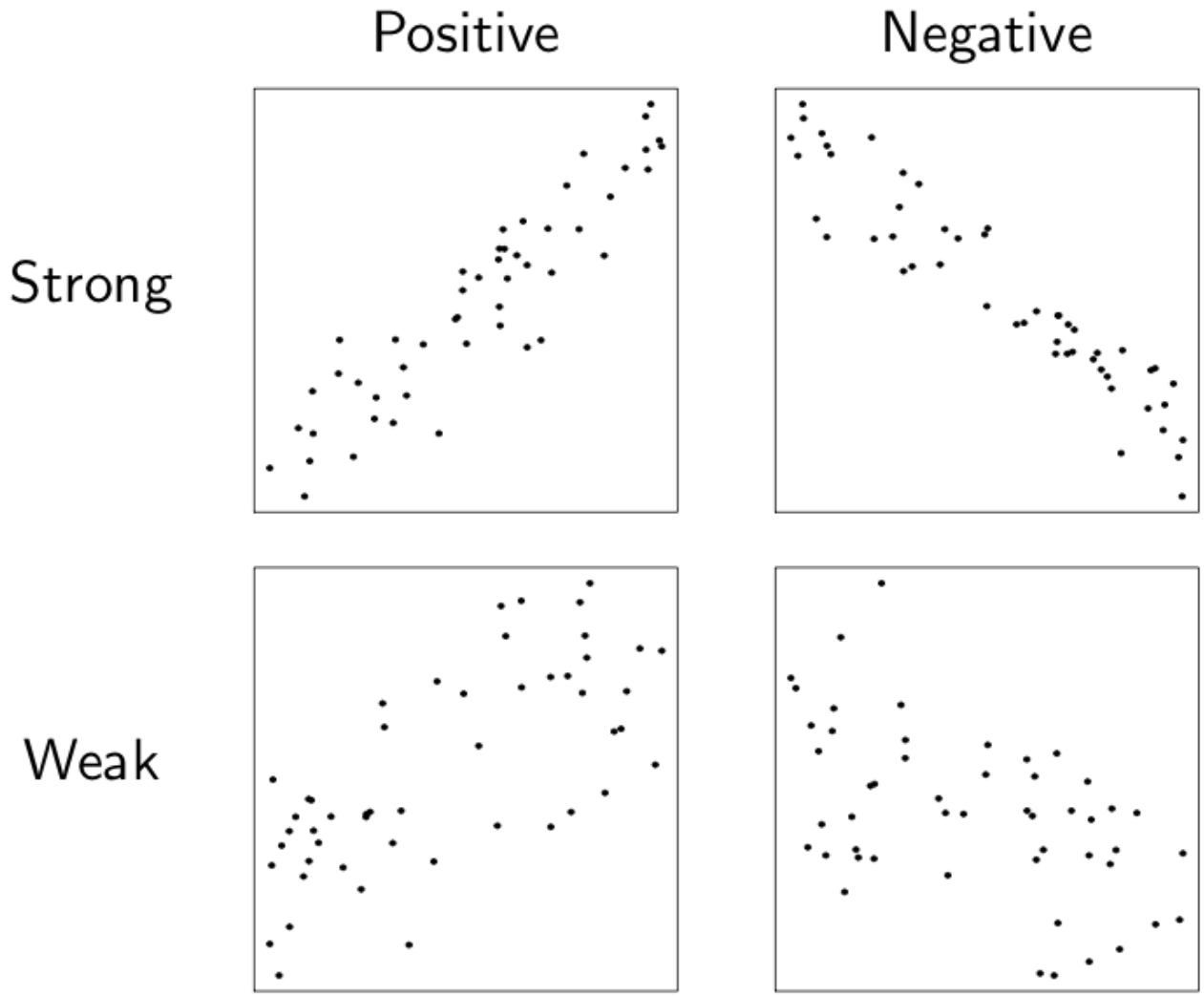
Lecture 2: Tables and Association

Kushal K Dey

04.05.2016

Association between quantitative variables



Categorical variables/ Qualitative variables

- We move away from quantitative variables to qualitative variables
- Variables whose values are categories, not numbers
- Categories may be ordered (ordinal, ex- Agree/Neutral/Disagree) or non-ordered (nominal, - Male/Female).
- How to analyze such data- Visualization and Inference

