

# Exploring the Law of Large Numbers through the Egg Roulette Game in Fathom

Amanda Walker and Alex White, Texas State University

## Introduction

This lesson incorporates a probability game and computer simulation to explore the Law of Large Numbers and conditional events. Students are shown two video clips from The Late Night show, starring Jimmy Fallon who plays the egg roulette game with celebrities. Students then play the game and an empirical probability is discussed. A fathom simulation is then used to simulate the law of large numbers in order to estimate a theoretical probability that Fallon wins the game.

## Rules of the Game

There are 12 eggs total, 8 hard boiled and 4 raw. Players take turns smashing an egg on their head and the first player to smash two raw eggs on his head loses. The “guest” of the show always takes the first turn. (Bready & Bush).

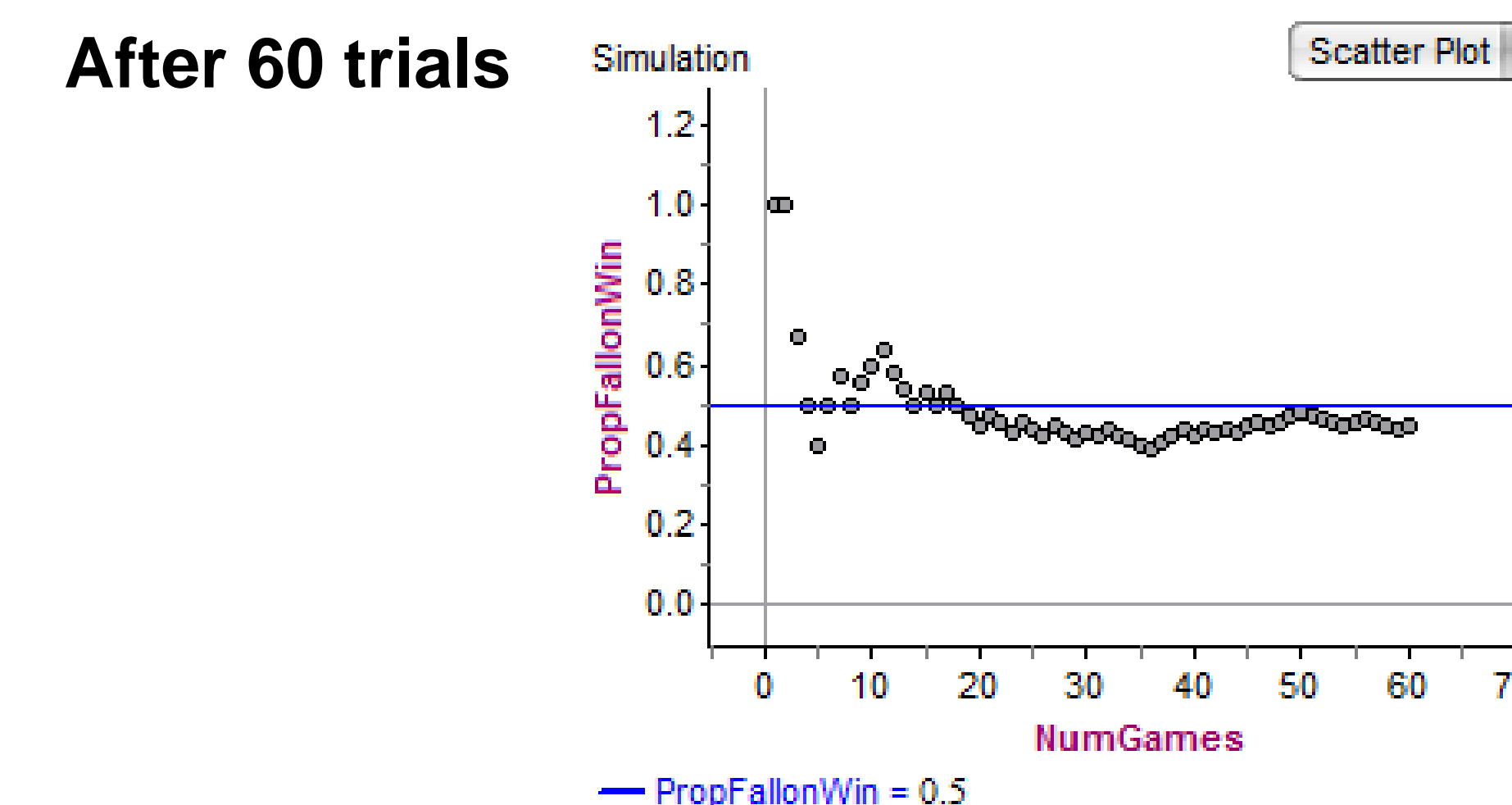
## Discussion

- Does one player have an advantage?
- Does each player have the same likelihood of winning?
- How can we interpret the empirical probability?
- How does the game relate to conditional probabilities?
- What information would we need to consider in order to compute the theoretical probability that Fallon wins the game?
- Explain the Law of Large Numbers.
- Using the Law of Large and the Fathom simulation, estimate the theoretical probability Fallon wins the game?

