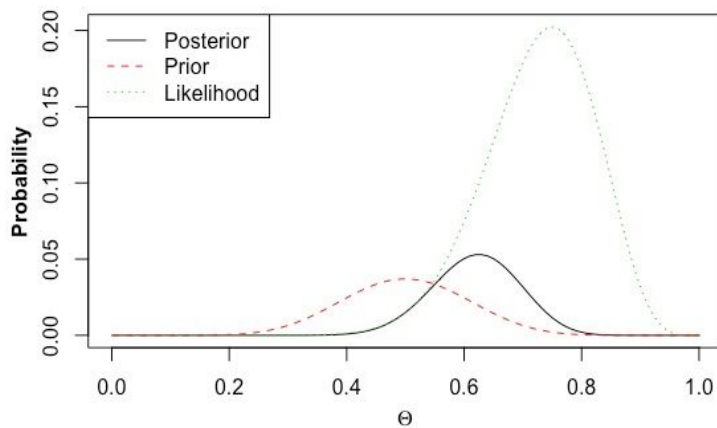


1). Coin Flips

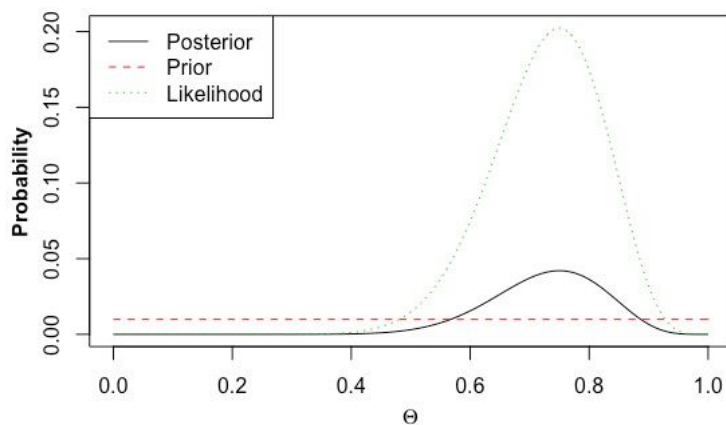
Equal number of coin flips for prior and likelihood:



The mode is about 0.5 for the prior, 0.625 for the posterior, and 0.75 for the likelihood. While changing the absolute number of coin flips changes the shape of the distributions, the modes remain the same.

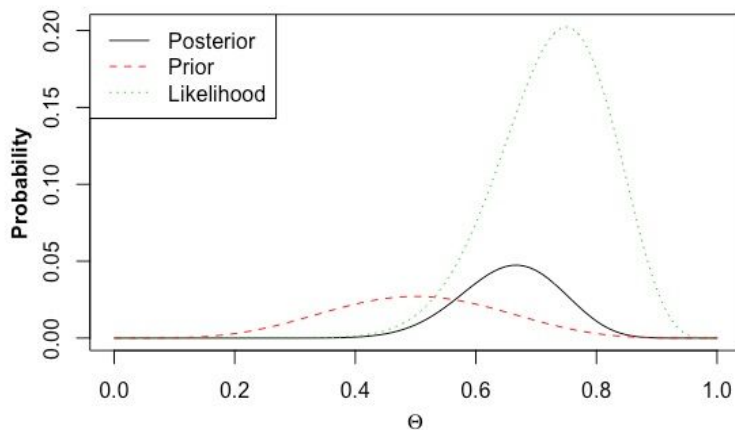
Change number of coin flips used as prior:

- No coin flips



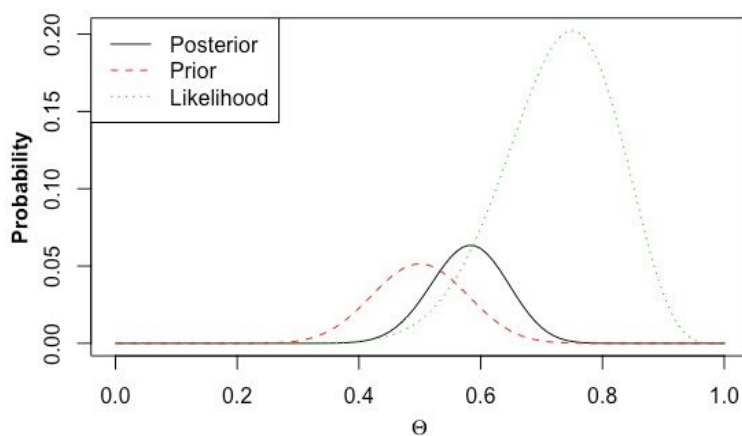
When no coin flips are used as the prior, the prior is completely flat. The mode of the likelihood remains the same, about 0.75, and the posterior distribution more closely resembles the likelihood and has a similar mode.

