# KRYPTOS

**Hidden Hill Cipher -** Robert Mereau

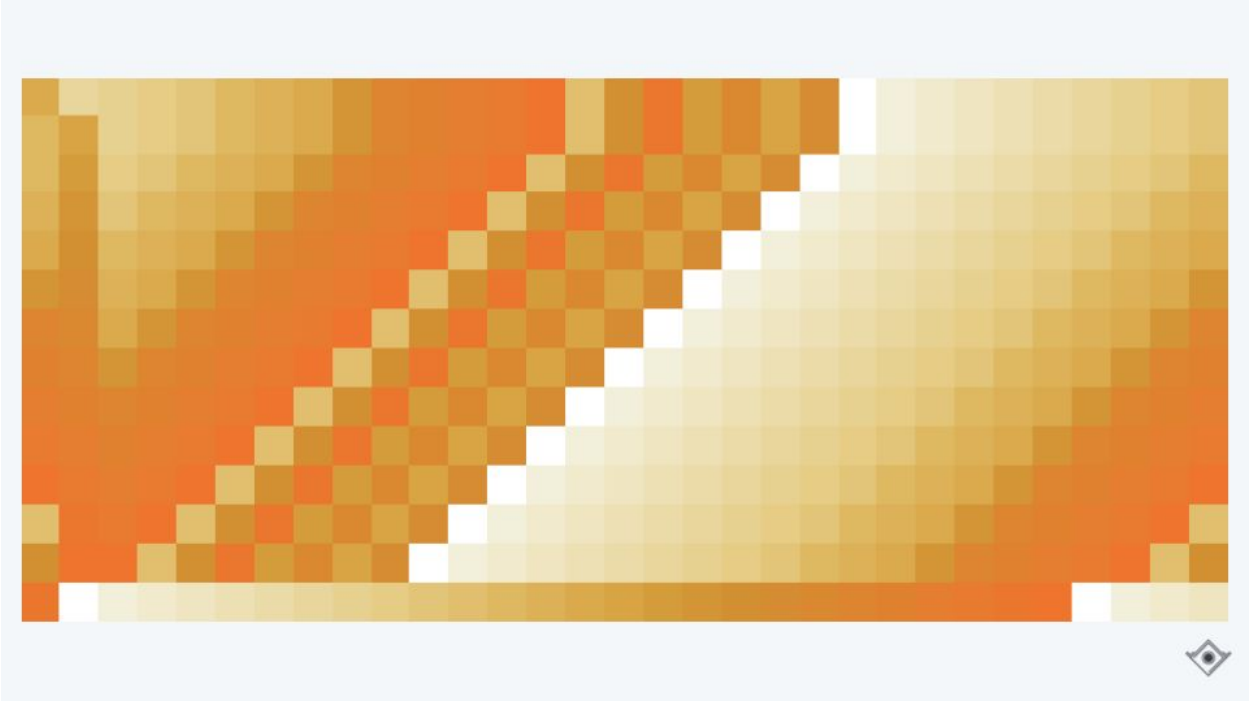
Preface:

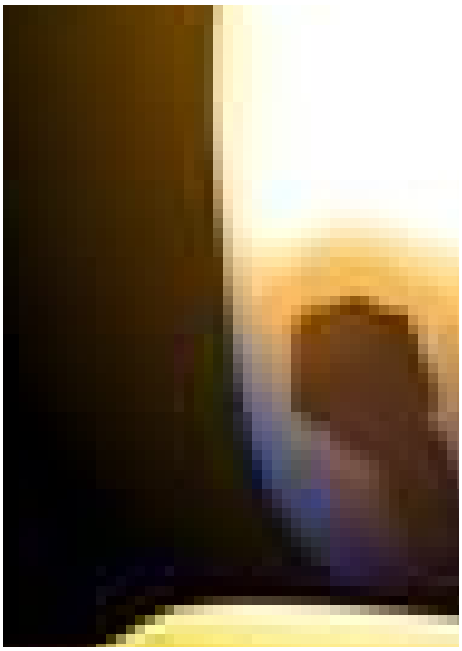
This paper is intended to provide support for those working to solve Kryptos. The hope is that the content, be it in part or complete, contains novel discoveries and mechanics that can assist the greater communities development of new approaches.

Before we begin, there's a few things I want to highlight. First, I have tried to simplify everything into steps that flow from the beginning to the end. In hindsight, some steps are more important than others, but rather than omitting steps that may not be required, I chose to divide this paper into two parts to help show the logical thinking and discovery process I went through. Second, I often use the letters Q and X as wildcards because Jim Sanborn does this. Finally and most importantly, the solution does not end with a *simple* decryption of the final passage. With that in mind, I found a number of clues through the entirety of the work which makes me believe this is intended.

