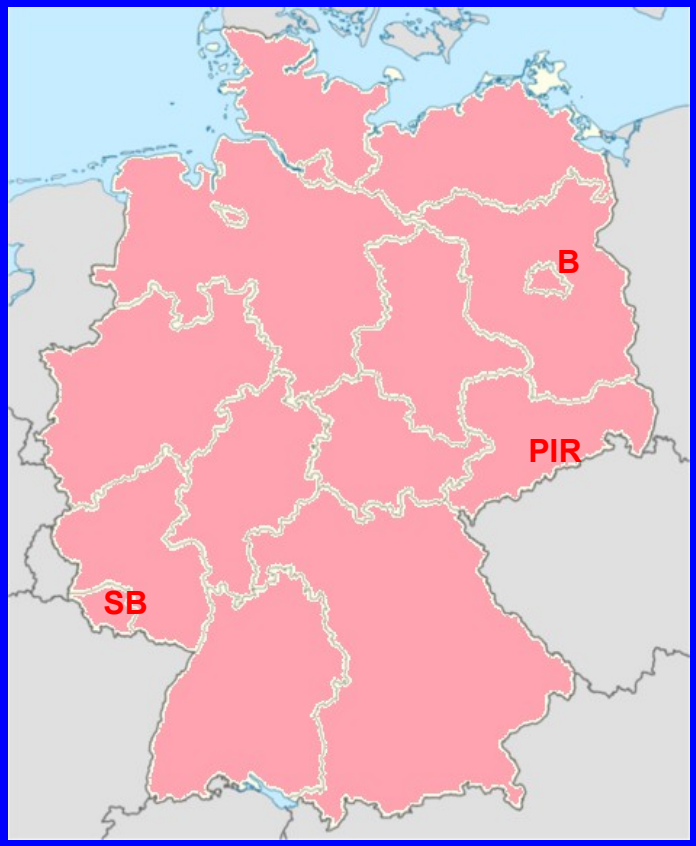
⇨ **Danger of misuse**

temporal:	**Calendar year**
local:	**Geographical region**
factual:	**Uniform characteristic** **compare apple and oranges** **(vergleiche Äpfel mit Birnen)**

2.1 Local criterium

Example: 1 murder in Pirna

statistically *smeared over* Germany



Result: „0.002 murder“ attributed to Saarbrücken, 0.05 to Berlin, ... 0.0005 to Pirna

But: „**Self-averaging**“, when **many** events are **homogeneously** distributed

3. Confidence region

… of data points

Example:

from PKS (German Police Crime Statistics):

The number of murder in Baden-Württemberg **in 1996 : 73**
in 1997 : 56

This is a decrease by 23.9 %

Confidence region of data points

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from PKS (German Police Crime Statistics):

The number of murder in Baden-Württemberg **in 1996 : 73**
in 1997 : 56

This is a decrease by 23.9 %

in 1998: 70

This is an increase by + 25.0 %

or a decrease by 4.1 % between 1996 and 1998 or … or … or

Example:

from PKS (German Police Crime Statistics):

The number of murder in Baden-Württemberg in 1996 : 73
In 1997 : 5[illegible]

