

# Why its good that *Soulstealer Vayne* is so damn hard to get - a statistical Analysis

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**Abstract**—I analyzed the Hextech-Crafting in a Stochastic Simulation with 10 Million Players and found that you're going to make more Riot Points than you spend (in value) and thats without counting Champs. I've made some assumptions, which can be found down in the paper itself for those interested. For everyone else: If you're trying to maximize your RP-Net-Worth stack up on Hextech Chests.

## I. ASSUMPTIONS

For the Simulation I've used measured probabilities of opening Hextech Chests (about 500) and then estimated a upper bound for them s.t. this paper will discuss the worst case.

### Assumptions:

- There are about 800 Skins in the game (there actually are more), each of them has the same probability of being generated by a Hextech Chest
- You are only interested in the Soulstealer Vayne (or future Skins of the same kind) and are going to re-roll every shards that is not it into permanent skins
- The Hextech Chest openings are independent of each other meaning the result of Chest  $X_i$  does not influence the outcome of Chest  $X_{i+1}$
- You only buy Riot Points the most efficient way (50 Euros) and spend them on chests in the most efficient way.
- The probability of getting a Gemstone is 4 percent

## II. STOCHASTIC BASICS

The process we are discussing here is a multi-level process. I will try to describe it as good as possible in words for those interested.

The process is the following: You're opening chests until you have obtained the SS Vayne Skin, this can happen in one of three ways.

- You obtain 10 Gemstones (I)
- You roll the Soulstealer Vayne Skin shard (II)
- You get the Soulstealer Vayne Skin by fusing 3 Skin shards into a permanent Skin (III)

(I) The first process is clearly BERNOULLI distributed s.t.  $X_{Gem} \sim Ber(p)$  with  $p$  being probability of getting a Gemstone  $\Rightarrow p = 0.04$ . So the first winning condition would be  $X_{Gem} = 10$ .

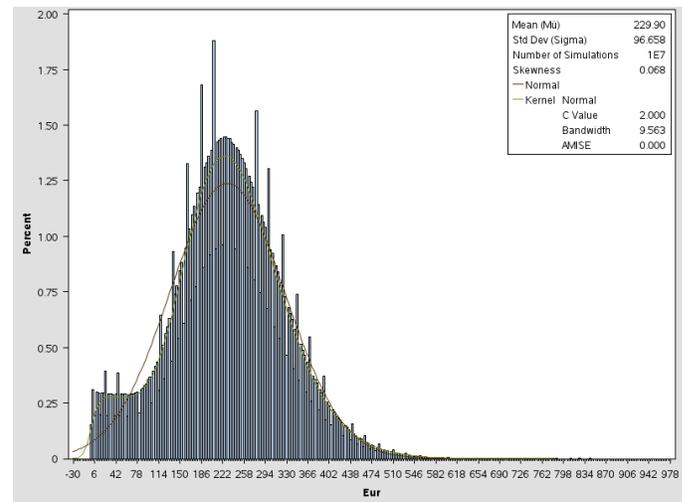
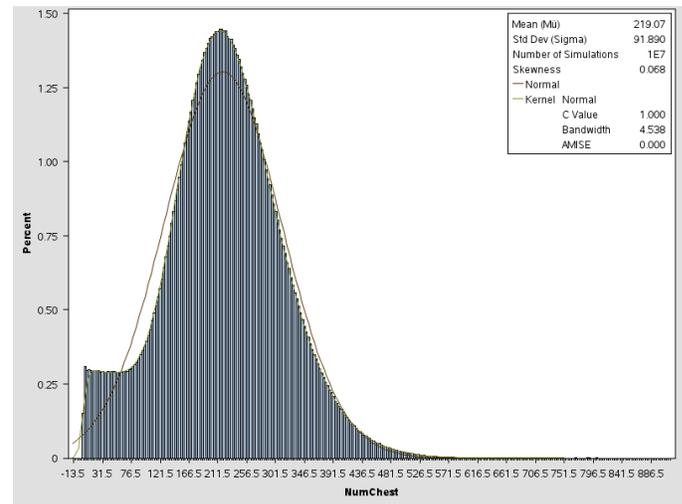
(II) However, I managed to calculate that the chance of getting a Skin Shard is about 60 percent. This means that after every roll you have a 60 percent chance of getting a Skin shard which technically could be the Vayne Skin meaning you have another Variable  $X_{Skin} \sim Ber(p)$  where  $p$  is the

probability of getting a specific Skin  $\Rightarrow p = \frac{1}{800}$ .

