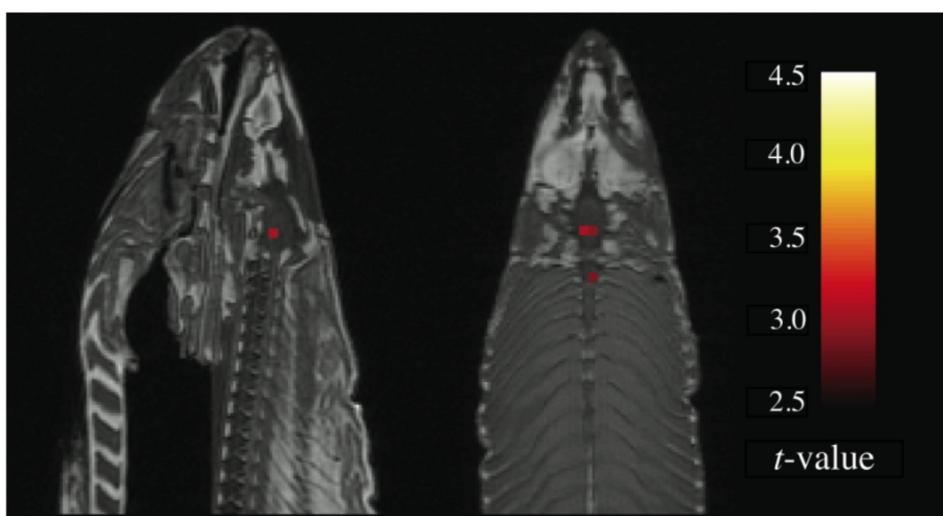


Пародоксы:

- Симпсоны
- Усториес Сарни Кларк
- Мозг мертвого носока

## Мертвый носок (Ингленд 2012)

### GLM RESULTS



A  $t$ -contrast was used to test for regions with significant BOLD signal change during the photo condition compared to rest. The parameters for this comparison were  $t(131) > 3.15$ ,  $p(\text{uncorrected}) < 0.001$ , 3 voxel extent threshold.

Усториес Сарни Кларк

### EXAMPLE: PITFALL OF THE DAY: INTERPRETATION FALACIES AND SALLY CLARK

In the late 1990s, Sally Clark was convicted of murder after both her sons died suddenly within a few weeks of birth. The prosecutors made two main claims:

- The probability of two children independently dying suddenly from natural causes like Sudden Infant Death Syndrome (SIDS) is 1 in 73 million. Such an event would occur by chance only once every 100 years, which was evidence that the death was not natural.
- If the death was not due to two independent cases of SIDS (as asserted above), the only other possibility was that they were murdered.

possibility was that they were murdered.

The assumption of independence in the first item was later shown to be incorrect: the two children were not only genetically similar but also were raised in similar environments, causing dependence between the two events. This wrongful assumption of independence is a common error in statistical analysis. The probability then goes up dramatically<sup>a</sup>.

Also, showing the unlikeliness of two chance deaths does *not* imply any particular alternative! Even if it were true, it doesn't make sense to consider the "1 in 73 million claim" by itself: it has to be compared to the probability of two murders (which was later estimated to be even lower). This second error is known as the *prosecutor's fallacy*. In fact, tests later showed bacterial infection in one of the children!

<sup>a</sup>See Royal Statistical Society concerned by issues raised in Sally Clark Case, October 2001.

## Парадокс Симпсона

Абстрагированные данные по  
поступившим в бирже

	Поступивш	Не поступивш	E(пост)	E(не пост)
М	3738	4704	3460.7	4981.3
Ж	1494	2827	1771.3	2549.7

Нужно ли разбираться  
с дискриминацией  
при поступлении?

	Мужчины		Женщины	
	Количество кандидатов	Доля поступивших	Количество кандидатов	Доля поступивших
Кафедра 1	825	62%	108	82%
Кафедра 2	560	63%	25	68%
Кафедра 3	325	37%	593	34%
Кафедра 4	417	33%	375	35%
Кафедра 5	191	28%	393	24%

Вашное защелчание про causality  
Event "Cause" increases the  
probability of "Effect" given  
a population P

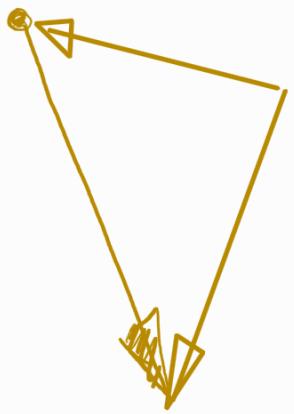
$$P(E|C) > P(E|\neg C)$$

$$P(E|C, F) < P(E|\neg C, F)$$

$$P(E|C, \neg F) < P(E|\neg C, \neg F)$$

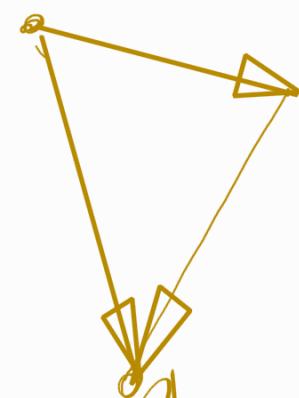
Нужно различать  
seeing from doing

Нечто



Non

Нечто



Non

- Granger Causality

$$f(x_1, \dots) = x_0$$



Max. laufzeit

- SEM (Structural Equation Models)

Flussraten - alegibarende bzg.

bioinformatics

- DCM (?) (dynamic causality modeling)  $\rightarrow$  fluid modeling  $[x, y, z]$

- PySindy (2018-zaus)  $\Rightarrow$  ODE

$$\frac{dx}{dt} = \dots$$

$$\frac{dy}{dt} = \dots$$

- $\frac{d^2}{dt^2} = \dots$
- Eureqa (2009)  robotics
- ~~Generative approach~~
- 
- Graph Neur. Network