Look at some Data

	Dance	Sports	TV
Male	2	10	8
Female	16	6	8

Add Marginals

	Dance	Sports	TV	Total
Male	2	10	8	20
Female	16	6	8	30
Total	18	16	16	50

Joint distribution

	Dance	Sports	TV	Total
Male	0.04	0.2	0.16	0.4
Female	0.32	0.12	0.16	0.6
Total	0.36	0.32	0.32	1

Row marginal distribution

	Dance	Sports	TV	Total
Male	0.04	0.2	0.16	0.4
Female	0.32	0.12	0.16	0.6
Total	0.36	0.32	0.32	1

Column marginal distribution

	Dance	Sports	TV	Total
Male	0.04	0.2	0.16	0.4
Female	0.32	0.12	0.16	0.6
Total	0.36	0.32	0.32	1

Row conditional distribution

	Dance	Sports	TV	Total
Male	0.1	0.5	0.4	1
Female	0.53	0.2	0.27	1

Column conditional distribution

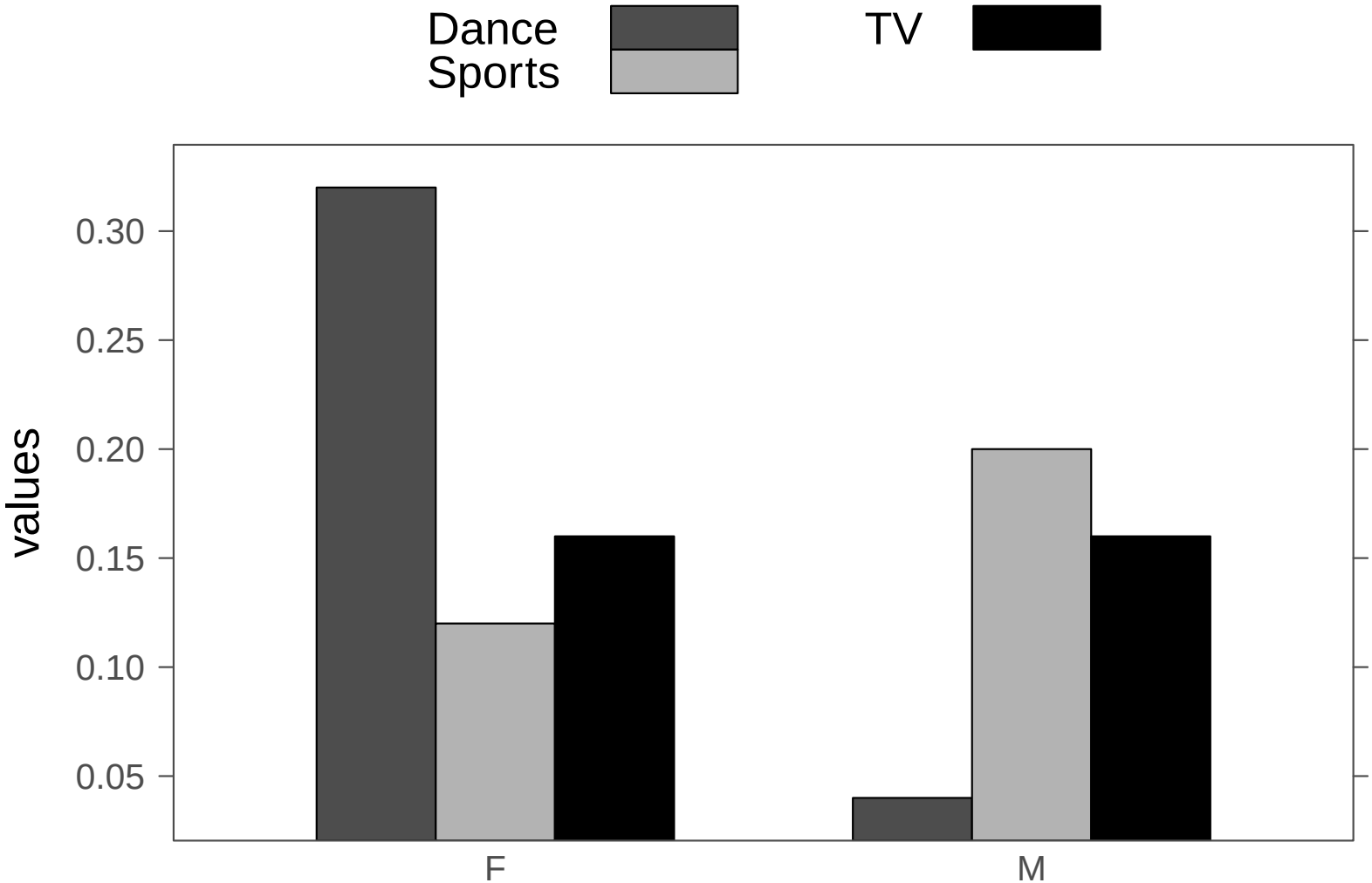
	Dance	Sports	TV
Male	0.11	0.63	0.5
Female	0.89	0.37	0.5
Total	1	1	1

