September 1, 2019

tomeoneil@gmail.com

http://www.colinmackinnon.com/newsletter.htm

https://proto57.wordpress.com/tag/nebula/

https://www.jasondavies.com/voynich/#f1r/0.568/0.45/2.00

https://www.youtube.com/watch?v=qDTVEz6rXMQ

https://soundcloud.com/tommy-oneil-265181099/vonyich-futility-clean

https://www.abbreviations.com/abbreviation/Telegram

https://youtu.be/W4G4enbWJYk

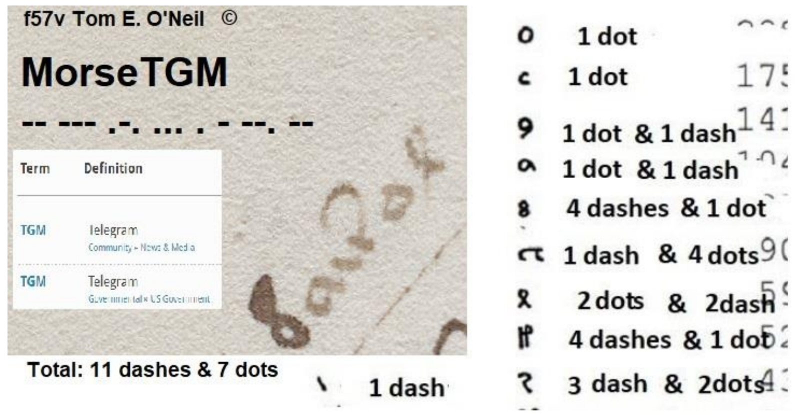
https://youtu.be/WYHb5h4nQqc

Voynich Morse code Steganography Cipher

By

Thomas E. O’Neil

Table of Contents



Preface

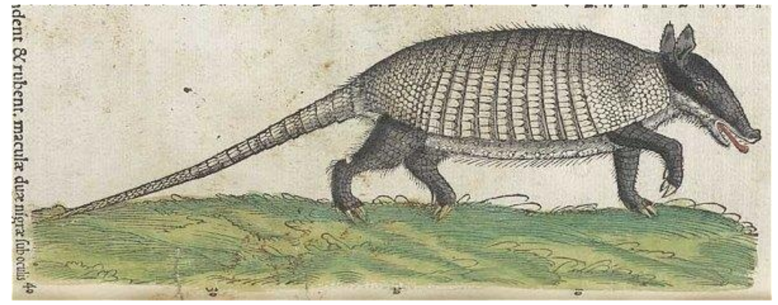
Before I begin, I have constructed an MS Access database using MS Office 2010 containing over 100,000 thousand defined Italian words and if you find some words not defined then go to deepl translator and copy and paste words. This database eases the burden for finding Italian words tremendously while decoding. I use this strategy while decoding Italian words. First I divide the total dash & dot count by 2.5 to get the average length of the Italian word, then I search through the database by setting it to ascending, current document, whole field, all and match case. The average word length helps me identify the likely Italian word. I proceed to type in either dashes & dots, dashes or just dots to find the Italian words which may fit the narrative or a label from the Voynich Manuscript. If you purchase the book I will give you access to download the database from a link, simply notify me from email.

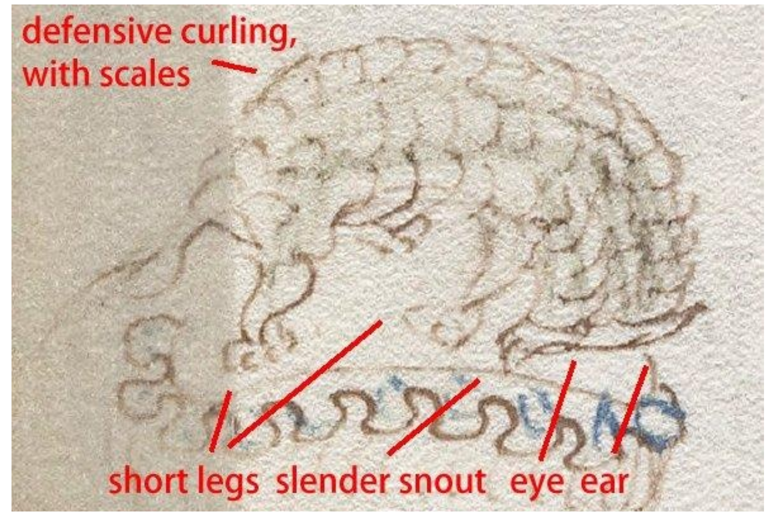
The Voynich Manuscript (VMS) has plagued my mind since 2008 when I first discovered it online. I have tried many options towards figuring out what language and cipher is at the heart of its inner workings. Likewise, I have published several books about its content and honestly I

stated that I believed I had solved the VMS. Deep down, I began to feel more had to be done by me, because those ciphers I produced in retrospect were erroneous. Also at the time I really believed that the VMS's text was created in the 15th Century. However, I have come full circle and this cipher which I created has found evidence to the contrary of the texts time of creation; furthermore I have found its provenance with it. The angst I have felt over the years of feelings of failure have been sidelined by this unique way of decoding the text and it is a modern forgery.

Forward, on how I came up with the idea to use Morse code as a Steganography cipher; I began thinking out of the box by scanning pictures of the actual text and then turning them into .wav files, so that a Morse code decoder program could pick out the text. This idea was done out of the thought that the VMS was produced by alien beings and I know this is funny! After focusing and totally realizing I was wrong about that method, it did shed light on my invention of the cipher to decode the VMS.

As it turned out my thoughts then zeroed in to what if Wilfrid Voynich has hoaxed us all by actually using Steganography and the encoding was Morse code. What is odd about the pictures in the VMS is there are a few anomalies regarding time and origin of some of the images for Europe in the 15th century. Take for instance f68v3 as it appears to be the Andromeda galaxy and no telescopes were around to observe this. Then there is the sunflower on page f33v which was in the America's at the time. Furthermore, on page f80v an Armadillo is evident which is from the America's.





In addition, f33v a root resembles the microscopic structure of a marine organism. Then there's the jigsaw puzzle root on f27v and jigsaw puzzles came out in 1760 by John Spilsbury a London engraver. The image of 69r resembles Carter's Diatom. Lastly the art work is sloppy and all this points to a forgery not to mention fake worm holes.!

This is how you solve the VMS. If you are referring to the voynich glyph's which I am, than order only appears after summation of the glyph's, (as in dashes & dots) when an Italian word is formed from them. I'm in the process of making a video regarding my cipher so that it is simple enough for a 6th grader to comprehend. That should ease everyone's mind.

Try to imagine that the glyphs don't really exist as a language on their own; they are just a mix of dashes & dots until an Italian word is applied to that vord. The cipher never changes as it is now established as bullet proof!

For example a voynich "ror" is in this current state ..---...--- totaling six dashes & five dots. Thus santo could be formed from this set of six dashes & five dots. "Santo" equals ... .- -. - --- which translates to "Holy".

For instance a Voynich “8” equals ----. or it can be in this order --.-- or this order -.--- and this is in abstract Morse code not Morse Code at the moment. Yet then since this is only one glyph which does appear on its own it translates to this Morse Code. -. --- which equals "no" and its the same for Italian.

Add up the total dashes & dots from the glyph's and apply it to an Italian word equal to the dashes & dots of that word, or rarely an English word.

Find an Italian word that equals the total of dashes & dots, apply to Italian word.

This is like anagrams however less words are found due to the dash & dot total key!

With all the research that has been put into figuring out if the VMS is actually a language and not gibberish; the research algorithms have suggested it is a language but what language? My cipher has pinned down Italian as its language. Let’s take a look at what I have to offer and here is an explanation why I think this way.

Why would Wilfrid Voynich Forge MS-408

Let us speculate upon what little facts we have on him. Between 1902 and1908 he was not experiencing a great deal of success and his wife Ethel became Famous with the publication of the Gadfly 1897. Could jealousy provoke him to forge the VMS? He perhaps knowingly sold a forged document of the Columbus Expedition. Richard Santocolma’s theory is that Wilfrid did forge the VMS.

“Also during this time, Voynich sold at least one (known) forgery, the Columbus Miniature. It is considered by some a “Spanish Forger” work, but is also sometimes attributed to another unknown forger or shop. From Wilfrid’s somewhat disingenuous sounding explanations as to where he acquired this work, I suspect he knew it was a forgery, and may have even known its true origin.”

"The Timeline:

A person's life can be divided chronologically in many ways, but for the purposes of this hypothesis, I have done so based on Wilfrid's business operations.

First phase, 1892 to 1902: During this period, Wilfrid built a successful book business, and developed a very positive reputation as a clever and knowledgeable bibliophile and businessman. At the end of this time, 1902, he sold 150 of rare incunabula to the British Library. They rejected several items, including a curious, and previously unknown, 1522 manuscript map related to Magellan's voyage.

As for this "Magellan Map", Wilfrid had said he found it in the binding of a 1536 book. I contend that map may be a fake, and that Voynich was aware it was a fake, and that this demonstrates that he had some connection to the world of forgery- at least, to the very active industry in manuscript map forgeries which existed at the time. I also believe it possible that, rather than the time honored claim of his possessing some incredible talent

at "sniffing out" unknown manuscripts and incunabula, Voynich actually relied mostly on one source: The Florence Libreria Franceschini, the vast stacks of which provided a large number of his acquisitions during this time."

"Third phase, 1908 to 1914: This is the era of Voynich's greatest successes, both economically and popularly. During this time he claims to have found many previously unknown works of immense value, and managed to sell several of them. I feel it is more than coincidental that these successes came soon after his purchase of the vast repositories of the Libreria Francescini, which had mountains of untapped materials… one estimate puts the number at over half a million.

Of course Voynich claimed to have found the Cipher Ms. In a "castle in Southern Europe", and an "Austrian Castle", and later, the Villa Mondragone in Frascati. There were other works which were also later claimed purchased from the Villa, and several of these have various perturbing scholarly and art history anomalies. I feel these problems imply that some may be forgeries, or at least, have forged elements. I won't go into a list of them, here, as this is an ongoing aspect of this work, and very involved. I even think it possible that the Libreria was a place where these forgeries were created, even before Voynich purchased it. Perhaps such operations continued after purchase, or maybe Voynich merely acquired these works along with the business. It is known that at least two "forgery factories" operated in Europe at the end of the 19th, and the beginning of the 20th century, producing maps, manuscripts, paintings, carvings in ivory and wood, castings, other metalwork and jewelry. The works of the famous but enigmatic "Spanish Forger", mentioned above, are considered products of such a factory, of which the location has never been determined.

So during this time, and very possibly at the Libreria, I believe Voynich created his magnum opus of forgery, the Voynich Manuscript, using some blank folios he found there. I also think it may be the only work he personally had a hand in creating. And the claim that the use of early 15th century calfskin is evidence that it must be real, because, supposedly, "the experts got it right", is incorrect: Most experts did not guess early 15th century, before the C14 radio carbon results of 1404 to 1438. In fact, when those results were revealed in the 2010 ORF documentary, they were billed as running counter to previous opinion on the matter. That is, I think the C14 results actually imply a forger's random selection of a then untestable (for age) stock of calfskin.

Fourth phase, 1914 to death: By 1914 Voynich had opened his shop in New York, right across from the New York Public Library. It was during this time that he worked tirelessly to promote his Roger Bacon Cipher Manuscript, showing it, lecturing on it, and passing around 9hotostats to various experts in botany, cryptography, herbals, and so on. By about 1921 the fame of his find was enormous, and it was generally accepted as a Roger Bacon work in the press and popular culture. This was due in no small part to the claims of Romaine Newbold, who famously claimed he could decipher much of it. He believed it contained amazing discoveries and inventions, such as advanced optics capable of seeing details of celestial bodies and microscopic organisms, previously thought discernible only by 19th century optics. This caused an understandable sensation, which in turn caused a scrutiny of not only the Voynich Manuscript, but also the life of Roger Bacon. This increased awareness of the known facts of Bacon's life ended up resulting in string of unintended consequences, which eventually hurt Newbold's reputation, and sent the Voynich spiraling, unidentified, into a scholarly limbo.

By 1928 Wilfrid Voynich was in poor health, and almost broke. He borrowed thousands of dollars, and was unable to sell the Voynich, or any of his greater remaining works. When he died in 1930 everything passed to his wife Ethel, who relied on her trusted friend and longtime employee, Anne Nill, to keep the business afloat. Herbert Garland continued to run the London shop, but the Florence Libreria seems to have been disposed of just after WWI.

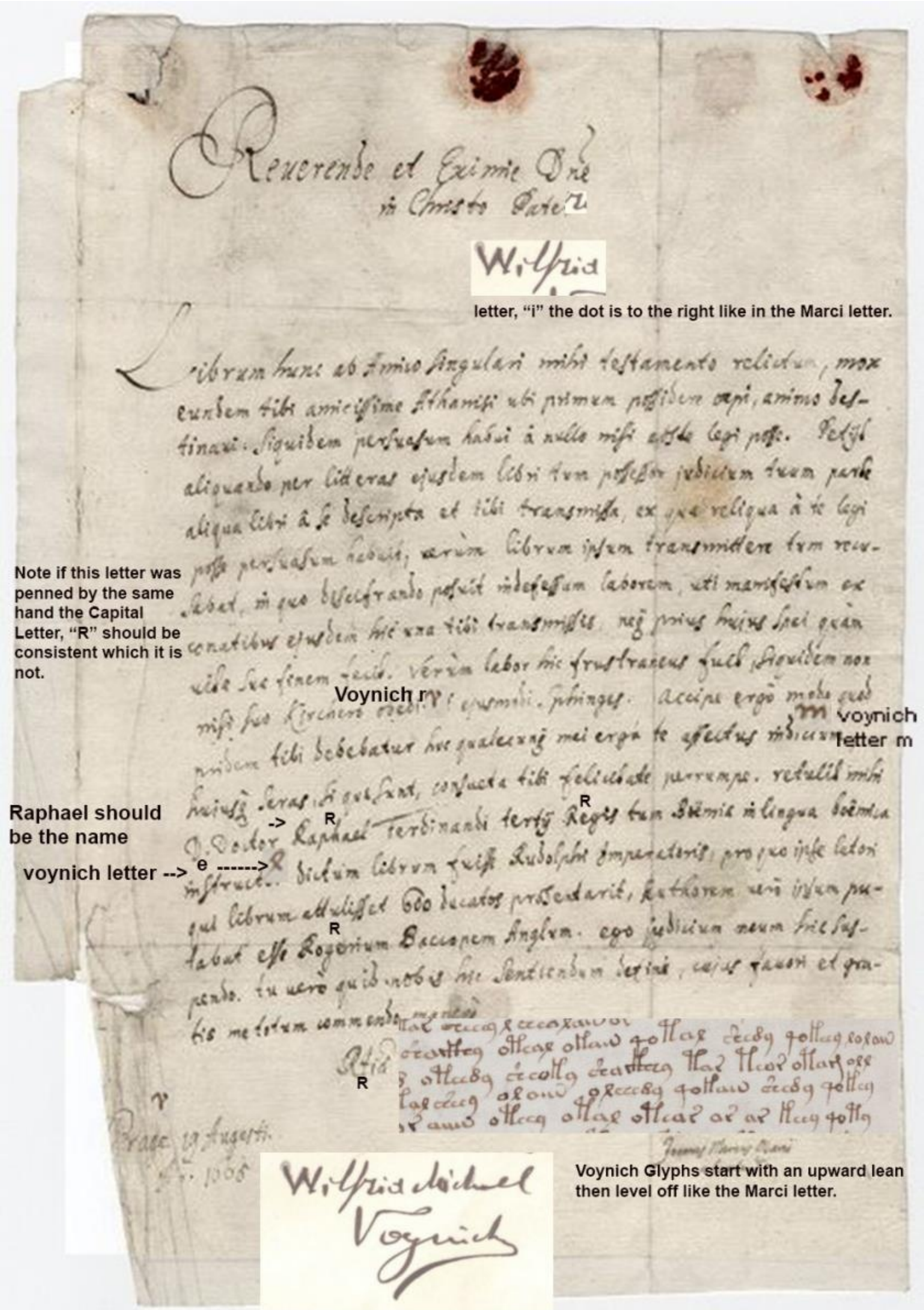
Both Anne and Ethel never gave up hope they would be able to resurrect the reputation of "the Cipher Ms.", and so, its value, and saleability, along with several other works they held. But of course, this never transpired, and the Voynich and other items were donated, sold and dispersed by the bookseller Hans P. Kraus, and are scattered in museums and collections around the world.

Damning Traits: In the 1948 book *Fakes* by Otto Kurz, the author outlines many features and "tells" of forgeries. From this book and others on the history and attributes of forgeries, and how they were reacted to by the scholarly establishment, it has become clear to me that the *Voynich Manuscript is practically a model case of forgery*: Multiple varied and diverse expert opinion as to origin, content, meaning, and era; anachronistic content, including but not

limited to possible modern optical devices, sciences, use of foldouts, imagery, celestial observations, animals, plants, even people; and poor and/or missing and/or contradictory provenance."

https://proto57.wordpress.com/category/history-provenance/

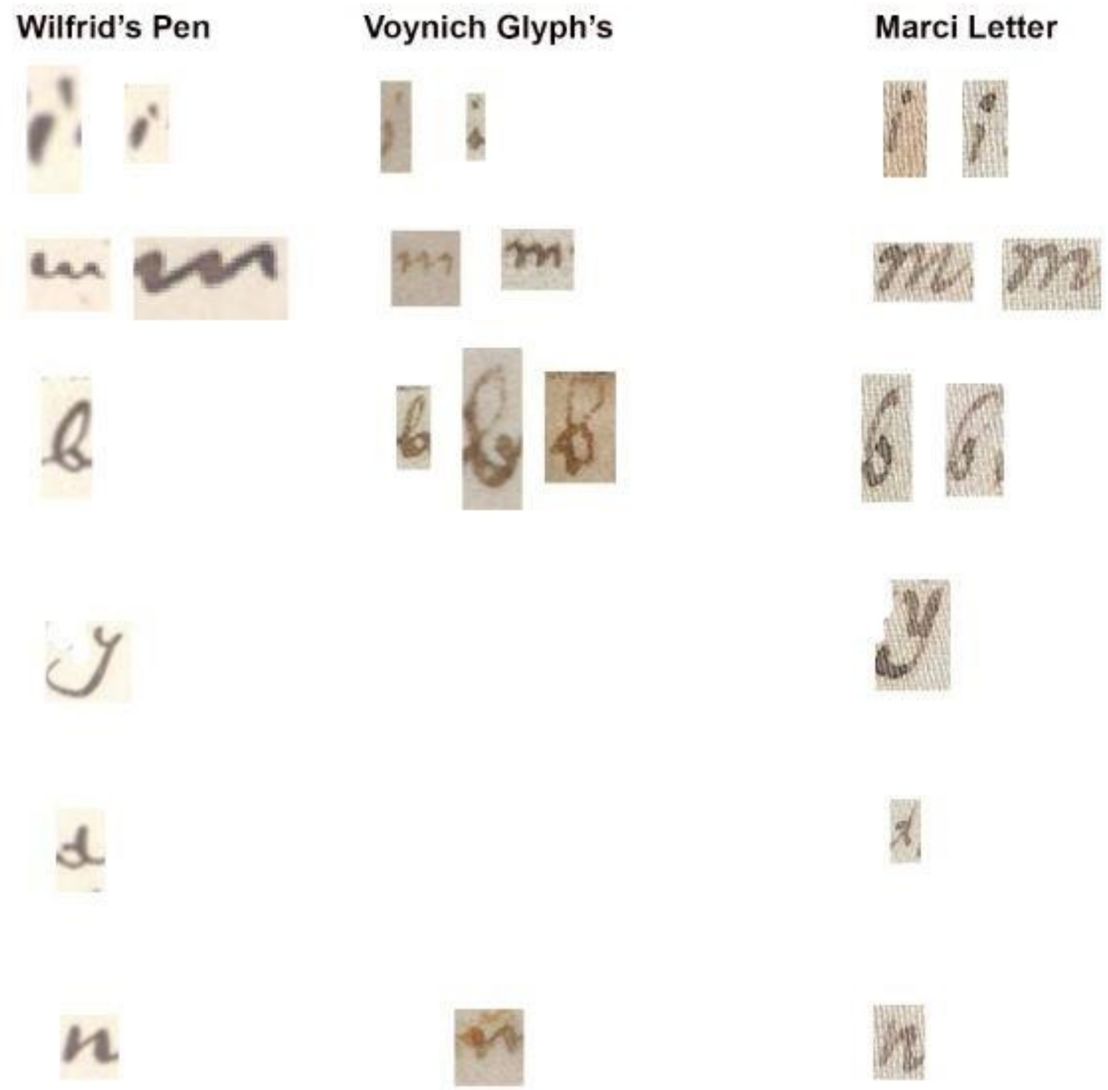
Here are some of the documents which I have provided including a writing analysis of the Marci letter.



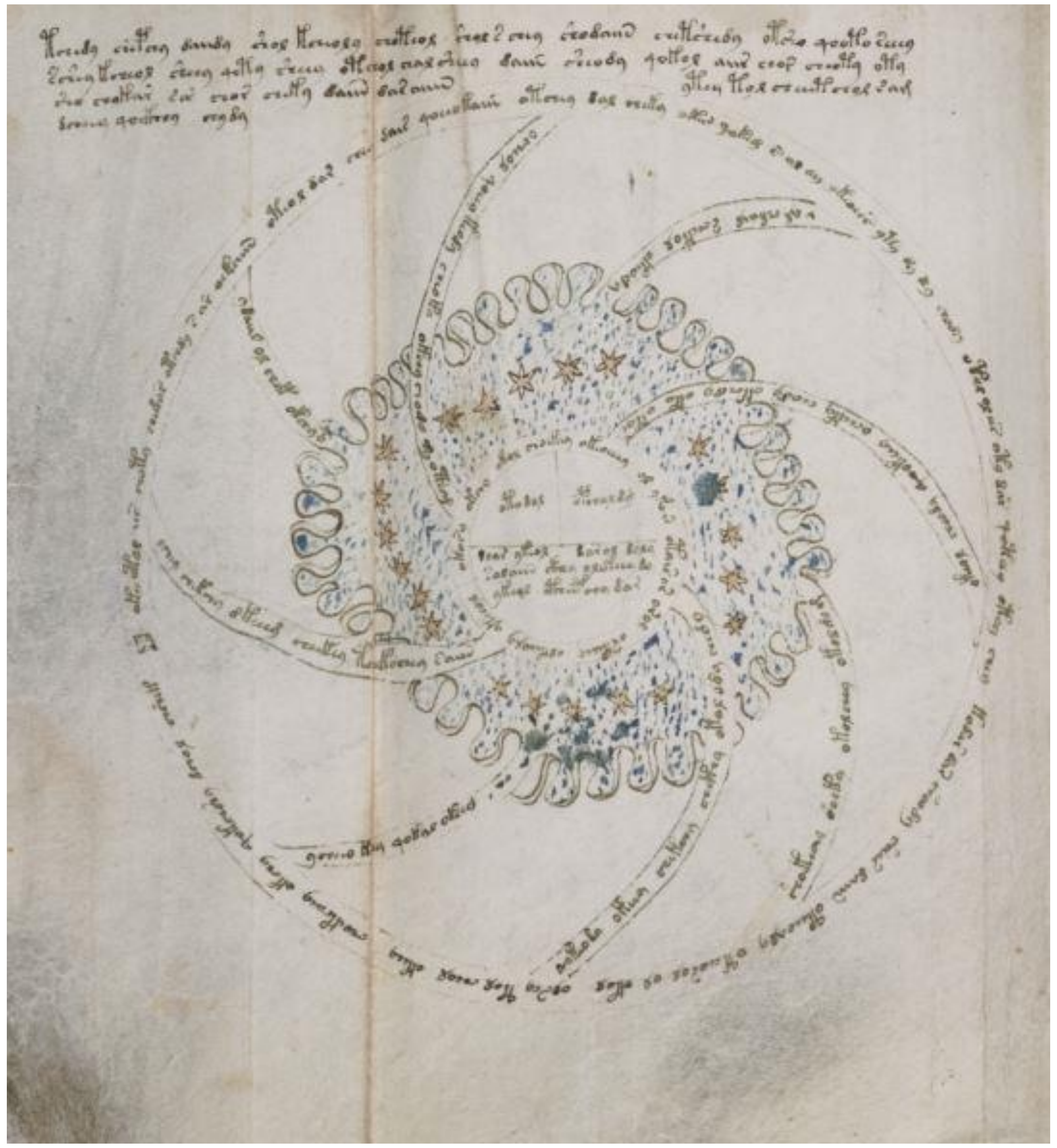
I produced this document about four years ago comparing Wilfrid's Voynich writing to the VMS and the Marci Letter. The letters (r, I, m and n) seem consistent with one hand.