- Half the data



When using half the number of coin flips for the prior, the prior is flatter and distributed over a wider interval. The likelihood and posterior look similar to how they look with an equal number of coin flips, but the posterior is shifted slightly towards the likelihood.

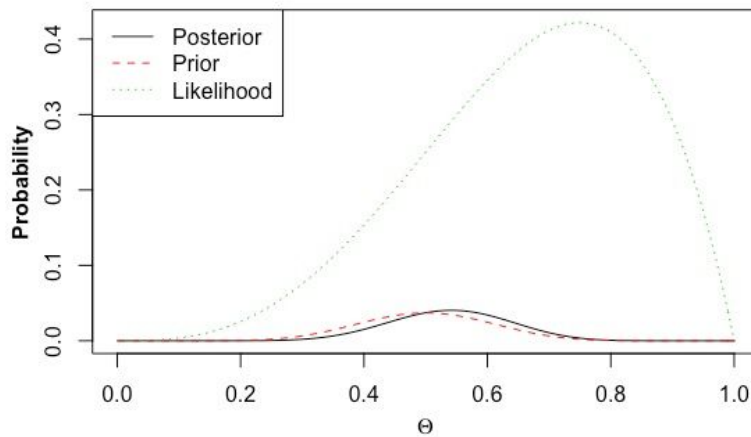
- Twice the data



When using twice the number of coin flips for the prior, the prior distribution is compressed and it becomes more important, so the posterior distribution is shifted closer to the prior. The likelihood looks similar to how it does under equal conditions.

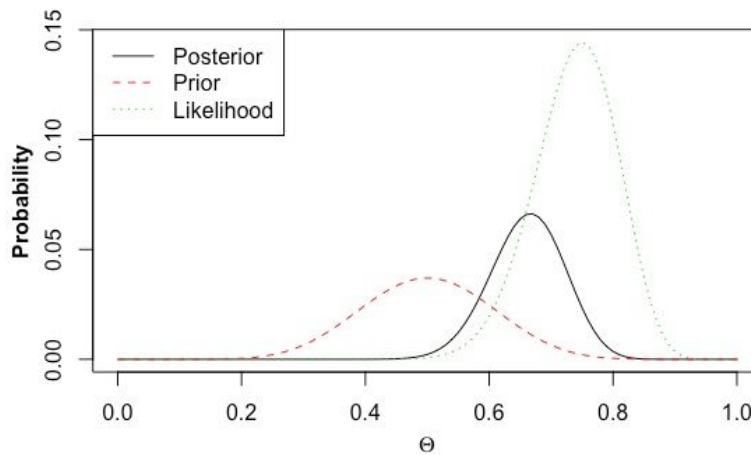
Change number of coin flips used as data:

- Only four coin flips



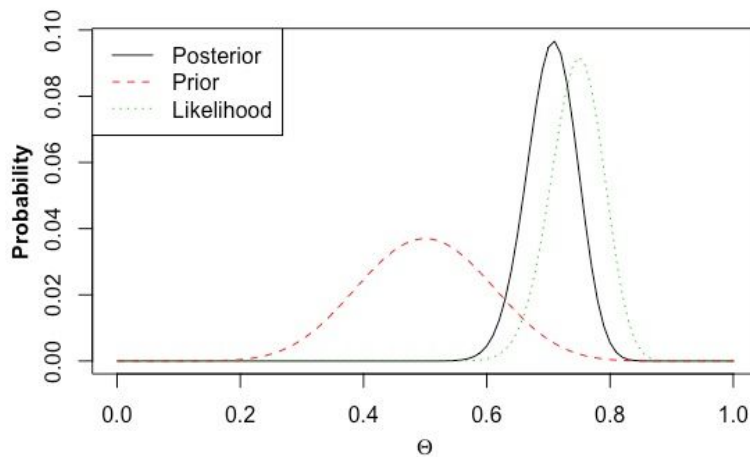
With only 4 coin flips used as data, the likelihood distribution becomes much wider and spread out, which means it is less important in explaining the posterior distribution. The prior distribution is also spread out, and the posterior closely tracks the prior distribution.

