The pennies used in the three-line where there was no situation but by letter watching, to which the final 26 there 

The final S occurs with frequency 1. (However, the final term would be $f(s)$ if the form were a double square.)

Defined in this manner, quality is approximately directly proportional to the expected number of fills. In other words, the higher the quality of a word, the larger the number of fills we expect to find using that word in that position. For unlikely events finding two or more fills should be much rarer than just finding one, so in this case the quality if also approximately directly proportional to the probability that a fill exists, e.g., if a given word has twice the quality of another word, then there is about twice the probability of a fill existing using the first word than one using the second.

Experimental Results

A program was written which uses a given list of words to first computer letter frequencies for each position in a word, and then to calculate word quality using these results. However, instead of using frequencies directly, it was found that calculations were simplified by using the natural logarithm (ln) of the number of times a given letter occurred in the appropriate position directly, as this allows the use of summations instead of multiplications.

CHRIS LONG
Bridgewater, New Jersey
and the resulting magnitudes of the numbers were also easier to work with. Therefore, when comparing the quality of the words given below, the numbers must first be exponentiated (the constant e raised to the power expressed by the quality number). Furthermore, if any letter did not occur in a particular position (e.g., it was found that no ten-letter word ended in a Q), it was counted as having occurred once to avoid words having a quality of zero (and thus a natural logarithm of negative infinity).

The first run was on a list of 82,794 nine-letter words (solid-form, hyphenated, and dictionary-sanctioned phrases) to find the lowest and highest quality words for each line n in a regular word square. It should be noted that this list lacks many derived forms (e.g., plurals), but I feel that the relative frequencies with which letters occur is still reflective of nine-letter dictionary words in general. None of the best words is a surprise, for all of them consist almost entirely of ADEINRST, the high-frequency letters. Most of the worst words were similarly unsurprising, as they contain many of the tough letters JQZ; the sole exception was the somewhat surprising SKEWWHIF which was the worst word in position 7. The results are given in the table below.

<table>
<thead>
<tr>
<th>n</th>
<th>Best Quality</th>
<th>Worst Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ass's steps</td>
<td>oxybenzyl</td>
</tr>
<tr>
<td>2</td>
<td>acerineae</td>
<td>jaszstick</td>
</tr>
<tr>
<td>3</td>
<td>recarrier</td>
<td>zulhijjah</td>
</tr>
<tr>
<td>4</td>
<td>reedenter</td>
<td>zulhijjah</td>
</tr>
<tr>
<td>5</td>
<td>treegeese</td>
<td>zulhijjah</td>
</tr>
<tr>
<td>6</td>
<td>triradial</td>
<td>equivoque</td>
</tr>
<tr>
<td>7</td>
<td>naiserie</td>
<td>skewwhiff</td>
</tr>
<tr>
<td>8</td>
<td>ensenteke</td>
<td>hjobjobbed</td>
</tr>
<tr>
<td>9</td>
<td>seedsseed</td>
<td>equivoque</td>
</tr>
</tbody>
</table>

Another run was now done on the same list to find the highest-quality words for the base position. The resulting output was checked against Murray Pearce's list of words which have appeared as base words in known nine-squares (words below are marked with an asterisk if they haven't been used as bases before).