Visualizing Tables I

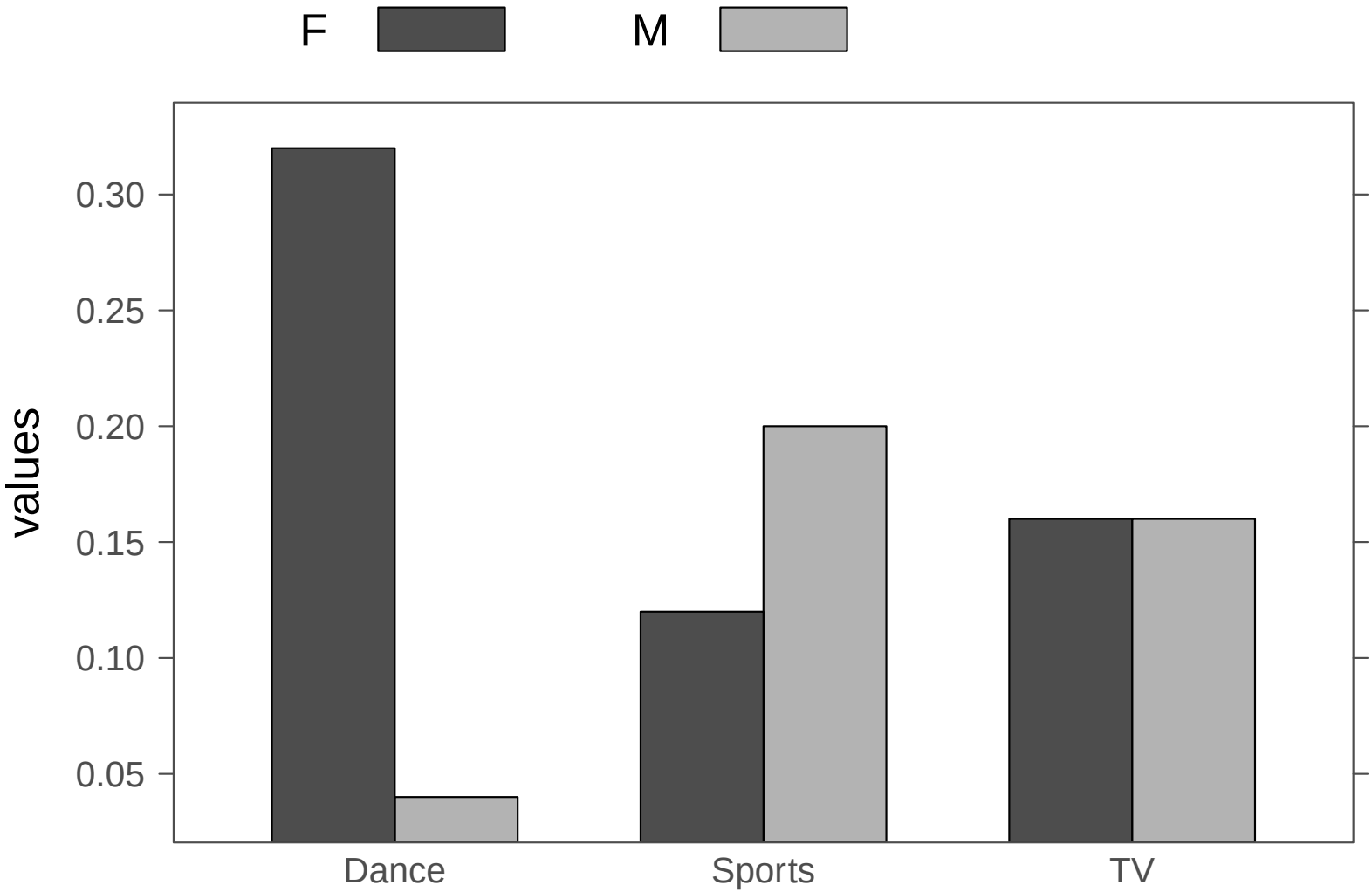
```
d <- data.frame(
      gender_id<- c("M","M","M","F","F","F"),
      entertain_id <- c("Dance", "Sports", "TV",
                        "Dance", "Sports", "TV"),
      values <- c(0.04, 0.2, 0.16, 0.32, 0.12, 0.16))

require(lattice)
barchart(values ~ gender_id, groups=entertain_id,
         data=d, auto.key = list(columns = 2))
```