# PART I

1. Start with Tableau IV.
    a. Map the letters to a color field, and partition until you see the flame of a candle. (Mengenlehreuhr - Berlin Clock Clue)





b. The tableau now has dimensions 14x31. Identify hidden parallel lines (*the illusion*).

c. Here we focus on the two vertical lines on the far left side and look for scrambled words hidden in between.

| Row | Word | Interpreted Definition |
|---|---|---|
| 1 | Pill | Something unpleasant that must be tolerated or endured |
| 4 | Damns<br>Mana | To bring about the failure of<br>Pervasive supernatural or magical power |
| 5 | Uncut | Not shaped by cutting or trimming |
| 8 | Wave<br>Wow<br>Wove<br>View | Act of signaling by a movement of the hand<br>Used to express **wonder**, amazement, or great pleasure.<br>To form by combining various elements into a whole<br>Look at carefully |
| 9 | Whizz | Someone who is dazzlingly skilled in any field : Wizard |
| 10 | Key | Serving as an essential component |

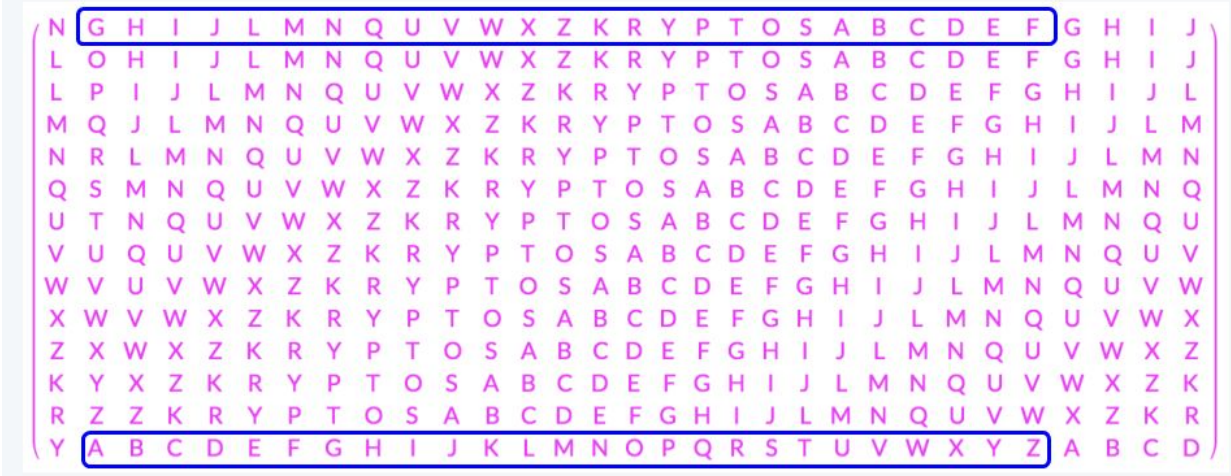
For the words here and in later parts, I am always going to bring extra attention to ones that go with my theory that **the secrecy of Kryptos is protected by claims made that may not be true**. In this case, *Pill* and *Damns* can both be interpreted in this way according to definition.

d. Go all the way to WW.

| Location | Word | Interpreted Definition |
|---|---|---|
| Row 1 | Unhelming Glim | To remove the helmet of Candle |
| Row 14 | Hijacked | To take control of (something) without permission or authorization and use it for one's own purposes |
| Column 2 | Upgrowth | The process of developing or growing upwards |

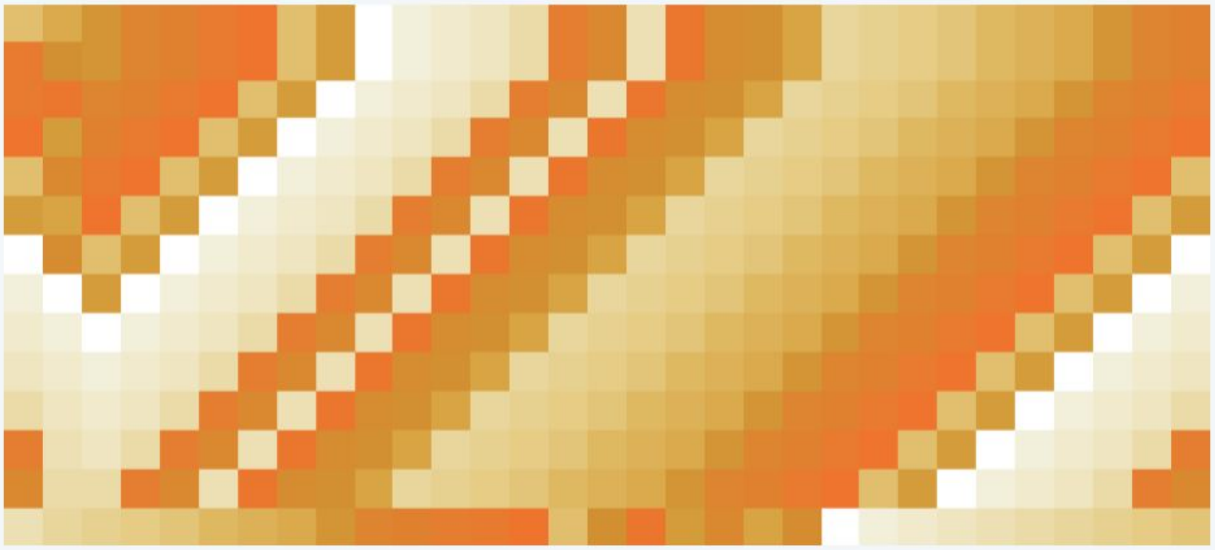
Without any wildcards, we get the word Hijacked. Jim Sanborn has been quoted in many instances saying he did something to Kryptos that not even the CIA knew about. Did he change both the solution and final answer? We also see the words *Unhelming* and *Upgrowth*, which we later see imply that Tableau II (which is above IV) needs to be added.

e. Back to the image of the flame, upon inspection there seems to be two clear *keys* at the top and bottom that differ from the subtle shading. There is a single 1:1 alphabet transform within the rows, which very nicely turns out to be those *keys*.




f. Apply transform from the bottom *key* to the top *key* as implied by the word *upgrowth*. Here is what we get.

g. Map back to a color spectrum. See the flame flicker.



