Penny Box Searches

Overview

As a coin collector, searching through rolls or boxes of coins can be an affordable and fun way to expand one's collection. All coins are acquired at face value, and the rest can easily be returned to the bank at no loss, making the time invested in the search the only real obstacle for entry. Conversely, purchasing specific coins from a dealer is relatively quick and simple, but costs can become prohibitive.

Another fun aspect of looking through coin rolls or boxes is the element of surprise; unlike shopping from a dealer, where the collector knows exactly what is being purchased, when searching rolls and/or boxes the collector has no way of knowing whether treasures are or aren't hidden inside. This can make the discovery of a rare variety or key date that much more exciting.

By far the easiest coin to obtain in bulk (boxes) are pennies. Unlike quarters, dimes, and nickels -- whose boxes come in sums of $500, $250, and $100, respectively -- a full 50-roll box of pennies is only $25, and banks are much less hesitant to give them out.

The most common cents worth finding in penny boxes nowadays are wheat cents (1958 and older), but other interesting finds could include various errors, proof editions that made their way into circulation, steel cents (1943), and even Indian Head cents (1909 and older), although these are exceedingly rare to come across in circulation.

I began searching penny boxes in high school, going through nearly 40 of them with varying degrees of success. Most boxes yielded a handful of wheat cents, averaging about a dozen per box. In only 4 did I exceed 30 wheats, and once I even struck out entirely, finding nothing but zinc cents (1983 and newer). There have been a few gems: I've found multiple wheat cents from the 1910s, a few King George VI Canadian cents, a couple from Caribbean nations, and even an Indian Head penny from 1905 (in my 28th box, searched in the backseat on a road trip)! As the years progress, I expect these interesting finds to become fewer and further between...

A New Beginning

After a college-induced hiatus, I'm returning to hunting through coin boxes, but with a new focus on data science. Since I work full-time now and likely won't be searching through boxes at the same rate, I am instead taking the extra effort to document every coin I search through in every box, noting data points such as year, mintmark, type, etc. This allows me to create visuals and answer questions that I wasn't able to before:

- *How does the distribution of coins I search compare to their reported mintages? Are certain years or periods more or less common than expected?*
- *What is the distribution of mintages? How often are coins minted in Denver and San Francisco making their way into East Coast coinage?*
- *Which boxes are the most exciting to go through? This can be measured by the number of wheats found, year variation, foreign or error coins found, etc.*

Penny Box Searches

Search Statistics

2	5,000	32
Boxes Searched	Total Coins Searched	Wheats Found

Box
- [ ] 1
- [ ] 2

Decade
Search
- [ ] 2020
- [ ] 2010
- [ ] 2000
- [ ] 1990
- [ ] 1980

Mintmark
- [ ] Denver
- [ ] Philadelphia
- [ ] San Francisco

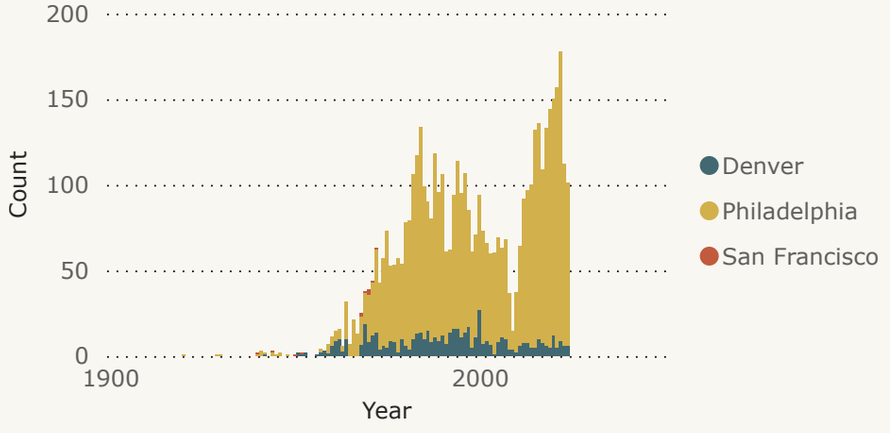
Box Statistics

Box	Date Searched	Years Found	Wheats	Oldest	Copper %
1	October 12, 2024	72	11	1929	16.4%
2	January 4, 2025	78	21	1920	24.1%
Total		**83**	**32**	**1920**	**20.2%**