(III) For the last way of getting the Skin: You can re-roll a Skin every time you get 3 Shards. This can be said in mathy language like this: You get an extra try to roll (at the  $i$ -th roll) a Skin when the following condition is met:  $NumSkin_i \bmod 3 = 0 \vee NumSkin_i \neq NumSkin_{i-1}$

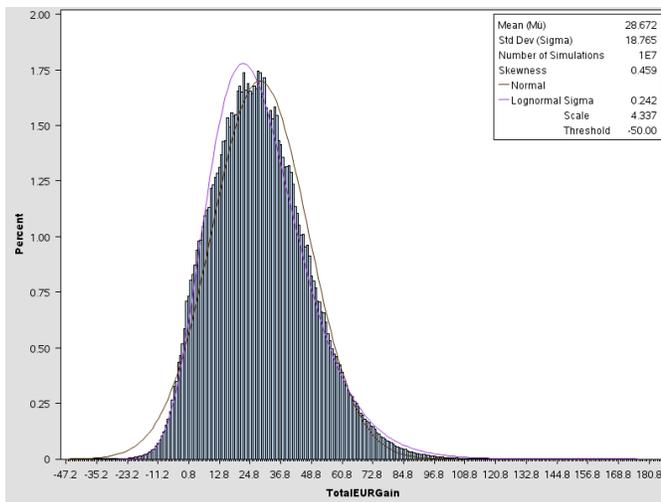
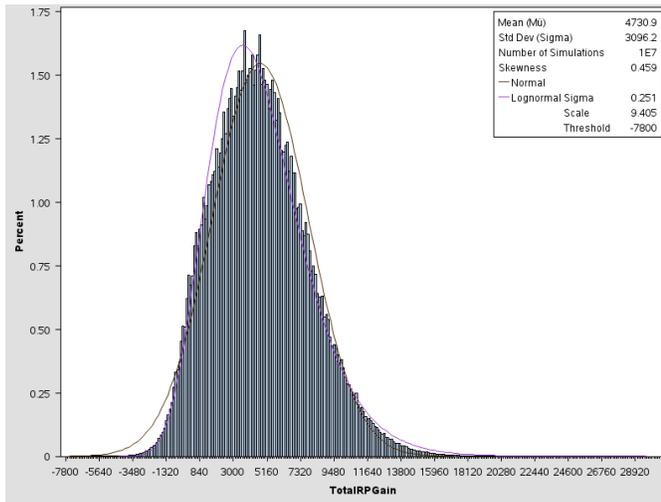
## III. THE SIMULATION

I conducted 2 Simulations, first of all the Number of Chests needed to get the Skin and the money spent on the amount of Chests. The first Simulation resulted in this:



The Spikes in the Money diagram probably have to do with the discrete nature RP are bought. The interesting part is, that the average is about 220 Chests, which is not what most people think. (Most people think it is about 250 since you get on Average one Gemstone per 25 Chests).

The Second Simulation was about the effective RP and Money Gain if you buy Chests instead of Skins directly. I personally expected the result found, however the Skewness of the Distribution kind of astonished me.



The Effective Value seem to follow a Lognormal Distribution, meaning that it actually gets a bit more effective the more Chests you buy. I am not sure if this property is wanted by Riot or if this happened by accident when designing the System.

#### IV. FINAL THOUGHTS

Since I have to work tomorrow, I am going to close this paper here, however if you have any questions or something you wish to be investigated I will do my best do so. So for everyone who actually read this short piece: Buy Chests if you want to maximize your RP.