This is a decrease by 23.9 %

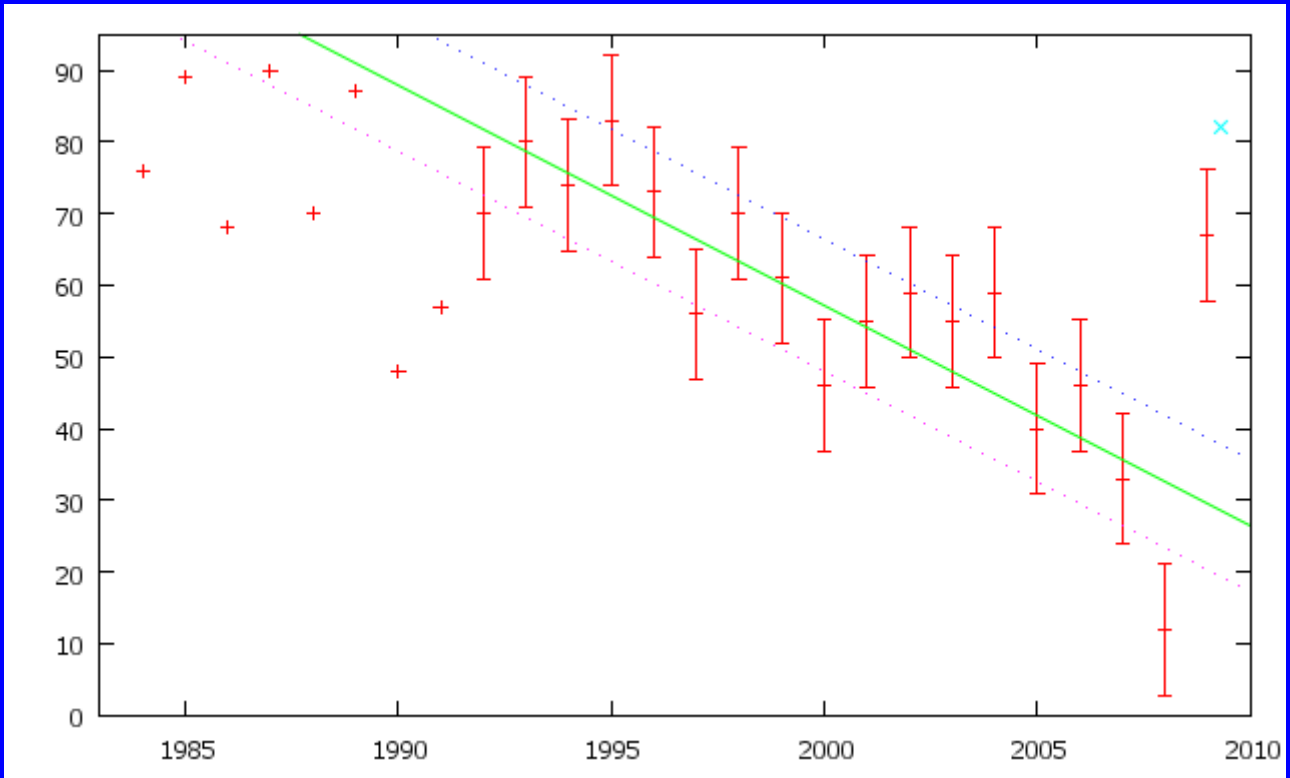
In 1998: 70

This is an increase by + 25.0 %

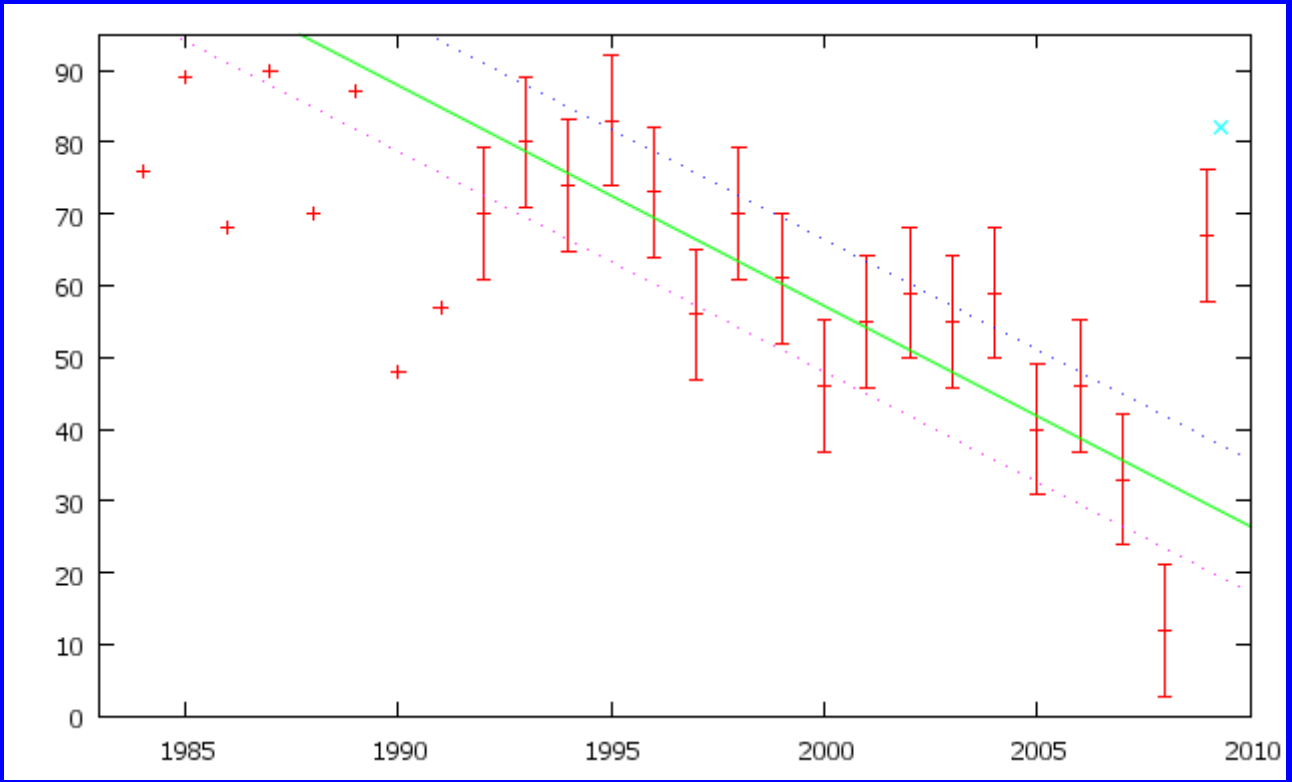
or a decrease by 4.1 % between 1996 and 1998 or … or … or