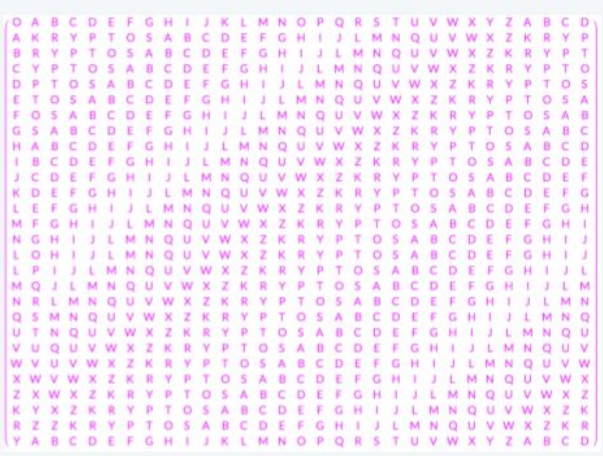
h. Look at the new keywords in the same place as before. (RQ/RY)

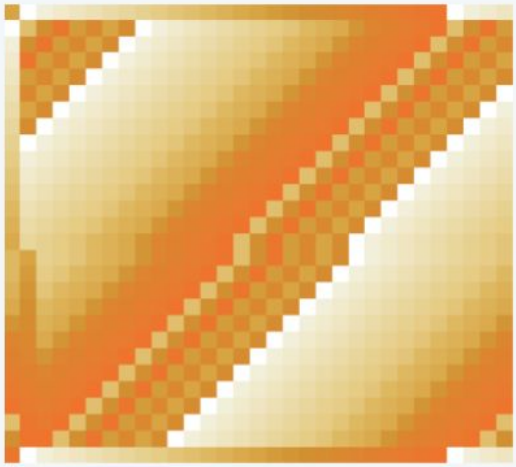
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| X | R | Q | U | V | X | Z | K | P |
| X | Y | U | V | X | Z | K | P | A |
| Z | P | V | X | Z | K | P | A | B |
| K | T | X | Z | K | P | A | B | C |
| P | O | Z | K | P | A | B | C | D |
| A | S | K | P | A | B | C | D | F |
| B | A | P | A | B | C | D | F | W |
| C | B | A | B | C | D | F | W | T |
| D | C | B | C | D | F | W | T | E |
| F | D | C | D | F | W | T | E | Y |
| W | E | D | F | W | T | E | Y | S |

| Location | Word | Interpreted Definition |
|---|---|---|
| Row 1 | Quiver | Tremble or shake with a slight rapid motion |
| Row 2 | Vapours | To rise in the form of vapor |
| Column 2 | Decrypts | To decode or decipher |

# PART II

2. We are going to do the same thing again, but this time, start by adding Tableau II to the top of Tableau IV. We now make a *tiny breach in the upper left hand corner* by adding an O to the start of Tableau II. This is necessary to have dimensions 28x31. I chose the letter O because it is most like a hole, but I also think a Q makes sense. It does not impact the invertible matrices used later.