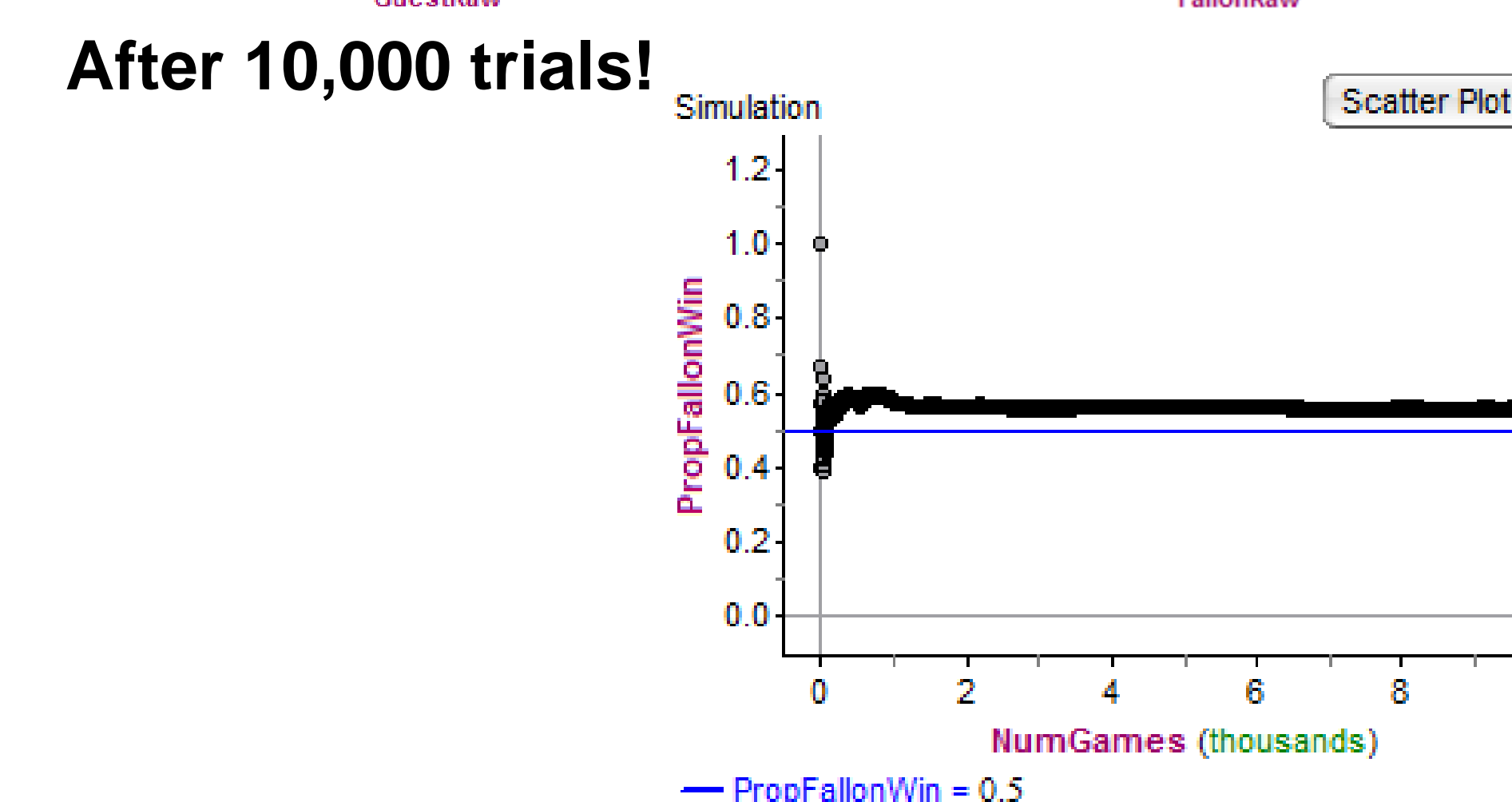
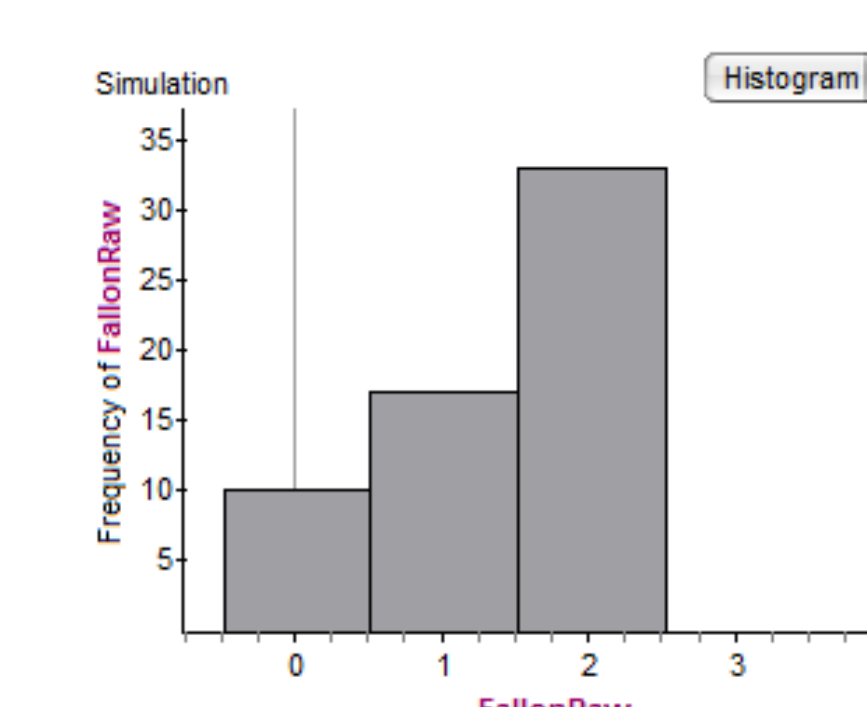