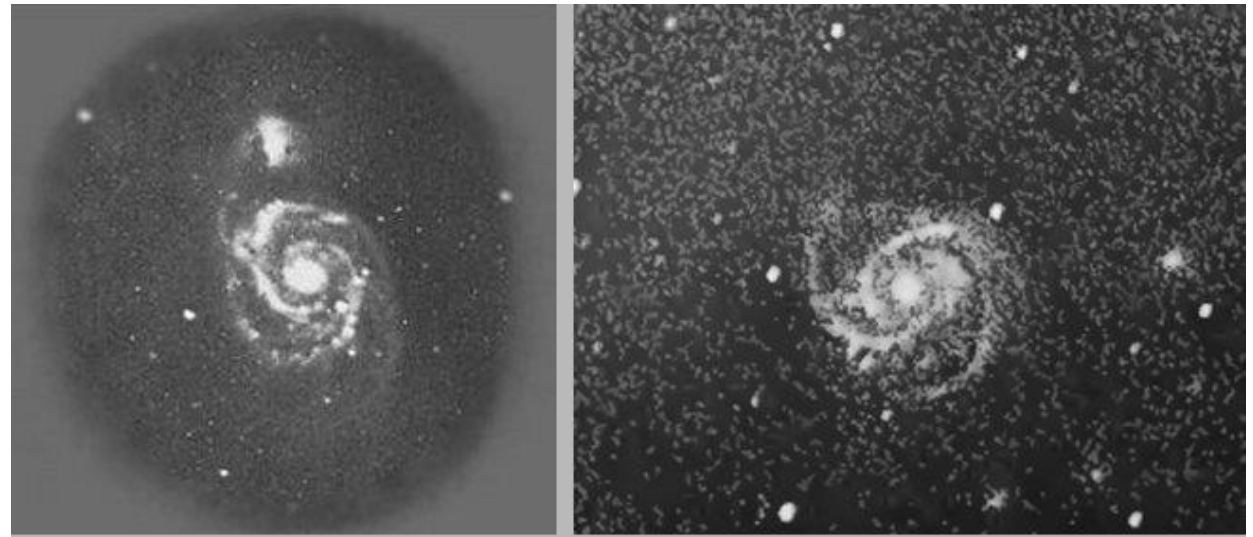
A comparison of penmanship:

By Tom E. O'Neil



If I were to choose one image out of the VMS as the basis of my proof that the document is a hoax it would be the depiction of the Andromeda Galaxy f68v1. To me it adds heavy weight to the fraud theory of the VMS.





Isaac Roberts' M51 and M100 "Comæ"

"Isaac Robert's 1899 Photo of the Andromeda Galaxy"

Morse code Steganography Cipher

It is truly amazing how a mind can strategize in abstract ways better than any computer for problem solving. I have had many a night's in depression thinking of ways to slay the VMS dragon. As matter of fact this problem has been rolling around my neurons for 11 long years thanks to visiting a website online named Grahamhancock. Finally I'm relaxed and I believe I have solved the encoding of MS-408.

The idea which launched me into writing this book was ironically that an alien from another world created the document with the tools of the day. This is how crazy it gets when faced trying to solve such an annoying problem of a bizarre text full of words constructed in an abstract manner! My method was to use technology which is available on the internet and the software I used was audiopaint and painttosound. I would scan voynich vords into the program and make a .wav recordings. Then I would use a site to either transcribe the message from the image via .wav speech to text or Morse code. After spending a few days doing this with no success I thought why not *create a cipher decoder with the loops in the text as dots and the horizontal lines as dashes and construct a cipher.* As I worked I then tested it on folio 1r for the first few words of its text. Thanks to UFO's it's done lol!

I found the language to be Italian and here is how to decode is my system for transmitting Morse code from glyphs. What I did was to interpret lines in the glyphs as dashes and loop enclosures as dots. I have

produced many Italian words with the system and you are now privy to them.

http://www.unit-conversion.info/texttools/morse-code/

Now let me show you through pictures how you decode a Voynich word. We will begin with the very first word of the VMS. Here is the image with instructions.

The eva glyph f can actually vary in meaning in interpreation due to the nature of the constructed encoding the glyph is represented as 4 dashes and 2 dots.

The method of decoding is to add up all the dots and dashes and farm out a word that fits in the Italian language to the total dot and dash count.

My thoughts on Newbold’s translation attempts with MS-408 are conspiracy oriented. My meaning is that I speculate Wilfrid might have intently set the path for Newbold’s Steganography attack on the VMS as a test to see how tough his cipher was. Wilfrid may have pretended to be speaking out loud while Newbold was in ear shot telling him it was a Steganography cipher to see if Newbold could crack it.

WILLIAM ROMAINE NEWBOLD
1865-1926

Newbold’s method of attack to decode the voynich was stenographic form of Greek shorthand where each letter could contain up to 25 strokes.

“If Newbold’s methods were obscure, his findings were dramatic. He believed he had stumbled on Bacon’s magnum opus, the summation of the hidden achievements of the greatest scientist of the Middle Ages. One passage has Bacon describing (and correctly dating) an eclipse that took place in the summer of 1290. Another passage, taken from a page that bears an illustration of a large, starry diadem, Newbold translated as follows: "In a concave mirror I saw a star in the form of a snail...between the navel of Pegasus, the girdle of Andromeda, and the head of Cassiopeia." Astronomers confirm that this is a valid description of the great nebula in the constellation Andromeda, which we now know to be a spiral galaxy. Other facts that Newbold "discovered" in the Voynich manuscript include the date of a comet that appeared in 1273 and a method for refining copper from ore. Newbold’s decipherment credits Bacon with the invention of the microscope and the telescope and with discoveries both micro- and macroscopic that remained hidden to science until centuries later.

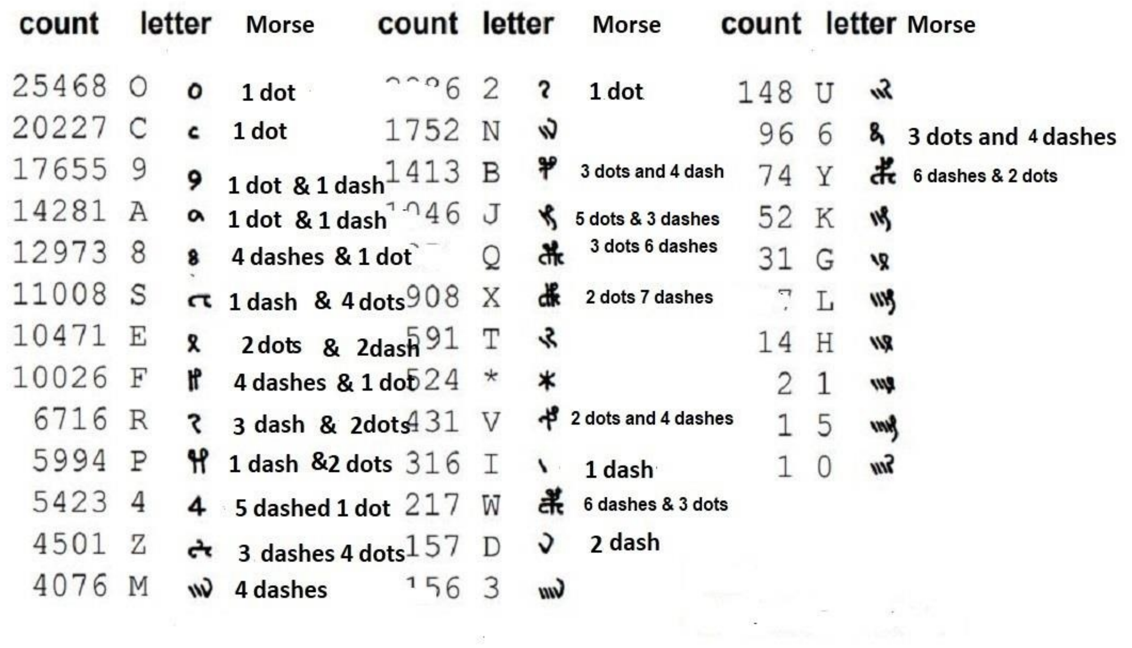
To add credence to his theory, Newbold claimed that he had no prior knowledge of chemistry or astronomy. His discoveries caught the attention of the national media. All the major newspapers ran articles, as did The Nationand Scientific American. A madwoman made a pilgrimage to Newbold’s home and begged him to use Bacon’s magic to exorcise her demons.

”

http://linguafranca.mirror.theinfo.org/9904/grossman.html

Here is the actual cipher that I created from the glyphs of the VMS. The decoding method is visual with the dots and dashes; where an enclosed letter equals a dot and horizontal portion of the glyph is a dash. There are some or statements where glyphs can vary in its representation for its output decoded letter. So this is what I believe Wilfrid encoded.

Wilfrid Michael Voynich
book dealer



count	letter	Morse	count	letter	Morse	count	letter	Morse
25468	O	1 dot	[illegible]6	2	1 dot	148	U	
20227	C	1 dot	1752	N		96	6	3 dots and 4 dashes
17655	9	1 dot & 1 dash	1413	B	3 dots and 4 dash	74	Y	6 dashes & 2 dots
14281	A	1 dot & 1 dash	[illegible]46	J	5 dots & 3 dashes	52	K	
12973	8	4 dashes & 1 dot		Q	3 dots 6 dashes	31	G	
11008	S	1 dash & 4 dots	908	X	2 dots 7 dashes	[illegible]	L	
10471	E	2 dots & 2dash	591	T		14	H	
10026	F	4 dashes & 1 dot	524	*		2	1	
6716	R	3 dash & 2dots	431	V	2 dots and 4 dashes	1	5	
5994	P	1 dash &2 dots	316	I	1 dash	1	0	
5423	4	5 dashed 1 dot	217	W	6 dashes & 3 dots			
4501	Z	3 dashes 4 dots	157	D	2 dash			
4076	M	4 dashes	156	3				

I designed a program in python which outputs anagrams. You may find this tool useful for your decoding methods. You will need the latest python interpreter. To decode a VMS vord, total up all the dots and dashes and then try and find Italian a word which equals the same total sum in Morse code for a VMS vord. This is sort of difficult and that is why you get the code with the book purchase. You could use this anagram engine.

https://ingesanagram.appspot.com/

```
print("Author Thomas O'Neil, copyright ver 0.1,VMS Italian Steganongraphy Morse Code to Anagrams, August 8, 2019")

# Python program to implement Morse Code Translator

'''
```



```
VARIABLE KEY

'cipher' -> 'stores the morse translated form of the english string'

'decipher' -> 'stores the english translated form of the morse string'

'citext' -> 'stores morse code of a single character'

'i' -> 'keeps count of the spaces between morse characters'

'message' -> 'stores the string to be encoded or decoded'

'''

# Dictionary representing the morse code chart

MORSE_CODE_DICT = { 'A':'.-', 'B':'-...',
                    'C':'-.-.', 'D':'-..', 'E':'.',
                    'F':'..-.', 'G':'--.', 'H':'....',
                    'I':'..', 'J':'.---', 'K':'-.-',
                    'L':'.-..', 'M':'--', 'N':'-.',
                    'O':'---', 'P':'.--.', 'Q':'--.-',
                    'R':'.-.', 'S':'...', 'T':'-',
                    'U':'..-', 'V':'...-', 'W':'.--',
                    'X':'-..-', 'Y':'-.--', 'Z':'--..',
                    '1':'.----', '2':'..---', '3':'...--',
                    '4':'....-', '5':'.....', '6':'-....',
                    '7':'--...', '8':'---..', '9':'----.',
                    '0':'-----', ', ':'--..--', '.':'.-.-.-',
                    '?':'..--..', '/':'-..-.', '-':'-....-',
```

```
                    '(':'-.--.', ')':'-.--.-',}

# Function to encrypt the string
# according to the morse code chart
def encrypt(message):
    cipher = ''
    for letter in message:
        if letter != ' ':

            # Looks up the dictionary and adds the
            # correspponding morse code
            # along with a space to separate
            # morse codes for different characters
            cipher += MORSE_CODE_DICT[letter] + ' '
        else:
            # 1 space indicates different characters
            # and 2 indicates different words
            cipher += ' '

    return cipher

# Function to decrypt the string
# from morse to english
```



```
def decrypt(message):

    # extra space added at the end to access the
    # last morse code
    message += ' '

    decipher = ''
    citext = ''
    for letter in message:

        # checks for space
        if (letter != ' '):

            # counter to keep track of space
            i = 0

            # storing morse code of a single character
            citext += letter

        # in case of space
        else:
            # if i = 1 that indicates a new character
            i += 1
```

```
                # if i = 2 that indicates a new word
                if i == 2 :

                    # adding space to separate words
                    decipher += ' '
                else:

                    # accessing the keys using their values (reverse of encryption)
                    decipher += list(MORSE_CODE_DICT.keys())[list(MORSE_CODE_DICT
                    .values()).index(citext)]
                    citext = ''

        return decipher
def anagrams(word):
    """ Generate all of the anagrams of a word. """
    if len(word) < 2:
        yield word
    else:
        for i, letter in enumerate(word):
            if not letter in word[:i]: #avoid duplicating earlier words
                for j in anagrams(word[:i]+word[i+1:]):
                    yield j+letter
```



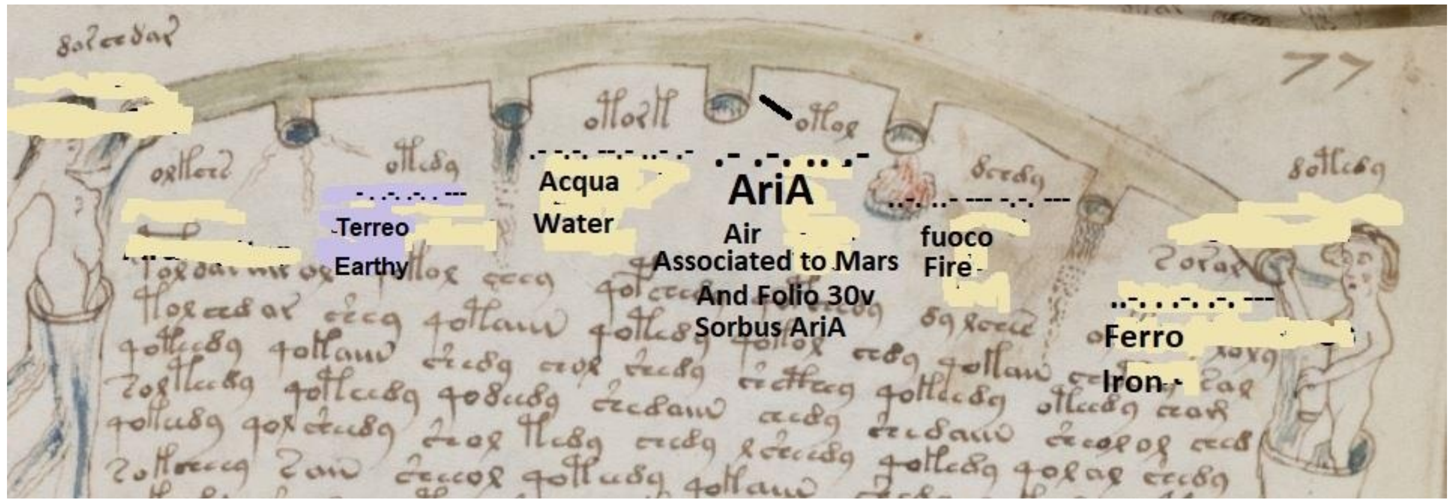
```
# Hard-coded driver function to run the program
while True:
    def main():


        message = input ("Type in Morse Code to output anagrams!: ")
        result = decrypt(message)
        print (result)
        return result # return result
    for i in anagrams(main()):
        print (i)




# Executes the main function
if __name__ == '__main__':
    main()
```

Now I would like to show off what many have claimed to be alchemy in the VMS in f77r. I was very happy to see that otol which is for eva translated to Aria in Italian which is Mars too indirectly through Ares and the Romans Mars is the God of War.



As you can see all the labels are decoded and seem to fit nicely. The female right is collecting the elixir potion from their kiln.

Another picture in VMS where cipher ideas arise would be folio f57v. Some proof that I'm on to something is the key which the lady hold's in her right hand at 3 o'clock. It is a ring and it is enclosed signifying to me a **dot** for a Morse code cipher.

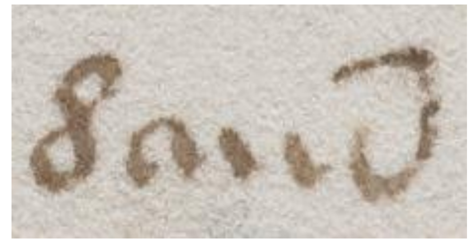
Let's discuss the most frequent word in the VMS and that is daiin in eva!

Uomo

..- --- -- ---

With my Morse code method I have decoded it to be "uomo" in Italian. This word oumo translates to, (man)!

https://www.wordreference.com/iten/orto

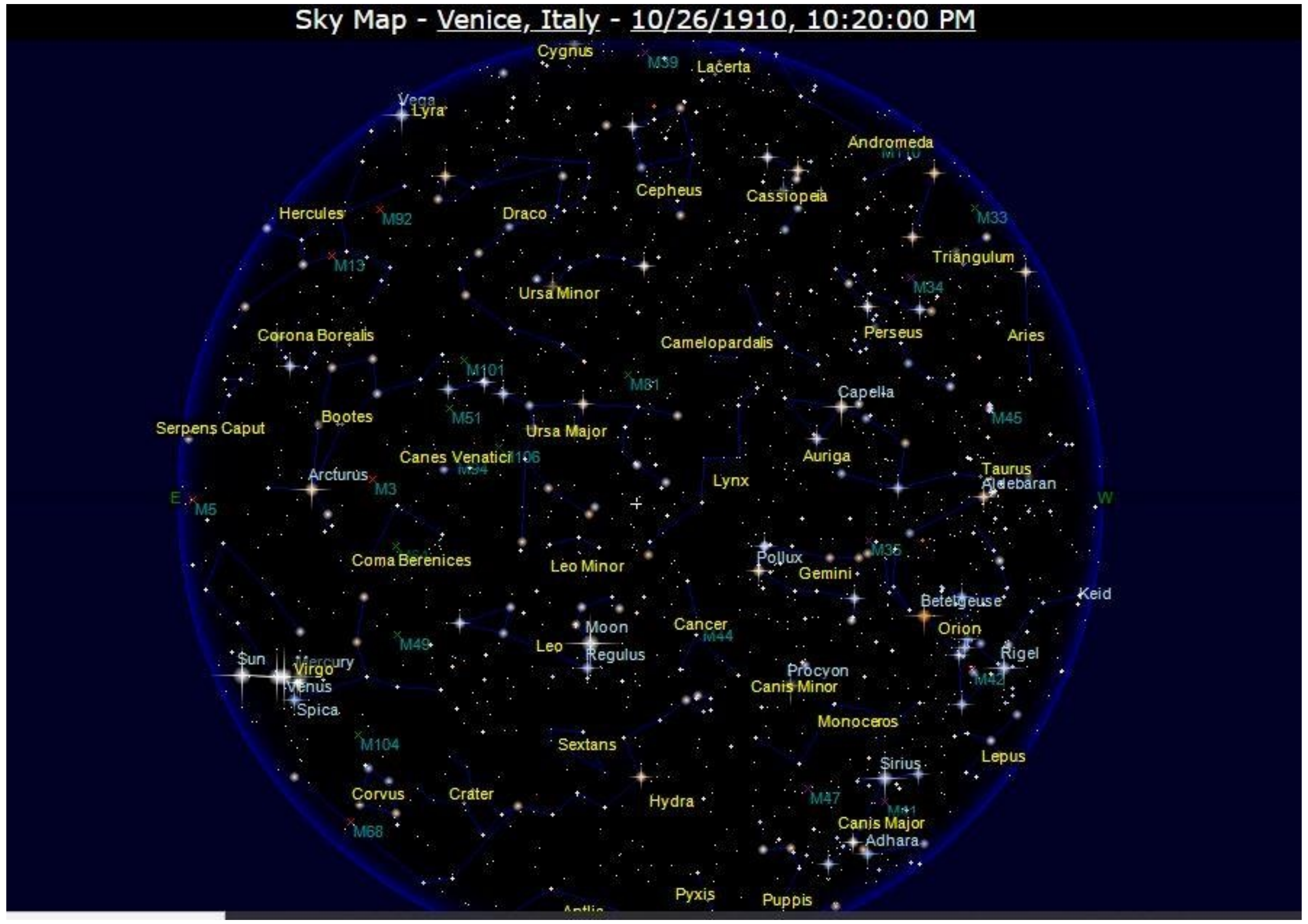


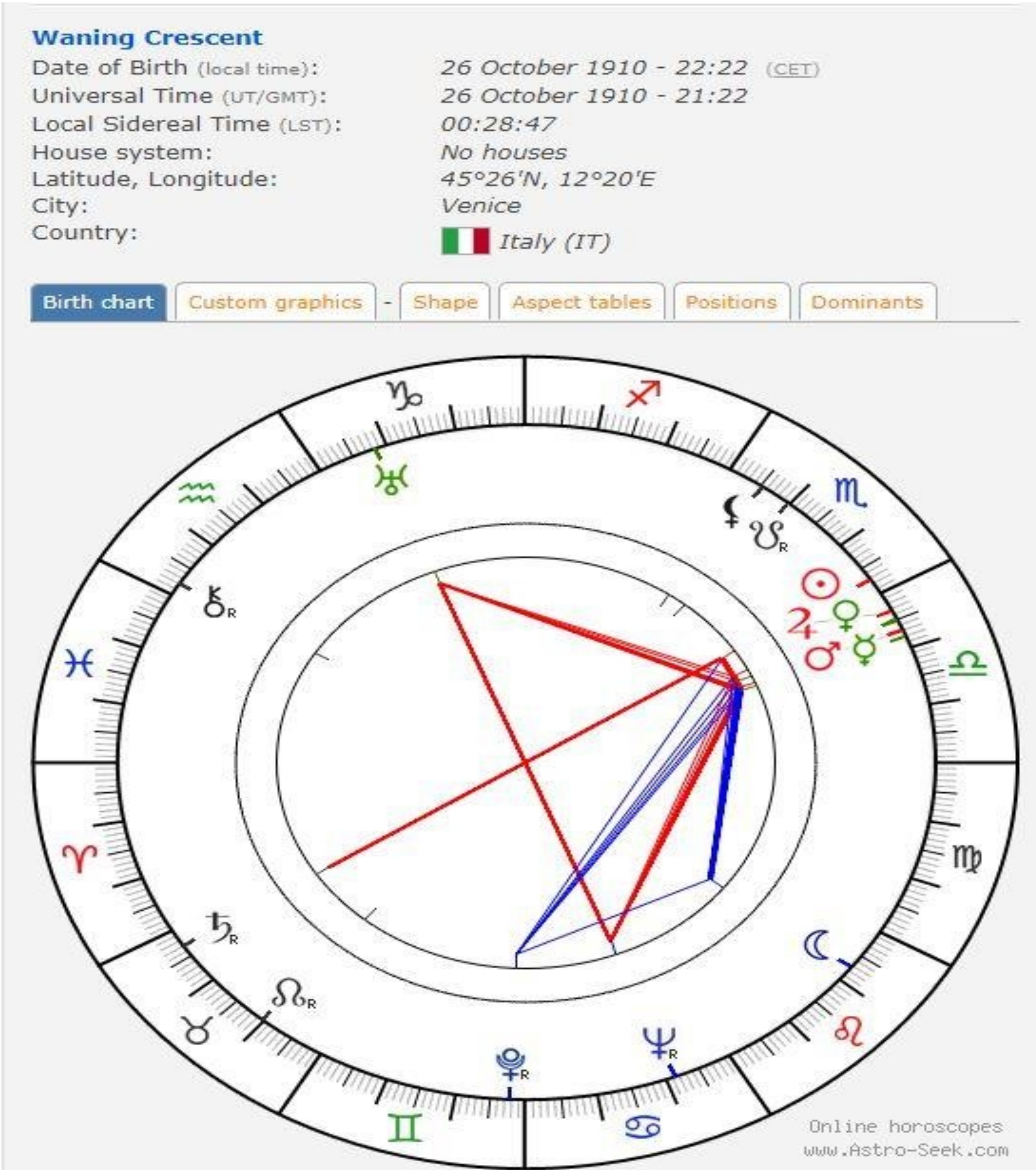
Maybe now you are seeing why running a frequency analysis on the letters for any language and trying to decode the VMS from a traditional method is fruitless. As it stands the glyphs vary in representation for the output of the decoded text. This is essential to decoding the text and a variable Steganography Morse cipher achieved the encoding and decoding of the text. As it is the VMS is plainly not simple for reading. Believe me I have tried many cipher to attack the VMS with and these include Alberti, Vegenere, Playfair and Caesar. Also I have tried Gematria, Numerology and anagrams and nothing works as-well as this cipher.

