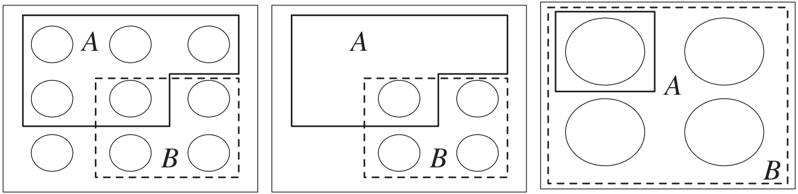

Figure 2.1 Pebble World intuition for $P(A|B)$. From left to right: (a) Events A and B are subsets of the sample space. (b) Because we know B occurred, get rid of the outcomes in B^c. (c) In the restricted sample space, renormalize so the total mass is still 1.

002x001.eps

10101010101001000010010

01010101001010000111110

11110010101010000000111

11001101101010101010110

01100001110101011110011

10100110111001001001110

⋮

Figure 2.2 Frequentist intuition for $P(A|B)$. The repetitions where B occurred are circled; among these, the repetitions where A occurred are highlighted in bold. $P(A|B)$ is the long-run relative frequency of the repetitions where A occurs, within the subset of repetitions where B occurs.

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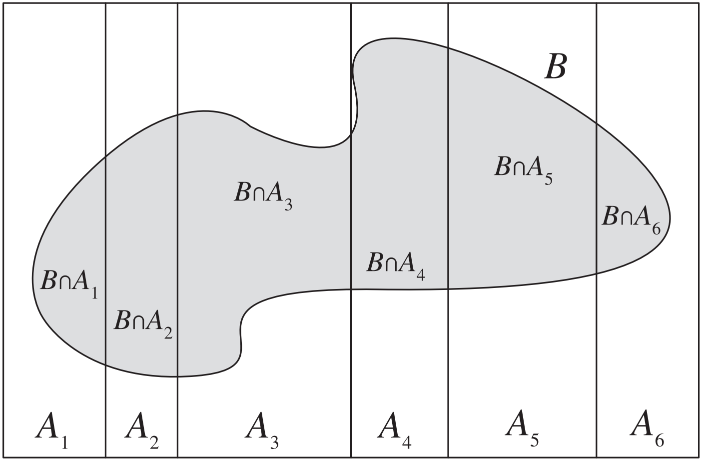

Figure 2.3 The A_i partition the sample space; $P(B)$ is equal to $\sum_i P(B \cap A_i)$.

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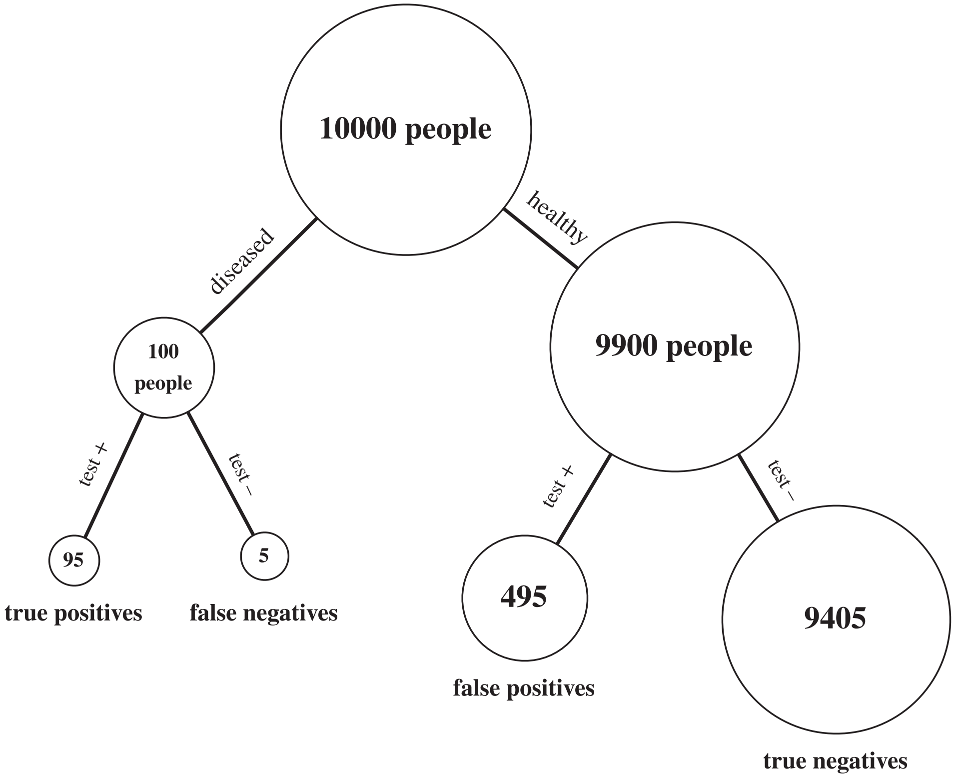

Figure 2.4 Testing for a rare disease in a population of 10000 people, where the prevalence of the disease is 1% and the true positive and true negative rates are both equal to 95%. Bubbles are not to scale.