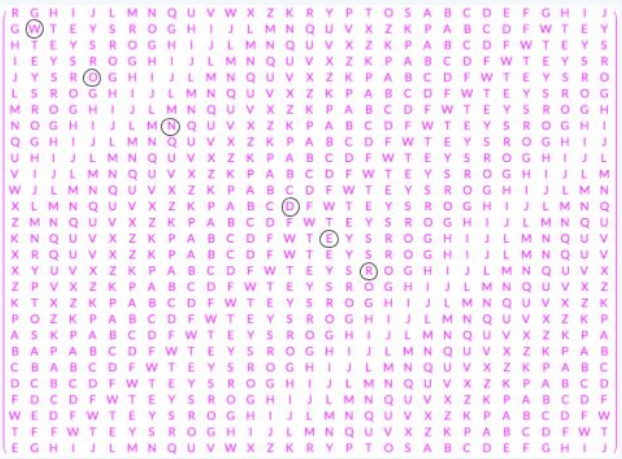


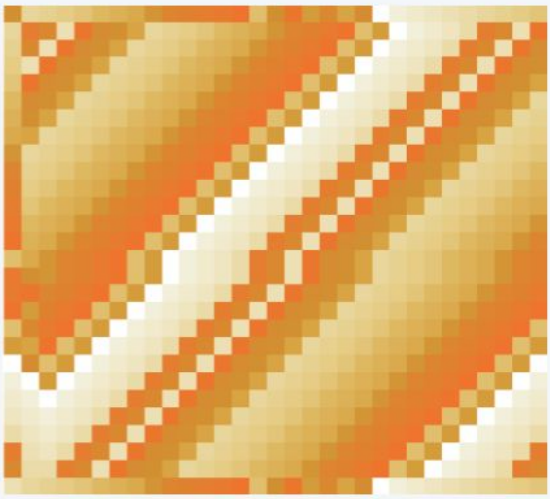


   a. Great Pyramid of Giza

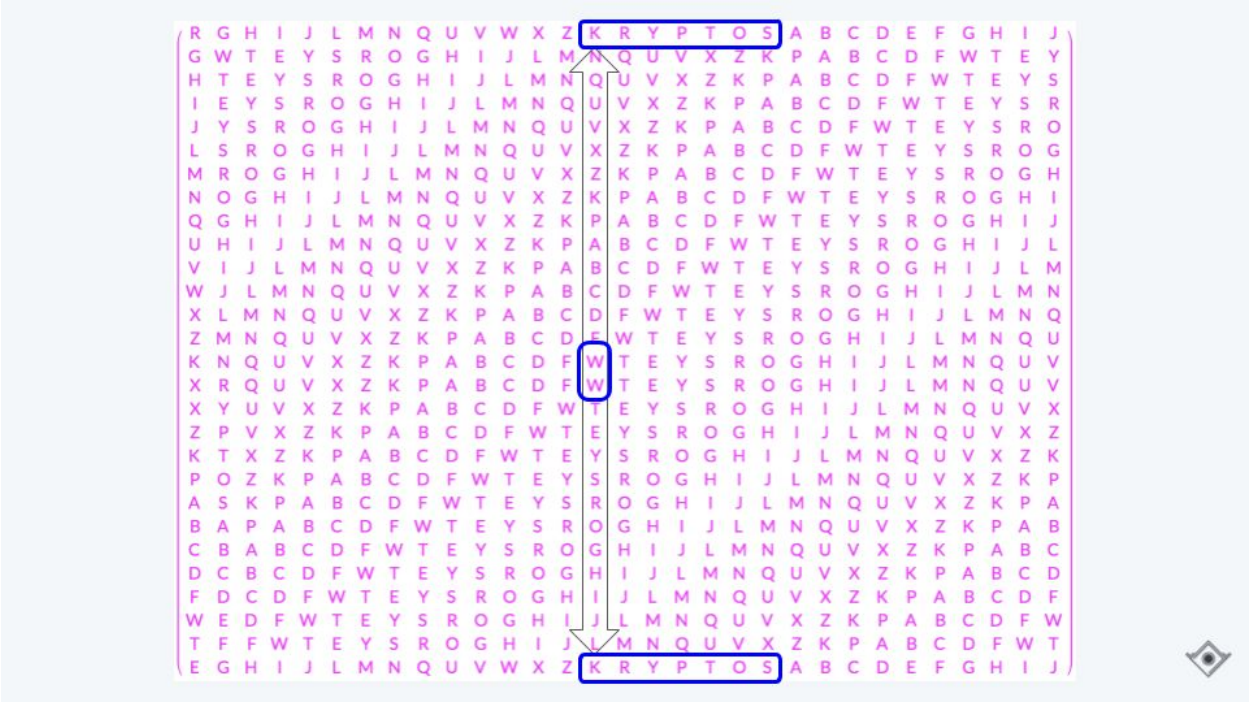
   After color mapping you get what looks a lot like the Great Pyramid of Giza, which is fitting with the Egyptian theme. Pyramids are also often used to symbolize mysteries and secrets. King Tut was not buried in a pyramid, and certainly not this one. The Great Pyramid of Giza is however, perhaps the most mysterious pyramid of all. Referred to as the *holiest of holies*, the name of the King whom it was dedicated to has been lost and is now referred to as *the name which only wise men know*. Many attribute the pyramid to the *holy grail*. We will see this theme repeat again and again as we continue.

b. Apply the *key* transform to the giza tablet. The word *wonder* now appears going through the appex.



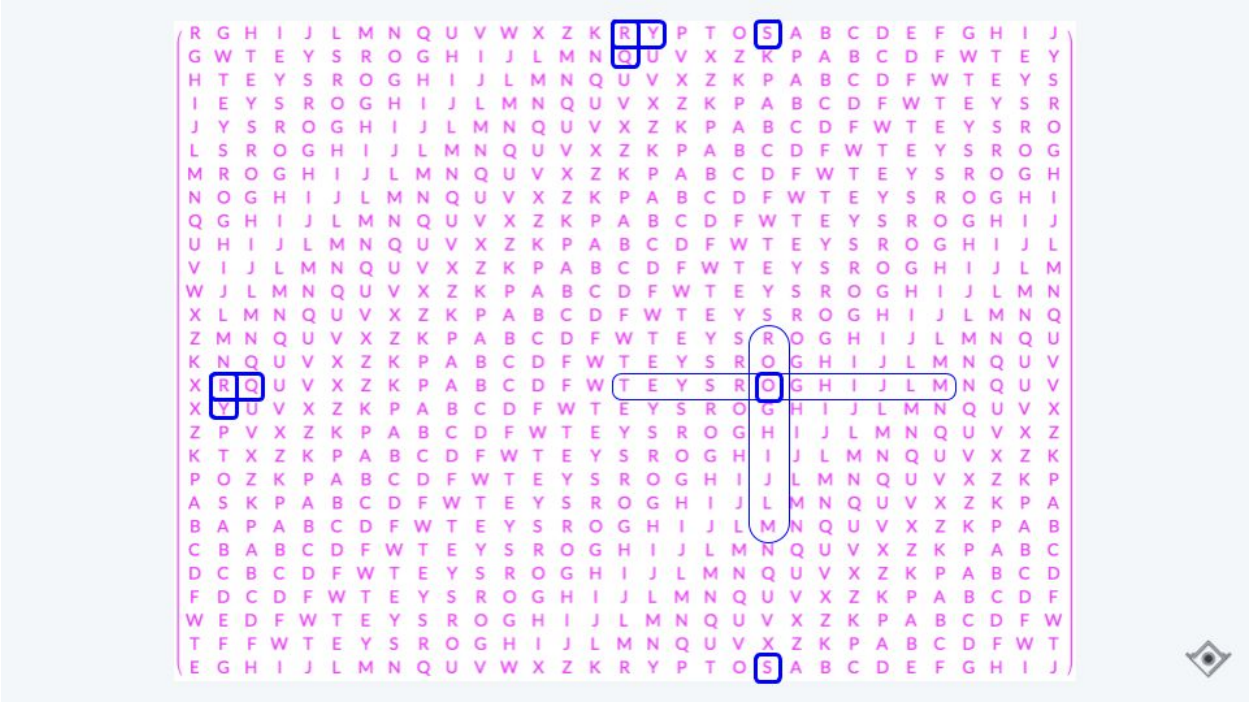


c. Let's do a check to see what evidence there is that we are correct so far.



