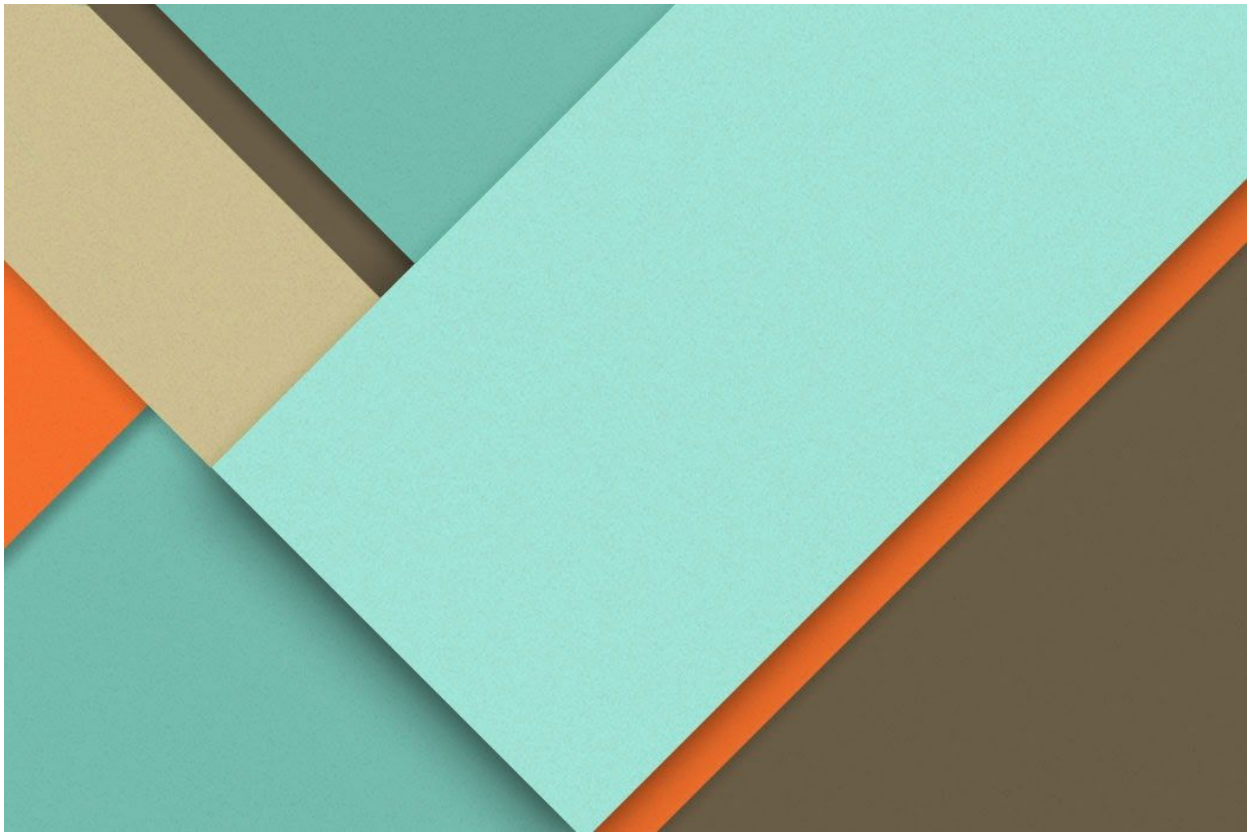

How Random Walk Influences our Decision Making Process

10.01.2020

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STATS 482
Fall 2020
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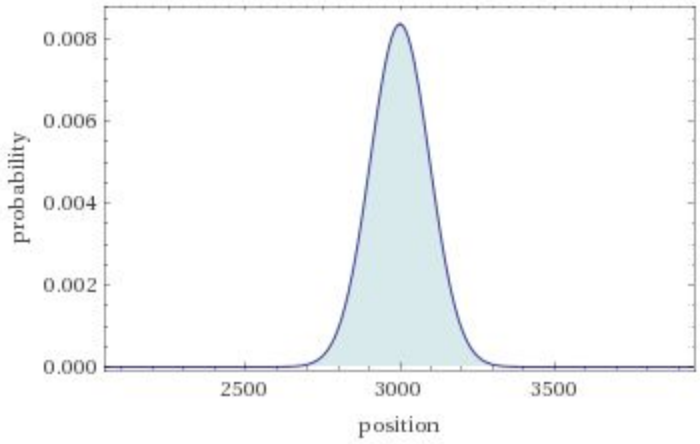
Making Decisions