Provenance

I place the provenance for the VMS between 1910 and 1911. Wilfrid Voynich worked from his Florence office and London too. He had purchased a library known as Libraria Franceschini in Florence in 1908. The library contained a half-million items including old vellum which I believe was used in the manufacturing of the VMS by Voynich. Wilfrid left a big opening for anyone to pin down squarely the time of creation of the VMS. Folio 68r1 is a astrolabe regarding the stars, if decoded would reveal the positions and would indicate a place in the night sky to view from. Thus the location for the VMS creation date and time could be found if the data was analyzed to reveal the location of where the VMS was created. This is what I found within f68r1. Andromeda is obviously in the folio on the outer rim at 1 o'clock and the Northern sun indicates she was released from chains just like in the Andromeda mythology. The bottom waning crescent moon was also found in this time period from

Venice, Italy.





Side Note: Andromeda has no bench cliff, under a Microscope it is not attached horizontally, also there is a tiny *dot between the Star symbol and the beginning of the* voynich glyph "o" to complete the word Andromeda in Morse Code. Also the picture with the eyes spying the Andromeda Star I believe is a drawing for Andromeda as she was the daughter of Cepheus.

Andromeda is a Greek name and in the image she has a Greek head band.

Arrow indicates 10 dots total

Gianfar if off a place by an inch. Mekbuda is off by a half inch and Altair is about to rise.

Rotte

.-. --- -- .

Broken

Tolgo

- --- .-.. --. ---

I take off

Scatenarono

... -.-. .- - . -. .- .-. --- -. ---

Unleashed

Creavo vista delle mappa star grafici zenit

I created view of the mapped star graphics zenith.

Contassi segnavo vidi decine pernottano bel stelle

I counted, I marked, I saw dozens overnight, beautiful stars

Cosmi travaso illuminino amerete mio temi Santa

Cosmos pouring light. You will love my topics Holy

Cristo Pastore anima Santo Monarca magistrato

Christ Shepherd, Spirit, Holy King, Judge

Mietuti mondo

-- .. . - ..- - ..|-- --- -. -.. ---|

harvested world.

Ora declinare aggrottate

Now Diminishing furrowed

lunata acuta

Moon acute

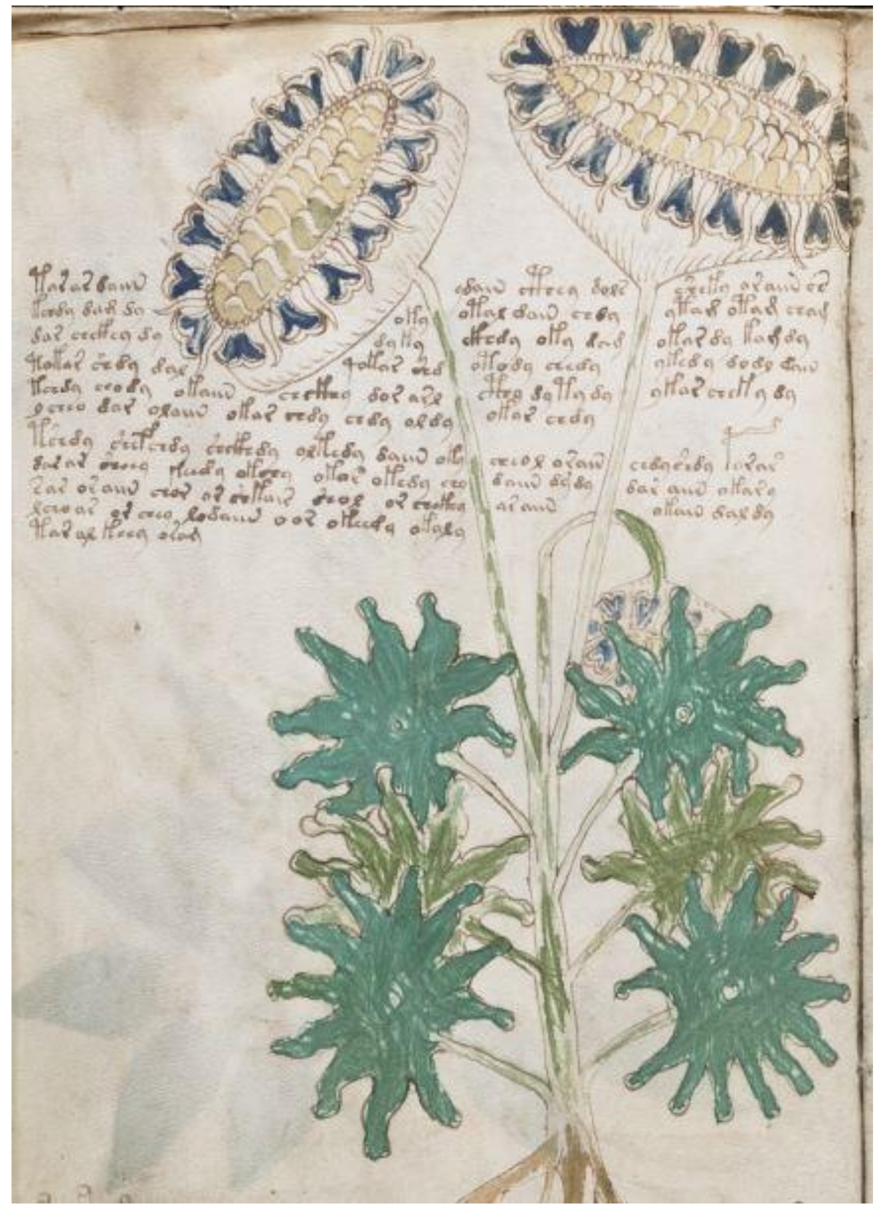
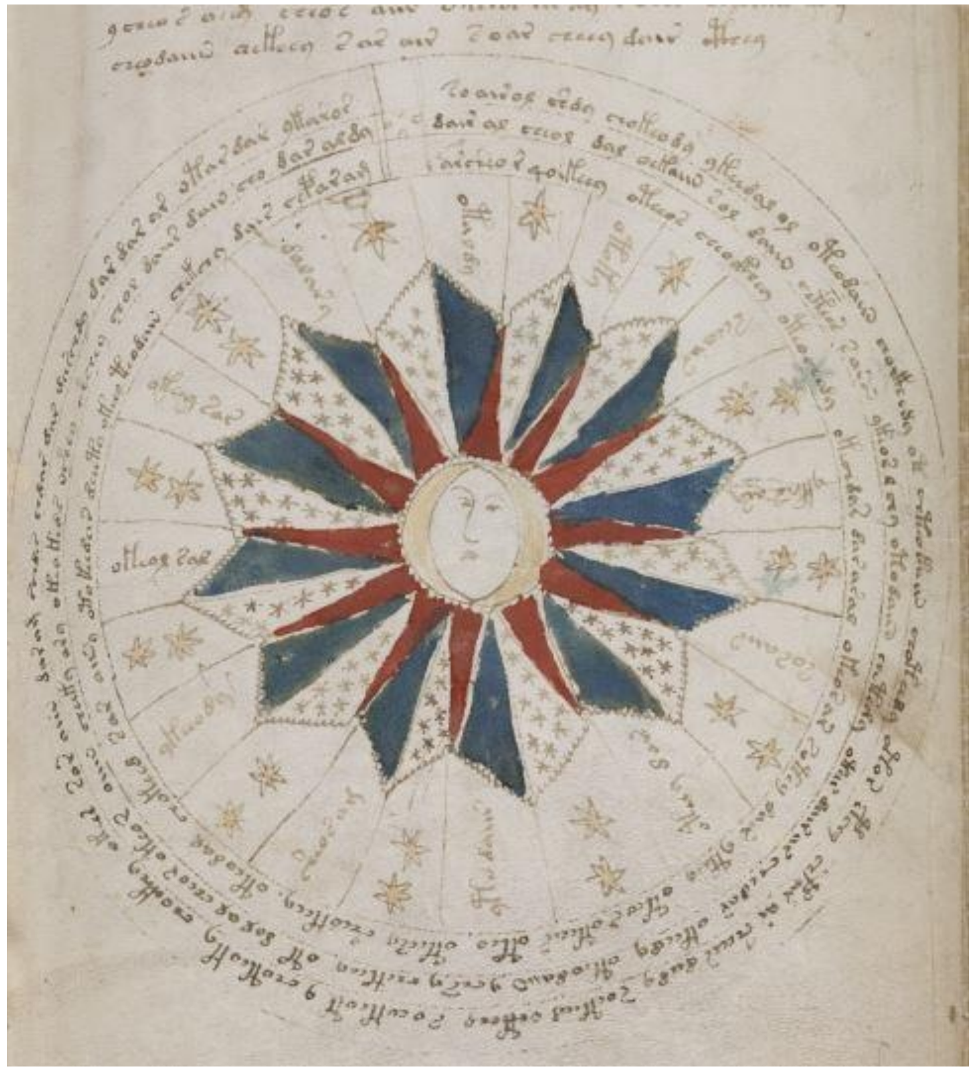
October 26, 1910 Venice Italy 10:22 PM

Do you see the correlation here? This is strong evidence for Provenance through the use of f68r1? Time and location does not lie and so this cipher looks strong.

Wilfrid also forged the Tepenenze signature

My Favorite Pictures from the VMS

Most of the art work is poor in my humble opinion and it looks like it was done in haste like the nymphs faces. If this was an authentic art piece and text more care would have been put in place for the art I believe. Most frauds are done in haste for various reasons like fame greed or praise. However there are two folios which I feel are classics in the art world and so let's take a look at what I like from the voynich manuscript image wise. The images I like are f33r and f67r1!



History

Rather then I writing out all my thoughts based on the history of the Voynich Manuscript and risking mistakes I will rely on wikepedia, although I don't agree that the VMS is a 15th century document.

"The **Voynich manuscript** is an illustrated codex hand-written in an unknown writing system. The vellum on which it is written has been carbon-dated to the early 15th century (1404–1438), and it may have been composed in Italy during the Italian Renaissance.[1][2] The manuscript is named after Wilfrid Voynich, a Polish-Samogitianbook dealer who purchased it in 1912.[18]

Some of the pages are missing, with around 240 remaining. The text is written from left to right, and most of the pages have illustrations or diagrams. Some pages are foldable sheets.

The Voynich manuscript has been studied by many professional and amateur cryptographers, including American and British codebreakers from both World War Iand World War II.[19] No one has yet demonstrably deciphered the text, and it has become a famous case in the history of cryptography. The mystery of the meaning and origin of the manuscript has excited the popular imagination, making the manuscript the subject of novels and speculation. None of the many hypotheses proposed over the last hundred years has yet been independently verified.[20]

In 1969, the Voynich manuscript was donated by Hans P. Kraus[21] to Yale University's Beinecke Rare Book and Manuscript Library, where it is catalogued under call number MS 408.[12][22]

Codicology[edit]

The codicology, or physical characteristics of the manuscript, has been studied by researchers. The manuscript measures 23.5 by 16.2 by 5 cm (9.3 by 6.4 by 2.0 in), with hundreds of vellum pages collected into 18 quires. The total number of pages is around 240, but the exact number depends on how the manuscript's unusual foldouts are counted.[12] The quires have been numbered from 1 to 20 in various locations, using numerals consistent with the 1400s, and the top righthand corner of each recto(righthand) page has been numbered from 1 to 116, using numerals of a later date. From the various numbering gaps in the quires and pages, it seems likely that in the past the manuscript had at least 272 pages in 20 quires, some of which were already missing when Wilfrid Voynich acquired the manuscript in 1912. There is strong evidence that many of the book's bifolios were reordered at various points in its history, and that the original page order may well have been quite different from what it is today.[13][10]

Parchment, covers, and binding[edit]

Radiocarbon dating of samples from various parts of the manuscript was performed at the University of Arizona in 2009. The results were consistent for all samples tested and indicated a date for the parchment between 1404 and 1438.[23] Protein testing in 2014 revealed that the parchment was made from calf skin, and multispectral analysis showed that it was unwritten on before the manuscript was created. The parchment was created with care, but deficiencies exist and the quality is assessed as average, at best.[23] The parchment is prepared from "at least fourteen or fifteen entire calfskins".[24]

Some folios are thicker than the usual parchment thickness, such as folios 42 and 47.[25]

The goat skin[26] binding and covers are not original to the book, but date to its possession by the Collegio Romano.[12] Insect holes are present on the first and last folios of the manuscript in the current order and suggest that a wooden cover was present before the later covers, and discolouring on the edges points to a tanned-leather inside cover.[23]

Ink[edit]

Many pages contain substantial drawings or charts which are colored with paint. Based on modern analysis using polarized light microscopy (PLM), it has been determined that a quill pen and iron gall ink were used for the text and figure outlines; the colored paint was applied (somewhat crudely) to the figures, possibly at a later date. The ink of the drawings, text and page and quire numbers have similar microscopic characteristics. Energy-dispersive X-ray spectroscopy (EDS) performed in 2009 revealed that the inks contained major amounts of iron, sulfur, potassium, calcium and carbon and trace amounts of copper and occasionally zinc. EDS did not show the presence of lead, while X-ray diffraction (XRD) identified potassium lead oxide, potassium hydrogen sulphate and syngenite in one of the samples tested. The similarity between the drawing inks and text inks suggested a contemporaneous origin.[13]

Paint[edit]

The blue, clear (or white), red-brown, and green paints of the manuscript have been analyzed using PLM, XRD, EDS, and scanning electron microscopy (SEM). The blue paint proved to be ground azurite with minor traces of the copper oxide cuprite. The clear paint is likely a mixture of eggwhite and calcium carbonate, while the green paint is tentatively characterized by copper and copper-chlorineresinate; the crystalline material might be atacamite or another copper-chlorine compound. Analysis of the red-brown paint indicated a red ochre with the crystal phases hematite and iron sulfide. Minor amounts of lead sulfide and palmierite were possibly present in the red-brown paint.[13] The pigments were considered inexpensive.[23]

Retouching[edit]

Computer scientist Jorge Stolfi of the University of Campinas highlighted that parts of the text and drawings are modified, using darker ink over a fainter earlier script. Evidence for this is visible in various folios, for example *f1r*, *f3v*, *f26v*, *f57v*, *f67r2*, *f71r*, *f72v1*, *f72v3* and *f73r*.[27]

Text[edit]

Page 119; *f66r*, showing characteristics of the text

Page 191; *f107r*, text detail

Every page in the manuscript contains text, mostly in an unidentified language, but some have extraneous writing in Latin script. The bulk of the text in the 240-page manuscript is written in an unknown script, running left to right. Most of the characters are composed of one or two simple pen strokes. Some dispute exists as to whether certain characters are distinct, but a script of 20–25 characters would account for virtually all of the text; the exceptions are a few dozen rarer characters that occur only once or twice each. There is no obvious punctuation.[4]

Much of the text is written in a single column in the body of a page, with a slightly ragged right margin and paragraph divisions and sometimes with stars in the left margin.[12] Other text occurs in charts or as labels associated with illustrations. There are no indications of any errors or corrections made at any place in the document. The ductus flows smoothly, giving the impression that the symbols were not enciphered; there is no delay between characters, as would normally be expected in written encoded text.

Extraneous writing[edit]

Only a few of the words in the manuscript are thought to have not been written in the unknown script:[17]

- *f1r*: A sequence of Latin letters in the right margin parallel with characters from the unknown script, also the now unreadable signature of "Jacobj à Tepenece" is found in the bottom margin.
- *f17r*: A line of writing in the Latin script in the top margin.
- *f70v–f73v*: The astrological series of diagrams in the astronomical section has the names of 10 of the months (from March to December) written in Latin script, with spelling suggestive of the medieval languages of France, northwest Italy, or the Iberian Peninsula.[28]
- *f66r*: A small number of words in the bottom left corner near a drawing of a nude man have been read as "*der musz del*", a High German[17] phrase for "a widow's share".
- *f116v*: Four lines written in rather distorted Latin script, except for two words in the unknown script. The words in Latin script appear to be distorted with characteristics of the unknown language. The lettering resembles European alphabets of the late 14th and 15th centuries, but the words do not seem to make sense in any language.[29]

Whether these bits of Latin script were part of the original text or were added later is not known.

Statistical patterns[edit]

The text consists of over 170,000 characters,[14] with spaces dividing the text into about 35,000 groups of varying length, usually referred to as "words" or "word tokens" (37,919); 8,114 of those words are considered unique "word types".[34] The structure of these words seems to follow phonological or orthographic laws of some sort; for example, certain characters must appear in each word (like English vowels), some characters never follow others, or some may be doubled or tripled, but others may not. The distribution of letters within words is also rather peculiar: Some characters occur only at the beginning of a word, some only at the end, and some always in the middle section.[35]

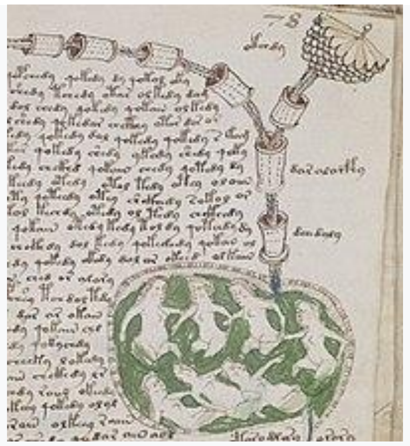
Many researchers have commented upon the highly regular structure of the words.[36] Professor Gonzalo Rubio, an expert in ancient languages at Pennsylvania State University, stated:

The things we know as ‘grammatical markers’ – things that occur commonly at the beginning or end of words, such as ‘s’ or ‘d’ in our language, and that are used to express grammar, never appear in the middle of ‘words’ in the Voynich manuscript. That’s unheard of for any Indo-European, Hungarian or Finnish language.[37]

Stephan Vonfelt studied statistical properties of the distribution of letters and their correlations (properties which can be vaguely characterized as rhythmic resonance, alliteration or assonance) and found that under that respect Voynichese is more similar to Chinese than European languages, although the numerical differences between Voynichese and Chinese look larger than those between Chinese and European languages.[38]

Practically no words have fewer than two letters or more than ten.[14] Some words occur in only certain sections, or in only a few pages; others occur throughout the manuscript. Few repetitions occur among the thousand or so labels attached to the illustrations. There are instances where the same common word appears up to three times in a row[14] (see *Zipf’s law*). Words that differ by only one letter also repeat with unusual frequency, causing single-substitution alphabet decipherings to yield babble-like text. In 1962, cryptanalyst Elizebeth Friedman described such attempts as “doomed to utter frustration”.[39]

Illustrations[edit]



A detail from the biological section of the manuscript

Detail of page 50, *f25v*; resembling a dragon

Detail of page 158, *f86r6*; the castle

The illustrations are conventionally used to divide most of the manuscript into six different sections, since the text itself cannot be read. Each section is typified by illustrations with different styles and supposed subject matter[14] except for the last section, in which the only drawings are small stars in the margin. The following are the sections and their conventional names:

- **Herbal, 112 folios:** Each page displays one or two plants and a few paragraphs of text, a format typical of European herbals of the time. Some parts of these drawings are larger and cleaner copies of sketches seen in the “pharmaceutical” section. None of the plants depicted are unambiguously identifiable.[12][40]
- **Astronomical, 21 folios:** Contains circular diagrams suggestive of astronomy or astrology, some of them with suns, moons, and stars. One series of 12 diagrams depicts conventional symbols for the zodiacal constellations (two fish for Pisces, a bull for Taurus, a hunter with crossbow for Sagittarius, etc.). Each of these has 30 female figures arranged in two or more concentric bands. Most of the females are at least partly nude, and each holds what appears to be a labeled star or is shown with the star attached to either arm by what could be a tether or cord of some kind. The last two pages of this section were lost (Aquarius and Capricornus, roughly January and February), while Aries and Taurus are split into four paired diagrams with 15 women and 15 stars each. Some of these diagrams are on fold-out pages.[12][40]
- **Biological, 20 folios:** A dense continuous text interspersed with figures, mostly showing small nude women, some wearing crowns, bathing in pools or tubs connected by an elaborate network of pipes. The bifolio consists of folios 78 (verso) and 81 (recto); it forms an integrated design, with water flowing from one folio to the other.[23][40]
- **Cosmological, 13 folios:** More circular diagrams, but they are of an obscure nature. This section also has foldouts; one of them spans six pages, commonly called the Rosettes folio, and contains a map or diagram with nine “islands” or “rosettes” connected by “causeways” and containing castles, as well as what might be a volcano.[12][40][41]
- **Pharmaceutical, 34 folios:** Many labeled drawings of isolated plant parts (roots, leaves, etc.), objects resembling apothecary jars, ranging in style from the mundane to the fantastical, and a few text paragraphs.[12][40]
- **Recipes, 22 folios:** Full pages of text broken into many short paragraphs, each marked with a star in the left margin.[12][40]

Five folios contain only text, and at least 28 folios are missing from the manuscript.[40]

Purpose[edit]

Page 66, *f33v*, has been interpreted to represent a sunflower

The overall impression given by the surviving leaves of the manuscript is that it was meant to serve as a pharmacopoeia or to address topics in medieval or early modern medicine. However, the puzzling details of illustrations have fueled many theories about the book's origin, the contents of its text, and the purpose for which it was intended.[14]

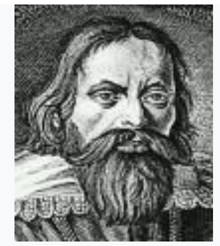
The first section of the book is almost certainly herbal, but attempts have failed to identify the plants, either with actual specimens or with the stylized drawings of contemporaneous herbals.[42] Only a few of the plant drawings can be identified with reasonable certainty, such as a wild pansy and the maidenhair fern. The herbal pictures that match pharmacological sketches appear to be clean copies of them, except that missing parts were completed with improbable-looking details. In fact, many of the plant drawings in the herbal section seem to be composite: the roots of one species have been fastened to the leaves of another, with flowers from a third.[42]

The basins and tubes in the biological section are sometimes interpreted as implying a connection to alchemy, yet they bear little obvious resemblance to the alchemical equipment of the period.[citation needed]

Astrological considerations frequently played a prominent role in herb gathering, bloodletting, and other medical procedures common during the likeliest dates of the manuscript. However, interpretation remains speculative, apart from the obvious Zodiac symbols and one diagram possibly showing the classical planets.[14]

History[edit]

Voynich among his books in Soho Square



Joannes Marcus Marci, who sent the manuscript to Athanasius Kircher in 1665 or 1666

Much of the early history of the book is unknown,[43] though the text and illustrations are all characteristically European. In 2009, University of Arizona researchers performed radiocarbon dating on the manuscript's vellum and dated it between 1404 and 1438.[2][44][45] In addition, McCrone Associates in Westmont, Illinois, found that the paints in the manuscript were of materials to be expected from that period of European history. It has been suggested that McCrone Associates found that much of the ink was added not long after the creation of the parchment, but the official report contains no statement to this effect.[13]

The first confirmed owner was Georg Baresch, an obscure alchemist from Prague. Baresch was apparently just as puzzled as modern scientists about this "Sphynx" that had been "taking up space uselessly in his library" for many years.[9] He learned that Jesuit scholar Athanasius Kircher from the Collegio Romano had published a Coptic (Egyptian) dictionary and claimed to have deciphered the Egyptian hieroglyphs; Baresch twice sent a sample copy of the script to Kircher in Rome, asking for clues. His 1639 letter to Kircher is the earliest confirmed mention of the manuscript that has been found to date.[16]

Whether Kircher answered the request is not known, but he was apparently interested enough to try to acquire the book, which Baresch refused to yield. Upon Baresch's death, the manuscript passed to his friend Jan Marek Marci(also known as Johannes Marcus Marci), then rector of Charles University in Prague. A few years later, Marci sent the book to Kircher, his longtime friend and correspondent.[16]

A letter written on August 19, 1665[9][46][47] or 1666[47][48][49] was found inside the cover and accompanied the manuscript when Johannes Marcus sent it to Kircher. It claims that the book once belonged to Emperor Rudolph II, who paid 600 gold ducats (about 2.07 kg of gold) for it. The letter was written in Latin[50] and has been translated to English.[46][51] The book was then given or lent to Jacobus Horcicky de Tepenecz, the head of Rudolph's botanical gardens in Prague, probably as part of the debt that Rudolph II owed upon his death.[43]

Marci's 1665/6 cover letter written in Latin was still with the manuscript when Voynich purchased it:[4]

Reverend and Distinguished Sir, Father in Christ:

This book, bequeathed to me by an intimate friend, I destined for you, my very dear Athanasius, as soon as it came into my possession, for I was convinced that it could be read by no one except yourself.