Visualizing Tables II



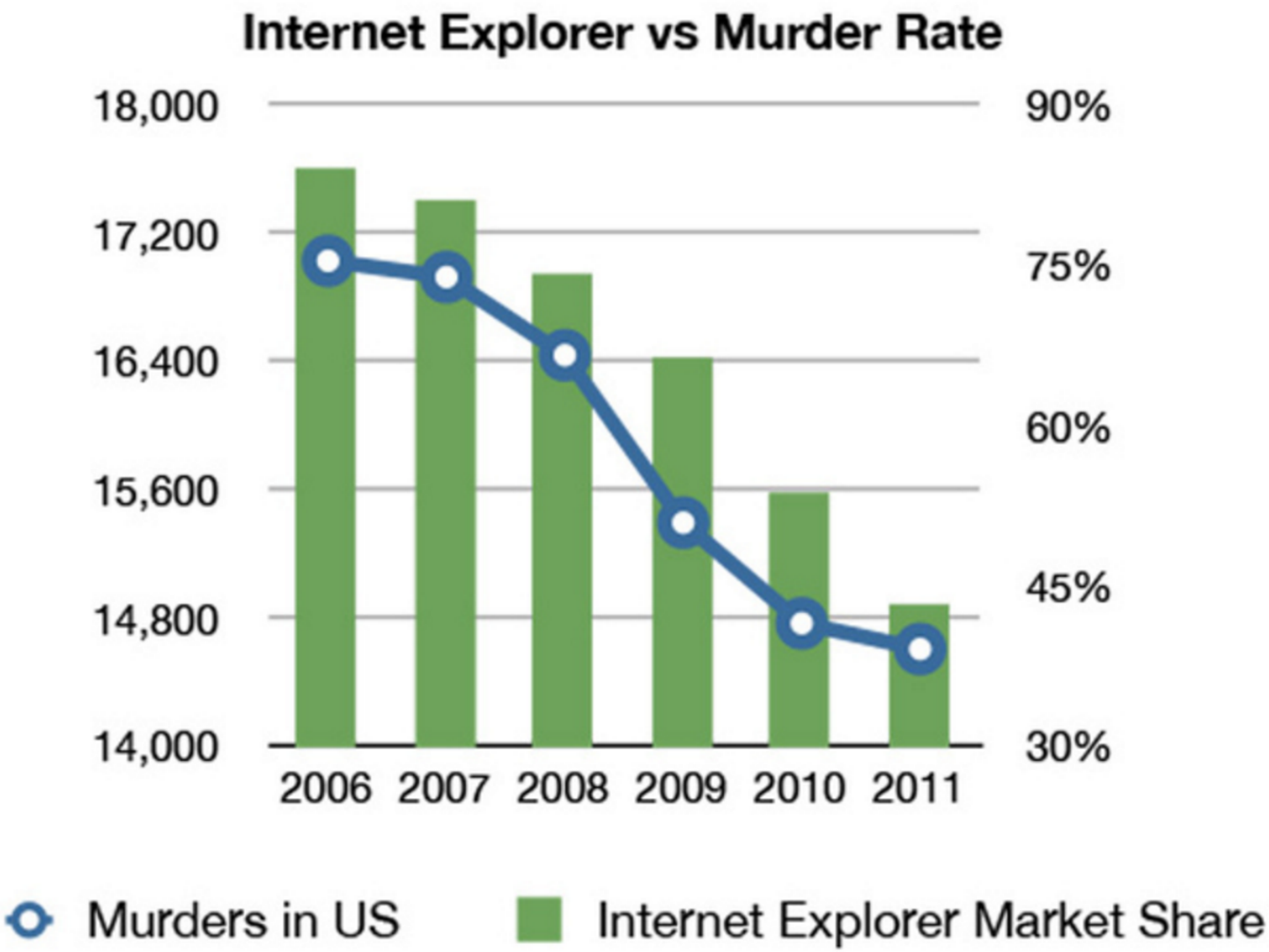
Visualizing Tables III



Confounders I

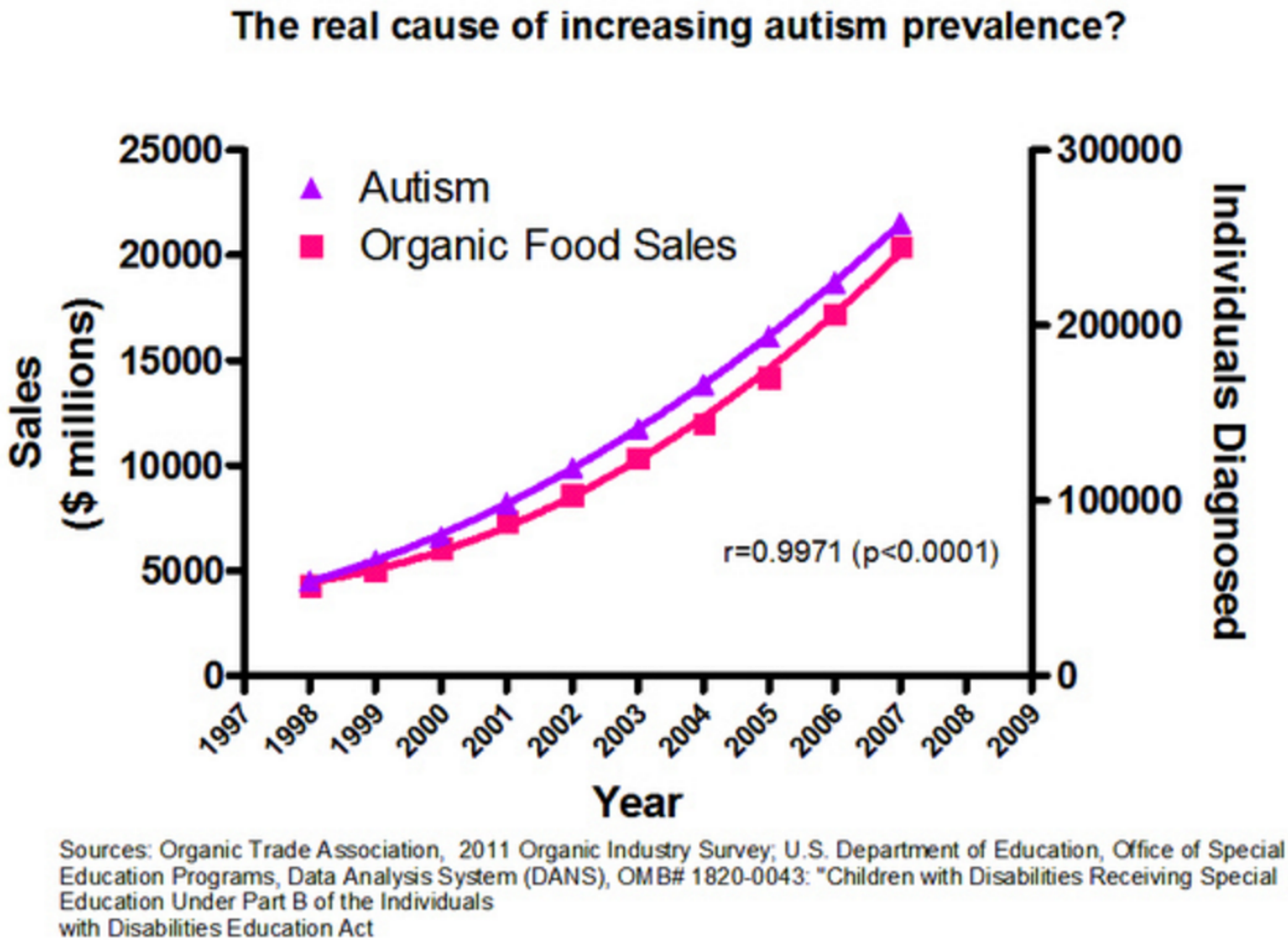
- From a table or visualization or scatter plot, one may infer two variables are associated (positively or negatively).
- That does not mean they are CAUSAL!!
- There may be confounders (hidden variables that may cause the association between observed variables).

