

# Probability case study: Simpson's Paradox

(sociology) In recent years, the influence of race on the imposition of the death penalty for murder has been much studied and contested in U.S. courts. The first table at right gives data from a 1981 paper in the *American Sociological Review* on 326 cases in which the defendant was convicted of murder (for example, in 19 of the 326 cases the defendant was white and the death penalty was imposed).

Defendant	Death penalty		Total
	Yes	No	
White	19	141	160
Black	17	149	166
Total	36	290	326

(a) Use the first table to compute the following probabilities for a defendant randomly chosen from among these 326 people:  $P(\text{death penalty})$ ,  $P(\text{death penalty given white})$ , and  $P(\text{death penalty given black})$ . This shows that overall the rate of imposition of the death penalty was higher for white defendants than for black ones.

Defendant	White victim Death penalty		Total
	Yes	No	
White	19	132	151
Black	11	52	63
Total	30	184	214

(b) But now compute the same three probabilities using the data in the middle table in which the victim was white, and repeat on the bottom table in which the victim was black. If you have worked the probabilities out correctly, when you are done you will have shown something quite strange: separately for cases in which the victim was white and in which the victim was black, the rate of imposition of the death penalty was higher for black defendants than for white ones, and yet overall the reverse is true. This is an example of something called *Simpson's Paradox*.

Defendant	Black victim Death penalty		Total
	Yes	No	
White	0	9	9
Black	6	97	103
Total	6	106	112

Explain briefly what happened in this case to make the paradoxical result occur.

R- (51)