The former owner of this book asked your opinion by letter, copying and sending you a portion of the book from which he believed you would be able to read the remainder, but he at that time refused to send the book itself. To its deciphering he devoted unflagging toil, as is apparent from attempts of his which I send you herewith, and he relinquished hope only with his life. But his toil was in vain, for such Sphinxes as these obey no one but their master, Kircher. Accept now this token, such as it is and long overdue though it be, of my affection for you, and burst through its bars, if there are any, with your wonted success.

Dr. Raphael, a tutor in the Bohemian language to Ferdinand III, then King of Bohemia, told me the said book belonged to the Emperor Rudolph and that he presented to the bearer who brought him the book 600 ducats. He believed the author was Roger Bacon, the Englishman. On this point I suspend judgement; it is your place to define for us what view we should take thereon, to whose favor and kindness I unreservedly commit myself and remain

> At the command of your Reverence,
> Joannes Marcus Marci of Cronland
> Prague, 19th August, 1665[9][46][47] (or 1666)[4][47][48][49]

[Wilfrid Voynich](#) acquired the manuscript in 1912.

No records of the book for the next 200 years have been found, but in all likelihood, it was stored with the rest of Kircher's correspondence in the library of the Collegio Romano (now the Pontifical Gregorian University).[16] It probably remained there until the troops of Victor Emmanuel II of Italy captured the city in 1870 and annexed the Papal States. The new Italian government decided to confiscate many properties of the Church, including the library of the Collegio.[16] Many books of the university's library were hastily transferred to the personal libraries of its faculty just before this happened, according to investigations by Xavier Ceccaldi and others, and those books were exempt from confiscation.[16]Kircher's correspondence was among those books, and so, apparently, was the Voynich manuscript, as it still bears the *ex libris* of Petrus Beckx, head of the Jesuit order and the university's rector at the time.[12][16]

Beckx's private library was moved to the Villa Mondragone, Frascati, a large country palace near Rome that had been bought by the Society of Jesus in 1866 and housed the headquarters of the Jesuits' Ghislieri College.[16]

In 1903, the Society of Jesus (Collegio Romano) was short of money and decided to sell some of its holdings discreetly to the Vatican Library. The sale took place in 1912, but not all of the manuscripts listed for sale ended up going to the Vatican.[52] Wilfrid Voynich acquired 30 of these manuscripts, among them the one which now bears his name.[16] He spent the next seven years attempting to interest scholars in deciphering the script, while he worked to determine the origins of the manuscript.[4]

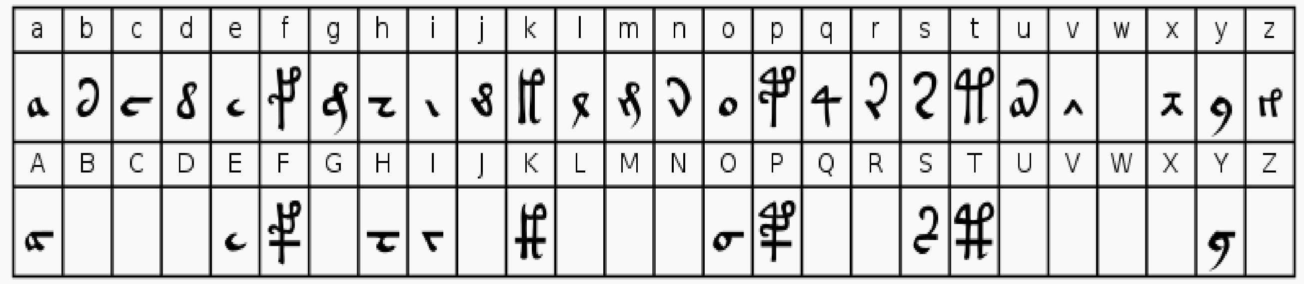
In 1930, the manuscript was inherited after Wilfrid's death by his widow Ethel Voynich, author of the novel *The Gadfly* and daughter of mathematician George Boole. She died in 1960 and left the manuscript to her close friend Anne Nill. In 1961, Nill sold the book to antique book dealer Hans P. Kraus. Kraus was unable to find a buyer and donated the manuscript to Yale University in 1969, where it was catalogued as "MS 408",[17] sometimes also referred to as "Beinecke MS 408".[12]

Timeline of ownership[edit]

The timeline of ownership of the Voynich manuscript is given below. The commonly accepted owners of the 17th century are shown in orange; the long period of storage in the Collegio Romano is shown in yellow; the location where Wilfrid Voynich allegedly acquired the manuscript (Frascati) is shown in green; Voynich is shown in red; and modern owners are shown in blue. Periods of unknown ownership are indicated in white, and the time when it was possibly created in green, based on the carbon dating of the vellum.[43]

Transcription[edit]

Various transcription alphabets have been created to equate the Voynich characters with Latin characters to help with cryptanalysis,[30]such as the Extensible (originally: European) Voynich Alphabet (EVA).[31] The first major one was created by the "First Study Group" led by cryptographer William F. Friedman in the 1940s, where each line of the manuscript was transcribed to an IBM punch card to make it machine readable.[32][33]



European Voynich Alphabet: Capital EVA letters are sometimes used to illustrate different variations of the same symbol.

Authorship hypotheses[edit]

Many people have been proposed as possible authors of the Voynich manuscript, among them, Roger Bacon, John Dee or Edward Kelley, Giovanni Fontana, or Voynich himself.

Early history[edit]

Rudolf II, portrait by Hans von Aachen.

Marci's 1665/1666 cover letter to Kircher says that, according to his friend the late Raphael Mnishovsky, the book had once been bought by Rudolf II, Holy Roman Emperor and King of Bohemia for 600 ducats (66.42 troy ounce actual gold weight, or 2.07 kg). (Mnishovsky had died in 1644, more than 20 years earlier, and the deal must have occurred before Rudolf's abdication in 1611, at least 55 years before Marci's letter. However, Karl Widemann sold books to Rudolf II in March 1599.)

Ernest Board's portrayal of Bacon in his observatory at Merton College

According to the letter, Mnishovsky (but not necessarily Rudolf) speculated that the author was 13th century Franciscan friar and polymath Roger Bacon.[6] Marci said that he was suspending judgment about this claim, but it was taken quite seriously by Wilfrid Voynich who did his best to confirm it.[16] Voynich contemplated the possibility that the author was Albertus Magnus if not Roger Bacon.[53]

Mathematician John Deemay have sold the manuscript to Emperor Rudolf around 1600.

The assumption that Bacon was the author led Voynich to conclude that John Dee sold the manuscript to Rudolf. Dee was a mathematician and astrologer at the court of Queen Elizabeth I of England who was known to have owned a large collection of Bacon's manuscripts.

Edward Kelley might have created the manuscript as a fraud

Dee and his *scrier* (spirit medium) Edward Kelley lived in Bohemia for several years, where they had hoped to sell their services to the emperor. However, this sale seems quite unlikely, according to John Schuster, because Dee's meticulously kept diaries do not mention it.[16]

If Bacon did not create the Voynich manuscript, a supposed connection to Dee is much weakened. It was thought possible, prior to the carbon dating of the manuscript, that Dee or Kelley might have written it and spread the rumor that it was originally a work of Bacon's in the hopes of later selling it.[54]

Fabrication by Voynich[edit]

Some suspect Voynich of having fabricated the manuscript himself.[7] As an antique book dealer, he probably had the necessary knowledge and means, and a lost book by Roger Bacon would have been worth a fortune. Furthermore, Baresch's letter and Marci's letter only establish the existence of a manuscript, not that the Voynich manuscript is the same one mentioned. These letters could possibly have been the motivation for Voynich to fabricate the manuscript, assuming that he was aware of them. However, many consider the expert internal dating of the manuscript and the June 1999[43] discovery of Baresch's letter to Kircher as having eliminated this possibility.[7][16]

Eamon Duffy says that the radiocarbon dating of the parchment (or, more accurately, vellum) "effectively rules out any possibility that the manuscript is a post-medieval forgery", as the consistency of the pages indicates origin from a single source, and "it is inconceivable" that a quantity of unused parchment comprising "at least fourteen or fifteen entire calfskins" could have survived from the early 15th century.[24]

Giovanni Fontana[edit]

One of Giovanni Fontana’s fantastical illustrations, c. 1420–1430

It has been suggested that some illustrations in the books of an Italian engineer, Giovanni Fontana, slightly resemble Voynich illustrations.[55] Fontana was familiar with cryptography and used it in his books, although he didn’t use the Voynich script but a simple substitution cipher. In the book *Secretum de thesauro experimentorum ymaginationis hominum* (Secret of the treasure-room of experiments in man’s imagination), written c. 1430, Fontana described mnemonicmachines, written in his cypher.[56] At least *Bellicorum instrumentorum liber* and this book used a cryptographic system, described as a simple, rational cipher, based on signs without letters or numbers.[57]

Other theories[edit]

Sometime before 1921, Voynich was able to read a name faintly written at the foot of the manuscript’s first page: “Jacobj à Tepenece”. This is taken to be a reference to Jakub Hořčický of Tepenec, also known by his Latin name Jacobus Sinapius. Rudolph II had ennobled him in 1607, had appointed him his Imperial Distiller, and had made him curator of his botanical gardens as well as one of his personal physicians. Voynich (and many other people after him) concluded that Jacobus owned the Voynich manuscript prior to Baresch, and he drew a link from that to Rudolf’s court, in confirmation of Mnishovsky’s story.

Jacobus’s name is still clearly visible under ultraviolet light; however, it does not match the copy of his signature in a document located by Jan Hurych in 2003.[1][8] As a result, it has been suggested that the signature was added later, possibly even fraudulently by Voynich himself.[1]

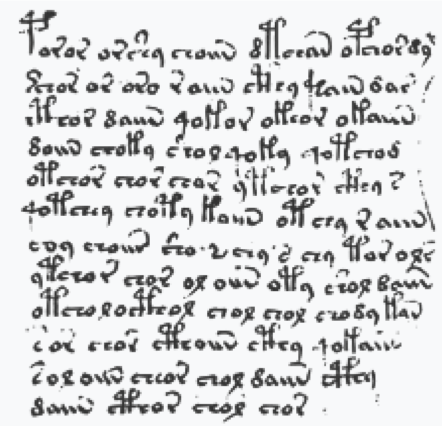
Baresch’s letter bears some resemblance to a hoax that orientalist Andreas Mueller once played on Kircher. Mueller sent some unintelligible text to Kircher with a note explaining that it had come from Egypt, and asking him for a translation. Kircher reportedly solved it.[58] It has been speculated that these were both cryptographic tricks played on Kircher to make him look foolish.[58]

Some pages of the manuscript fold out to show larger diagrams.

Raphael Mnishovsky, the friend of Marci who was the reputed source of Bacon’s story, was himself a cryptographer and apparently invented a cipher which he claimed was uncrackable (c. 1618).[59] This has led to the speculation that Mnishovsky might have produced the Voynich manuscript as a practical demonstration of his cipher and made Baresch his unwitting test subject. Indeed, the disclaimer in the Voynich manuscript cover letter could mean that Marci suspected some kind of deception.[59]

In his 2006 book, Nick Pelling proposed that the Voynich manuscript was written by 15th century North Italian architect Antonio Averlino (also known as “Filarete”), a theory broadly consistent with the radiocarbon dating.[10]

Ciphers[edit]



The Voynich manuscript is written in an unknown script.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
A	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
B	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A
C	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B
D	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C
E	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D
F	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E
G	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F
H	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G
I	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H
J	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I
K	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J
L	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K
M	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L
N	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M
O	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N
P	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Q	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
R	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
S	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
T	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
U	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
V	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
W	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
X	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
Y	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
Z	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y

The Vigenère square or table has been used for encryption and decryption.

According to the “letter-based cipher” theory, the Voynich manuscript contains a meaningful text in some European language that was intentionally rendered obscure by mapping it to the Voynich manuscript “alphabet” through a cipher of some sort—an algorithm that operated on individual letters. This was the working hypothesis for most 20th-century deciphering attempts, including an informal team of NSA cryptographers led by William F. Friedman in the early 1950s.[33]

The main argument for this theory is that it is difficult to explain a European author using a strange alphabet—except as an attempt to hide information. Indeed, even Roger Bacon knew about ciphers, and the estimated date for the manuscript roughly coincides with the birth of cryptography in Europe as a relatively systematic discipline.[citation needed]

The counterargument is that almost all cipher systems consistent with that era fail to match what is seen in the Voynich manuscript. For example, simple substitution ciphers would be excluded because the distribution of letter frequencies does not resemble that of any known language; while the small number of different letter shapes used implies that nomenclator and homophonic ciphers would be ruled out, because these typically employ larger cipher alphabets. Polyalphabetic ciphers were invented by Alberti in the 1460s and included the later Vigenère cipher, but they usually yield ciphertexts where all cipher shapes occur with roughly equal probability, quite unlike the language-like letter distribution which the Voynich manuscript appears to have.

However, the presence of many tightly grouped shapes in the Voynich manuscript (such as “or”, “ar”, “ol”, “al”, “an”, “ain”, “aiin”, “air”, “48ec”, “am”, “ee”, “eee”, among others) does suggest that its cipher system may make use of a “verbose cipher”, where single letters in a plaintext get enciphered into groups of fake letters. For example, the first two lines of page *f15v* (seen above) contain “oror or” and “or or oro r”, which strongly resemble how Roman numbers such as “CCC” or “XXXX” would look if verbosely enciphered.[60]

That the encryption system started from a fundamentally simple cipher and then augmented it by adding nulls (meaningless symbols), homophones (duplicate symbols), transposition cipher (letter rearrangement), false word breaks, and more is also entirely possible.

Codes[edit]

According to the “codebook cipher” theory, the Voynich manuscript “words” would actually be codes to be looked up in a “dictionary” or codebook. The main evidence for this theory is that the internal structure and length distribution of many words are similar to those of Roman numerals, which at the time would be a natural choice for the codes. However, book-based ciphers would be viable for only short messages, because they are very cumbersome to write and to read.[citation needed]

Shorthand[edit]

In 1943, Joseph Martin Feely claimed that the manuscript was a scientific diary written in shorthand. According to D’Imperio,[17] this was “Latin, but in a system of abbreviated forms not considered acceptable by other scholars, who unanimously rejected his readings of the text”.

Steganography[edit]

This theory holds that the text of the Voynich manuscript is mostly meaningless, but contains meaningful information hidden in inconspicuous details—e.g., the second letter of every word, or the number of letters in each line. This technique, called steganography, is very old and was described by Johannes Trithemius in 1499. Though the plain text was speculated to have been extracted by a Cardan grille (an overlay with cut-outs for the meaningful text) of some sort, this seems somewhat unlikely because the words and letters are not arranged on anything like a regular grid. Still, steganographic claims are hard to prove or disprove, since stegotexts can be arbitrarily hard to find.

It has been suggested that the meaningful text could be encoded in the length or shape of certain pen strokes.[61][62] There are indeed examples of steganography from about that time that use letter shape (italic vs. upright) to hide information. However, when examined at high magnification, the Voynich manuscript pen strokes seem quite natural, and substantially affected by the uneven surface of the vellum.[citation needed]

Natural language[edit]

Statistical analysis of the text reveals patterns similar to those of natural languages. For instance, the word entropy (about 10 bits per word) is similar to that of English or Latin texts.[3] In 2013, Diego Amancio *et al* argued that the Voynich manuscript “is mostly compatible with natural languages and incompatible with random texts”.[63]

The linguist Jacques Guy once suggested that the Voynich manuscript text could be some little-known natural language, written in the plain with an invented alphabet. The word structure is similar to that of many language families of East and Central Asia, mainly Sino-Tibetan (Chinese, Tibetan, and Burmese), Austroasiatic (Vietnamese, Khmer, etc.) and possibly Tai (Thai, Lao, etc.). In many of these languages, the words have only one syllable; and syllables have a rather rich structure, including tonal patterns.

This theory has some historical plausibility. While those languages generally had native scripts, these were notoriously difficult for Western visitors. This difficulty motivated the invention of several phonetic scripts, mostly with Latin letters, but sometimes with invented alphabets. Although the known examples are much later than the Voynich manuscript, history records hundreds of explorers and missionaries who could have done it—even before Marco Polo’s 13th-century journey, but especially after Vasco da Gama sailed the sea route to the Orient in 1498.

The first page includes two large red symbols, which have been compared to a Chinese-style book title.

The main argument for this theory is that it is consistent with all statistical properties of the Voynich manuscript text which have been tested so far, including doubled and tripled words (which have been found to occur in Chinese and Vietnamese texts at roughly the same frequency as in the Voynich manuscript). It also explains the apparent lack of numerals and Western syntactic features (such as articles and copulas), and the general inscrutability of the illustrations. Another possible hint is two large red symbols on the first page, which have been compared to a Chinese-style book title, inverted and badly copied. Also, the apparent division of the year into 360 days (rather than 365 days), in groups of 15 and starting with Pisces, are features of the Chinese agricultural calendar (*jie qi*, 節氣). The main argument against the theory is the fact that no one (including scholars at the Chinese Academy of Sciences in Beijing) has been able to find any clear examples of Asian symbolism or Asian science in the illustrations.

In 1976, James R Child of the National Security Agency, a linguist of Indo-European languages, proposed that the manuscript was written in a “hitherto unknown North Germanic dialect”.[64] He identified in the manuscript a “skeletal syntax several elements of which are reminiscent of certain Germanic languages”, while the content itself is expressed using “a great deal of obscurity”.[65]

In February 2014, Professor Stephen Bax of the University of Bedfordshire made public his research into using “bottom up” methodology to understand the manuscript. His method involves looking for and translating proper nouns, in association with relevant illustrations, in the context of other languages of the same time period. A paper he

posted online offers tentative translation of 14 characters and 10 words.[66][67][68][69] He suggests the text is a treatise on nature written in a natural language, rather than a code.

In 2014, Arthur O. Tucker and Rexford H. Talbert published a paper claiming a positive identification of 37 plants, six animals, and one mineral referenced in the manuscript to plant drawings in the *Libellus de Medicinalibus Indorum Herbis* or Badianus manuscript, a fifteenth-century Aztec herbal.[70] Together with the presence of atacamite in the paint, they argue that the plants were from Colonial New Spain and represented the Nahuatl language, and date the manuscript to between 1521 (the date of the Conquest) and *circa* 1576, in contradiction of radiocarbon dating evidence of the vellum and many other elements of the manuscript. However, the vellum, while creation of it was dated earlier, could just have been stored and used at a later date for manuscript making. The analysis has been criticized by other Voynich manuscript researchers,[71] pointing out that – among other things – a skilled forger could construct plants that have a passing resemblance to theretofore undiscovered existing plants.[72]

In 2014, a team led by Dr Diego Amancio of the University of São Paulo's Institute of Mathematical and Computer Sciences published a paper detailing a study using statistical methods to analyse the relationships of the words in the text. Instead of trying to find the meaning, Amancio's team used complex network 50ecogniz to look for connections and clusters of words. By employing concepts such as frequency and intermittence, which measure occurrence and concentration of a term in the text, Amancio was able to discover the manuscript's keywords and create three-dimensional models of the text's structure and word frequencies. Their conclusion was that in 90% of cases, the Voynich systems are similar to those of other known books such as the Bible, indicating that the book is an actual piece of text in an actual language, and not well-planned gibberish.[63]

The use of the framework was exemplified with the analysis of the Voynich manuscript, with the final conclusion that it differs from a random sequence of words, being compatible with natural languages. Even though our approach is not aimed at deciphering Voynich, it was capable of providing keywords that could be helpful for decipherers in the future.[63]

Constructed language[edit]

See also: Philosophical language

The peculiar internal structure of Voynich manuscript words led William F. Friedman to conjecture that the text could be a constructed language. In 1950, Friedman asked the British army officer John Tiltman to analyze a few pages of the text, but Tiltman did not share this conclusion. In a paper in 1967, Brigadier Tiltman said:

After reading my report, Mr. Friedman disclosed to me his belief that the basis of the script was a very primitive form of synthetic universal language such as was developed in the form of a philosophical classification of ideas by Bishop Wilkins in 1667 and Dalgarno a little later. It was clear that the productions of these two men were much too systematic, and anything of the kind would have been almost instantly 50ecognizable. My analysis seemed to me to reveal a cumbersome mixture of different kinds of substitution.[4]

The concept of a constructed language is quite old, as attested by John Wilkins's *Philosophical Language* (1668), but still postdates the generally accepted origin of the Voynich manuscript by two centuries. In most known examples, categories are subdivided by adding suffixes; as a consequence, a text in a particular subject would have many words with similar prefixes—for example, all plant names would begin with similar letters, and likewise for all diseases, etc. This feature could then explain the repetitious nature of the Voynich text. However, no one has been able yet to assign a plausible meaning to any prefix or suffix in the Voynich manuscript.[5]

Hoax[edit]

Page 175; *f99r*, of the pharmaceutical section

Page 135; *f75r*, from the biological section showing apparentnymphs

The unusual features of the Voynich manuscript text, such as the doubled and tripled words, and the suspicious contents of its illustrations support the idea that the manuscript is a hoax. In other words, if no one is able to extract meaning from the book, then perhaps this is because the document contains no meaningful content in the first place. Various hoax theories have been proposed over time.

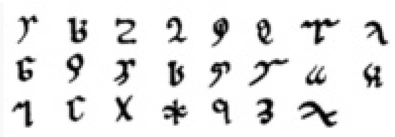
In 2003, computer scientist Gordon Rugg showed that text with characteristics similar to the Voynich manuscript could have been produced using a table of word prefixes, stems, and suffixes, which would have been selected and combined by means of a perforated paper overlay.[73][74] The latter device, known as a Cardan grille, was invented around 1550 as an encryption tool, more than 100 years after the estimated creation date of the Voynich manuscript. Some maintain that the similarity between the pseudo-texts generated in Gordon Rugg's experiments and the Voynich manuscript is superficial, and the grille method could be used to emulate any language to a certain degree.[75]

In April 2007, a study by Austrian researcher Andreas Schinner published in *Cryptologia* supported the hoax hypothesis.[76] Schinner showed that the statistical properties of the manuscript's text were more consistent with meaningless gibberish produced using a quasi-stochastic method, such as the one described by Rugg, than with Latin and medieval German texts.[76]

Some scholars have claimed that the manuscript's text appears too sophisticated to be a hoax. In 2013 Marcelo Montemurro, a theoretical physicist from the University of Manchester, published findings claiming that semantic networks exist in the text of the manuscript, such as content-bearing words occurring in a clustered pattern, or new words being used when there was a shift in topic.[77]With this evidence, he believes it unlikely that these features were intentionally "incorporated" into the text to make a hoax more realistic, as most of the required academic knowledge of these structures did not exist at the time the Voynich manuscript would have been written.[78]

In September 2016, Gordon Rugg and Gavin Taylor addressed these objections in another article in *Cryptologia*, and illustrated a simple hoax method that they claim could have caused the mathematical properties of the text.[79]

Glossolalia[edit]



Script invented by Hildegard von Bingen

Detail of the nymphs on page 141; *f78r*

In their 2004 book, Gerry Kennedy and Rob Churchill suggest the possibility that the Voynich manuscript may be a case of glossolalia (speaking-in-tongues), channeling, or outsider art.[15] If so, the author felt compelled to write large amounts of text in a manner which resembles stream of consciousness, either because of voices heard or because of an urge. This often takes place in an invented language in glossolalia, usually made up of fragments of the author's own language, although invented scripts for this purpose are rare.

Kennedy and Churchill use Hildegard von Bingen's works to point out similarities between the Voynich manuscript and the illustrations that she drew when she was suffering from severe bouts of migraine, which can induce a trance-like state prone to glossolalia. Prominent features found in both are abundant "streams of stars", and the repetitive nature of the "nymphs" in the biological section.[80] This theory has been found unlikely by other researchers.[81]

The theory is virtually impossible to prove or disprove, short of deciphering the text. Kennedy and Churchill are themselves not convinced of the hypothesis, but consider it plausible. In the culminating chapter of their work, Kennedy states his belief that it is a hoax or forgery. Churchill acknowledges the possibility that the manuscript is either a synthetic forgotten language (as advanced by Friedman), or else a forgery, as the preeminent theory. However, he concludes that, if the manuscript is a genuine creation, mental illness or delusion seems to have affected the author.[15]

Decipherment claims[edit]

Since the manuscript's modern rediscovery in 1912, there have been a number of claimed decipherings.