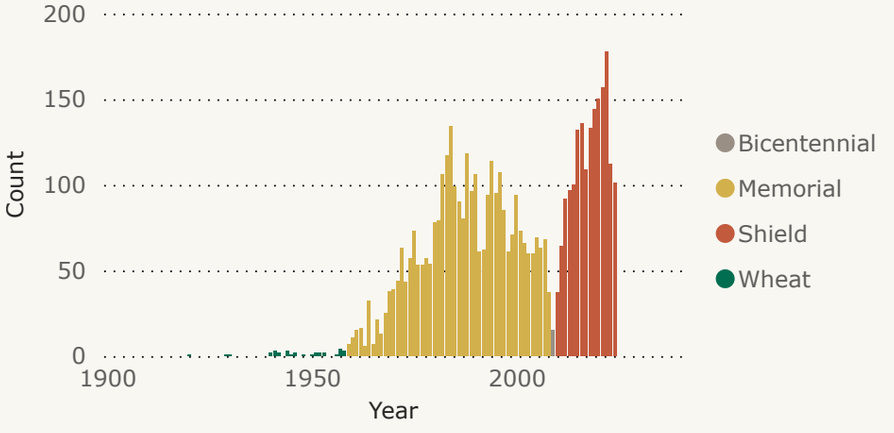
Year Distribution

Year	Denver	Philadelphia	San Francisco	Total
2024	6	95		**101**
2023	6	106		**112**
2022	9	169		**178**
2021	5	152		**157**
2020	12	138		**150**
2019	5	139		**144**
Total	**568**	**4,379**	**12**	**4,959**

Pennies Searched by Year and Mintmark



Pennies Searched by Year and Reverse Type



Penny Box Searches

Distributions

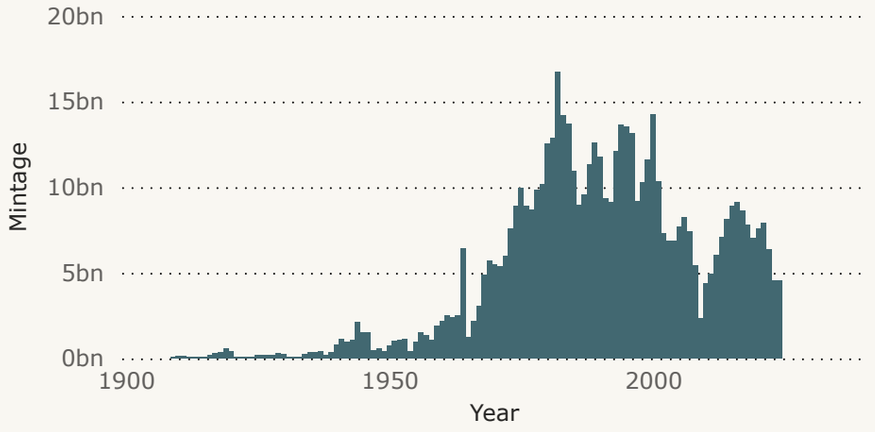
Compare reported mintages of cents to those found. We see that mintages report a much higher proportion of mid-century years. What if we assume that some percentage of cents are pulled from circulation or lost to damage each year? Move the slider in the bottom chart to see which % results in the closest distribution.

Box
- 1
- 2

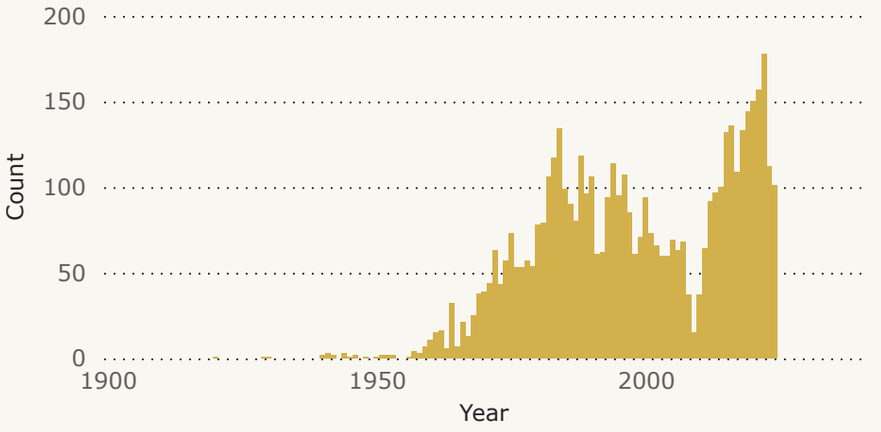
Decade
Search
- 2020
- 2010
- 2000
- 1990
- 1980