When Statistics go Wrong!-I



When Statistics go Wrong! -II

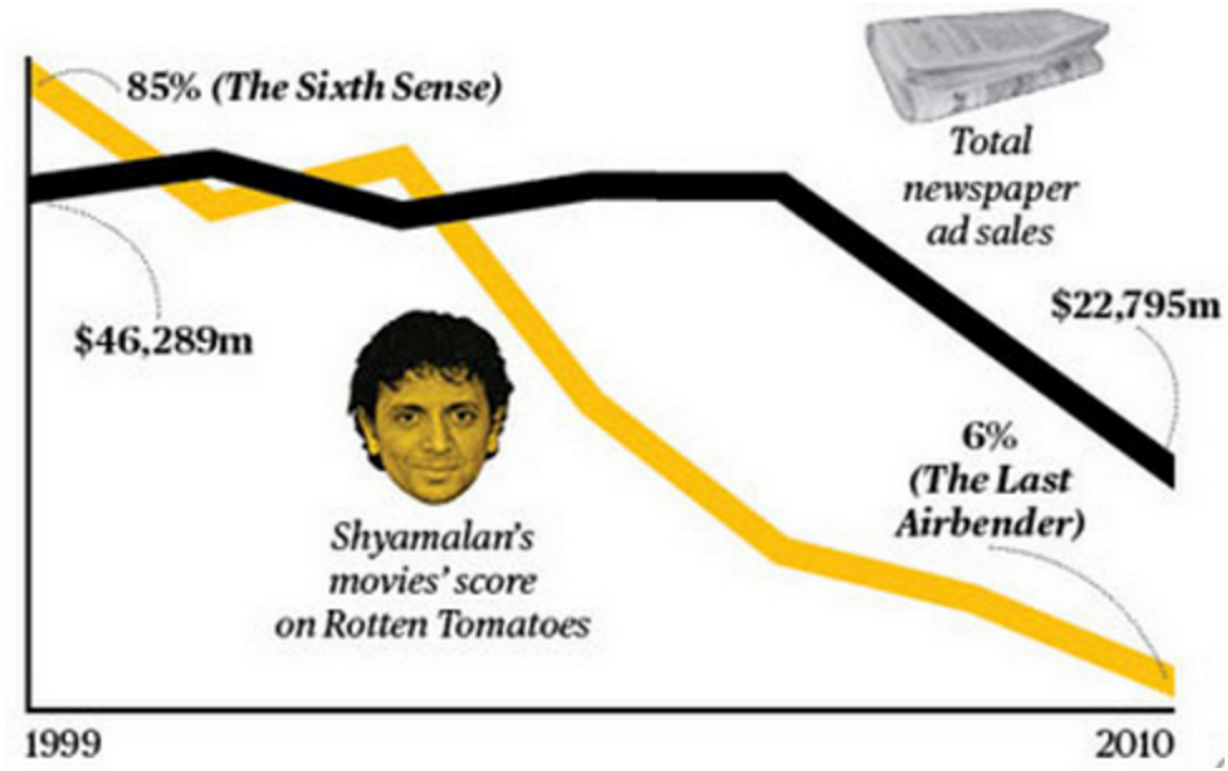
4. Eating organic food causes autism.