William Romaine Newbold[edit]

One of the earliest efforts to unlock the book's secrets (and the first of many premature claims of decipherment) was made in 1921 by William Romaine Newbold of the University of Pennsylvania. His singular hypothesis held that the visible text is meaningless itself, but that each apparent "letter" is in fact constructed of a series of tiny markings

discernible only under magnification. These markings were supposed to be based on ancient Greek shorthand, forming a second level of script that held the real content of the writing. Newbold claimed to have used this knowledge to work out entire paragraphs proving the authorship of Bacon and recording his use of a compound microscope four hundred years before van Leeuwenhoek. A circular drawing in the astronomical section depicts an irregularly shaped object with four curved arms, which Newbold interpreted as a picture of a galaxy, which could be obtained only with a telescope.[4]Similarly, he interpreted other drawings as cells seen through a microscope.

However, Newbold's analysis has since been dismissed as overly speculative[82] after John Matthews Manly of the University of Chicagopointed out serious flaws in his theory. Each shorthand character was assumed to have multiple interpretations, with no reliable way to determine which was intended for any given case. Newbold's method also required rearranging letters at will until intelligible Latin was produced. These factors alone ensure the system enough flexibility that nearly anything at all could be discerned from the microscopicmarkings. Although evidence of micrography using the Hebrew language can be traced as far back as the ninth century, it is nowhere near as compact or complex as the shapes Newbold made out. Close study of the manuscript revealed the markings to be artefacts caused by the way ink cracks as it dries on rough vellum. Perceiving significance in these artefacts can be attributed to pareidolia. Thanks to Manly's thorough refutation, the micrography theory is now generally disregarded.[83]

Joseph Martin Feely[edit]

In 1943, Joseph Martin Feely published *Roger Bacon's Cipher: The Right Key Found*, in which he claimed that the book was a scientific diary written by Roger Bacon. Feely's method posited that the text was a highly abbreviated medieval Latin written in a simple substitution cipher.[17]

Leonell C. Strong[edit]

Leonell C. Strong, a cancer research scientist and amateur cryptographer, believed that the solution to the Voynich manuscript was a "peculiar double system of arithmetical progressions of a multiple alphabet". Strong claimed that the plaintext revealed the Voynich manuscript to be written by the 16th-century English author Anthony Ascham, whose works include *A Little Herbal*, published in 1550. Notes released after his death reveal that the last stages of his analysis, in which he selected words to combine into phrases, were questionably subjective.[84]

Robert S. Brumbaugh[edit]

In 1978, Robert Brumbaugh, a professor of medieval philosophy at Yale University, claimed that the manuscript was a forgery intended to fool Emperor Rudolf II into purchasing it, and that the text is Latin enciphered with a complex, two-step method.[17]

John Stojko[edit]

In 1978, John Stojko published *Letters to God's Eye*,[85] in which he claimed that the Voynich Manuscript was a series of letters written in vowelless Ukrainian.[53] The theory caused some sensation among the Ukrainian diaspora at the time, and then in independent Ukraine after 1991.[86] However, the date Stojko gives for the letters, the lack of relation between the text and the images, and the general looseness in the method of decryption all speak against his theory.[53]

Leo Levitov[edit]

Leo Levitov proposed in his 1987 book, *Solution of the Voynich Manuscript: A Liturgical Manual for the Endura Rite of the Cathari Heresy, the Cult of Isis*,[87] that the manuscript is a handbook for the Cathar rite of *Endura*, written in a Flemish based creole. He further claimed that Catharism was descended from the cult of Isis.[88]

However, Levitov's decipherment has been refuted on several grounds, not least of which is its being unhistorical. Levitov had a poor grasp of the history of the Cathars, and his depiction of *Endura* as an elaborate suicide ritual is at odds with surviving documents describing it as a fast.[88] Likewise, there is no known link between Catharism and Isis.

Stephen Bax[edit]

In 2014, applied linguistics Professor Stephen Bax published an article in conjunction with the Swedish-Australian linguist Shaun R. L. King,[89] in which they claimed to have translated ten words from the manuscript using techniques

similar to those used to successfully translate Egyptian hieroglyphs. They claimed the manuscript to be a treatise on nature, in a Near Eastern or Asian language, but no full translation was made before Bax's death in 2017.[90]

Nicholas Gibbs[edit]

In September 2017, television writer Nicholas Gibbs claimed to have decoded the manuscript as idiosyncratically abbreviated Latin.[91] He declared the manuscript to be a mostly plagiarized guide to women's health.

Medieval scholars judged Gibbs' hypothesis to be trite. His work was criticized as patching together already-existing scholarship with a highly speculative and incorrect translation; Lisa Fagin Davis, director of the Medieval Academy of America, stated that Gibbs' decipherment "doesn't result in Latin that makes sense."[92][93]

Greg Kondrak[edit]

Professor Greg Kondrak, a natural language processing expert at the University of Alberta, together with his graduate student Bradley Hauer, used computational linguistics in an attempt to decode the manuscript.[94] Their findings were presented at the Annual Meeting of the Association for Computational Linguistics in 2017, in the form of an article suggesting that the language of the manuscript is most likely Hebrew, but encoded using alphagrams, i.e. alphabetically ordered anagrams. However, the team admitted that experts in medieval manuscripts who reviewed the work were not convinced.[95][96][97] The claim is also disputed by an expert in the Hebrew language and its history.[98]

Gerard Cheshire[edit]

In 2019, the journal *Romance Studies* published a paper by Gerard Cheshire titled "The Language and Writing System of MS408 (Voynich) Explained".[99] Cheshire, a biology research assistant at the University of Bristol, claimed to have deciphered the manuscript in two weeks using a combination of "lateral thinking and ingenuity."[100][101] He suggested that the manuscript is "a compendium of information on herbal remedies, therapeutic bathing and astrological readings", with a focus on female physical and mental health, reproduction, and parenting; and that the manuscript is the only known text written in proto-Romance.[102] He said: "The manuscript was compiled by Dominican nuns as a source of reference for Maria of Castile, Queen of Aragon."[103] However, experts in medieval documents disputed this interpretation vigorously,[104] with the executive editor of Medieval Academy of America Lisa Fagin Davis denouncing the paper as "just more aspirational, circular, self-fulfilling nonsense".[102] Approached for comment by *Ars Technica*,[104]Davis gave this explanation:

As with most would-be Voynich interpreters, the logic of this proposal is circular and aspirational: he starts with a theory about what a particular series of glyphs might mean, usually because of the word's proximity to an image that he believes he can interpret. He then investigates any number of medieval Romance-language dictionaries until he finds a word that seems to suit his theory. Then he argues that because he has found a Romance-language word that fits his hypothesis, his hypothesis must be right. His "translations" from what is essentially gibberish, an amalgam of multiple languages, are themselves aspirational rather than being actual translations.

— *Fagin Davis*

The University of Bristol subsequently removed a reference to Cheshire's claims from its website,[105] referring in a statement to concerns about the validity of the research, and stating: "This research was entirely the author's own work and is not affiliated with the University of Bristol, the School of Arts nor the Centre for Medieval Studies".[106][107]

Facsimile[edit]

Many books and articles have been written about the manuscript. Copies of the manuscript pages were made by alchemist Georgius Barschius in 1637 and sent to Athanasius Kircher, and later by Wilfrid Voynich.[108]

In 2004, the Beinecke Rare Book and Manuscript Library made high-resolution digital scans publicly available online, and several printed facsimiles appeared. In 2016, the Beinecke Library and Yale University Press co-published a facsimile, *The Voynich Manuscript*, with scholarly essays.[109]

The Beinecke Library also authorized the production of a print run of 898 replicas by the Spanish publisher Siloé in 2017.[110][111]

Cultural influence[edit]

The manuscript has also inspired several works of fiction, including *The Book of Blood and Shadow* (2012) by Robin Wasserman, *Time Riders: The Doomsday Code* (2011) by Alex Scarrow, *Codex* (2004) by Lev Grossman, *PopCo* (2004) by Scarlett Thomas, *Prime* (2013) by Jeremy Robinson with Sean Ellis, *The Sword of Moses* (2013) by Dominic Selwood, *The Return of the Lloigor* (1974) by Colin Wilson, *Datura tai harha jonka jokainen näkee* (2001) (Eng: *Datura: or, A Delusion We All See*, 2013) by Leena Krohn, *Assassin's Code* (2012) by Jonathan Maberry, *The Book of Life* (2014) by Deborah Harkness, *The 39 Clues—Cahills vs. Vespers: Book 5, Trust No One* (2012) by Linda Sue Park, and *The Source* (2008) by Michael Cordy.

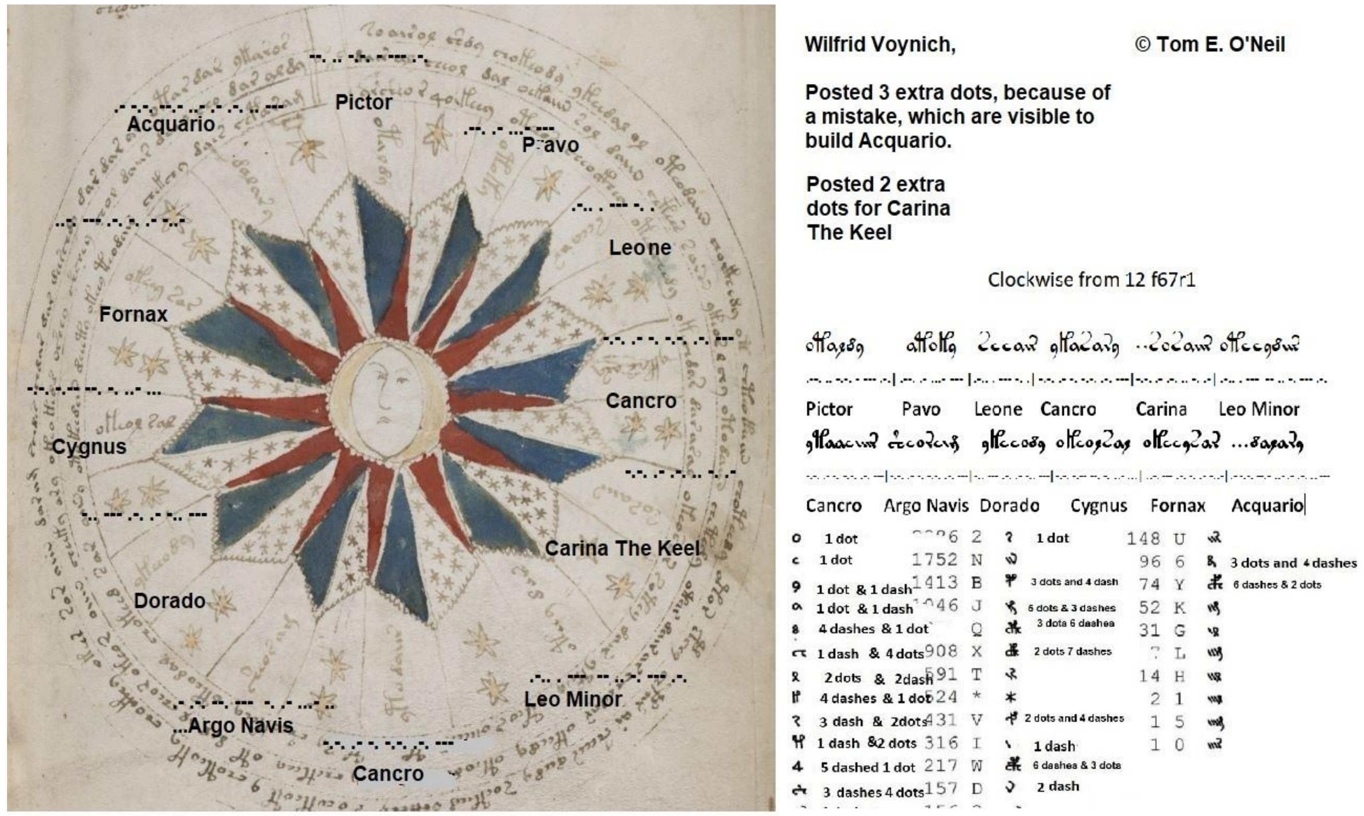
Between 1976 and 1978,[112] Italian artist Luigi Serafini created the *Codex Seraphinianus* containing false writing and pictures of imaginary plants in a style reminiscent of the Voynich manuscript.[113][114][115]

Contemporary classical composer Hanspeter Kyburz's 1995 chamber work *The Voynich Cipher Manuscript, for chorus & ensemble* is inspired by the manuscript.[116]

In 2015, the New Haven Symphony Orchestra commissioned Hannah Lash to compose a symphony inspired by the manuscript.[117]

https://en.wikipedia.org/wiki/Voynich_manuscript"

Conclusion and more evidence from my cipher

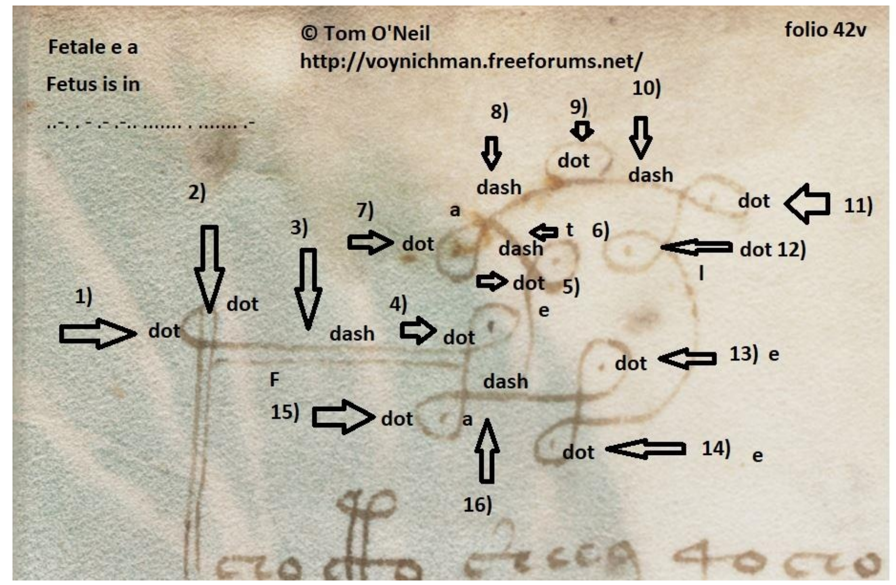


My name is Tom O'Neil and Thank you for your purchase☺

tomeoneil@gmail.com

Addendum

I just decoded the weird pregnant woman on the first glyph of the folio 42v. The dots in the loops are indicative of a Voynich Morse code Steganography Cipher.



This is a prime example of the Voynich Morse Code Stenography Cipher at work. The Image displays a pregnant woman on a Voynich Glyph. It contains dots in the loops. I used the strings and horizontal lines as dashes.

<u>The phrase is clearly:</u>

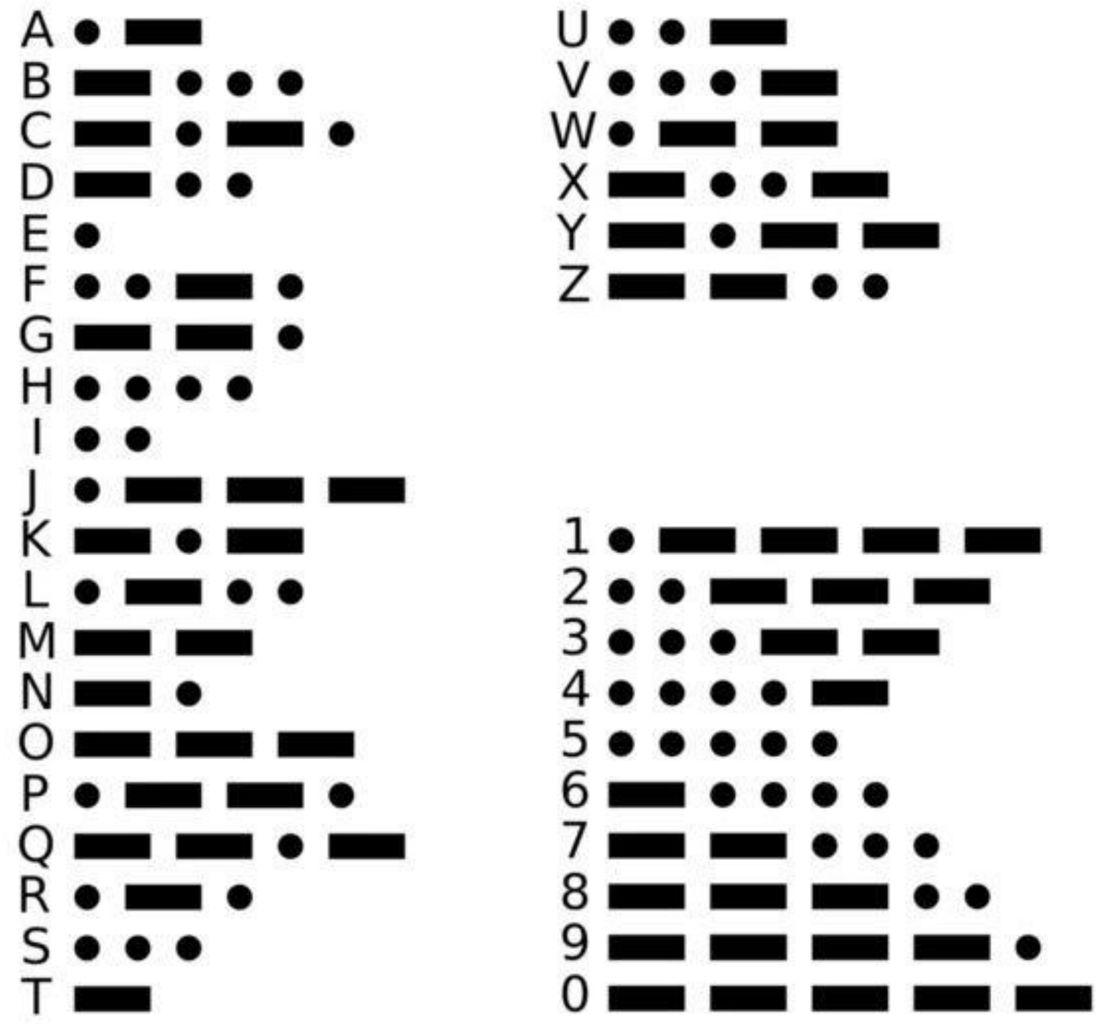
<u>Fetus is in!</u>

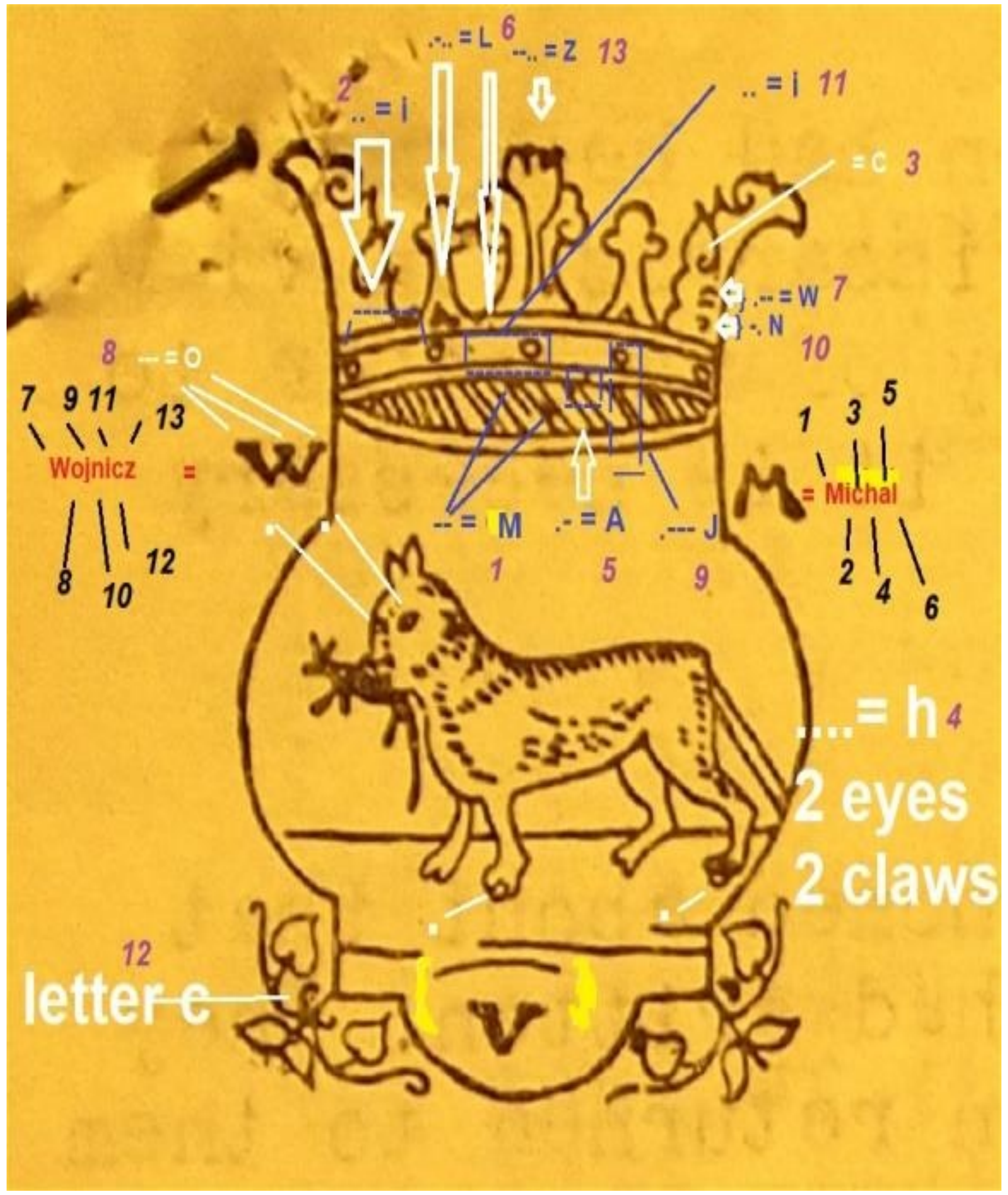
Michal Wojnicz Business Card From Rich SantoColoma Proto57 site

.