- Twice the number of prior flips



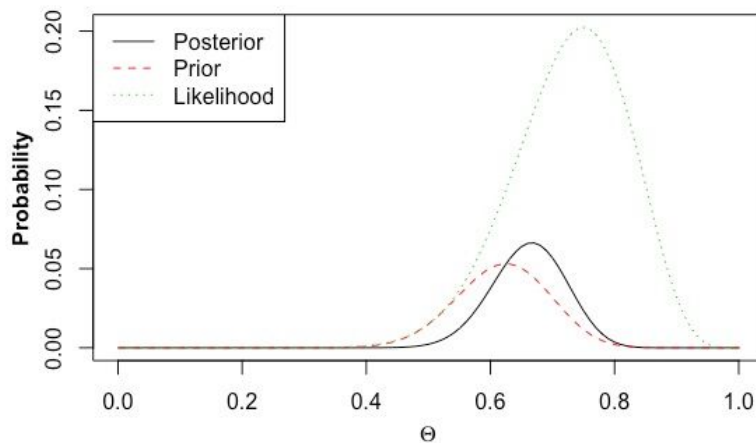
With twice the number of prior flips, the likelihood distribution becomes compressed and it is more important in explaining the posterior distribution, so the posterior is shifted towards the likelihood. The prior looks largely the same as it does under equal conditions.

- Five times the number of prior flips



When five times the number of prior flips are used, the likelihood distribution is very narrow and compressed and this largely controls the posterior distribution, which is also compressed. The prior looks similar to how it looks under equal conditions and has a similar mode, but it is slightly more compressed.

Divide coin flips into two parts:



After dividing the coin flips into two parts and comparing the resulting distributions to the distributions from 40 coin flips, it is clear that the posterior distributions are the same. Dividing the coin flips into two parts shifts the prior distribution towards the likelihood, as the mode is about 0.6 instead of 0.5. The likelihood distribution is also more spread out, which means it is less important in explaining the posterior distribution.

2). Monte Carlo Sampling

<u>State</u>	<u>Population Prop.</u>	<u>Visits Prop.</u>
California	0.121519489	0.119904468
Texas	0.087692647	0.092939231
Florida	0.065109487	0.069260446
New York	0.06068061	0.05880912
Pennsylvania	0.039177697	0.039539488
Illinois	0.039007626	0.036620466
Ohio	0.035727573	0.034354651
Georgia	0.032215734	0.031782645
North Carolina	0.031742238	0.032680806
Michigan	0.030523366	0.029251465
New Jersey	0.027595713	0.026373267
Virginia	0.026046164	0.026312029
Washington	0.023006077	0.022413195
Arizona	0.021763736	0.023107228
Massachusetts	0.021067247	0.019351283
Tennessee	0.02072095	0.021862051
Indiana	0.020467581	0.019861602
Missouri	0.018745334	0.019249219
Maryland	0.018573379	0.018432709
Wisconsin	0.017774326	0.01784074
Colorado	0.017365422	0.017065055
Minnesota	0.017194215	0.016473086

South Carolina	0.015546801	0.015513687
Alabama	0.014935896	0.014595113
Louisiana	0.014305215	0.01367654
Kentucky	0.013662913	0.013288697
Oregon	0.012829799	0.012513013
Oklahoma	0.012038418	0.01353365
Connecticut	0.010963541	0.011247423
Iowa	0.009655591	0.01018596
Utah	0.0096519	0.010206373
Nevada	0.009338695	0.009491927
Arkansas	0.009227196	0.008899957
Mississippi	0.009112504	0.009165323
Kansas	0.008916157	0.007920145
New Mexico	0.00638718	0.006144236
Nebraska	0.005903999	0.006287126
West Virginia	0.005508458	0.004939884
Idaho	0.005358098	0.005368552
Hawaii	0.004357676	0.004409153
New Hampshire	0.00412605	0.003653881
Maine	0.004098576	0.003960073
Montana	0.003245452	0.003470167
Rhode Island	0.003243564	0.00349058
Delaware	0.002966986	0.002939435
South Dakota	0.002681677	0.002755721

North Dakota	0.002307276	0.002592419
Alaska	0.002254821	0.002204577
Vermont	0.001906218	0.002388291
Wyoming	0.001752733	0.001673845

Repeating my Monte Carlo Sampling function 50,000 times, I got a proportion of visits for each state that very closely resembles the proportion of the population in each state. As expected, these two proportions converged after many rounds of sampling.