002x004.eps

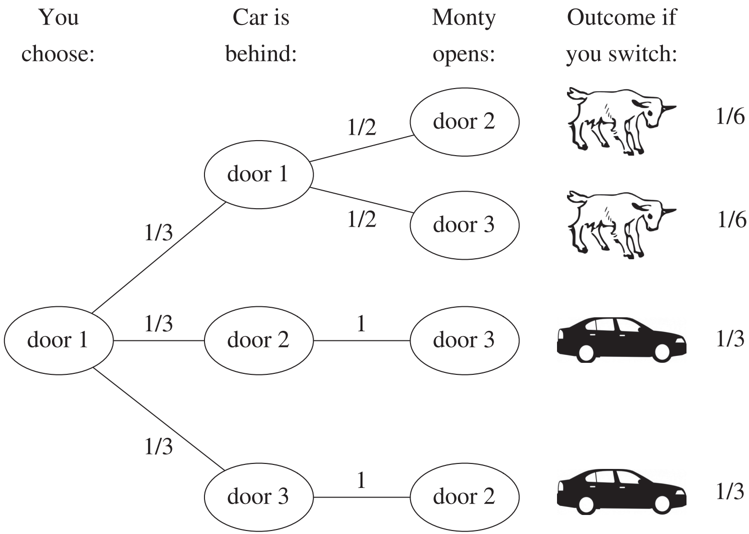

Figure 2.5 Tree diagram of Monty Hall problem. Switching gets the car 2/3 of the time.

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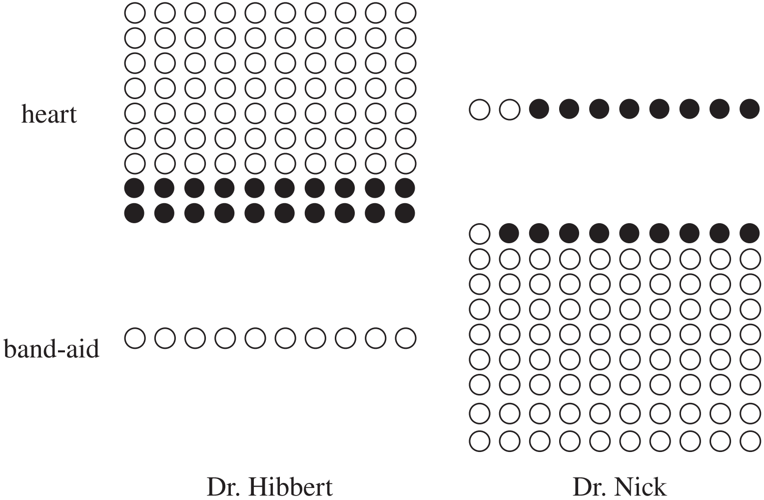

Figure 2.6 An example of Simpson's paradox. White dots represent successful surgeries and black dots represent failed surgeries. Dr. Hibbert is better in both types of surgery but has a lower overall success rate, because he is performing the harder type of surgery much more often than Dr. Nick is.

002x006.eps

Monday

events

numbers

A, B, C

We learn on Monday that B occurred.

$\xrightarrow{P}$

$P(A)$
(Monday's prior for A)

$$P(A|B) = \frac{P(A,B)}{P(B)} = \frac{P(B|A)P(A)}{P(B)}$$
(Monday's posterior for A)

Tuesday

events

numbers

A, B, C

We already know that B occurred.
We learn on Tuesday that C occurred.

$\xrightarrow{P}$

$P(A|B)$
(Tuesday's prior for A)

$$P(A|B,C) = \frac{P(A,B,C)}{P(B,C)} = \frac{P(C|A,B)P(A|B)}{P(C|B)}$$
(Tuesday's posterior for A)

Figure 2.7 Conditional probability tells us how to update probabilities as new evidence comes in. Shown are the probabilities for an event A initially, after obtaining one piece of evidence B, and after obtaining a second piece of evidence C. The posterior for A after observing the first piece of evidence becomes the new prior before observing the second piece of evidence. After both B and C are observed, a new posterior for A can be found in various ways. This then becomes the new prior if more evidence will be collected.