I feel this is important, which contains further evidence to methods I use regarding the encoding of the Voynich Manuscript. I'm extremely happy to have found this file of Michal Wojnicz's Cat Mouse business Card. Here is the link https://proto57.wordpress.com/
As you can see I have decoded his full name using Morse Code. If this does not shock you I don't know what will. This is evidence of Michal Wojnicz's fraud pointer to the VMS. Here are the Images.
-- .. -.-. .... .- .-.. ....-- --- .--- -. .. -.-. --..
Michal Wojnicz

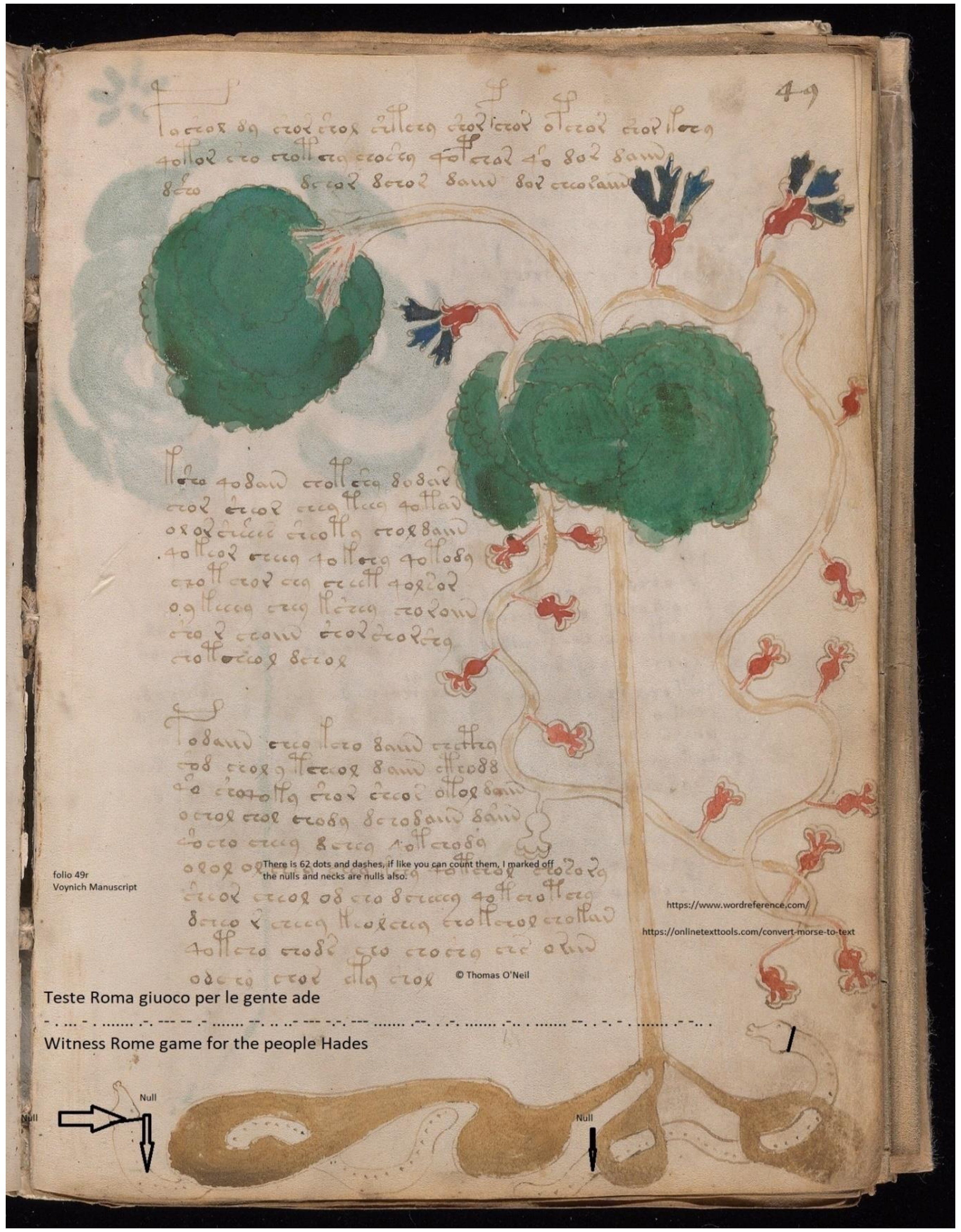
Voynich's adaptation was a close copy of the version of the Sessa coat of arms above and changed little over the years. Sometimes he included the initials "WMV," sometimes not. Unlike the Sessas, he seems never to have adopted any sort of inscription or motto. The version below, without initials, is from Voynich's sale catalogue, "No. 31. An Illustrated Catalogue of Remarkable Incunabula, many with Woodcuts, and a Specimen of an Unknown Xylographical Press, Offered by Wilfrid M. Voynich [no date]." Save for its lack of intials, it is virtually identical to the Sessa coat of arms above: There seems to be no genuine Voynich family coat of arms. But why would Voynich adopt that of the Sessas? What was it about that coat of arms that appealed to him? 1 The Sessas developed ornate versions of their coat of arms, some of which included the Latin motto Dissimilium Infida Societas, "Association with those not alike [oneself] is treacherous" –a truth presumably illustrated by the fate of the mouse or rat. Voynich would have come across these versions. 2 c
There seems to be no genuine Voynich family coat of arms. But why would Voynich adopt that of the Sessas? What was it about that coat of arms that appealed to him? 1 The Sessas developed ornate versions of their coat of arms, some of which included the Latin motto Dissimilium Infida Societas, "Association with those not alike [oneself] is treacherous" –a truth presumably illustrated by the fate of the mouse or rat. Voynich would have come across these versions.
http://www.colinmackinnon.com/attachments/The_Voynich_Coat_of_Arms_and_Michael_Voynichs_Flight_from_Siberia_W.pdf





.-.. = L 6
--.. = Z 13
2 .. = i
.. = i 11
= c 3
.-- = W 7
-. N 10
8 --- = O
Wojnicz =
7 9 11 13
8 10 12
-- = M 1
.- = A 5
.--- J 9
= Michal
1 3 5
2 4 6
.... = h 4
2 eyes
2 claws
12
letter e
W
M
V

W
M
V



http://voynichman.freeforums.net/thread/39/voynich-morse-code-Steganography-cipher?page=1&scrollTo=68

Sorbus AriA plant f102v2 otol found AriA plant in f30v

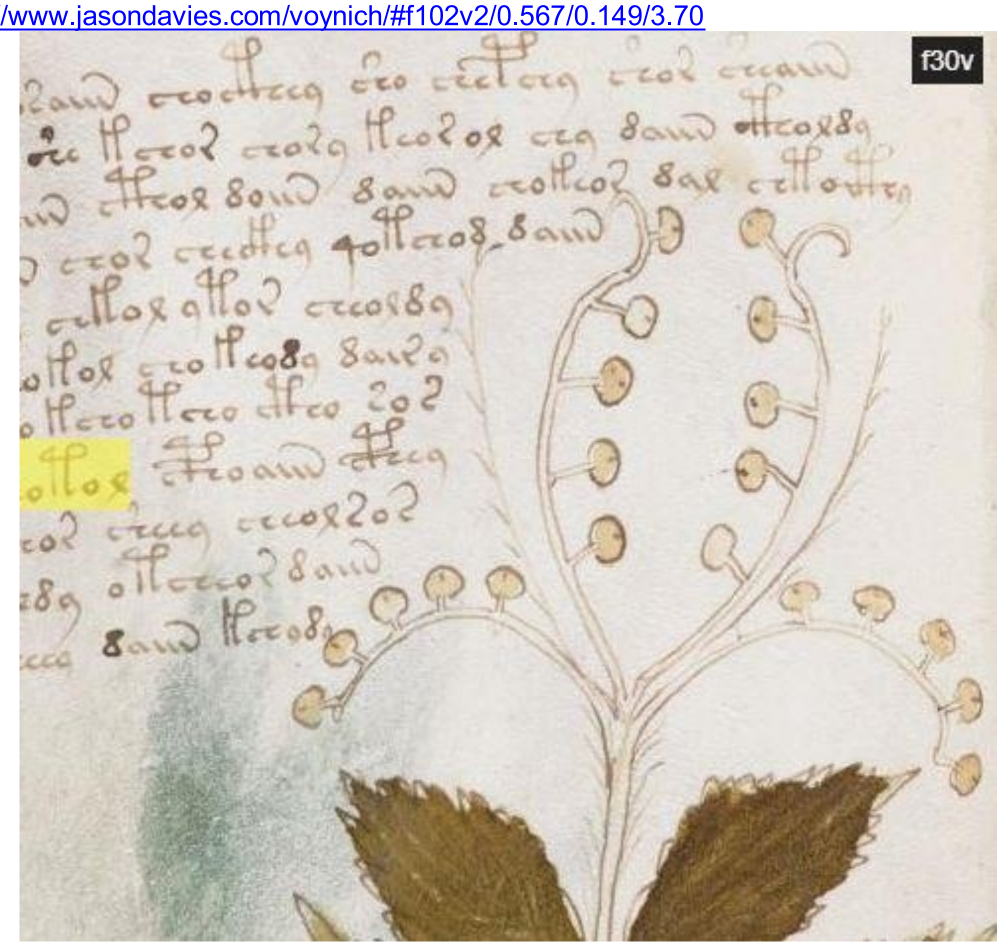
.

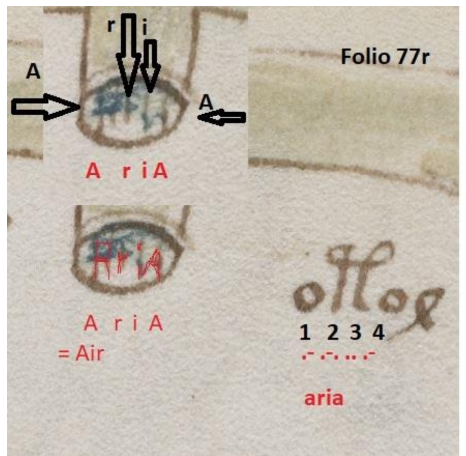
The facts are in otol is AriA!
Looks like the facts are slamming us right in logical hemisphere of our minds! AriA is associated to Mars from Ares the God of war from Greek Mythology, which the Romans inherited as Mars the God of War. Yet AriA in Italian translates to air in English as it follows the theme of an empty otol pipe in f77r. So I just looked up AriA as keywords (vegetation, plant). The plant leaf in f102v2 which looks like its cut in half has the serrated edges.
https://www.theoi.com/Olympios/Ares.html

https://pladias.cz/en/taxon/pictures/Sorbus%20aria%20agg.

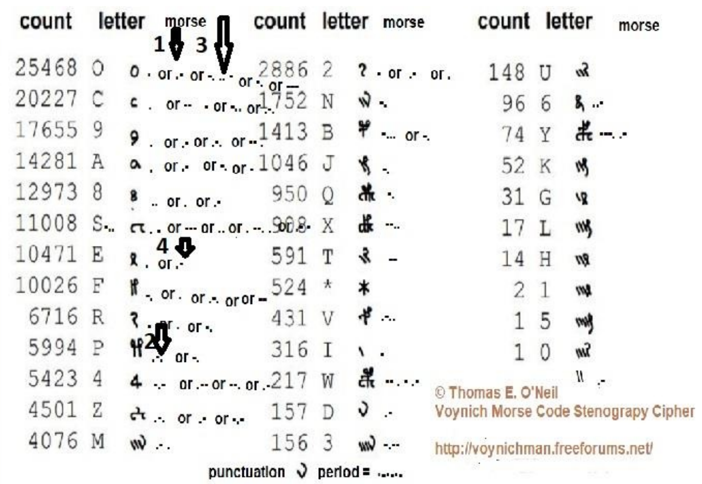
http://www.voynichese.com/#/exa:shed-:crimson/exa:ched-:royal-blue/f30v/all:otol/200

https://www.jasondavies.com/voynich/#f30v/0.772/0.588/0.80
https://www.jasondavies.com/voynich/#f102v2/0.567/0.149/3.70





The image of the pipe symbolizes air and the author actually wrote in AriA.



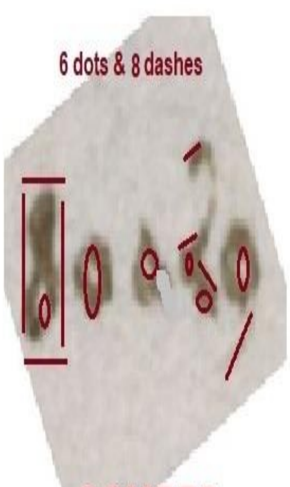
count	letter	morse	count	letter	morse	count	letter	morse
25468	O	[illegible]	2886	2	[illegible]	148	U	[illegible]
20227	C	[illegible]	1752	N	[illegible]	96	6	[illegible]
17655	9	[illegible]	1413	B	[illegible]	74	Y	[illegible]
14281	A	[illegible]	1046	J	[illegible]	52	K	[illegible]
12973	8	[illegible]	950	Q	[illegible]	31	G	[illegible]
11008	S	[illegible]	908	X	[illegible]	17	L	[illegible]
10471	E	[illegible]	591	T	[illegible]	14	H	[illegible]
10026	F	[illegible]	524	*	*	2	1	[illegible]
6716	R	[illegible]	431	V	[illegible]	1	5	[illegible]
5994	P	[illegible]	316	I	[illegible]	1	0	[illegible]
5423	4	[illegible]	217	W	[illegible]			
4501	Z	[illegible]	157	D	[illegible]			
4076	M	[illegible]	156	3	[illegible]			

punctuation period =

© Thomas E. O'Neil
Voynich Morse Code Stenograpy Cipher
http://voynichman.freeforums.net/

Like all new cipher interpretations to images, adjustments are needed, however the cipher is still the same! I believe an attempt was made to write (aria) in the actual image itself.

Folio 68r3 Voynich Manuscript



1 dot
1 dot 175
1 dot & 1 dash 141
1 dot & 1 dash
4 dashes & 1 dot
1 dash & 4 dots 90
2dots & 2dash 59

COMETS

-.-. --- -- . - ...

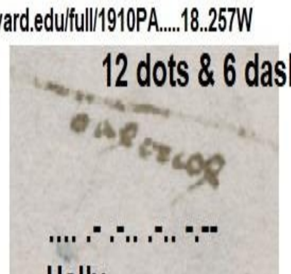
By February of 1910, Halley's Comet was obscured by the Sun, but, after a few days, the comet once again became visible. It now appeared on the eastern horizon rising before dawn. Halley's Comet reached perihelion on April 20, 1910 while near the constellation Corvus.

The month of May is the most important time of the present return of the comet. During this time it will be visible to the naked eye.

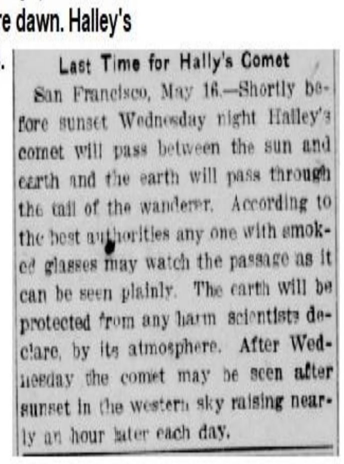
It may be of interest to know just when and where to look for the comet. The accompanying diagrams are graphic representations of the comet's motion through space. Figure 1 shows the real path and Figure 2, the apparent path of the comet. For clearness' sake seven principal dates have been taken and are represented in both diagrams. The reader can easily supply for himself the remaining dates and thus have a

http://adsabs.harvard.edu/full/1910PA.....18..257W

12 dots & 6 dashes

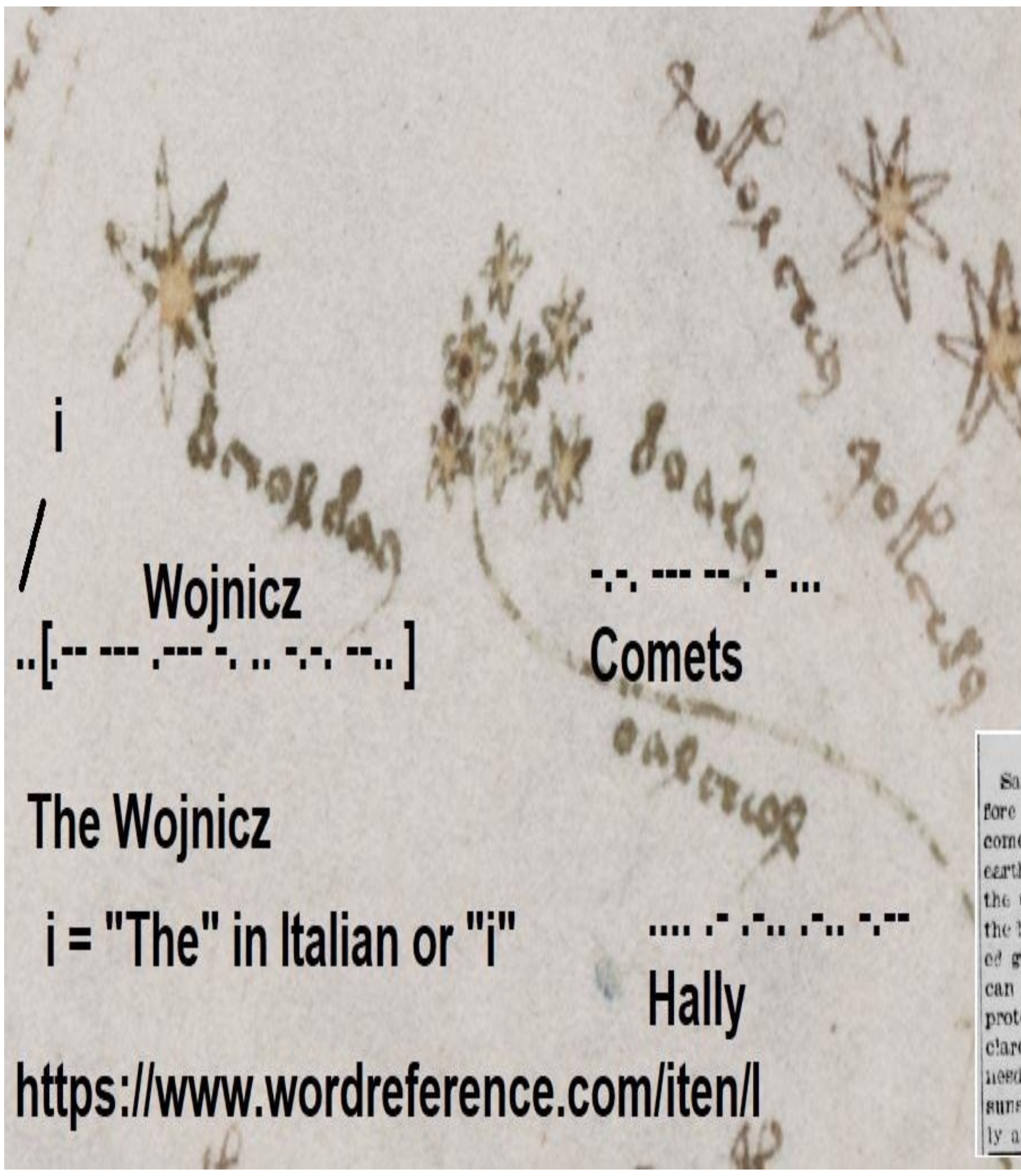


.... .- .-.. .-.. -.--
Hally

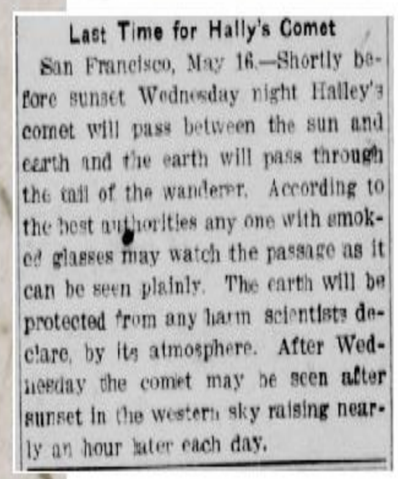


Last Time for Hally's Comet

San Francisco, May 16.—Shortly before sunset Wednesday night Halley's comet will pass between the sun and earth and the earth will pass through the tail of the wanderer. According to the best authorities any one with smoked glasses may watch the passage as it can be seen plainly. The earth will be protected from any harm scientists declare, by its atmosphere. After Wednesday the comet may be seen after sunset in the western sky raising nearly an hour later each day.



1 dot
1 dot 175
1 dot & 1 dash 141
1 dot & 1 dash
4 dashes & 1 dot
1 dash & 4 dots 90
2dots & 2dash 59
4 dashes & 1 dot 52
3 dash & 2dots 43



Last Time for Hally's Comet

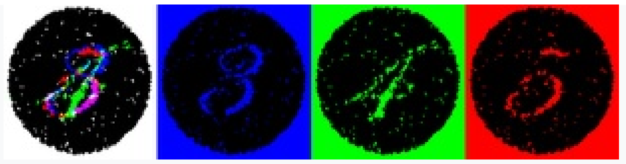
San Francisco, May 16.—Shortly before sunset Wednesday night Halley's comet will pass between the sun and earth and the earth will pass through the tail of the wanderer. According to the best authorities any one with smoked glasses may watch the passage as it can be seen plainly. The earth will be protected from any harm scientists declare, by its atmosphere. After Wednesday the comet may be seen after sunset in the western sky raising nearly an hour later each day.

“Steganography

From Wikipedia, the free encyclopedia

Jump to navigationJump to search

For the process of writing in shorthand, see Stenography. For the prefix "Stego-" as used in taxonomy, see List of commonly used taxonomic affixes.



The same image viewed by white, blue, green and red lights reveals different hidden numbers.

Steganography (/ˌstɛɡəˈnɒɡrəfi/ (listen) *STEG-ə-NOG-rə-fee*) is the practice of concealing a file, message, image, or video within another file, message, image, or video. The word *steganography* combines the Greek words *steganos* (στεγᾰνός), meaning "covered or concealed", and *graphe* (γραφή) meaning "writing".

The first recorded use of the term was in 1499 by Johannes Trithemius in his *Steganographia*, a treatise on cryptography and steganography, disguised as a book on magic. Generally, the hidden messages appear to be (or to be part of) something else: images, articles, shopping lists, or some other cover text. For example, the hidden message may be in invisible ink between the visible lines of a private letter. Some implementations of steganography that lack a shared secret are forms of security through obscurity, and key-dependent steganographic schemes adhere to Kerckhoffs's principle.[1]

The advantage of steganography over cryptography alone is that the intended secret message does not attract attention to itself as an object of scrutiny. Plainly visible encrypted messages, no matter how unbreakable they are, arouse interest and may in themselves be incriminating in countries in which encryption is illegal.[2]

Whereas cryptography is the practice of protecting the contents of a message alone, steganography is concerned both with concealing the fact that a secret message is being sent and its contents.

Steganography includes the concealment of information within computer files. In digital steganography, electronic communications may include steganographic coding inside of a transport layer, such as a document file, image file, program or protocol. Media files are ideal for steganographic transmission because of their large size. For example, a sender might start with an innocuous image file and adjust the color of every hundredth pixel to correspond to a letter in the alphabet. The change is so subtle that someone who is not specifically looking for it is unlikely to notice the change.

Contents

History[edit]

A chart from Johannes Trithemius's *Steganographia* copied by Dr John Dee in 1591

The first recorded uses of steganography can be traced back to 440 BC when Herodotus mentions two examples in his *Histories*.[3] Histiaeus sent a message to his vassal, Aristagoras, by shaving the head of his most trusted servant, "marking" the message onto his scalp, then sending him on his way once his hair had regrown, with the instruction, "When thou art come to Miletus, bid Aristagoras shave thy head, and look thereon." Additionally, Demaratus sent a warning about a forthcoming attack to Greece by writing it directly on the wooden backing of a wax tablet before applying its beeswax surface. Wax tablets were in common use then as reusable writing surfaces, sometimes used for shorthand.

In his work *Polygraphiae,* Johannes Trithemius developed his so-called "Ave-Maria-Cipher" that can hide information in a Latin praise of God. "*Auctor Sapientissimus Conseruans Angelica Deferat Nobis Charitas Potentissimi Creatoris*" for example contains the concealed word *VICIPEDIA*.[4]

Techniques[edit]

Deciphering the code. *Steganographia*

Physical[edit]

Steganography has been widely used for centuries. Here are some examples:[citation needed]

- Hidden messages on paper written in secret inks.

- Hidden messages distributed, according to a certain rule or key, as smaller parts (e.g. words or letters) among other words of a less suspicious covertext. This particular form of steganography is called a null cipher.
- Messages written in Morse code on yarn and then knitted into a piece of clothing worn by a courier.
- Messages written on envelopes in the area covered by postage stamps.
- In the early days of the printing press, it was common to mix different typefaces on a printed page because the printer did not have enough copies of some letters in one typeface. Thus, a message could be hidden by using two or more different typefaces, such as normal or italic.
- During and after World War II, espionage agents used photographically-produced microdots to send information back and forth. Microdots were typically minute (less than the size of the period produced by a typewriter). World War II microdots were embedded in the paper and covered with an adhesive, such as collodion that was reflective and so was detectable by viewing against glancing light. Alternative techniques included inserting microdots into slits cut into the edge of postcards.
- During World War II, Velvalee Dickinson, a spy for Japan in New York City, sent information to accommodation addresses in neutral South America. She was a dealer in dolls, and her letters discussed the quantity and type of doll to ship. The stegotext was the doll orders, and the concealed "plaintext" was itself encoded and gave information about ship movements, etc. Her case became somewhat famous and she became known as the Doll Woman.
- During World War II, photosensitive glass was declared secret, and used for transmitting information to Allied armies.
- Jeremiah Denton repeatedly blinked his eyes in Morse code during the 1966 televised press conference that he was forced into as an American prisoner-of-war by his North Vietnamese captors, spelling out "T-O-R-T-U-R-E". That confirmed for the first time to the US Naval Intelligence and other Americans that the North Vietnamese were torturing American prisoners-of-war.
- In 1968, crew members of the USS *Pueblo* intelligence ship, held as prisoners by North Korea, communicated in sign language during staged photo opportunities, to inform the United States that they were not defectors but captives of the North Koreans. In other photos presented to the US, crew members gave "the finger" to the unsuspecting North Koreans, in an attempt to discredit photos that showed them smiling and comfortable.

Digital messages[edit]

Image of a tree with a steganographically hidden image. The hidden image is revealed by removing all but the two least significant bits of each color component and a subsequent normalization. The hidden image is shown below.