Let's assume that a coin is flipped 10,000 times and for heads you take a step forward, for tails you take a step backwards. Now let's assume that the coin is unfair and lands on heads 65% of the time. We can simulate this with a Random Walk trajectory in R by setting an initial probability to 0.65 and the number of steps as 10,000. The simulation tells us that we will average at taking 3,000 steps forward. Now relating this to decision making, we can say that the number of steps represents the number of decisions made and the initial probability represents the probability of making a correct decision. From this, we can conclude that we will make about 3,000 correct decisions with our previous simulation.



Goal

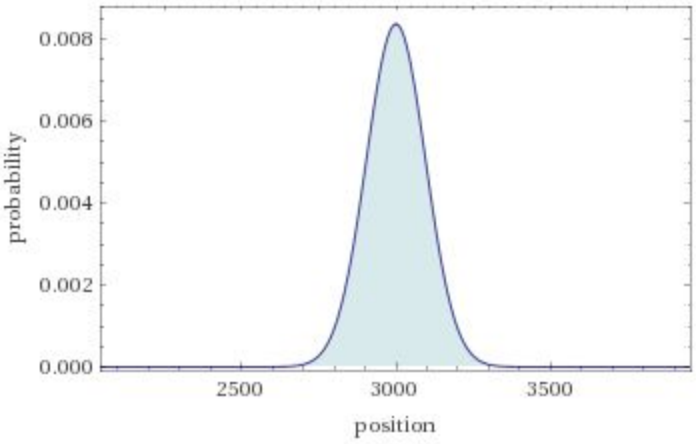
The intent of this study is to show that decision making isn't binary and it follows some type of Random Walk. The main factors that affect Decision making are Probability of Correct Decision, Speed of Making a Decision and Size of the Decision.

Probability of Correct Decision

To explain the probability of making a correct decision, we simulare two Random Walk trajectories with 10,000 steps.

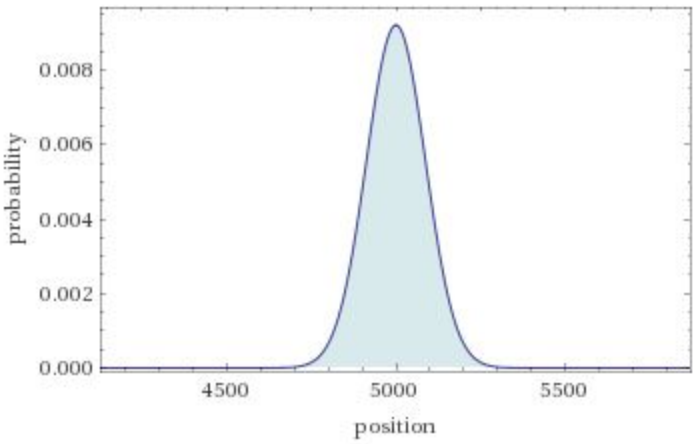
I. Probability of Making the Correct Decision = 0.65

With the probability equal to 0.65 and the number of decisions equal to 10,000, we can expect to see at least 3,000 correct decisions made.



II. Probability of Making the Correct Decision = 0.75

With the probability equal to 0.75 and the number of decisions equal to 10,000, we can expect to see at least 5,000 correct decisions made.



If you make a correct decision more frequently, the further forward we move towards success. Thus, with a 10% increase in the probability of making a successful decision, we can expect to see 2,000 more correct decisions made.

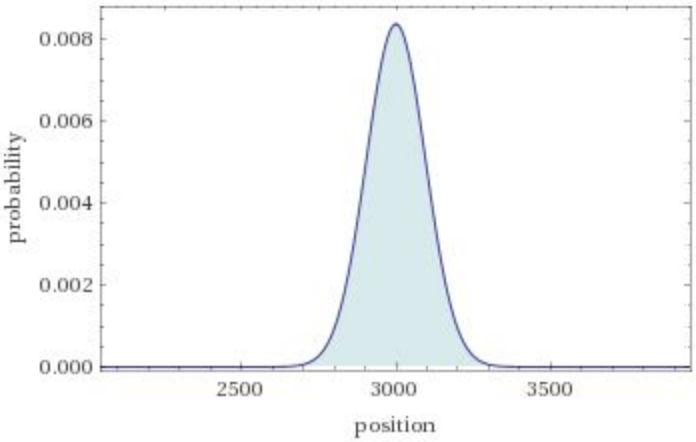
Speed of Decision

Let's assume that we make decisions 10% slower, meaning that our initial number of steps is decreased from 10,000 to 9,000. In terms of decision making, this indicates that we now only make 9,000 decisions compared to 10,000 decisions.