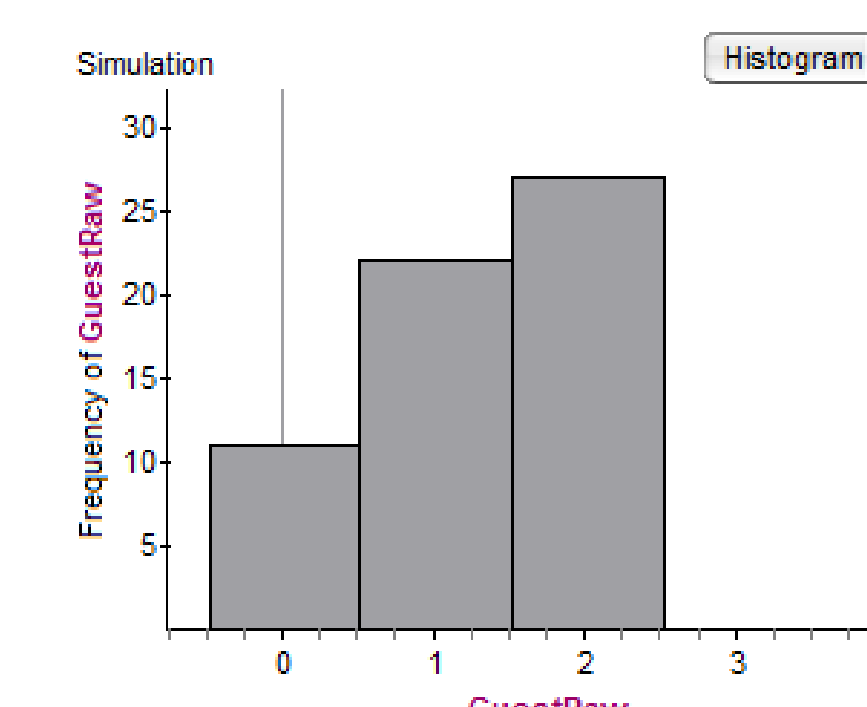
## Fathom Simulation