Mintmark Key
- Denver
- Philadelphia
- San Francisco

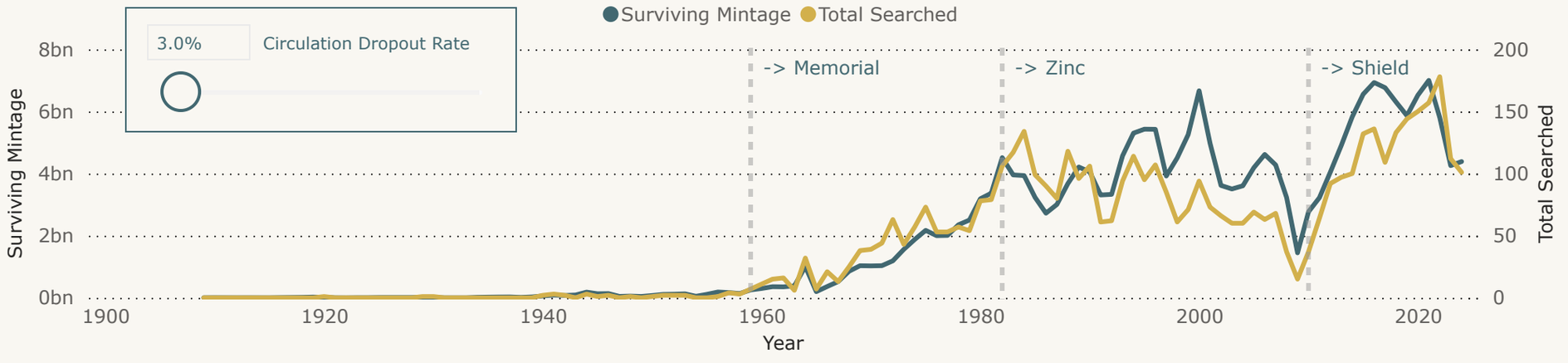
Reported Mintage by Year



Pennies Searched by Year



Surviving Mintage vs Total Found



Penny Box Searches

Box Comparison

Decade
- [ ] 2020
- [ ] 2010
- [ ] 2000
- [ ] 1990
- [ ] 1980
- [ ] 1970
- [ ] 1960
- [ ] 1950
- [ ] 1940
- [ ] 1930
- [ ] 1920
- [ ] 1910
- [ ] 1900

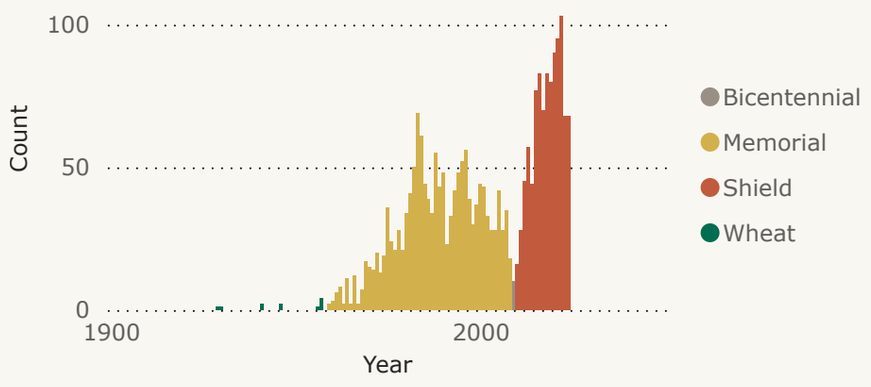
Mintmark Key
- [ ] Denver
- [ ] Philadelphia
- [ ] San Francisco

