

## Decision Making in Excel Using a Bayesian Approach

Whether it is a highly emotional personal decision (which phone or car should I buy) or a hugely important corporate decision (which product line should I sell off), there are basic pieces of information that need to be considered before you arrive at a conclusion. And, despite all the factors that you may be considering, bear in mind that there may be a surprise choice that you haven't thought about at all.

How can we use Excel to help us make a better decision? Can the Bayes Theorem provide any clarity?

Inspired by a highly robust decision software platform designed by Professor Emeritus Willard Zangwill, University of Chicago Booth School of Business, a colleague of mine, Shep Pryor, employed the Bayes Theorem to program the essence of an analytical decision process, while leaving the parameterization of the weights and relative importance of the inputs to the user. Seemingly simple decisions, such as the choice of a phone, can shed light on how more complex decisions can be made with greater confidence by decision makers, consensus among the decision team, and commitment to common action. Here are the basic inputs:

Which Phone	What Are The Factors	How Important Are the Factors H=3, M=2, L=1	How Does Each Phone Perform Relative to the Factors 5=++, 4=+, 3=N, 2=-, 1=--			
			Motorola	L G	Samsung	iPhone
Motorola	Ease of Use	3	3	4	4	5
LG	Camera Quality	2	4	5	2	4
Samsung	Cost of Apps	1	3	5	3	4
iPhone	Hook Up with Corporate	3	4	3	5	3

Now it is a question of relating the weighted importance of the factors to the rated performance of each of the phones relative to those factors.

The Bayes Theorem provides guidance. It states that for any hypothesis there is a related probability. As you get new information relative to that hypothesis, the probability changes.

At the outset, the probability of choice between any of the phones, including a surprise choice, is equal. Thus,

	Prior Probability
Motorola	20%
LG	20%
Samsung	20%
iPhone	20%
Surprise	20%
	100%

**Prior probabilities are states of the world. They are what they are and, as such, are uncontrollable.**

**So, what moves the needle? You, as the decision maker, are stirring the pot by assigning two categories of weightings to the factors. First, you have decided how important the factors are to you on a scale of 1 to 3; with 1 being the least important and 3 being the most important. The key here is that you decide how important each factor is to you. The numerical weights are what you think them to be. If you think the most important weight is 10 times more important than the least important weight, you can certainly make them 10 and 1.**

**Second, you have evaluated how each of the potential phones being considered performs against each factor and then have assigned a numerical weight to that performance. Thus,**

Performance	Score	Numeric Equivalent
++	5	.9
+	4	.7
N	3	.5
-	2	.3
--	1	.1

**Here again the numeric equivalents assigned to the performance are what you think they are. If you believe that the difference between scores of 5 and 4 is greater than .2, change it.**

**For those interested in the Excel formulas necessary to produce the answer or if there is interest in the more robust software developed by Professor Zangwill, please e-mail me at Jerry Scherer ([januerry@comcast.net](mailto:januerry@comcast.net)) or contact Carlo Attademo ([caronly@libero.it](mailto:caronly@libero.it)).**

**Conditional probabilities are reactions to the states of the world. The choice that will be made will depend on meeting certain states. Posterior probabilities are likely states of the world.**

It is interesting to see how the weightings influence the results. The unidentified Surprise choice, which takes major prominence, in the example here, may change dramatically as importance weights are changed.

Here is the Oracle that will help you with your phone choice:

This is the Oracle! It will help you choose your cell phone. You just fill in the **yellow** boxes.

Which 4 phones do you want to compare?

Phone 1	Motorola
Phone 2	LG
Phone 3	Samsung
Phone 4	iPhone

What four attributes of the phones do you think are the most important? Also tell me how important each attribute is.

Importance  
H=3; M=2;  
L=1

Attribute 1	Ease of Use	3
Attribute 2	Camera Quality	2
Attribute 3	Cost of Apps	1
Attribute 4	Hook Up With Corporate	3

Now for some work. You need to think about how well each phone fulfills each attribute you are seeking. In each box, rate the phone on each attribute. The key is 5=++; 4=+; 3=Neutral; 2=-; and 1=-=.

	Motorola	LG	Samsung	iPhone
Ease of Use	3	4	4	5
Camera Quality	4	5	2	4
Cost of Apps	3	5	3	4
Hook Up With Corporate	4	3	5	3

OK, that is all you have to do. Here is a graphic comparison of how the phones fit your criteria. Those % amounts are the relative probabilities that each choice might be the right one. The surprise column is the chance that there might be another unidentified phone out there that could do better than the one you have chosen. If the surprise is big, maybe you haven't yet fallen in love with the "best" phone.