Fathom is a statistical software that is inexpensive, and can be downloaded from the internet. Fathom is a very effective method for visualization of data analysis and sampling, and is easy to use.

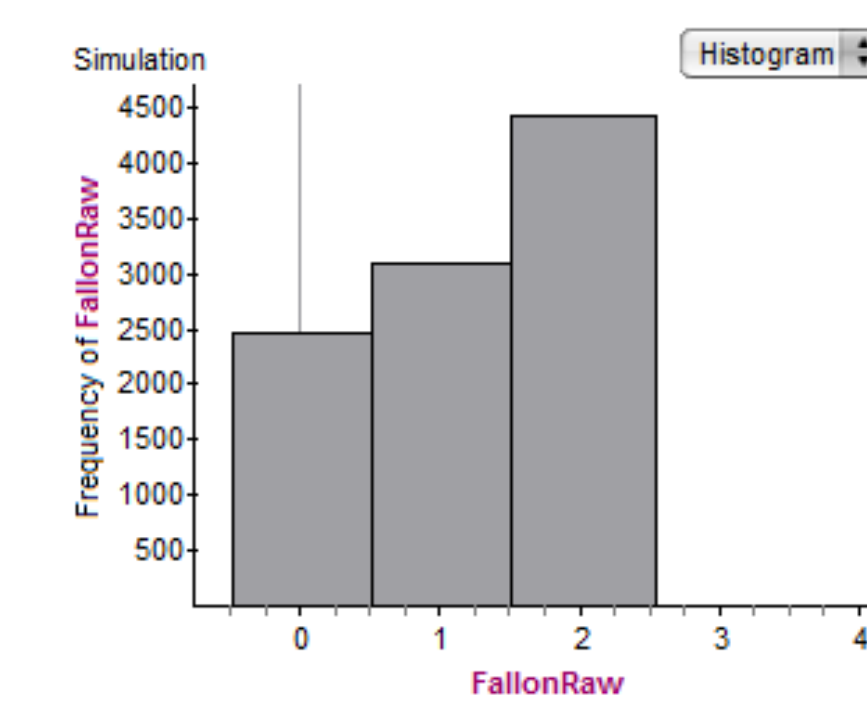
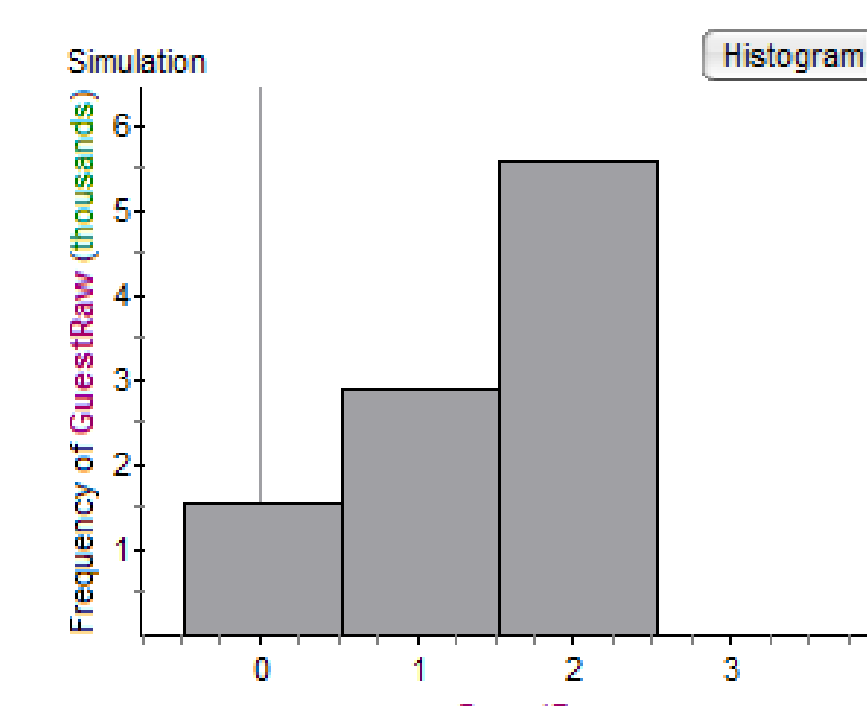
## Results