Box

1 | 2

72	16.3%
Years Found	Copper Proportion
11	1929
Wheats Found	Oldest Found

Pennies Searched by Year and Reverse Type

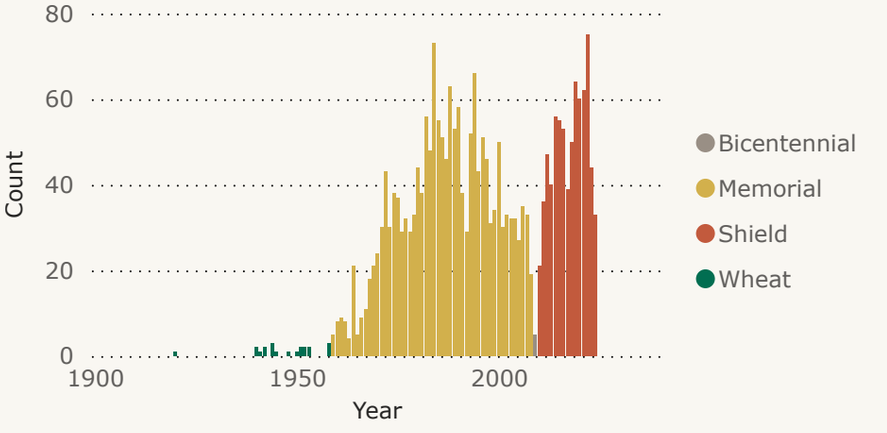


Box

1 | 2

78	24.0%
Years Found	Copper Proportion
21	1920
Wheats Found	Oldest Found

Pennies Searched by Year and Reverse Type



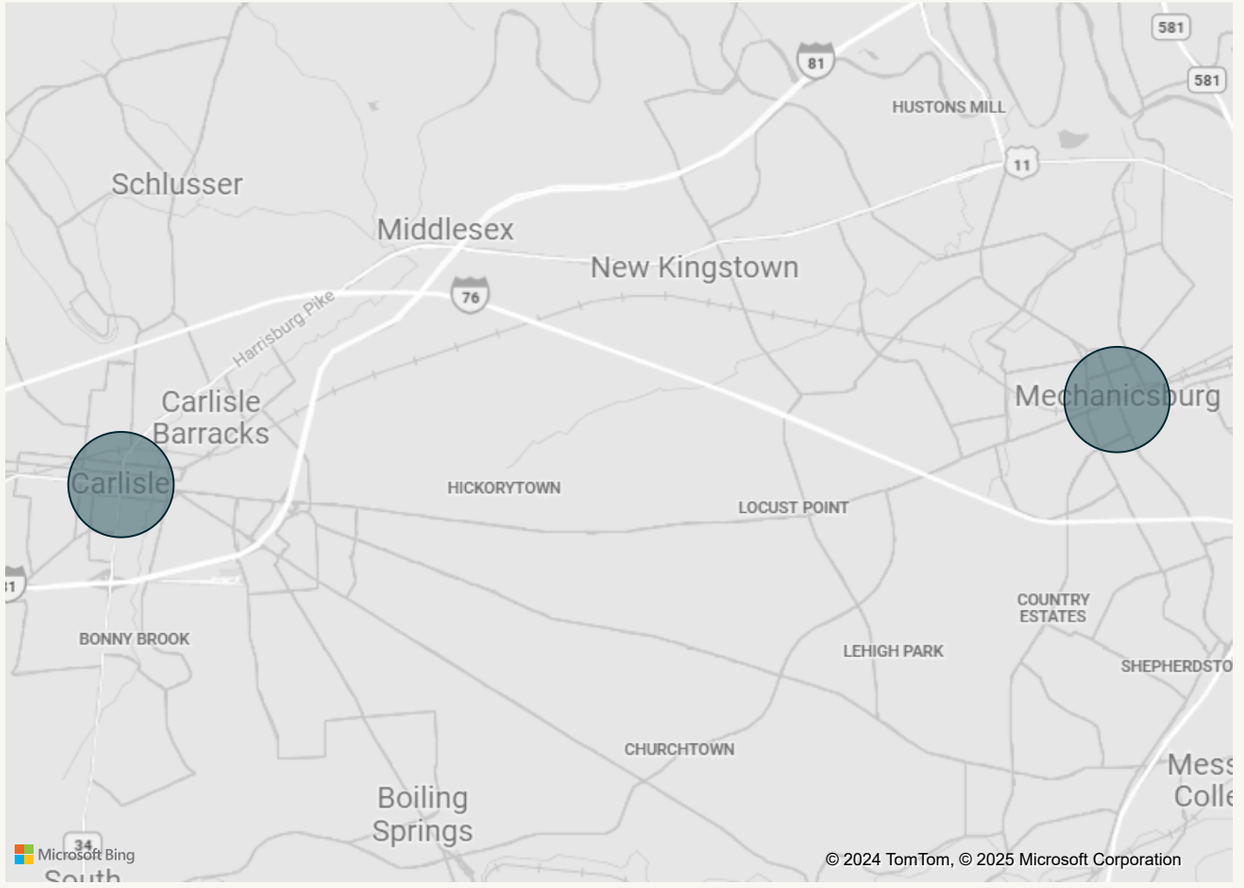
Penny Box Searches

Bank Locations

Box Statistics

Bank Location	Boxes Searched	Wheats per Box	Oldest	Copper %
⊞ Carlisle, Pennsylvania	1	21.00	1920	24.1%
⊞ Mechanicsburg, Pennsylvania	1	11.00	1929	16.4%

Boxes Searched by Bank Location



Penny Box Searches

Wheats

Box
- [ ] 1
- [ ] 2

Decade

Search
- [ ] 1900
- [ ] 1910
- [ ] 1920
- [ ] 1930
- [ ] 1940

Mintmark Key
- [ ] Denver
- [ ] Philadelphia
- [ ] San Francisco

Overview

The distribution between face-up and face-down wheats should be the same, because it is literally a flip of a coin which side you see first.

To me, it is more exciting to find a wheat penny face down, as I can wait to look at the date until I reach the end of the box and let the excitement build.

This page serves as a way to track which boxes were the most "exciting", measured by 3 things:
- Total number of wheat pennies
- % of wheat pennies found face down
- Occurrence of pre-1940s wheat pennies

32
Wheats Found

1920
Oldest Found

1940-S (112.94M)
Rarest Found

Box Statistics

Box	Face Down	Face Up	Total Wheats	Face Down Percentage
1	7	4	11	63.6%
2	9	12	21	42.9%
Total	**16**	**16**	**32**	**50.0%**

Orientation

Penny Box Searches

Year Lookup

Year

- 2024
- 2023
- 2022
- 2021
- 2020
- 2019
- 2018
- 2017
- 2016
- 2015
- 2014
- 2013
- 2012
- 2011
- 2010
- 2009
- 2008
- 2007
- 2006
- 2005
- 2004
- 2003
- 2002
- 2001