Common with Vigenere solutions in previous parts, we see Kryptos still remains along the edges. It also lines up nicely with our WW which is promising because *only WW knows.*

d. Use the Morse clues (RQ/RY & SOS)



Using the clues from the Morse code component along with the location of WW, we see something spectacular happens. We have a candle in a dark and misty room.

e. Look at the spectacular finesse by which these letters align.

Note that words *Mist*, *Morse* and *Room* are all in the correct order, and in the center you can make the words *Glim* and *Gloom*.

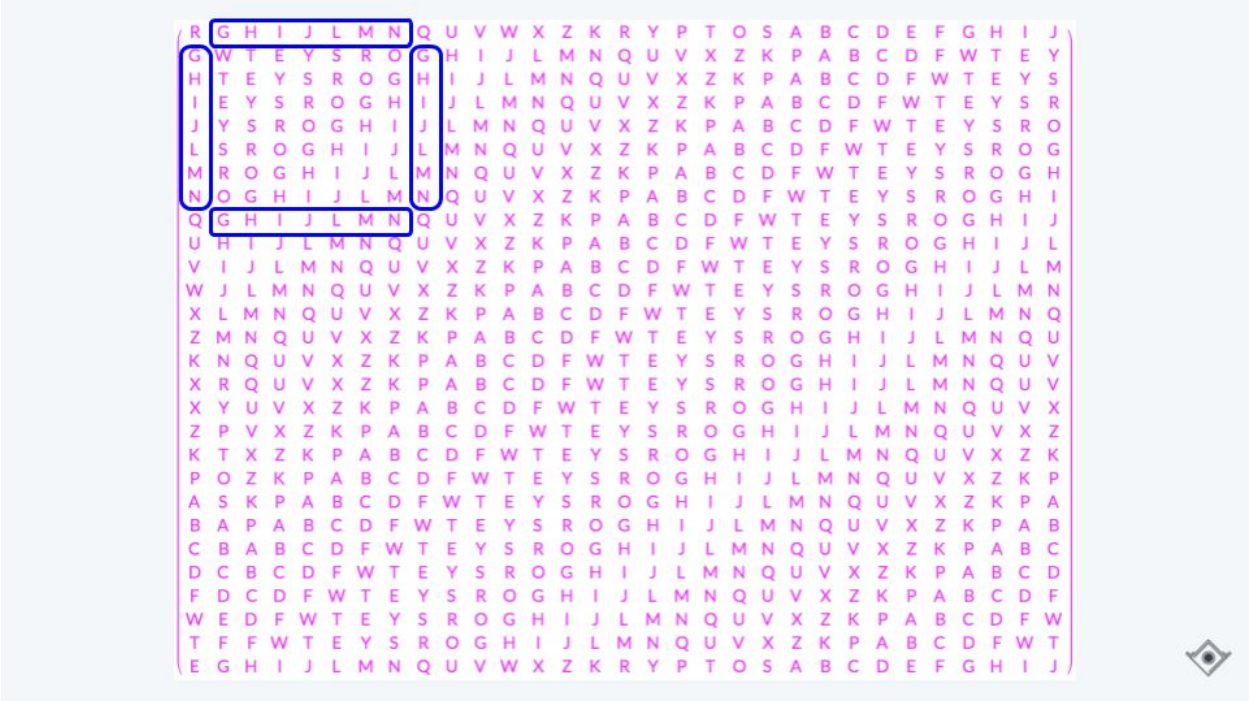
f. Words hidden inside - connection to King Tut's Tomb

**KEYWORD** TEYSROGHILM

| WORD | INTERPRETED DEFINITION |
|---|---|
| Lightsome | : Well lighted : To give light : |
| Regoliths | : The layer of unconsolidated rocky material covering bedrock : |
| Rhyolite | : Rhyolite Nevada Ghost Town |
| Ghostlier | : More ghostly : An apparition of a dead person that is believed to appear or become manifest to the living, typically as a nebulous image. |
| Ogreish | : From Latin - *Orcus* - God of Underworld |

The words here are not as important as the alignment (which signals the transformation is correct), but to me they paint a picture of an eerie entrance to a tomb only lit by the candle we hold, where the ghost of King Tut reigns over the underworld. The ancient Egyptian society was a death oriented culture after all and believed not only in Gods of the underworld, but that the entrance to the underworld (Duat) was a tomb of the deceased.