Image of a cat extracted from the tree image above.

Modern steganography entered the world in 1985 with the advent of personal computers being applied to classical steganography problems.[5] Development following that was very slow, but has since taken off, going by the large number of steganography software available:

- Concealing messages within the lowest bits of noisy images or sound files. A survey and evaluation of relevant literature/techniques on the topic of digital image steganography can be found here.[6]
- Concealing data within encrypted data or within random data. The message to conceal is encrypted, then used to overwrite part of a much larger block of encrypted data or a block of random data (an unbreakable cipher like the one-time pad generates ciphertexts that look perfectly random without the private key).
- Chaffing and winnowing.
- Mimic functions convert one file to have the statistical profile of another. This can thwart statistical methods that help brute-force attacks identify the right solution in a ciphertext-only attack.
- Concealed messages in tampered executable files, exploiting redundancy in the targeted instruction set.
- Pictures embedded in video material (optionally played at slower or faster speed).
- Injecting imperceptible delays to packets sent over the network from the keyboard. Delays in keypresses in some applications (telnet or remote desktop software) can mean a delay in packets, and the delays in the packets can be used to encode data.
- Changing the order of elements in a set.
- Content-Aware Steganography hides information in the semantics a human user assigns to a datagram. These systems offer security against a nonhuman adversary/warden.
- Blog-Steganography. Messages are fractionalized and the (encrypted) pieces are added as comments of orphaned web-logs (or pin boards on social network platforms). In this case the selection of blogs is the symmetric key that sender and recipient are using; the carrier of the hidden message is the whole blogosphere.
- Modifying the echo of a sound file (Echo Steganography).[7]
- Steganography for audio signals.[8]
- Image bit-plane complexity segmentation steganography
- Including data in ignored sections of a file, such as after the logical end of the carrier file.
- Adaptive steganography: Skin tone based steganography using a secret embedding angle.[9]

Digital text[edit]

- Making text the same color as the background in word processor documents, e-mails, and forum posts.
- Using Unicode characters that look like the standard ASCII character set (the homograph spoofing attack). On most systems, there is no visual difference from ordinary text. Some systems may display the fonts differently, and the extra information would then be easily spotted, of course.
- Using hidden (control) characters, and redundant use of markup (e.g., empty bold, underline or italics) to embed information within HTML, which is visible by examining the document source. HTML pages can contain code for extra blank spaces and tabs at the end of lines, and colors, fonts and sizes, which are not visible when displayed.

- Using non-printing Unicode characters Zero-Width Joiner (ZWJ) and Zero-Width Non-Joiner (ZWNJ).[10][11] These characters are used for joining and disjoining letters in Arabic and Persian, but can be used in Roman alphabets for hiding information because they have no meaning in Roman alphabets: because they are "zero-width" they are not displayed. ZWJ and ZWNJ can represent "1" and "0". This may also be done with en space, figure space and whitespace characters.[12]
- Embedding a secret message in the pattern of deliberate errors and marked corrections in a word processing document, using the word processor's change tracking feature.[13]

Social steganography[edit]

In communities with social or government taboos or censorship, people use cultural steganography—hiding messages in idiom, pop culture references, and other messages they share publicly and assume are monitored. This relies on social context to make the underlying messages visible only to certain readers.[14][15] Examples include:

- Hiding a message in the title and context of a shared video or image.
- Misspelling names or words that are popular in the media in a given week, to suggest an alternate meaning.
- Hiding a picture which can be traced by using Paint or any other drawing tool.[citation needed]

Steganography in Streaming Media[edit]

Since the era of evolving network applications, steganography research has shifted from image steganography to steganography in streaming media such as Voice Over Internet Protocol (VoIP).

In 2003, Giannoula et al. developed a data hiding technique leading to compressed forms of source video signals on a frame-by-frame basis.[16]

In 2005, Dittmann et al. studied steganography and watermarking of multimedia contents such as VoIP.[17]

In 2008, Yongfeng Huang and Shanyu Tang presented a novel approach to information hiding in low bit-rate VoIP speech stream, and theirs published work on steganography in [18] is the first ever effort to improve the codebook partition by using Graph theory along with Quantization Index Modulation in low bit-rate streaming media.

In 2011 and 2012, Yongfeng Huang and Shanyu Tang devised new steganographic algorithms that use codec parameters as cover object to realise real-time covert VoIP steganography. Their findings were published in *IEEE Transactions on Information Forensics and Security*.[19][20]

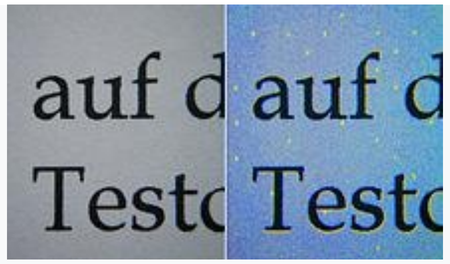
Cyber-physical systems/Internet of Things[edit]

Academic work since 2012 demonstrated the feasibility of steganography for cyber-physical systems (CPS)/the Internet of Things (IoT). Some techniques of CPS/IoT steganography overlap with network steganography, i.e. hiding data in communication protocols used in CPS/the IoT. However, specific techniques hide data in CPS components. For instance, data can be stored in unused registers of IoT/CPS components and in the states of IoT/CPS actuators.[21][22]

Printed[edit]

Digital steganography output may be in the form of printed documents. A message, the *plaintext*, may be first encrypted by traditional means, producing a *ciphertext*. Then, an innocuous *covertext* is modified in some way so as to contain the ciphertext, resulting in the *stegotext*. For example, the letter size, spacing, typeface, or other characteristics of a covertext can be manipulated to carry the hidden message. Only a recipient who knows the technique used can recover the message and then decrypt it. Francis Bacon developed Bacon's cipher as such a technique.

The ciphertext produced by most digital steganography methods, however, is not printable. Traditional digital methods rely on perturbing noise in the channel file to hide the message, and as such, the channel file must be transmitted to the recipient with no additional noise from the transmission. Printing introduces much noise in the ciphertext, generally rendering the message unrecoverable. There are techniques that address this limitation, one notable example being ASCII Art Steganography.[23]



Yellow dots from a laser printer

Although not classic steganography, some types of modern color laser printers integrate the model, serial number and timestamps on each printout for traceability reasons using a dot-matrix code made of small, yellow dots not recognizable to the naked eye—see printer steganography for details.

Using puzzles[edit]

The art of concealing data in a puzzle can take advantage of the degrees of freedom in stating the puzzle, using the starting information to encode a key within the puzzle / puzzle image.

For instance, steganography using sudoku puzzles has as many keys as there are possible solutions of a sudoku puzzle, which is 6.71×10^{21}.[24]

Network[edit]

In 1987, **Girling** first studied covert channels on a local area network (LAN), identified and realised three obvious covert channels (two storage channels and one timing channel), and his research paper entitled “Covert channels in LAN’s” published in *IEEE Transactions on Software Engineering*, vol. SE-13 of 2, in February 1987.[25]

In 1989, **Wolf** implemented covert channels in LAN protocols, e.g. using the reserved fields, pad fields and undefined fields in the TCP/IP protocol.[26]

In 1997, **Rowland** used the IP identification field, the TCP initial sequence number and acknowledge sequence number fields in TCP/IP headers to build covert channels.[27]

In 2002, **Kamran Ahsan** made an excellent summary of research on network steganography.[28]

In 2005, Steven J. **Murdoch** and Stephen **Lewis** contributed a chapter entitled "Embedding Covert Channels into TCP/IP" in the "*Information Hiding*" book published by Springer.[29]

All information hiding techniques that may be used to exchange steganograms in telecommunication networks can be classified under the general term of network steganography. This nomenclature was originally introduced by Krzysztof Szczypiorski in 2003.[30] Contrary to typical steganographic methods that use digital media (images, audio and video files) to hide data, network steganography uses communication protocols' control elements and their intrinsic functionality. As a result, such methods can be harder to detect and eliminate.[31]

Typical network steganography methods involve modification of the properties of a single network protocol. Such modification can be applied to the PDU (Protocol Data Unit),[32][33][34] to the time relations between the exchanged PDUs,[35] or both (hybrid methods).[36]

Moreover, it is feasible to utilize the relation between two or more different network protocols to enable secret communication. These applications fall under the term inter-protocol steganography.[37] Alternatively, multiple network protocols can be used simultaneously to transfer hidden information and so-called control protocols can be embedded into steganographic communications to extend their capabilities, e.g. to allow dynamic overlay routing or the switching of utilized hiding methods and network protocols.[38][39]

Network steganography covers a broad spectrum of techniques, which include, among others:

- Steganophony — the concealment of messages in Voice-over-IP conversations, e.g. the employment of delayed or corrupted packets that would normally be ignored by the receiver (this method is called LACK — Lost Audio Packets Steganography), or, alternatively, hiding information in unused header fields.[40]

- WLAN Steganography – transmission of steganograms in Wireless Local Area Networks. A practical example of WLAN Steganography is the HICCUPS system (Hidden Communication System for Corrupted Networks)[41]

Additional terminology[edit]

Discussions of steganography generally use terminology analogous to and consistent with conventional radio and communications technology. However, some terms appear specifically in software and are easily confused. These are the most relevant ones to digital steganographic systems:

The *payload* is the data covertly communicated. The *carrier* is the signal, stream, or data file that hides the payload, which differs from the *channel*, which typically means the type of input, such as a JPEG image. The resulting signal, stream, or data file with the encoded payload is sometimes called the *package*, *stego file*, or *covert message*. The proportion of bytes, samples, or other signal elements modified to encode the payload is called the *encoding density* and is typically expressed as a number between 0 and 1.

In a set of files, the files that are considered likely to contain a payload are *suspects*. A *suspect* identified through some type of statistical analysis can be referred to as a *candidate*.

Countermeasures and detection[edit]

Detecting physical steganography requires careful physical examination, including the use of magnification, developer chemicals and ultraviolet light. It is a time-consuming process with obvious resource implications, even in countries that employ many people to spy on their fellow nationals. However, it is feasible to screen mail of certain suspected individuals or institutions, such as prisons or prisoner-of-war (POW) camps.

During World War II, prisoner of war camps gave prisoners specially-treated paper that would reveal invisible ink. An article in the 24 June 1948 issue of *Paper Trade Journal* by the Technical Director of the United States Government Printing Office had Morris S. Kantrowitz describe in general terms the development of this paper. Three prototype papers (*Sensicoat*, *Anilith*, and *Coatalith*) were used to manufacture postcards and stationery provided to German prisoners of war in the US and Canada. If POWs tried to write a hidden message, the special paper rendered it visible. The US granted at least two patents related to the technology, one to Kantrowitz, U.S. Patent 2,515,232, "Water-Detecting paper and Water-Detecting Coating Composition Therefor," patented 18 July 1950, and an earlier one, "Moisture-Sensitive Paper and the Manufacture Thereof," U.S. Patent 2,445,586, patented 20 July 1948. A similar strategy issues prisoners with writing paper ruled with a water-soluble ink that runs in contact with water-based invisible ink.

In computing, steganographically encoded package detection is called steganalysis. The simplest method to detect modified files, however, is to compare them to known originals. For example, to detect information being moved through the graphics on a website, an analyst can maintain known clean copies of the materials and then compare them against the current contents of the site. The differences, if the carrier is the same, comprise the payload. In general, using extremely high compression rates makes steganography difficult but not impossible. Compression errors provide a hiding place for data, but high compression reduces the amount of data available to hold the payload, raising the encoding density, which facilitates easier detection (in extreme cases, even by casual observation).

There are a variety of basic tests that can be done to identify whether or not a secret message exists. This process is not concerned with the extraction of the message, which is a different process and a separate step. The most basic approaches of steganalysis are visual or aural attacks, structural attacks, and statistical attacks. These approaches attempt to detect the steganographic algorithms that were used.[42] These algorithms range from unsophisticated to very sophisticated, with early algorithms being much easier to detect due to statistical anomalies that were present. The size of the message that is being hidden is a factor in how difficult it is to detect. The overall size of the cover object also plays a factor as well. If the cover object is small and the message is large, this can distort the statistics and make it easier to detect. A larger cover object with a small message decreases the statistics and gives it a better chance of going unnoticed.

Steganalysis that targets a particular algorithm has much better success as it is able to key in on the anomalies that are left behind. This is because the analysis can perform a targeted search to discover known tendencies since it is aware of the behaviors that it commonly exhibits. When analyzing an image the least significant bits of many images

are actually not random. The camera sensor, especially lower end sensors are not the best quality and can introduce some random bits. This can also be affected by the file compression done on the image. Secret messages can be introduced into the least significant bits in an image and then hidden. A steganography tool can be used to camouflage the secret message in the least significant bits but it can introduce a random area that is too perfect. This area of perfect randomization stands out and can be detected by comparing the least significant bits to the next-to-least significant bits on image that hasn't been compressed.[42]

Generally though, there are many techniques known to be able to hide messages in data using steganographic techniques. None are, by definition, obvious when users employ standard applications, but some can be detected by specialist tools. Others, however, are resistant to detection - or rather it is not possible to reliably distinguish data containing a hidden message from data containing just noise - even when the most sophisticated analysis is performed. Steganography is being used to hide cyber attacks, referred to as *Stegware*, and detection is therefore not an adequate defence. The only way of defeating the threat is to transform data in a way that destroys any hidden messages,[43] a process called Content Threat Removal.

Applications[edit]

Use in modern printers[edit]

Main article: Printer steganography

Some modern computer printers use steganography, including Hewlett-Packard and Xerox brand color laser printers. The printers add tiny yellow dots to each page. The barely-visible dots contain encoded printer serial numbers and date and time stamps.[44]

Example from modern practice[edit]

The larger the cover message (in binary data, the number of bits) relative to the hidden message, the easier it is to hide the hidden message so digital pictures, which contain much data, are used to hide messages on the Internet and on other communication media. It is not clear how common this practice actually is.

For example, a 24-bit bitmap uses 8 bits to represent each of the three color values (red, green, and blue) of each pixel. The blue alone has 2^8 different levels of blue intensity. The difference between 11111111 and 11111110 in the value for blue intensity is likely to be undetectable by the human eye. Therefore, the least significant bit can be used more or less undetectably for something else other than color information. If that is repeated for the green and the red elements of each pixel as well, it is possible to encode one letter of ASCII text for every three pixels.

Stated somewhat more formally, the objective for making steganographic encoding difficult to detect is to ensure that the changes to the carrier (the original signal) because of the injection of the payload (the signal to covertly embed) are visually (and ideally, statistically) negligible. The changes are indistinguishable from the noise floor of the carrier. All media can be a carrier, but media with a large amount of redundant or compressible information is better suited.

From an information theoretical point of view, that means that the channel must have more capacity than the "surface" signal requires. There must be redundancy. For a digital image, it may be noise from the imaging element; for digital audio, it may be noise from recording techniques or amplification equipment. In general, electronics that digitize an analog signal suffer from several noise sources, such as thermal noise, flicker noise, and shot noise. The noise provides enough variation in the captured digital information that it can be exploited as a noise cover for hidden data. In addition, lossy compression schemes (such as JPEG) always introduce some error to the decompressed data, and it is possible to exploit that for steganographic use, as well.

Although steganography and digital watermarking seem similar, they are not. In steganography, the hidden message should remain intact until it reaches its destination. Steganography can be used for digital watermarking in which a message (being simply an identifier) is hidden in an image so that its source can be tracked or verified (for example, Coded Anti-Piracy) or even just to identify an image (as in the EURion constellation). In such a case, the technique of hiding the message (here, the watermark) must be robust to prevent tampering. However, digital watermarking sometimes requires a brittle watermark, which can be modified easily, to check whether the image has been tampered with. That is the key difference between steganography and digital watermarking.

Alleged use by intelligence services[edit]

In 2010, the Federal Bureau of Investigation alleged that the Russian foreign intelligence service uses customized steganography software for embedding encrypted text messages inside image files for certain communications with "illegal agents" (agents without diplomatic cover) stationed abroad.[45]

Distributed steganography[edit]

There are distributed steganography methods,[46] including methodologies that distribute the payload through multiple carrier files in diverse locations to make detection more difficult. For example, U.S. Patent 8,527,779 by cryptographer William Easttom (Chuck Easttom).

Online challenge[edit]

See also: Voynich manuscript

The puzzles that are presented by Cicada 3301 incorporate steganography with cryptography and other solving techniques since 2012.[47] As time goes on, more instigates that include steganography have been present in alternate reality games.

The communications[48][49] of The Mayday Mystery incorporate steganography and other solving techniques since 1981.[50]

”

“Morse code

From Wikipedia, the free encyclopedia

Jump to navigationJump to search

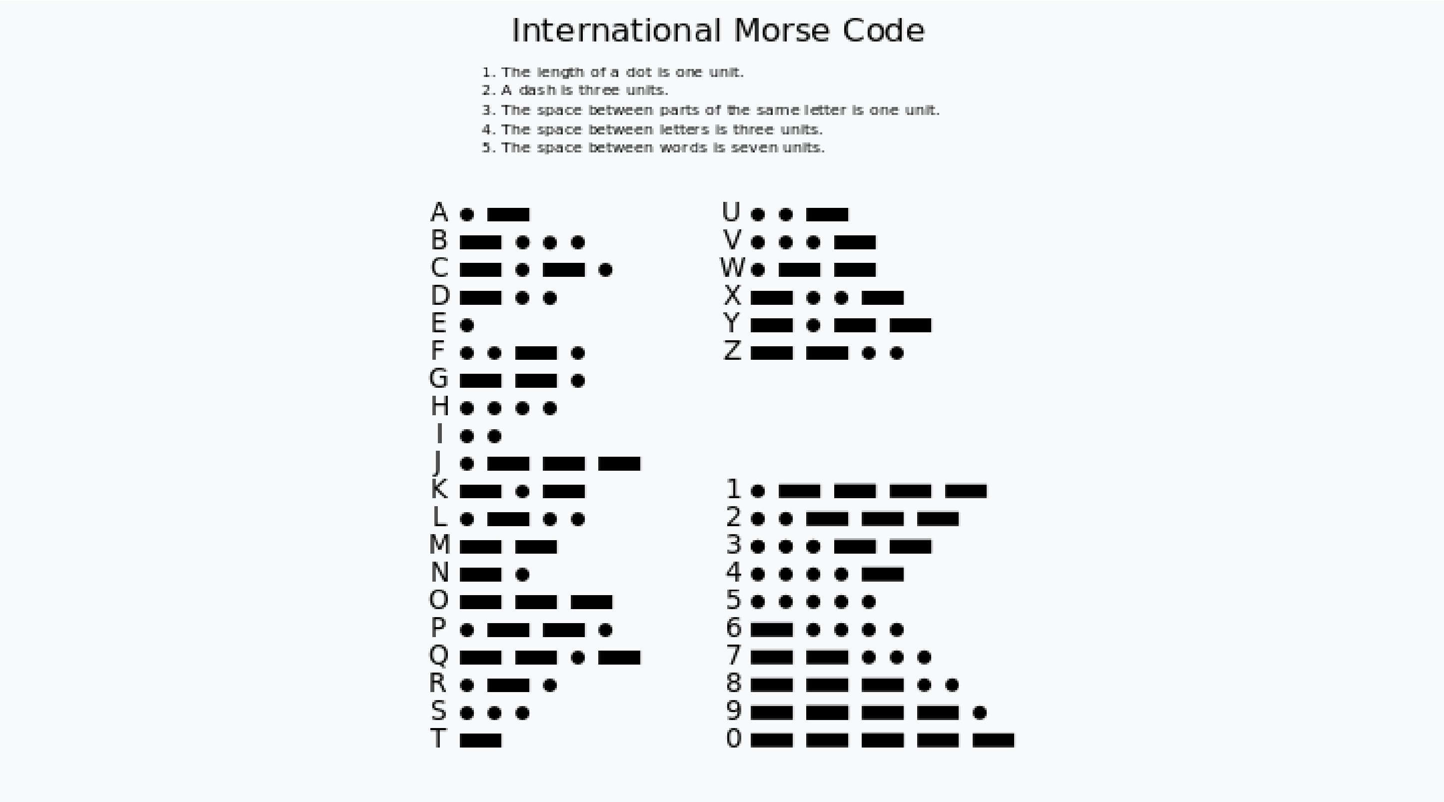


Chart of the Morse code 26 letters and 10 numerals.[1]

Morse code is a character encoding scheme used in telecommunication that encodes text characters as standardized sequences of two different signal durations called *dots* and *dashes* or *dits* and *dahs*.[2][3] Morse code is named for Samuel F. B. Morse, an inventor of the telegraph.

The International Morse Code encodes the 26 English letters A through Z, some non-English letters, the Arabic numerals and a small set of punctuation and procedural signals (prosigns). There is no distinction between upper and lower case letters.[1] Each Morse code symbol is formed by a sequence of dots and dashes. The dot duration is the basic unit of time measurement in Morse code transmission. The duration of a dash is three times the duration of a dot. Each dot or dash within a character is followed by period of signal absence, called a *space*, equal to the dot duration. The letters of a word are separated by a space of duration equal to three dots, and the words are separated by a space equal to seven dots.[1] To increase the efficiency of encoding, Morse code was designed so that the length of each symbol is approximately inverse to the frequency of occurrence in text of the English language character that it represents. Thus the most common letter in English, the letter "E", has the shortest code: a single dot. Because the Morse code elements are specified by proportion rather than specific time durations, the code is usually transmitted at the highest rate that the receiver is capable of decoding. The Morse code transmission rate (*speed*) is specified in *groups per minute*, commonly referred to as *words per minute*.[4]

Morse code is usually transmitted by on-off keying of an information carrying medium such as electric current, radio waves, visible light or sound waves.[5][6] The current or wave is present during time period of the dot or dash and absent during the time between dots and dashes.[7][8]

Morse code can be memorized, and Morse code signalling in a form perceptible to the human senses, such as sound waves or visible light, can be directly interpreted by persons trained in the skill.[9][10]

Because many non-English natural languages use other than the 26 Roman letters, Morse alphabets have been developed for those languages.[11]

SOS, the standard emergency signal, is a Morse code prosign

In an emergency, Morse code can be generated by improvised methods such as turning a light on and off, tapping on an object or sounding a horn or whistle, making it one of the simplest and most versatile methods of telecommunication. The most common distress signal is SOS – three dots, three dashes, and three dots – internationally recognized by treaty.

Contents

Development and history

Single needle telegraph instrument

Telegraph key and sounder. The signal is "on" when the knob is pressed, and "off" when it is released. Length and timing of the dots and dashes are entirely controlled by the telegraphist.