1968

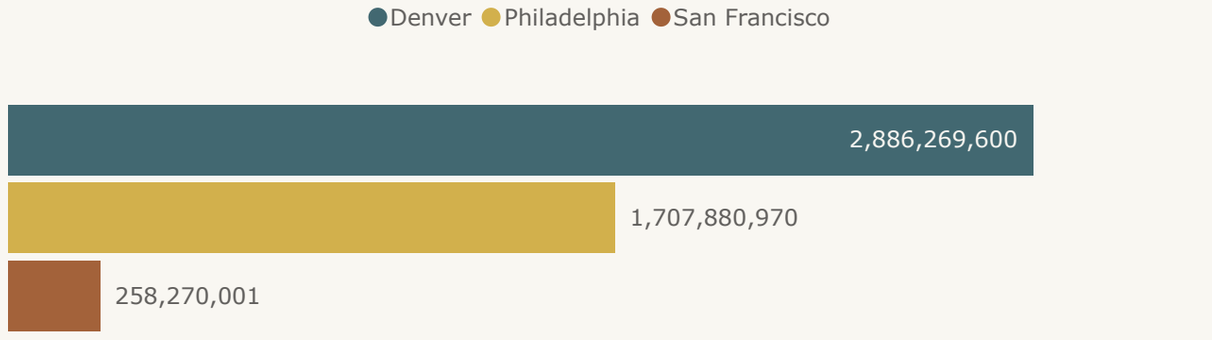
Memorial
Reverse Type

Copper
Composition

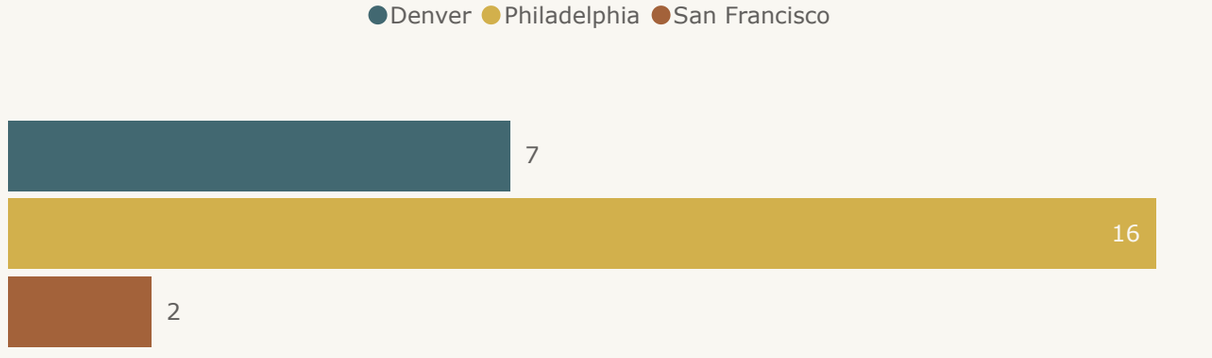
4,852,420,571
Mintage

25 / 5,000
Total Found in Search

Pennies Produced by Mintmark



Pennies Found by Mintmark



Penny Box Searches

Dropout Rate

On the "Distributions" page, we saw that our sample distribution looked a little different than that of the total production of pennies. Why is that?

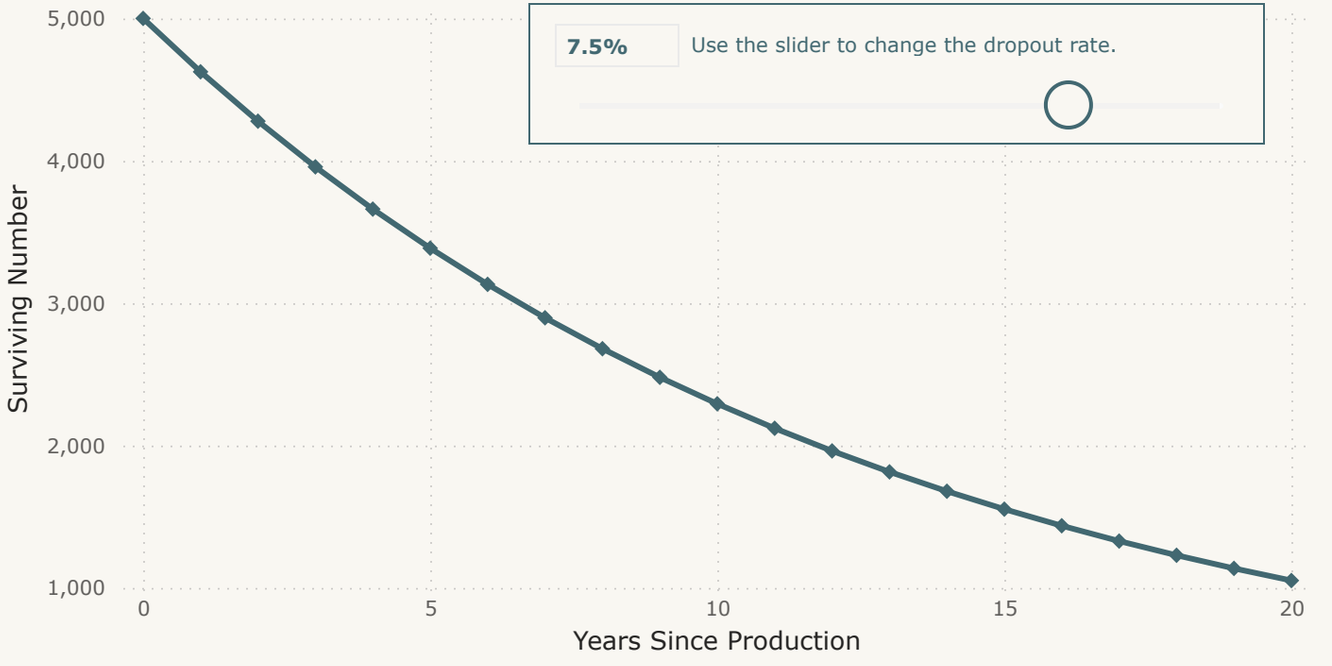
It can be assumed some percentage of pennies fall out of circulation every year. This could be because they fall out of pockets and are buried in the ground, corrode and are unusable, are stored in people's coin jars and forgotten, etc. This is likely to change depending on the year, type, or general rarity of the coin -- those such as the 1909-S VDB, worth into the thousands of dollars, were probably pretty quickly taken out of circulation at a higher rate than the much more common 1909 VDB. Likewise, although the production numbers for 1942 and 1943 cents were about equal, the fact that 1943s are made from steel mean they probably were kept or rusted away at the faster rate than 1942s, so it wouldn't surprise me if 1942s stayed around in circulation for longer.