3. With evidence we are in the right place, we make a breach again in the upper left and find a hole to place a candle.



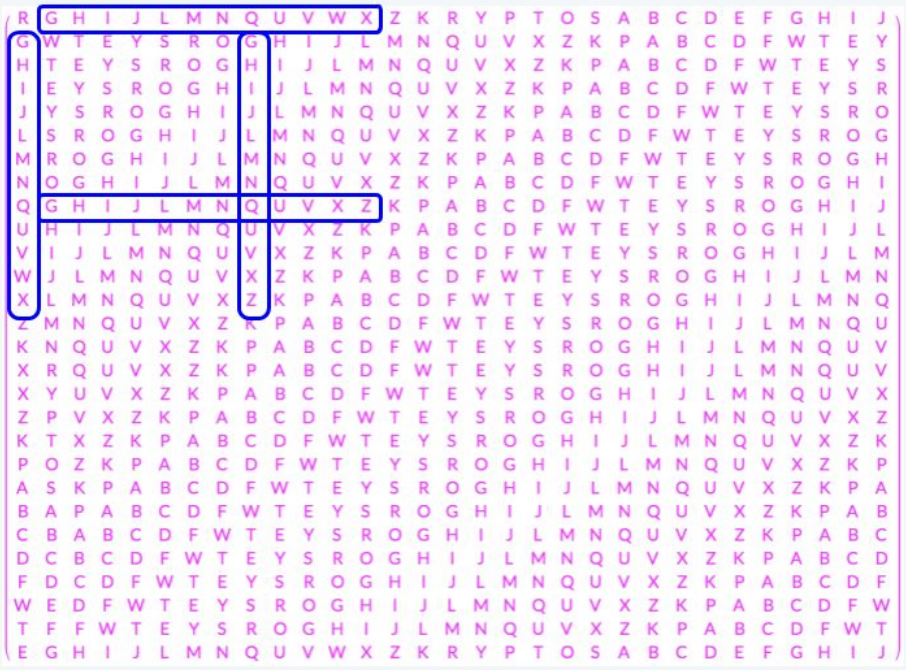

One of the many things I find brilliant about Kryptos is its versatility, reusability and reinterpretation of clues. This is the *palimpsest* phenomenon. Clues like *WW*, *RQ*, *RY* and *do you see anything Q* always seem to come together with such force that it seems the artist makes sure you know when you are lost and when you have found something. In the case above, the corners of the square formed by parallel lines are Qs, and I detected them first before finding the candle or lines. We also can see all the letters for *room*, *gloom*, *light* and *Lester Hill* - who is the creator of the Hill Cipher which we will soon use.

a. We now search the room. This letter matrix is conveniently symmetric, so we only need to check the rows.

| Row | Word | Interpreted Definition |
|---|---|---|
| 1 | Storey | Room at a single position along a vertical scale |
| 2 | Toyer | One who toys; one who is full of trifling tricks; a trifler. |
| 3 | Horsey | Dealing with or devoted to horses |
| 4 | Girl | --- |
| 5 | Roil | Make (a liquid) turbid or muddy by disturbing the sediment :<br>Make (someone) annoyed or irritated |

There are two groups of words that stick out to me here. The first is *Toyer* and *Roil*, as they again go with the theme that something more secretive is going on behind the scenes. Though they may be 4-5 letter words which statistically are easy to make, they do appear in the *apex of the pyramid* which I imagine was highly calculated by the artist. The second group of words is *Storey*, *Horsey* and *Girl*. To me, these are the perfect words used to describe King Tut's tomb. His death was attributed to a *horse*; he was buried in a *girl's* tomb; his tomb was a single *storey*.

b. *Widen the hole a little.*



The parallel lines continue further than the inside square, and if you account for the use of Xs as wildcards, the lines can be thought to continue further.

c. Details of the room are clear

W T E Y S R O G H I J L

| WORD | INTERPRETED DEFINITION |
|---|---|
| Relight | Light (something) again |
| Worthy | Having qualities or abilities that merit recognition in some way |
| Holiest | Belonging to, derived from, or associated with a divine power; sacred. |
| Glister | The quality of shining with a bright reflected light |
| Glories | A highly praiseworthy asset |

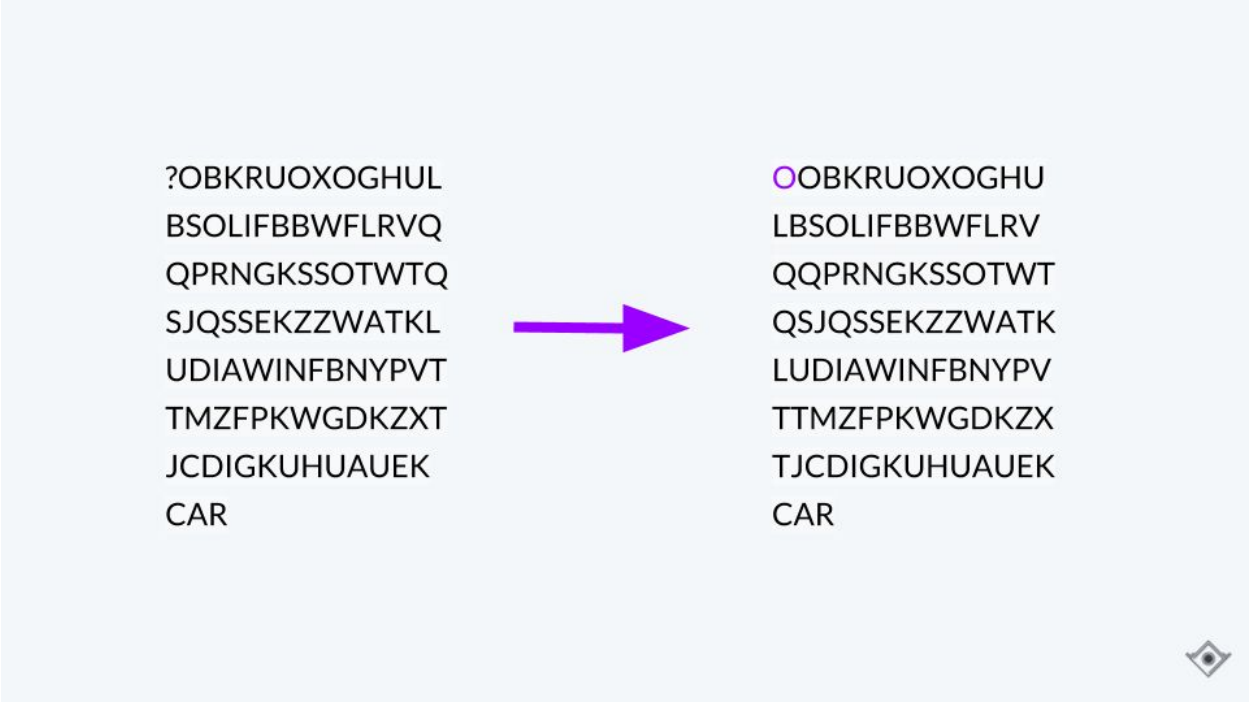
Taking a look at Row 2, we see the original keyword *TEYSROGHIJLM*, but this time it starts at *W* and ends at *L (WTEYSROGHIJL)*. The words we find inside have taken on a whole new significance. To me, it paints a picture of a shimmering grail that sparkles with divinity, and the light it shines is awesomely more powerful than the candle we hold.