Simulation	FallonRaw	GuestRaw	FallonWin	NumGames	NumFallonWin	PropFallonWin
52	2	0	0	52	24	0.461538
53	2	1	0	53	24	0.45283
54	2	1	0	54	24	0.444444
55	1	2	1	55	25	0.454545
56	0	2	1	56	26	0.464286
57	2	1	0	57	26	0.45614
58	2	1	0	58	26	0.448276
59	2	1	0	59	26	0.440678
60	1	2	1	60	27	0.45

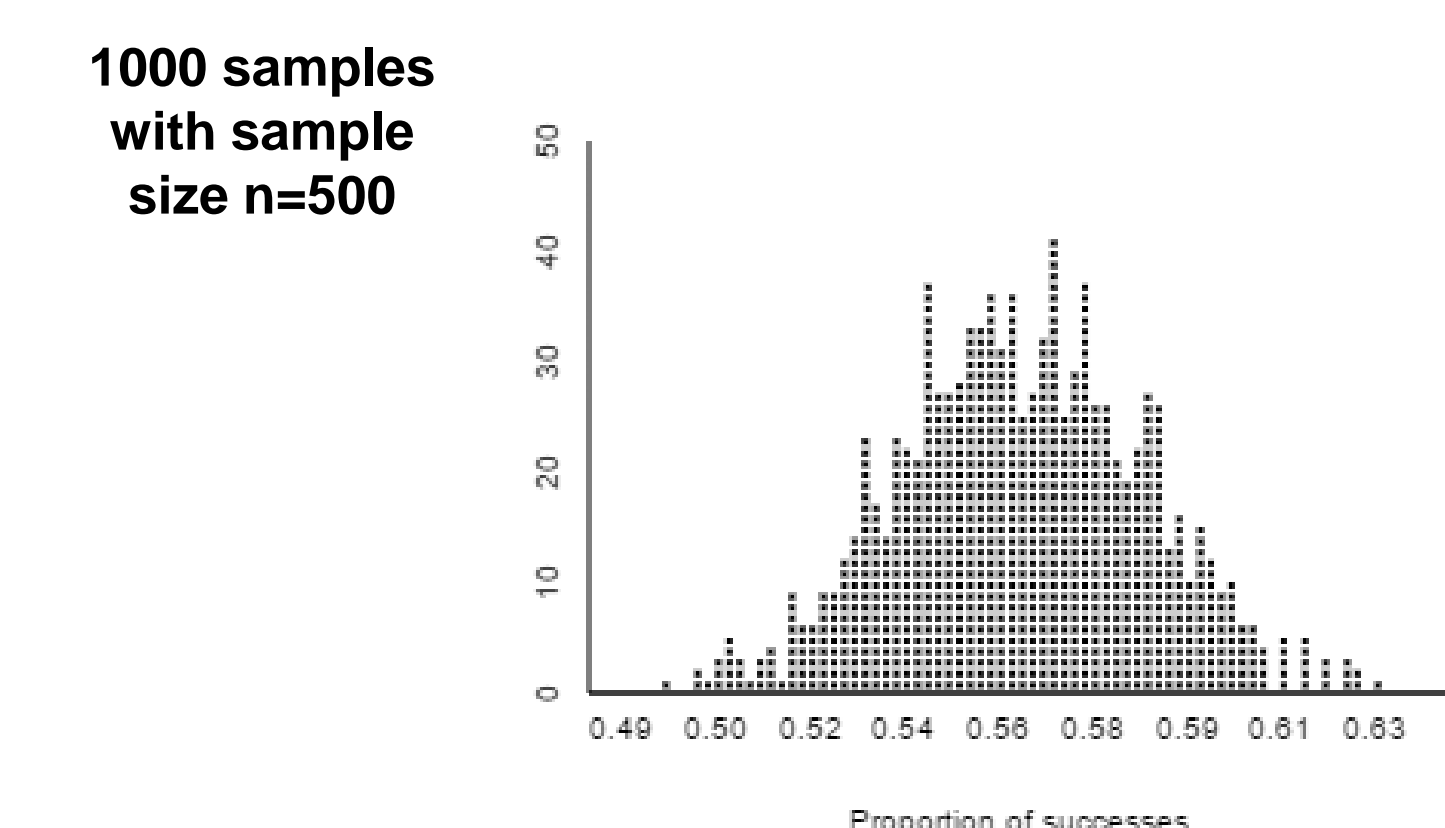
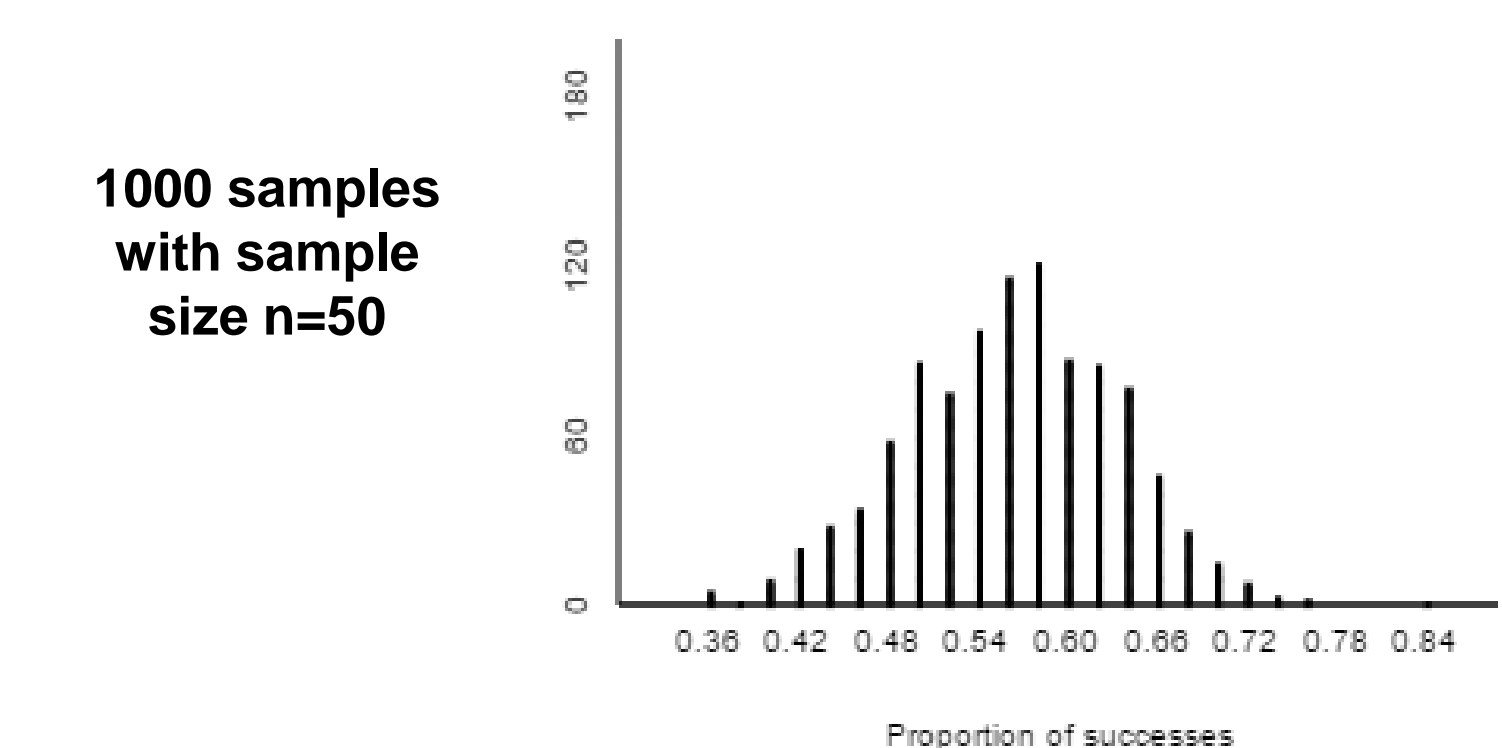