Complete nonsens !!!

Data fit:

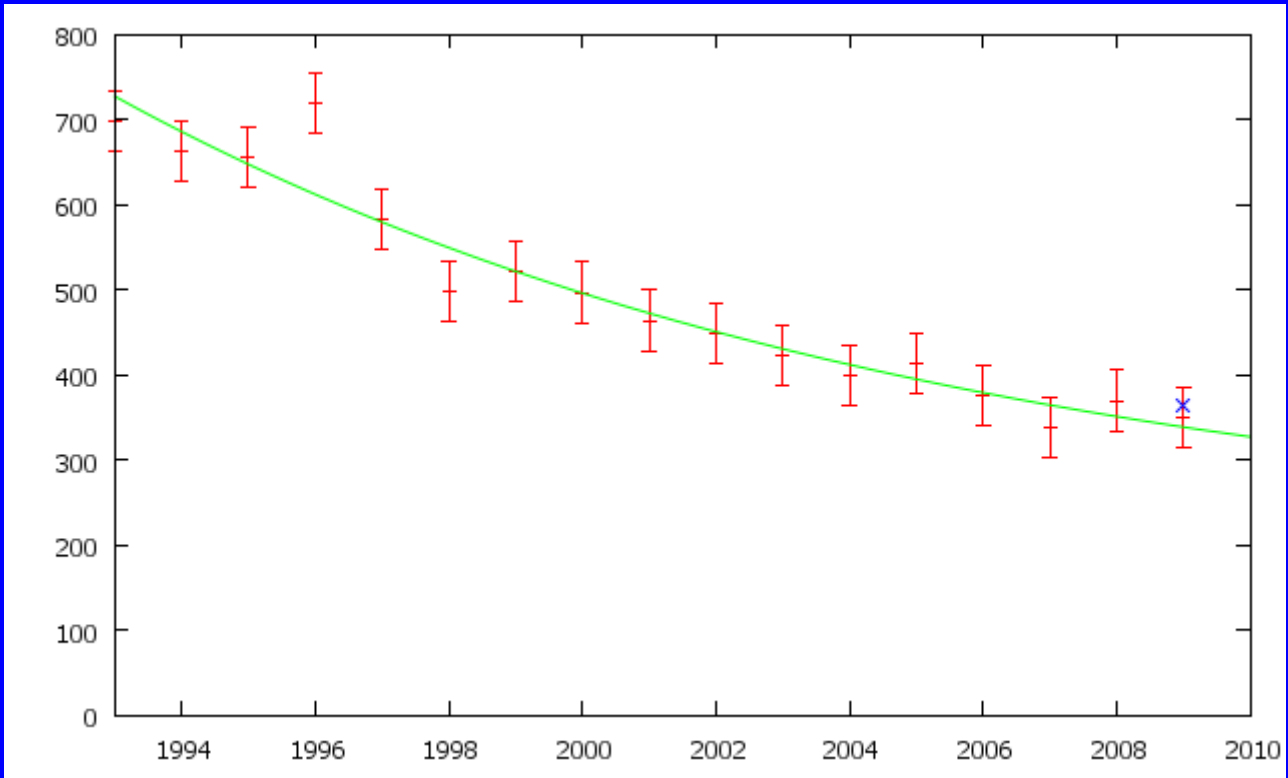


Victims of murder in Baden-Württemberg fitted by *y(x) = 6200 - 3.1*x*



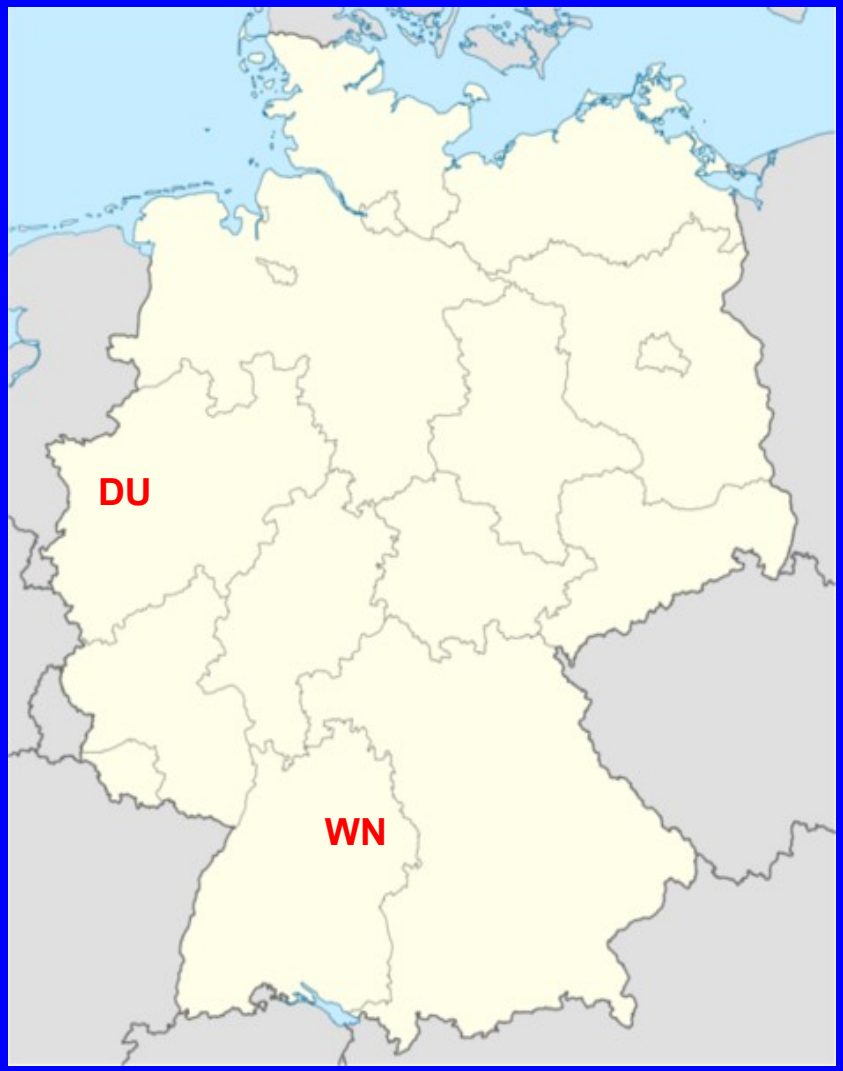
Victims of murder in Baden-Württemberg fitted by *y(x) = 6200 – 3.1*x*
(Cross x denotes data including victims of Winnenden 2009)

The mean decrease rate between 1990 and 2010 is about 3 % per year



Victims of murder in Germany fitted by *y(x)=191+exp(-(x-2071)*0.08)*

4. Statistics of rare events



examples of extreme events:

Amok (school-shooting)
in Winnenden/Wendlingen
11 March 2009

15 victims

Love parade
In Duisburg
24 July 2010

21 victims of
involuntary manslaughter

Singularity violates local and temporal criteria !