d. Now it is time to use Mr. Lester Hill's cipher. You need an invertible matrix, and sure enough, there is one in the room. We will refer to this matrix below as the "*Hill Cipher*" matrix

Is it not a thing of wonder to have Lester Hill with a lit candle in the dark room with us? It is wonderful. This is the invertible matrix we soon use to decrypt the *unsolved Kryptos code* in next steps, but before we do, I need to explain why this is my favorite part.

Kryptos is amazingly powerful, and to me, it is arguably one of the most powerful cryptographic tools on the planet. This is because the matrix above is not the only invertible matrix - there are in fact 143 invertible 7x7 invertible matrices, 6 invertible 14x14 matrices and hundreds of other sizes. When you take into account linear combinations and recursive *key* transforms, the total number of available ciphers is not computable. Again, note that the **invertible matrix used in this solution is the one hidden in the apex of the pyramid**. You can also see that the J in the first column looks like a backwards L, so the word Hill is almost explicitly written.

4. Decode Passage




Recall when we merged the tableaus, we were required to insert an O to make the dimensions work. The same idea applies here. We have a 7x7 invertible matrix and the *unsolved code* has 97 characters which is not divisible by 7. Conveniently the character before the code begins is a question mark, so I interpret this as our missing piece. We therefore insert a *hole* in the upper left hand side again, and apply the Hill cipher using our matrix.

a. This is the code after decryption. For consistency, we can refer to this as the true *candle*.

| Location | Word | Interpreted Definition |
|---|---|---|
| Row 1 | Light<br><br>Wight | Understanding of a problem or mystery : Enlightenment<br>A spirit, ghost, or other supernatural being<br>:A person of a specified kind, especially one regarded as unfortunate (desperate) |
| Row 2 | Aeon<br><br>Eon | Class of powers or beings conceived as emanating from the Supreme Being<br>An indefinite and very long period of time |
| Row 4 | God | The supreme being |
| Column 3 | Goblet | A drinking glass with a foot and a stem : Chalice |

First, take a look at the words that appear verbatim. *Light* is perhaps the best word to have hoped for considering the theme so far. We also have the words *You* and *Wax* align with *WW*, and a phonetic spelling of Lotto which implies a prize *(maybe the latter is a stretch but never underestimate the creators!)*. Visually we can imagine a person (YOU) holding a lit candle. Now take a look at the words discovered. It appears the grail is almost close enough to grab.

Something also worth mentioning is the importance of the words *Wight*, *Aeon* and *Eon*. I chose a less-used definition of Aeon because it fits very well in the spectrum, but commonly Aeon means the same thing as Eon - which is a long period of time. This was a big deal, because part of the final clue I felt lacked evidence was *slowly desperately slowly*. There are also some three letter words and acronyms that appear in L shapes. The word *job* for instance.

b. Place *candle* in the top left hand corner - apply modular alphabetic arithmetic.

| Location | Word | Interpreted Definition |
|---|---|---|
| Row 1 | Clasps<br>Psst | A grip or grasp of the hand<br>Used to capture someone's attention inconspicuously |
| Row 2 | Chugs | A large swig of liquid |
| Row 3 | Mummy | (Egypt) a body of a human being that has been ceremonially preserved |
| Row 4 | Amen | A primeval Egyptian personification of air and breath |
| Column 3 | Upholds | To maintain, affirm, or defend against opposition or challenge<br>: To hold aloft |

I have kept the enclosed portions of letters exactly where they were in the previous step. At first glance only one word appears verbatim, which is *Dig*. It may seem underwhelming but this word is very special. Kryptos artist Jim Sanborn has said that in order to solve Kryptos you have to dig. Dig also appears verbatim in the *unsolved code;* another indicator of its significance. Anecdotally, I can say that in the process of working on Kryptos I have looked at over a thousand matrices of letters assuming *Dig* will be easy to find (it is a three letter word), but the reality is that it is astonishingly rare. I only found it in two defensible places; the second being a symmetric component of the transformed tableau used here.