We can explain this by simulating two Random Walk trajectories, both with the probability of making a correct decision of 0.65.

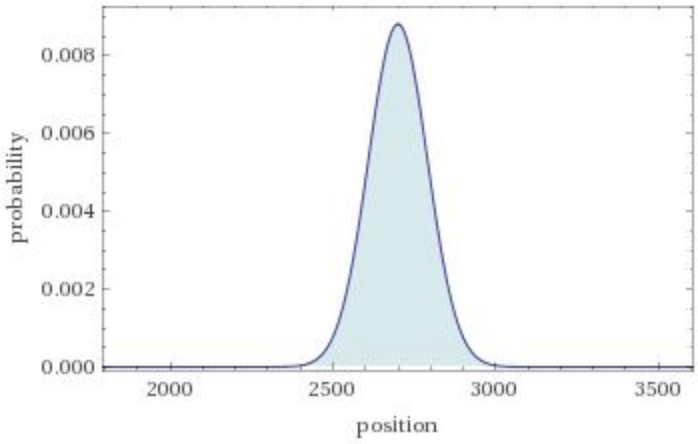
I. Making Decisions Faster

This trajectory has 10,000 steps, meaning that 10,000 decisions were made. After running the simulation, we conclude that 3,000 correct decisions were made.



II. Making Decisions Slower

This trajectory has 9,000 steps, meaning that 9,000 decisions were made. After running the simulation, we can conclude that 2,750 correct decisions were made. With less decisions being made, we can see that we are making decisions slower compared to the trajectory with 10,000 decisions.



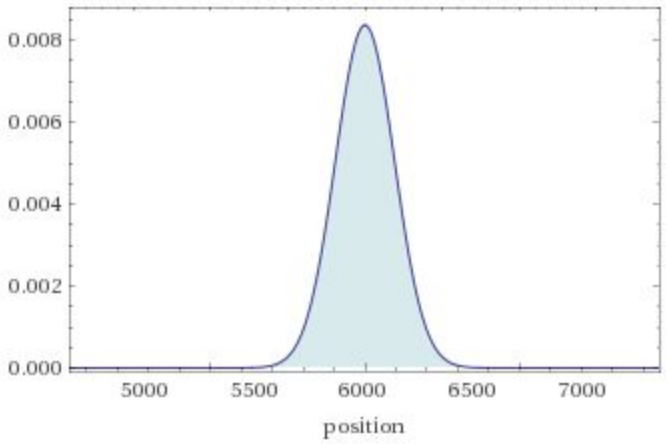
Making decisions slower results in 250 fewer decisions to be made, resulting in a 8.9% decrease in the number of correct decisions. This is not too significant of a decrease because as we are making less correct decisions, we are also making less incorrect decisions.

Size of Decision

To simulate the impact of the size of a decision, we can increase the step size in the Random Walk trajectory. Let a correct decision that is twice as important be equal to 2 steps forward in our simulation and an incorrect decision equal to 2 steps backwards.

I. Simulation

We can simulate this with a probability of making the correct decision equal to 0.65, the number of steps equal to 10,000 and the step size equal to 2. Our expected results should be doubled and our simulation yields 6,000 correct decisions made. It is important to consider that if we start with an initial probability that is less than 0.5, we can yield negative results as the simulation will be taking far more steps backwards.