For the sake of this demonstration and the following estimations, assume that the dropout rate is constant across all years and types of pennies. One thing that's important to note is that because dropout rate covers multiple years, it compounds year over year. Consider the following demonstration:

In Year 0, 5000 coins were produced. Move the slider below to see how many coins are left in circulation after each year at various dropout rates.

Surviving Population by Year

Years Since Production	Surviving Proportion	Surviving Number
0	100.0%	5,000
1	92.5%	4,625
2	85.6%	4,278
3	79.1%	3,957
4	73.2%	3,660
5	67.7%	3,386
6	62.6%	3,132
7	57.9%	2,897
8	53.6%	2,680
9	49.6%	2,479
10	45.9%	2,293
11	42.4%	2,121
12	39.2%	1,962
13	36.3%	1,815
14	33.6%	1,679
15	31.1%	1,553
16	28.7%	1,436
17	26.6%	1,329
18	24.6%	1,229
19	22.7%	1,137
20	21.0%	1,051



Penny Box Searches

Dropout Rate

On the "Distributions" page, we saw that if we assume that some percentage of coins fall out of circulation each year, our sample distribution and the distribution of "surviving" coins start to look pretty similar. At what point are they *most* similar? We can calculate this!

Below is a table that calculates the difference between our sample distribution and the actual population distribution at some circulation dropout rate (0-10%, in 0.1% steps), as defined by the sum of squares error, or residual sum of squares. This is calculated as follows:

1) Find the surviving population for each year/mintmark at a specific rate of attrition.
   For example, a 10 year-old coin with a mintage of 1M at 5% annual dropout = 1M * (.95^10) = 600K surviving coins.
2) With the "new mintage" figures, calculate the expected distribution of our coin population (what a representative sample of the same size would look like).
3) Find the difference between what we actually found and what we would expect to find if this circulation dropout rate were true.
4) Square these differences and add them up.

Statistics tells us that the rate which gives us the lowest sum of squares (lowest error) is our estimate for the true rate of circulation dropout. Move the slider above the table below to find that rate. Stuck? The graph in the bottom right plots the residual sum of squares at every rate increase of 0.1%. We can see that it forms a nice parabola, whose base represents the rate with the lowest sum of squares. There is our answer!

Box

- [ ] 1
- [ ] 2

Mintmark

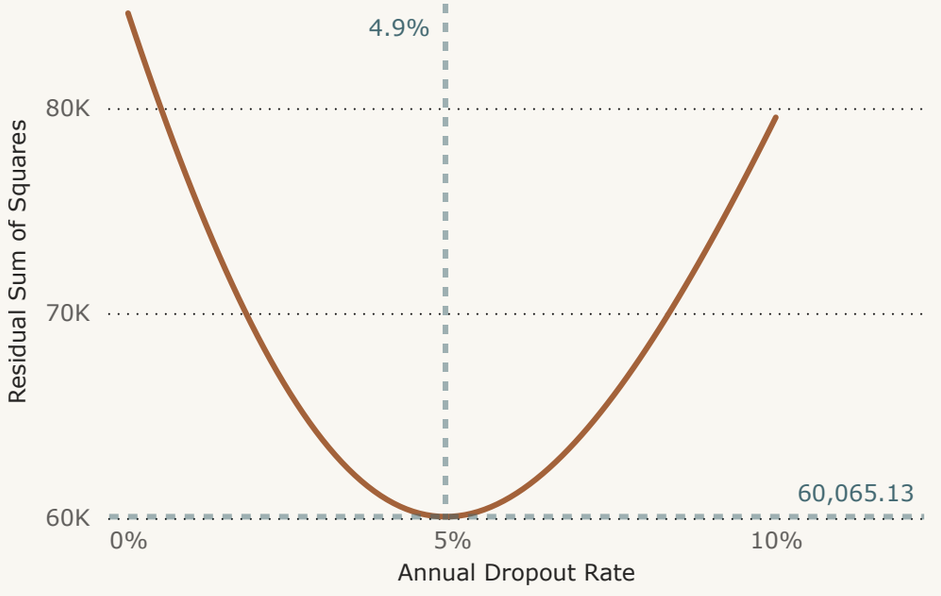
- [ ] Denver
- [ ] Philadelphia
- [ ] San Francisco