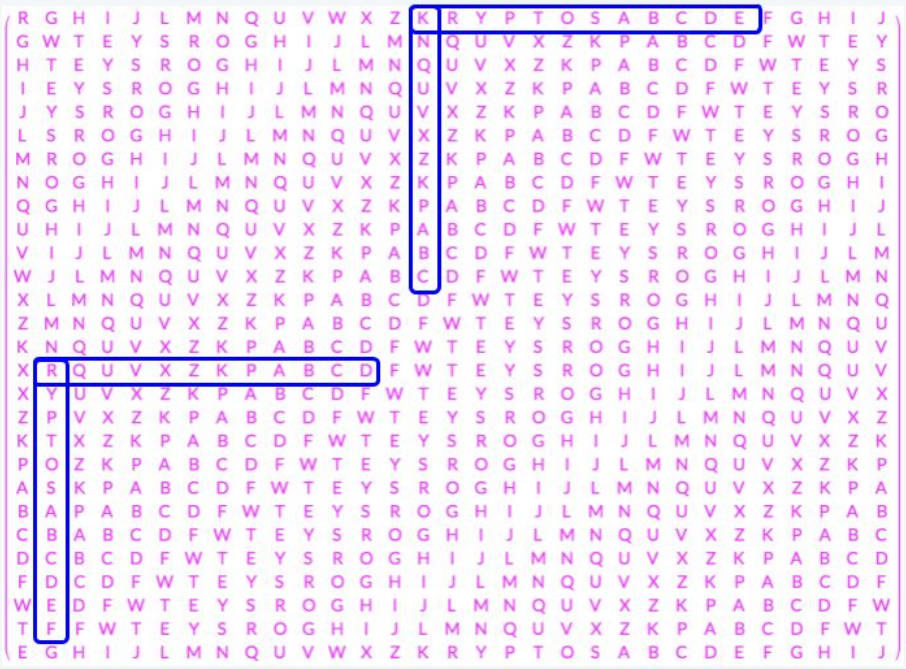
One other peculiar component is what happens to the words *Light* and *You*. *Light* transformed into a sleuth of the word *psst*. As for *You* - have you ever seen when someone writes the letter *i* with a big bubble at the top rather than a dot?

c. Reshape from a 7x14 to 14x7 matrix. This step is hinted at earlier on by the extended parallel lines in the upper left.

| Word | Interpreted Definition |
|---|---|
| Accompanies | Be present or occur at the same time as (something else) |

A few cases of palimpsest really stick out. First, we see our RQ/RY reappear. Below that has the word *key* wrapped around a Q. We also see a square form between the Qs and O on the top and bottom rows, and as the two have been interchangeable in earlier steps, it looks like a square of Qs. The word dig is also unaffected. Looking in the cusp of the RQ/RY there is a 12 character list of letters with no wildcards, which makes the word *Accompanies*.

5. The next step is to decide what *ENOPCAMCAPIS* is meant to *accompany*. Going back to one of the early instances of RQ/RY, recall that we had found the word decrypts. We can also apply this to places where the word Kryptos is still visible, as this seems like an elegant spot to conclude.



a. Apply modular alphabetic addition using *ENOPCAMCAPIS* to each part.

E N O P C A M C A P I S

R Q U V X Z K P A B C D

R Y P T O S A B C D E F

K R Y P T O S A B C D E

K N Q U V X Z K P A B C

b. New codes appear

E N O P C A M C A P I S

VDIKZZWRAQKV

VLDIQSMDCSMX

OEMEVOECBRLW

OAEJXXLMPPJU

c. Discover words inside

| Code | Word | Interpreted Definition |
|---|---|---|
| VDIKZZWRAQKV | Vizard<br>Wizard<br>Izzard<br>Dark | A mask or disguise<br>A wise man : Wonderful<br>A to izzard - "from beginning to end"<br>The absence of light |
| VLDIQSMDCSMX | Disclaims<br>Disclosed<br>Dissolved<br>Misclaims | To reject the claims<br>Make (secret or new information) known<br>To bring to an end<br>A wrong or mistaken claim |
| OEMEVOECBRLW | Overcome | Succeed in dealing with (a problem or difficulty) |
| OAEJXXLMPPJU | Applause | Show strong approval of (a person or action) |

Going back to the idea that Kryptos may consist of misclaims made to achieve greater secrecy; I find this final step supports my theory. Most of the words here are relatively self-explanatory but the ones I want to focus on are *Vizard* and *Wizard*. *Vizard* implies that a mask has been used, and there have been several quotes from Jim Sanborn stating that he "masked the English language". *Wizard* is, in my opinion, one of the best concluding words to my interpretation of Kryptos. Recall the relationship to the Great Pyramid of Giza and *the name which only wise men know*. And last but not least - the very final clue to Kryptos ends with the question - *Do you see anything?* This quote is taken from a historical account of the discovery of King Tut's tomb, where the reply was *"it is wonderful"*.

Additional:

1. Caesar cipher

I want to include this additional component, which is not part of the solution but is something I found the first day I worked on Kryptos. Using only tableau IV, it is clear that the top two rows share an identical key, so a 1:1 mapping is easy. I learned that this is commonly known as a Caesar cipher and he liked to use the number 3. I applied this to tableau IV and found:

I discovered other words hidden as well, but that is not the focus of this paper.