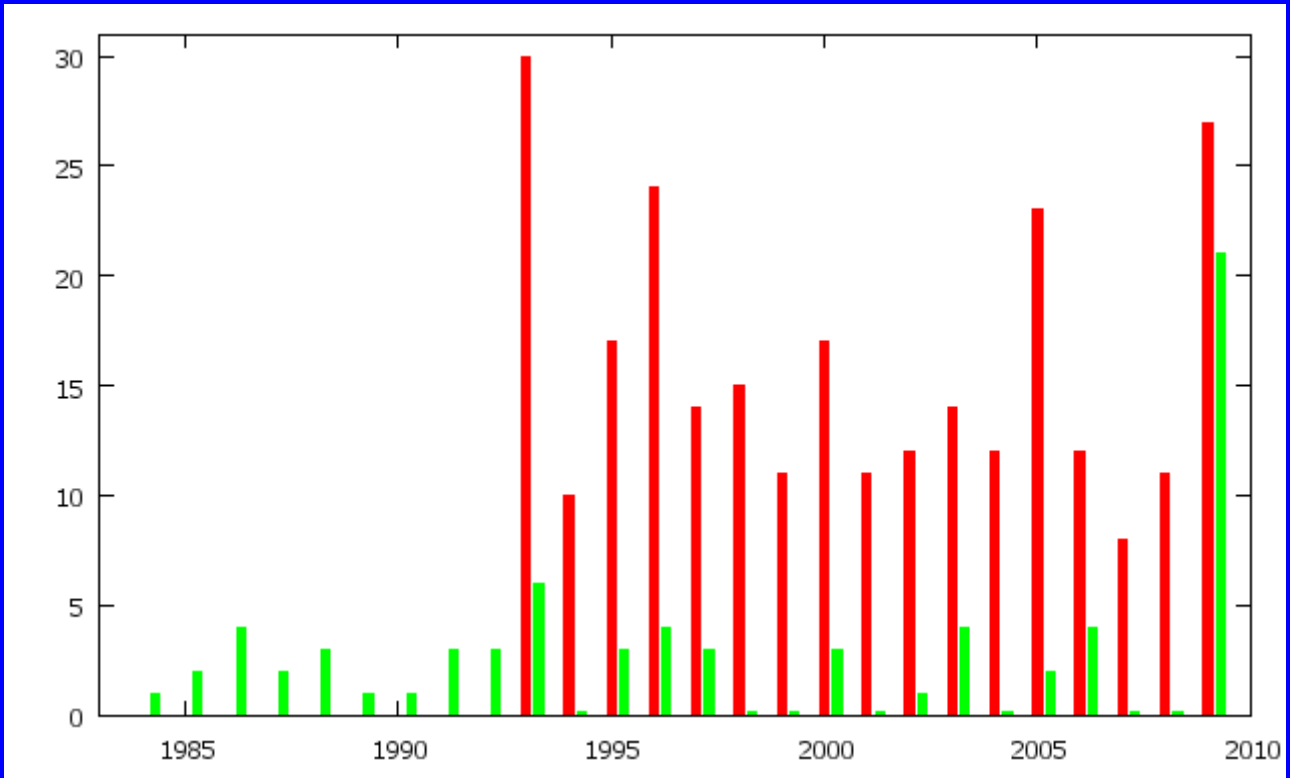
Consequences:

Rare events cannot be included in the PKS;
„statistical statements“ depend on
an *arbitrary* chosen reference parameter:

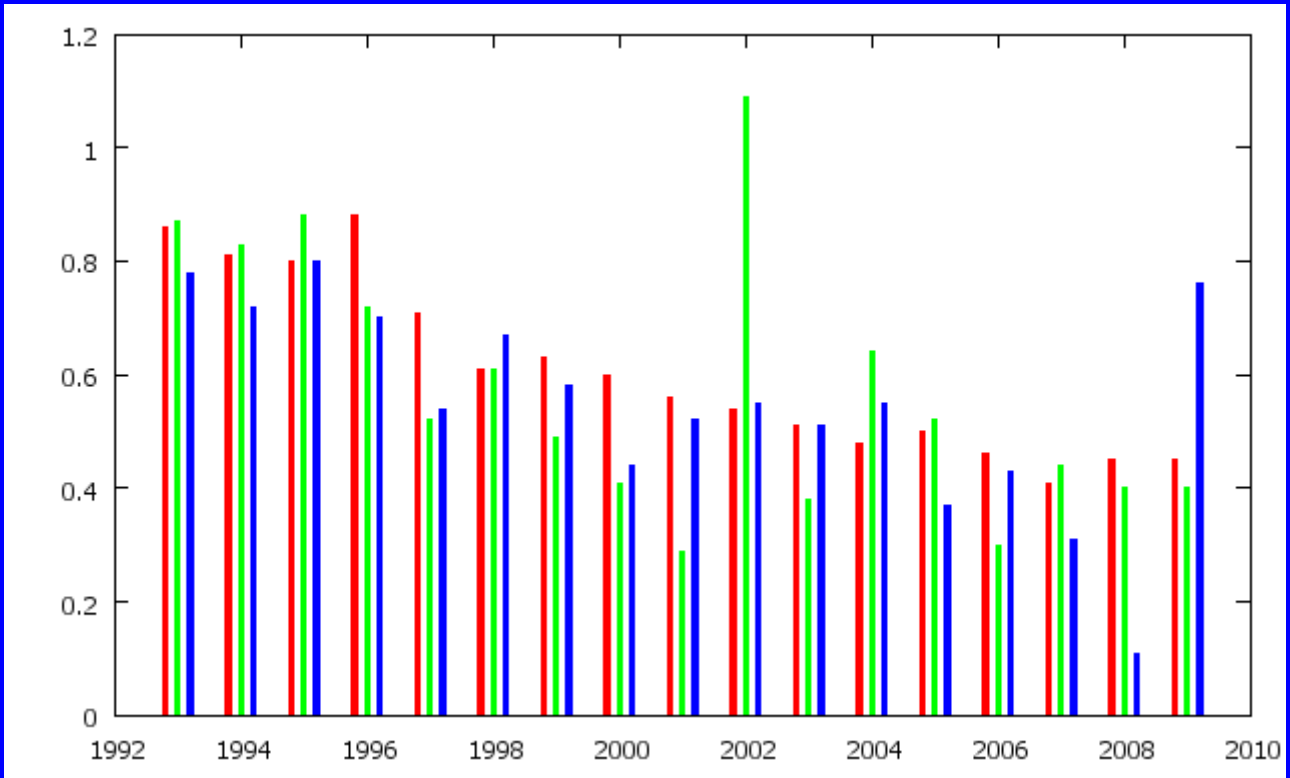
Winnenden:
4 % of victims of murder in Germany per year
7 times the expectation value of murder in Rems-Murr-Kreis p.a.
100 times ..... in Winnenden p.a.

the murder rate in Germany during the school schooting
was 6000 times so high as usual
(.... in Winnenden … 18 000 000 times so high as usual) ...

Duisburg:
The number of victims is comparable with the number of
young people, which are killed by negligence in Germany p.a.



Victims of murder in the age of 14 to <18 in Germany and Baden-Württemberg



Frequency ratio of victims of murder (per 100 000 inhabitants) in Germany, Thuringia and Baden-Württemberg

5. Summary

Statistics (in public) is very prone to misuse !

Mittwoch, 6. Oktober 2010 (Sächsische Zeitung)

Amokläufer Tim K. schoss nicht gezielt auf Mädchen

Stuttgart. Der Amokläufer von Winnenden hat einem Gutachten zufolge nicht gezielt auf Mädchen geschossen. Der Rechtsmediziner Heinz-Dieter Wehner sagte gestern vor dem Landgericht Stuttgart, Tim K. habe „nicht selektiv geschossen“. Beim Amoklauf am 11. März 2009 in der Albertville Realschule habe der 17-Jährige mehreren seiner Opfer gezielt in den Oberkörper geschossen, dabei aber nicht zwischen Mädchen und Jungen unterschieden. Allerdings waren elf seiner 15 Opfer weiblich.
Viele von ihnen seien sofort tot gewesen, sie zeigten aber Schusswunden an unterschiedlichen Körperstellen auf, sagte der Rechtsmediziner. Einen Zusammenhang mit dem Geschlecht der Opfer könne er nicht erkennen. (dapd)

School-shooter Tim K. did not shot directed to girls

… However, eleven of his 15 victims were female.

This statement is true, but violates the statistical factual criterium

True *and statistically correct*:

… However, 8 of the 9 killed (and all 9 injured) students were female.

Numbers pretends exactness

Violation of (at least one) identification criterium:
Not all true statements are statistically significant

Every point of a data set has a confidence region

...

Protect statistics against unauthorized access!