Residual Sum of Squares Calculation Details

7.5% Use the slider to minimize the residual sum of squares (right column)

Year	Total Found	Surviving Mintage	Expected Value	Residual	Residual^2
2024	101	8,367,180,000	114.23	-13.23	731.33
2023	112	7,739,641,500	105.66	6.34	441.64
2022	178	10,066,650,588	135.71	42.29	1,865.81
2021	157	11,579,708,725	157.17	-0.17	662.57
2020	150	10,288,367,870	133.66	16.34	628.69
2019	144	8,820,185,649	120.98	23.02	652.96
2018	133	9,044,949,797	127.45	5.55	650.82
2017	109	9,255,010,332	127.32	-18.32	506.48
2016	136	9,041,558,173	126.30	9.70	394.94
Total	**4,959**	**181,224,644,709**	**2,469.84**	**2,489.16**	**65,996.28**

Minimizing Error to Find Dropout Rate



Penny Box Searches

Dropout Rate

Notes About Circulation Dropout Rate

I'm using a few bold assumptions in this process, namely that dropout rate is constant. This is likely false, since some people pull wheats whenever they find them, implying a much higher dropout rate pre-1959. The same may be said to a lesser extent for copper coins (pre-1982), and bicentennials, or to a greater extent for any key dates/varieties.

If I'm finding a higher proportion of newer coins, it suggests the dropout percentage is high (old coins are quickly falling out of circulation and are no longer being found). Conversely, if I find lots of old coins, it must mean that they are not dropping out of circulation very fast.

Because I am searching mainly in Pennsylvania, I assume it takes a while for Denver-minted coins to make it to this side of the country. If I do find coins minted in Denver, I can assume that I'm more likely to find a higher proportion of older Denver-minted coins because they've had this time to travel.

Because of this, I believe that my distribution with respect to Denver will suggest a low rate of circulation dropout in comparison to Philadelphia. Looking at all mints together might skew the calculated dropout percentage smaller, since my mid/older coins are bolstered by those minted in Denver. Limiting to Philadelphia-minted coins may give a more accurate estimate of the theoretical dropout rate, because I'm not relying on the time it takes to travel the country.

That being said, perhaps my proximity to the Philadelphia mint (about 100 miles) means that I see newer coins than the average American, which would skew my dropout rate higher than reality (see first note above). Therefore, I'm comfortable using all mintmarks to hypothesize the dropout rate, since US coinage is mobile and I can reasonably assume to have a mix of mintmarks wherever I go.

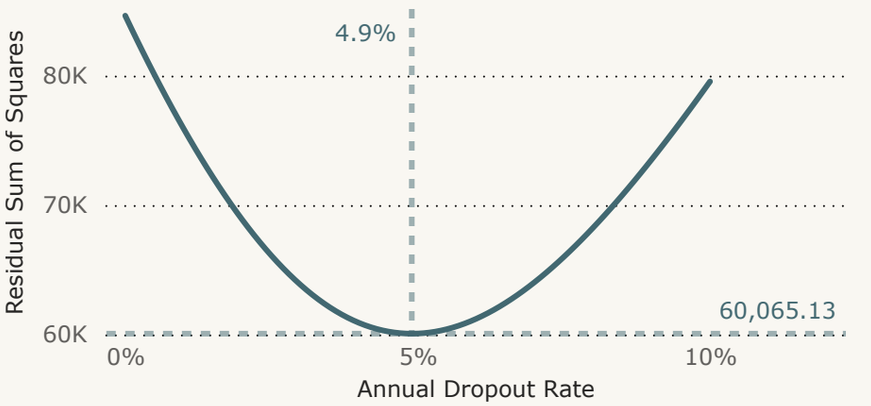
I would be interested to see if this would change were I to search penny boxes in different areas of the US. Does the Denver area see a similar proportion of Philadelphia-minted coins as the reverse? What about somewhere in the Midwest? Which states/regions source their coins from which mint?

4,959
Sample Size

Mintmark

- [ ] Denver
- [ ] Philadelphia
- [ ] San Francisco

Minimizing Error to Find Dropout Rate



Dropout Rate by Mint