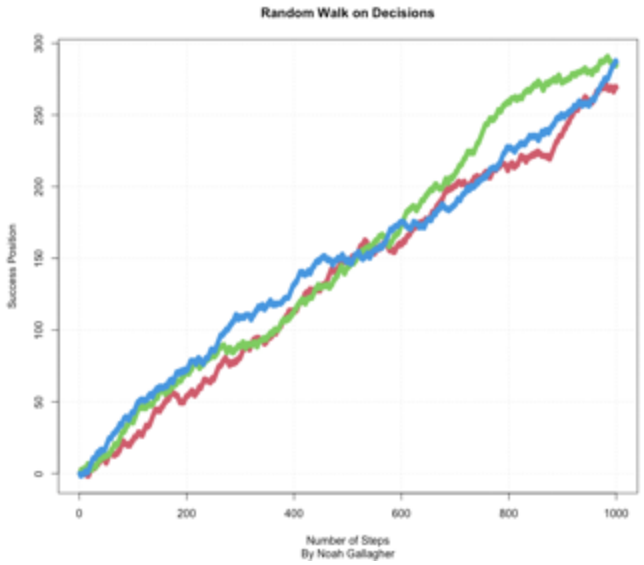


Conclusion

From the article and simulating multiple trajectories, we can conclude that making a correct decision is much more important than making decisions quickly. Taking time to think over your decision is more beneficial than making more decisions. We can also conclude that large decisions have a much larger influence on results without sacrificing precision. Lastly, we can maximize decision making performance by aiming for successful high-impact decisions while making unsuccessful low-impact decisions.

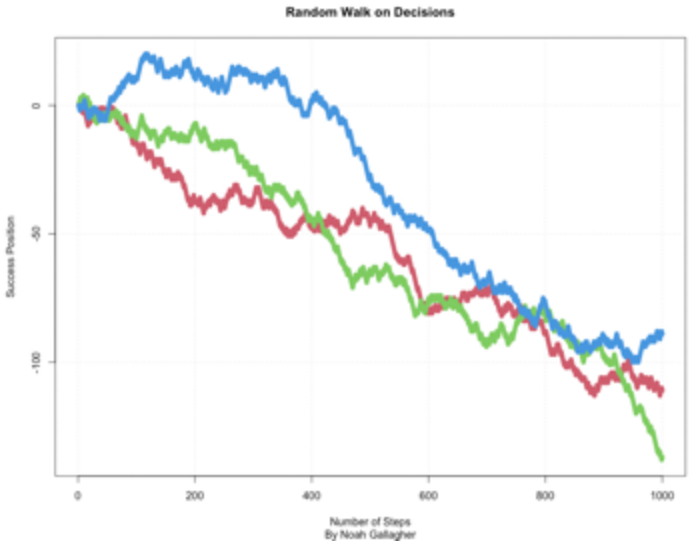
Appendix 1 : Simulating Trajectories in Favor of Correct Decision with R

```
#Specifying probability of correct decision
p<- 0.65
#Number of steps
nsteps<- 1000
#Number of trajectories
ntraj<- 3
#Turning walk into Matrix representation
rand.walk<- matrix(NA,nrow=nsteps, ncol=ntraj)
#Setting seed
set.seed(90823)
#Simulating Trajectories
for (j in 1:ntraj) {
 rand.walk[1,j]<- 0
 for (i in 2:nsteps)
        rand.walk[i,j]<- ifelse(runif(1)<p, rand.walk[i-1,j]+1,
                rand.walk[i-1,j]-1)
}
#Plotting Simulations
matplot(rand.walk, type="b", pch=16,lty=1, col=2:4, panel.first=grid(),
        ylim=c(range(rand.walk)), ylab='Success Position', xlab='Number of Steps',
        main="Random Walk on Decisions",sub="By Noah Gallagher")
```



Appendix 2 : Simulating Trajectories in Favor of Wrong Decision with R

```
#Specifying probability of correct decision
p<- 0.45
#Number of steps
nsteps<- 1000
#Number of trajectories
ntraj<- 3
#Turning walk into Matrix representation
rand.walk<- matrix(NA,nrow=nsteps, ncol=ntraj)
#Setting seed
set.seed(90823)
#Simulating Trajectories
for (j in 1:ntraj) {
 rand.walk[1,j]<- 0
 for (i in 2:nsteps)
        rand.walk[i,j]<- ifelse(runif(1)<p, rand.walk[i-1,j]+1,
                rand.walk[i-1,j]-1)
}
#Plotting Simulations
matplot(rand.walk, type="b", pch=16,lty=1, col=2:4, panel.first=grid(),
        ylim=c(range(rand.walk)), ylab='Success Position', xlab='Number of Steps',
        main="Random Walk on Decisions",sub="By Noah Gallagher")
```



Reference

Leybovich, B. (2019, January 25). Decision Making as a Random Walk. Retrieved December 01, 2020, from https://towardsdatascience.com/decision-making-as-a-random-walk-6ed37e154633