Simulation	FallonRaw	GuestRaw	FallonWin	NumGames	NumFallonWin	PropFallonWin
9992	2	1	0	9992	5573	0.557746
9993	0	2	1	9993	5574	0.55779
9994	1	2	1	9994	5575	0.557835
9995	2	1	0	9995	5575	0.557779
9996	2	0	0	9996	5575	0.557723
9997	0	2	1	9997	5576	0.557767
9998	2	1	0	9998	5576	0.557712
9999	0	2	1	9999	5577	0.557756
10000	1	2	1	10000	5578	0.5578



## Low Tech Adaptions

This lesson can be adapted to a low tech classroom without the use of Fathom. After students play the game and an empirical probability is discussed, the teacher can tell students the theoretical probability that Fallon wins the game is 5/9. The online rossmanchance applet can be used to demonstrate the sampling distribution.



## Bibliography

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- Chance, B., Cobb, G., Rossman, A., Roy, S., Swanson, T., Tintle, N., VanderStoep, J. (2014). *Applets for Introduction to Statistical Investigation Process*. [Computer Software]. Retrieved from <http://www.rossmanchance.com/ISlapplets.html>.
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- [The Tonight Show Starring Jimmy Fallon]. (2013, April 12). *Egg Roulette with Tom Cruise – Late Night with Jimmy Fallon*. [Video File]. Retrieved from <https://www.youtube.com/watch?v=v6jb0cOYqAI>.
- [The Tonight Show Starring Jimmy Fallon]. (2014, October 17). *Egg Roulette with Bradley Cooper – Late Night with Jimmy Fallon*. [Video File]. Retrieved from <https://www.youtube.com/watch?v=ZVUfnJipFh0>. <http://fathom.concord.org/>