<table>
<thead>
<tr>
<th>Word</th>
<th>Quality</th>
<th>Word</th>
<th>Quality</th>
<th>Word</th>
<th>Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>seedsseed</td>
<td>76.862</td>
<td>res's test</td>
<td>75.466</td>
<td>deessendo</td>
<td>75.083</td>
</tr>
<tr>
<td>nessessest</td>
<td>76.565</td>
<td>stressess</td>
<td>75.466</td>
<td>deessenedes</td>
<td>75.083</td>
</tr>
<tr>
<td>sessenest</td>
<td>76.565</td>
<td>*setnesses</td>
<td>75.407</td>
<td>esegersee</td>
<td>75.031</td>
</tr>
<tr>
<td>seenessel</td>
<td>76.430</td>
<td>rees's test</td>
<td>75.331</td>
<td>seedaseer</td>
<td>74.942</td>
</tr>
<tr>
<td>sleenessest</td>
<td>76.354</td>
<td>Essermee</td>
<td>75.316</td>
<td>lesneses</td>
<td>74.911</td>
</tr>
<tr>
<td>assessest</td>
<td>75.956</td>
<td>seernessse</td>
<td>75.316</td>
<td>*senseless</td>
<td>74.911</td>
</tr>
<tr>
<td>dyassesst</td>
<td>75.922</td>
<td>sereenessse</td>
<td>75.316</td>
<td>readeedes</td>
<td>74.872</td>
</tr>
<tr>
<td>seednessse</td>
<td>75.824</td>
<td>sernesses</td>
<td>75.316</td>
<td>lesseresest</td>
<td>74.835</td>
</tr>
<tr>
<td>asseessees</td>
<td>75.818</td>
<td>teresseen</td>
<td>75.196</td>
<td>sleeresse</td>
<td>74.835</td>
</tr>
<tr>
<td>edesseesse</td>
<td>75.689</td>
<td>segeesera</td>
<td>75.166</td>
<td>assesseath</td>
<td>74.795</td>
</tr>
</tbody>
</table>

Note that out of the thirty best words, only two have not been used as bases before, so it would appear that our definition of quality is a good one. The difference in quality among the best and worst words was surprisingly 10 words with...
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Further Research

There are several areas for further exploration. It appears that word quality may be used to settle the argument of which order of word placement is best when searching for squares by computer. Preliminary results suggest that neither a pure top-down or bottom-up approach is best, but that for nine-squares it is best to first put in the ninth word, then the eighth, and then the second. Further work in this area should prove enlightening.

Word quality may also aid in the construction of squares directly. For the person attempting construction by hand, a list of the best words which have never appeared as bases before is a good place to start. For the person doing construction by computer, a good approach is to actively seek out high-quality words to add to your word stock. As an example, this is how I found NESSHESST and REEDLESSE, which resulted in new nine-squares. The REEDLESE square in particular was a nice find, as it turned out that all words were in the Oxford English Dictionary. This is only the second single-dictionary nine-square known, the other being Eric Albert's Webster's Second square described in the November 1991 *Word Ways*. Those interested in this approach can readily determine the quality of a potential nine-letter or ten-letter base word by summing the following letter quality values for each letter of the word, excluding the final one.

<table>
<thead>
<tr>
<th>Nine</th>
<th>Ten</th>
<th>Nine</th>
<th>Ten</th>
<th>Nine</th>
<th>Ten</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>7.848</td>
<td>7.588</td>
<td>J</td>
<td>2.197</td>
<td>0.000</td>
</tr>
<tr>
<td>D</td>
<td>9.027</td>
<td>9.003</td>
<td>M</td>
<td>7.703</td>
<td>7.520</td>
</tr>
<tr>
<td>F</td>
<td>5.740</td>
<td>5.537</td>
<td>O</td>
<td>6.390</td>
<td>5.665</td>
</tr>
<tr>
<td>H</td>
<td>7.520</td>
<td>7.035</td>
<td>Q</td>
<td>0.693</td>
<td>0.000</td>
</tr>
<tr>
<td>I</td>
<td>6.138</td>
<td>5.236</td>
<td>R</td>
<td>8.519</td>
<td>8.457</td>
</tr>
</tbody>
</table>

THE PRINCIPAL

PETER NEWBERRY
Chesterfield...

Whilst the old lady is still in exchange. They place a coin on the fat lady's side. In Texas in 1655, "Once a kl"...

The following actions.

Actions stipulated in the following:

Fine WORDs only.
One picture serves.
Hard WORDs only.
A WORD that
An English...
Many a time...

To augment:

from the same...
word or word you restore.

1. It is the...
2. WORDS or...
3. Keep a...
4. Old WORD...
5. Better b...
6. One WORD...
7. WORDS in...
8. WORDS no...
9. WORDS s...
10. Where W...
11. New WORD...
12. There is...
13. All thin...
14. A WORD...
15. He who...
16. One mar...
17. The WORD...