Sources: Organic Trade Association, 2011 Organic Industry Survey; U.S. Department of Education, Office of Special Education Programs, Data Analysis System (DANS), OMB# 1820-0043: "Children with Disabilities Receiving Special Education Under Part B of the Individuals with Disabilities Education Act

When Statistics go Wrong!- III

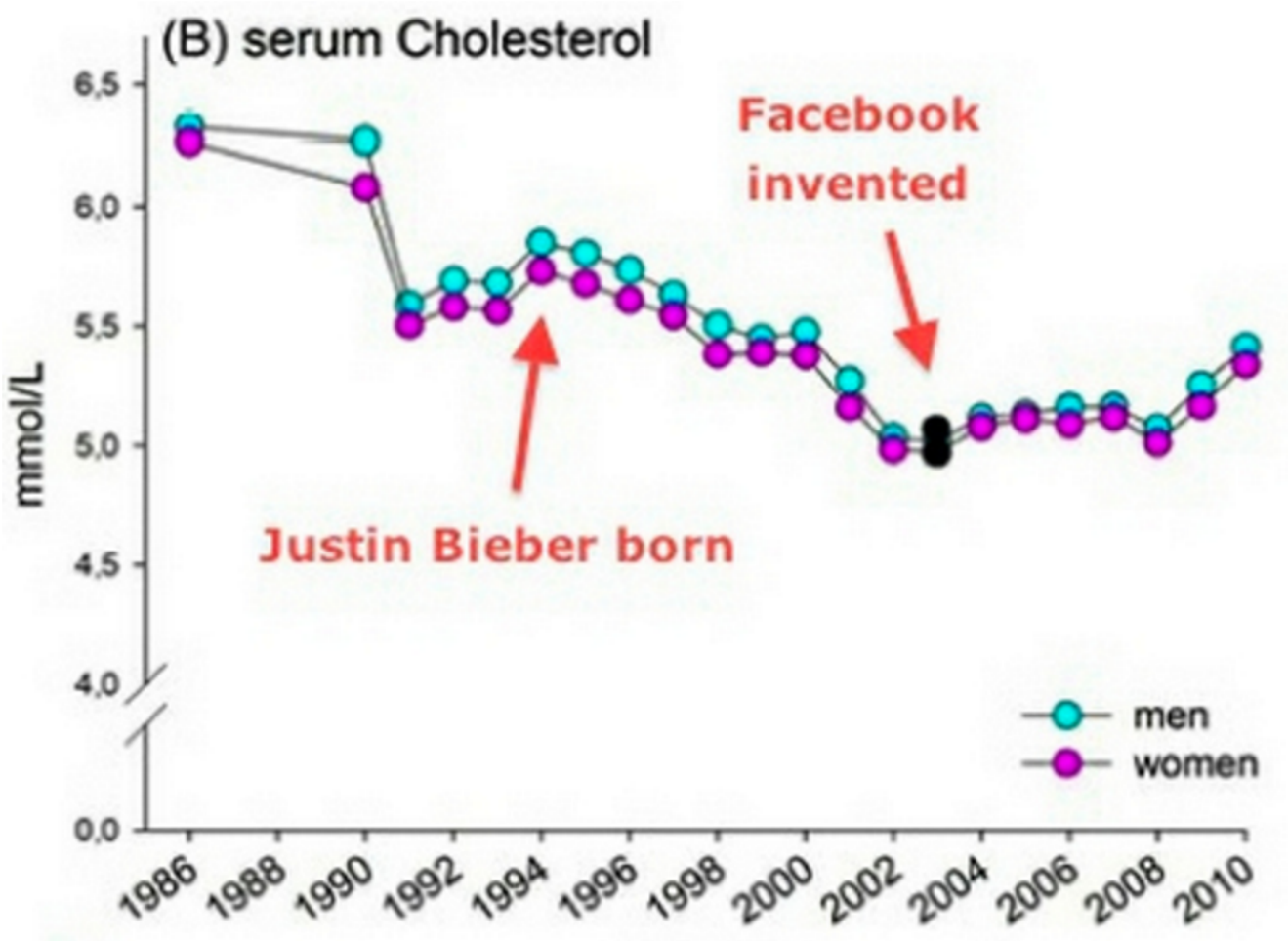
5. M. Night Shyamalan makes bad movies because people don't buy newspapers.



businessweek.com

When Statistics go Wrong!- IV

10. Facebook also cancelled out the cholesterol-lowering effects of Justin Bieber.



When Statistics go Wrong!- IV

HEALTH

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Competition and conflicts of interest distort too many medical findings

By John P. A. Ioannidis on June 1, 2011 29

PLoS Med. 2005 Aug; 2(8): e124.
Published online 2005 Aug 30. doi: 10.1371/journal.pmed.0020124
PMCID: PMC1182327

Why Most Published Research Findings Are False

John P. A. Ioannidis

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