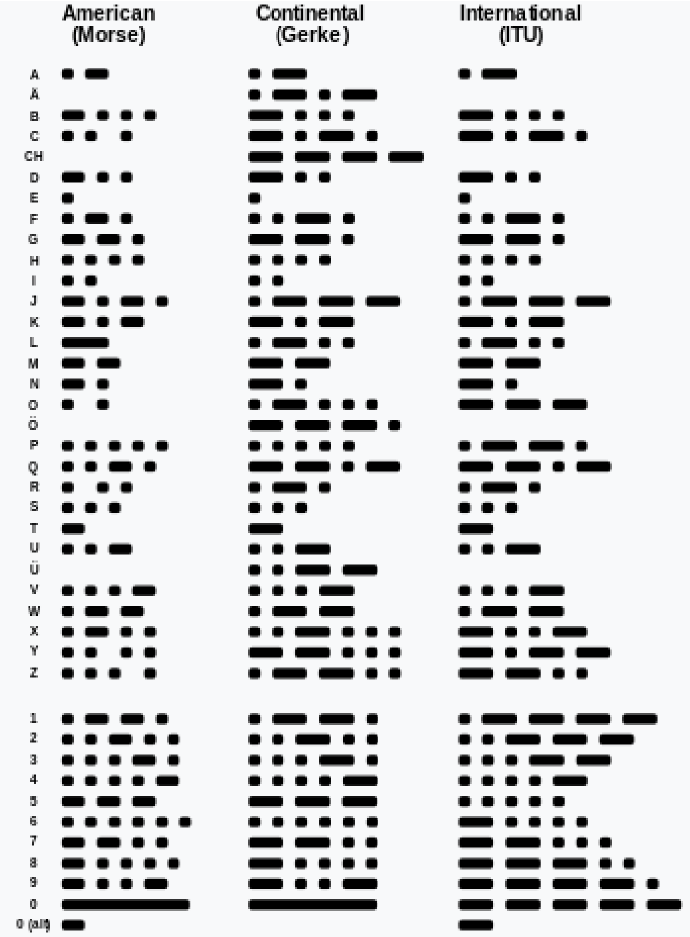
Early in the nineteenth century, European experimenters made progress with electrical signaling systems, using a variety of techniques including static electricity and electricity from Voltaic piles producing electrochemical and electromagnetic changes. These numerous ingenious experimental designs were precursors to practical telegraphic applications.[12]

Following the discovery of electromagnetism by Hans Christian Ørsted in 1820 and the invention of the electromagnet by William Sturgeon in 1824, there were developments in electromagnetic telegraphy in Europe and America. Pulses of electric current were sent along wires to control an electromagnet in the receiving instrument. Many of the earliest telegraph systems used a single-needle system which gave a very simple and robust instrument. However, it was slow, as the receiving operator had to alternate between looking at the needle and writing down the message. In Morse code, a deflection of the needle to the left corresponded to a dot and a deflection to the right to a dash.[13] By making the two clicks sound different with one ivory and one metal stop, the single needle device became an audible instrument, which led in turn to the Double Plate Sounder System.[14]

Morse code receiver, recording on paper tape

The American artist Samuel F. B. Morse, the American physicist Joseph Henry, and Alfred Vail developed an electrical telegraph system. It needed a method to transmit natural language using only electrical pulses and the silence between them. Around 1837, Morse, therefore, developed an early forerunner to the modern International Morse code. William Cooke and Charles Wheatstone in Britain developed an electrical telegraph that used electromagnets in its receivers. They obtained an English patent in June 1837 and demonstrated it on the London and Birmingham Railway, making it the first commercial telegraph. Carl Friedrich Gauss and Wilhelm Eduard Weber (1833) as well as Carl August von Steinheil (1837) used codes with varying word lengths for their telegraphs. In 1841, Cooke and Wheatstone built a telegraph that printed the letters from a wheel of typefaces struck by a hammer.[15]

The Morse system for telegraphy, which was first used in about 1844, was designed to make indentations on a paper tape when electric currents were received. Morse's original telegraph receiver used a mechanical clockwork to move a paper tape. When an electrical current was received, an electromagnet engaged an armature that pushed a stylus onto the moving paper tape, making an indentation on the tape. When the current was interrupted, a spring retracted the stylus and that portion of the moving tape remained unmarked. Morse code was developed so that operators could translate the indentations marked on the paper tape into text messages. In his earliest code, Morse had planned to transmit only numerals and to use a codebook to look up each word according to the number which had been sent. However, the code was soon expanded by Alfred Vail in 1840 to include letters and special characters so it could be used more generally. Vail estimated the frequency of use of letters in the English language by counting the movable type he found in the type-cases of a local newspaper in Morristown.[16] The shorter marks were called "dots" and the longer ones "dashes", and the letters most commonly used were assigned the shorter sequences of dots and dashes. This code was used since 1844 and became known as *Morse landline code* or *American Morse code*.



Comparison of historical versions of Morse code with the current standard. 1. American Morse code as originally defined. 2. The modified and rationalized version used by Gerke on German railways. 3. The current ITU standard.

In the original Morse telegraphs, the receiver's armature made a clicking noise as it moved in and out of position to mark the paper tape. The telegraph operators soon learned that they could translate the clicks directly into dots and dashes, and write these down by hand, thus making the paper tape unnecessary. When Morse code was adapted to radio communication, the dots and dashes were sent as short and long tone pulses. It was later found that people become more proficient at receiving Morse code when it is taught as a language that is heard, instead of one read from a page.[17]

To reflect the sounds of Morse code receivers, the operators began to vocalize a dot as "dit", and a dash as "dah". Dots which are not the final element of a character became vocalized as "di". For example, the letter "c" was then vocalized as "dah-di-dah-dit".[18][19] Morse code was sometimes facetiously known as "iddy-umpty" and a dash as "umpty", leading to the word "umpteen".[20]

The Morse code, as it is used internationally today, was derived from a much refined proposal by Friedrich Clemens Gerke in 1848 that became known as the "Hamburg alphabet" . It was adopted by the Deutsch-Österreichischer Telegraphenverein (German-Austrian Telegraph Society) in 1851. This finally led to the International Morse code in 1865.

In the 1890s, Morse code began to be used extensively for early radio communication before it was possible to transmit voice. In the late 19th and early 20th centuries, most high-speed international communication used Morse code on telegraph lines, undersea cables and radio circuits. In aviation, Morse code in radio systems started to be used on a regular basis in the 1920s. Although previous transmitters were bulky and the spark gap system of transmission was difficult to use, there had been some earlier attempts. In 1910, the US Navy experimented with sending Morse from an airplane.[21] That same year, a radio on the airship *America* had been instrumental in coordinating the rescue of its crew.[22] Zeppelin airships equipped with radio were used for bombing and naval

scouting during World War I,[23] and ground-based radio direction finders were used for airship navigation.[23] Allied airships and military aircraft also made some use of radiotelegraphy. However, there was little aeronautical radio in general use during World War I, and in the 1920s, there was no radio system used by such important flights as that of Charles Lindbergh from New York to Paris in 1927. Once he and the *Spirit of St. Louis* were off the ground, Lindbergh was truly alone and incommunicado. On the other hand, when the first airplane flight was made from California to Australia in 1928 on the *Southern Cross*, one of its four crewmen was its radio operator who communicated with ground stations via radio telegraph.

Beginning in the 1930s, both civilian and military pilots were required to be able to use Morse code, both for use with early communications systems and for identification of navigational beacons which transmitted continuous two- or three-letter identifiers in Morse code. Aeronautical charts show the identifier of each navigational aid next to its location on the map.

Radiotelegraphy using Morse code was vital during World War II, especially in carrying messages between the warships and the naval bases of the belligerents. Long-range ship-to-ship communication was by radio telegraphy, using encrypted messages because the voice radio systems on ships then were quite limited in both their range and their security. Radiotelegraphy was also extensively used by warplanes, especially by long-range patrol planes that were sent out by those navies to scout for enemy warships, cargo ships, and troop ships.

In addition, rapidly moving armies in the field could not have fought effectively without radiotelegraphy because they moved more rapidly than telegraph and telephone lines could be erected. This was seen especially in the blitzkrieg offensives of the Nazi German Wehrmacht in Poland, Belgium, France (in 1940), the Soviet Union, and in North Africa; by the British Army in North Africa, Italy, and the Netherlands; and by the U.S. Army in France and Belgium (in 1944), and in southern Germany in 1945.

A U.S. Navy Morse Code training class in 2015. The sailors will use their new skills to collect signals intelligence.

Morse code was used as an international standard for maritime distress until 1999 when it was replaced by the Global Maritime Distress Safety System. When the French Navy ceased using Morse code on January 31, 1997, the final message transmitted was "Calling all. This is our last cry before our eternal silence."[24] In the United States the final commercial Morse code transmission was on July 12, 1999, signing off with Samuel Morse's original 1844 message, "What hath God wrought", and the prosign "SK".[25]

As of 2015, the United States Air Force still trains ten people a year in Morse.[26] The United States Coast Guard has ceased all use of Morse code on the radio, and no longer monitors any radio frequencies for Morse code transmissions, including the international medium frequency (MF) distress frequency of 500 kHz.[27] However, the Federal Communications Commission still grants commercial radiotelegraph operator licenses to applicants who pass its code and written tests.[28] Licensees have reactivated the old California coastal Morse station KPH and regularly transmit from the site under either this Call sign or as KSM. Similarly, a few US Museum ship stations are operated by Morse enthusiasts.[29]

User proficiency

A commercially manufactured iambic paddle used in conjunction with an electronic keyer to generate high-speed Morse code, the timing of which is controlled by the electronic keyer. Manipulation of dual-lever paddles is similar to the Vibroplex, but pressing the right paddle generates a series of *dahs*, and squeezing the paddles produces dit-dah-dit-dah sequence. The actions are reversed for left-handed operators.

Morse code speed is measured in words per minute (wpm) or characters per minute (cpm). Characters have differing lengths because they contain differing numbers of dots and dashes. Consequently, words also have different lengths in terms of dot duration, even when they contain the same number of characters. For this reason, a standard word is helpful to measure operator transmission speed. "PARIS" and "CODEX" are two such standard words.[30] Operators skilled in Morse code can often understand ("copy") code in their heads at rates in excess of 40 wpm.

In addition to knowing, understanding, and being able to copy the standard written alpha-numeric and punctuation characters or symbols at high speeds, skilled high speed operators must also be fully knowledgeable of all of the special unwritten Morse code symbols for the standard Prosigns for Morse code and the meanings of these special procedural signals in standard Morse code communications protocol.

International contests in code copying are still occasionally held. In July 1939 at a contest in Asheville, North Carolina in the United States Ted R. McElroy W1JYN set a still-standing record for Morse copying, 75.2 wpm.[31] William Pierpont N0HFF also notes that some operators may have passed 100 wpm.[31] By this time, they are "hearing" phrases and sentences rather than words. The fastest speed ever sent by a straight key was achieved in 1942 by Harry Turner W9YZE (d. 1992) who reached 35 wpm in a demonstration at a U.S. Army base. To accurately compare code copying speed records of different eras it is useful to keep in mind that different standard words (50 dot durations versus 60 dot durations) and different interword gaps (5 dot durations versus 7 dot durations) may have been used when determining such speed records. For example, speeds run with the CODEX standard word and the PARIS standard may differ by up to 20%.

Today among amateur operators there are several organizations that recognize high-speed code ability, one group consisting of those who can copy Morse at 60 wpm.[32] Also, Certificates of Code Proficiency are issued by several amateur radio societies, including the American Radio Relay League. Their basic award starts at 10 wpm with endorsements as high as 40 wpm, and are available to anyone who can copy the transmitted text. Members of the Boy Scouts of America may put a Morse interpreter's strip on their uniforms if they meet the standards for translating code at 5 wpm.

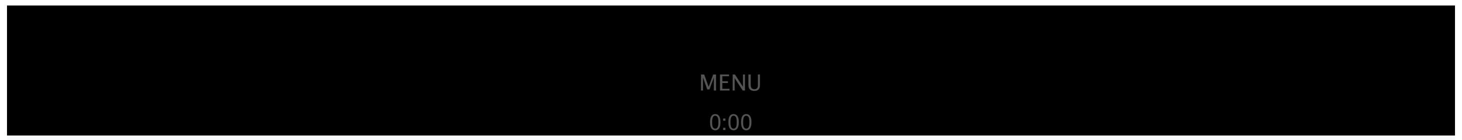
International Morse Code

Morse code has been in use for more than 160 years—longer than any other electrical coding system. What is called Morse code today is actually somewhat different from what was originally developed by Vail and Morse. The Modern International Morse code, or *continental code*, was created by Friedrich Clemens Gerke in 1848 and initially used for telegraphy between Hamburg and Cuxhaven in Germany. Gerke changed nearly half of the alphabet and all of the numerals, providing the foundation for the modern form of the code. After some minor changes, International Morse Code was standardized at the International Telegraphy Congress in 1865 in Paris and was later made the standard by the International Telecommunication Union (ITU). Morse's original code specification, largely limited to use in the United States and Canada, became known as American Morse code or *railroad code*. American Morse code is now seldom used except in historical re-enactments.

Aviation

Cayo Largo Del Sur VOR-DME.

In aviation, pilots use radio navigation aids. To ensure that the stations the pilots are using are serviceable, the stations transmit a set of identification letters (usually a two-to-five-letter version of the station name) in Morse code. Station identification letters are shown on air navigation charts. For example, the VOR-DME based at Vilo Acuña Airport in Cayo Largo del Sur, Cuba is coded as "UCL", and UCL in Morse code is transmitted on its radio frequency. In some countries, during periods of maintenance, the facility may radiate a T-E-S-T code (________) or the code may be removed which tells pilots and navigators that the station is unreliable. In Canada, the identification is removed entirely to signify the navigation aid is not to be used.[33][34] In the aviation service, Morse is typically sent at a very slow speed of about 5 words per minute. In the U.S., pilots do not actually have to know Morse to identify the transmitter because the dot/dash sequence is written out next to the transmitter's symbol on aeronautical charts. Some modern navigation receivers automatically translate the code into displayed letters.



The sound of non directional beacon WG, on 248 kHz, located at 49.8992 North, 97.349197 West,[35] near Winnipeg's main airport

Amateur radio

Vibroplex brand semiautomatic key (generically called a "bug"). The paddle, when pressed to the right by the thumb, generates a series of *dits*, the length and timing of which are controlled by a sliding weight toward the rear of the unit. When pressed to the left by the knuckle of the index finger, the paddle generates a single *dah*, the length of which is controlled by the operator. Multiple *dahs* require multiple presses. Left-handed operators use a key built as a mirror image of this one.

International Morse code today is most popular among amateur radio operators, in the mode commonly referred to as "continuous wave" or "CW". (This name was chosen to distinguish it from the damped wave emissions from spark transmitters, not because the transmission is continuous.) Other keying methods are available in radio telegraphy, such as frequency shift keying.

The original amateur radio operators used Morse code exclusively since voice-capable radio transmitters did not become commonly available until around 1920. Until 2003, the International Telecommunication Union mandated Morse code proficiency as part of the amateur radio licensing procedure worldwide. However, the World

Radiocommunication Conference of 2003 made the Morse code requirement for amateur radio licensing optional.[36] Many countries subsequently removed the Morse requirement from their licence requirements.[37]

Until 1991, a demonstration of the ability to send and receive Morse code at a minimum of five words per minute (wpm) was required to receive an amateur radio license for use in the United States from the Federal Communications Commission. Demonstration of this ability was still required for the privilege to use the HF bands. Until 2000, proficiency at the 20 wpm level was required to receive the highest level of amateur license (Amateur Extra Class); effective April 15, 2000, the FCC reduced the Extra Class requirement to five wpm.[38] Finally, effective on February 23, 2007, the FCC eliminated the Morse code proficiency requirements from all amateur radio licenses.

While voice and data transmissions are limited to specific amateur radio bands under U.S. rules, Morse code is permitted on all amateur bands—LF, MF, HF, VHF, and UHF. In some countries, certain portions of the amateur radio bands are reserved for transmission of Morse code signals only.

The relatively limited speed at which Morse code can be sent led to the development of an extensive number of abbreviations to speed communication. These include prosigns, Q codes, and a set of Morse code abbreviations for typical message components. For example, CQ is broadcast to be interpreted as "seek you" (I'd like to converse with anyone who can hear my signal). OM (old man), YL (young lady) and XYL ("ex-YL" – wife) are common abbreviations. YL or OM is used by an operator when referring to the other operator, XYL or OM is used by an operator when referring to his or her spouse. QTH is "location" ("My QTH" is "My location"). The use of abbreviations for common terms permits conversation even when the operators speak different languages.

Although the traditional telegraph key (straight key) is still used by some amateurs, the use of mechanical semi-automatic keyers (known as "bugs") and of fully automatic electronic keyers is prevalent today. Software is also frequently employed to produce and decode Morse code radio signals.

Many amateur radio repeaters identify with Morse, even though they are used for voice communications.

Other uses

A U.S. Navy signalman sends Morse code signals in 2005.

Through May 2013, the First, Second, and Third Class (commercial) Radiotelegraph Licenses using code tests based upon the CODEX standard word were still being issued in the United States by the Federal Communications Commission. The First Class license required 20 WPM code group and 25 WPM text code proficiency, the others 16 WPM code group test (five letter blocks sent as simulation of receiving encrypted text) and 20 WPM code text (plain language) test. It was also necessary to pass written tests on operating practice and electronics theory. A unique additional demand for the First Class was a requirement of a year of experience for operators of shipboard and coast stations using Morse. This allowed the holder to be chief operator on board a passenger ship. However, since 1999 the use of satellite and very high-frequency maritime communications systems (GMDSS) has made them obsolete. (By that point meeting experience requirement for the First was very difficult.) Currently, only one class of license, the Radiotelegraph Operator License, is issued. This is granted either when the tests are passed or as the Second and

First are renewed and become this lifetime license. For new applicants, it requires passing a written examination on electronic theory and radiotelegraphy practices, as well as 16 WPM codegroup and 20 WPM text tests. However, the code exams are currently waived for holders of Amateur Extra Class licenses who obtained their operating privileges under the old 20 WPM test requirement.

Radio navigation aids such as VORs and NDBs for aeronautical use broadcast identifying information in the form of Morse Code, though many VOR stations now also provide voice identification.[39] Warships, including those of the U.S. Navy, have long used signal lamps to exchange messages in Morse code. Modern use continues, in part, as a way to communicate while maintaining radio silence.

ATIS (Automatic Transmitter Identification System) uses Morse code to identify uplink sources of analog satellite transmissions.

Applications for the general public

Representation of SOS-Morse code.

An important application is signalling for help through SOS, "▄▄▄▄▄▄▄▄▄". This can be sent many ways: keying a radio on and off, flashing a mirror, toggling a flashlight, and similar methods. SOS is not three separate characters, rather, it is a prosign SOS, and is keyed without gaps between characters.[40]

Some Nokia mobile phones offer an option to alert the user of an incoming text message with the Morse tone "▄▄▄▄▄▄▄" (representing SMS or Short Message Service).[41] In addition, applications are now available for mobile phones that enable short messages to be input in Morse Code.[42]

Morse code as an assistive technology

Morse code has been employed as an assistive technology, helping people with a variety of disabilities to communicate. For example, the Android operating system versions 5.0 and higher allow users to input text using Morse Code as an alternative to a keypad or handwriting recognition.[43]

Morse can be sent by persons with severe motion disabilities, as long as they have some minimal motor control. An original solution to the problem that caretakers have to learn to decode has been an electronic typewriter with the codes written on the keys. Codes were sung by users; see the voice typewriter employing morse or votem, Newell and Nabarro, 1968.

Morse code can also be translated by computer and used in a speaking communication aid. In some cases, this means alternately blowing into and sucking on a plastic tube ("sip-and-puff" interface). An important advantage of Morse code over row column scanning is that once learned, it does not require looking at a display. Also, it appears faster than scanning.

In one case reported in the radio amateur magazine *QST*,[44] an old shipboard radio operator who had a stroke and lost the ability to speak or write could communicate with his physician (a radio amateur) by blinking his eyes in Morse. Two examples of communication in intensive care units were also published in *QST*,[45][46] Another example occurred in 1966 when prisoner of war Jeremiah Denton, brought on television by his North Vietnamese captors, Morse-blinked the word *TORTURE*. In these two cases, interpreters were available to understand those series of eye-blinks.

Use in Embedded Systems

Many embedded systems are controlled by an inexpensive microcontroller with dedicated firmware. Often they cannot afford a screen, but almost all can afford a small light emitting diode attached to a digital output pin of the microcontroller.

These lights typically blink to indicate normal operation. However, sending a Morse error code can be convenient because Morse numerals are especially easy to read: If it starts with a dit, count the dits. If starts with a dah, count the dahs, but start at six. If the count reaches ten, that is a zero. Most such units seem to send at 5 words per minute, so slowly that the Morse can be recorded with pencil and paper if necessary.

Electronic units in an aircraft often include a signal light to speed repairs while an aircraft is preparing for its next flight. For example, in self-test mode, seat controls flash service request lights to indicate failures. A clever use of Morse occurred in a model of aircraft in-flight entertainment system. The system's video switch is not attached to the central maintenance computer, because aircraft systems vary, and it can be costly to make a unit work with all of

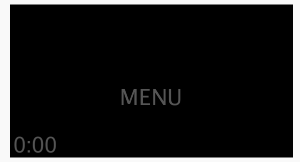
them. Instead the switch had a single green light-emitting diode. The light turns on when the unit is powered, showing that power reached the unit. It blinks fast (3 times per second) when the unit passes self-test. When a valid command comes over the control cables, indicating they are correctly attached, it begins to blink slowly (once per second.) If an internal printed circuit board fails, the light sends Morse numerals to indicate the board to replace.

This cheap system lets the manufacturer diagnose and repair most field failures without removing video units from an aircraft. Also, rapid repair depots in major airports can stock relatively inexpensive single printed circuit boards, rather than very expensive entire video-switch units. The savings in warranty costs and parts inventories ran to millions of dollars per year while also dramatically decreasing the mean time to repair, and the perceived reliability of the unit.[47]

In another usage, a low-cost optical mark reader was required to have a "ready" light, a small light-emitting diode on the front panel. It would light to invite the user to scan a form, and send the data to a PC. To indicate user-correctable errors, such as an unplugged cable, the light would send a single Morse letter. The device's manual included a plastic sticker in the language of the manual. The sticker fit in the unit and explained the codes in the user's native language.[48]

Representation, timing, and speeds

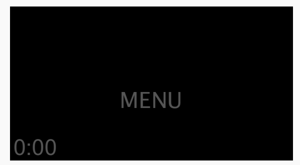
A sample Morse code transmission



The text "Welcome to Wikipedia, the free encyclopedia that anyone can edit." sent as Morse code at 13 wpm.

Problems playing this file? See media help.

Morse code A through Z



"A B C D E F G H I J K L M N O P Q R S T U V W X Y Z" in Morse code at 8 wpm.

Problems playing this file? See media help.

This section includes inline links to audio files. If you have trouble playing the files,

see Wikipedia Media help.

International Morse code is composed of five elements:[1]

1. short mark, dot or "dit" (▄): "dot duration" is one time unit long
2. longer mark, dash or "dah" (▄▄▄): three time units long
3. inter-element gap between the dots and dashes within a character: one dot duration or one unit long
4. short gap (between letters): three time units long
5. medium gap (between words): seven time units long

Transmission

Morse code can be transmitted in a number of ways: originally as electrical pulses along a telegraph wire, but also as an audio tone, a radio signal with short and long tones, or as a mechanical, audible, or visual signal (e.g. a flashing light) using devices like an Aldis lamp or a heliograph, a common flashlight, or even a car horn. Some mine rescues have used pulling on a rope - a short pull for a dot and a long pull for a dash.

Morse code is transmitted using just two states (on and off). Historians have called it the first digital code. Morse code may be represented as a binary code, and that is what telegraph operators do when transmitting messages. Working from the above ITU definition and further defining a bit as a dot time, a Morse code sequence may be made from a combination of the following five bit-strings:

1. short mark, dot or "dit" (▄): 1
2. longer mark, dash or "dah" (▄▄▄): 111
3. intra-character gap (between the dots and dashes within a character): 0
4. short gap (between letters): 000
5. medium gap (between words): 0000000

Note that the marks and gaps alternate: dots and dashes are always separated by one of the gaps, and that the gaps are always separated by a dot or a dash.

Morse messages are generally transmitted by a hand-operated device such as a telegraph key, so there are variations introduced by the skill of the sender and receiver — more experienced operators can send and receive at faster speeds. In addition, individual operators differ slightly, for example, using slightly longer or shorter dashes or gaps, perhaps only for particular characters. This is called their "fist", and experienced operators can recognize specific individuals by it alone. A good operator who sends clearly and is easy to copy is said to have a "good fist". A "poor fist" is a characteristic of sloppy or hard to copy Morse code.

Cable code

The very long time constants of 19th and early 20th century submarine communications cables required a different form of Morse signalling. Instead of keying a voltage on and off for varying times, the dits and dahs were represented by two polarities of voltage impressed on the cable, for a uniform time.[49]

Timing

Below is an illustration of timing conventions. The phrase "MORSE CODE", in Morse code format, would normally be written something like this, where `–` represents dahs and `·` represents dits:

```
–– ––– ·–· ··· ·         –·–· ––– –·· ·
M   O   R   S  E          C    O   D  E
```

Next is the exact conventional timing for this phrase, with `=` representing "signal on", and `.` representing "signal off", each for the time length of exactly one dit:


```
         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789

M------   O----------   R------   S----   E       C----------   O----------   D------   E

===.===...===.===.===...=.===.=...=.=.=...=.......===.=.===.=...===.===.===...===.=.=...=
   ^               ^    ^       ^             ^
   |              dah  dit      |             |
symbol space                letter space   word space
```

Spoken representation

Morse code is often spoken or written with "dah" for dashes, "dit" for dots located at the end of a character, and "di" for dots located at the beginning or internally within the character. Thus, the following Morse code sequence:

```
M   O   R   S  E          C    O   D  E
–– ––– ·–· ··· · (space) –·–· ––– –·· ·
```

is orally:

Dah-dah dah-dah-dah di-dah-dit di-di-dit dit, Dah-di-dah-dit dah-dah-dah dah-di-dit dit.

There is little point in learning to read *written* Morse as above; rather, the *sounds* of all of the letters and symbols need to be learned, for both sending and receiving.

Speed in words per minute

All Morse code elements depend on the dot length. A dash is the length of 3 dots, and spacings are specified in number of dot lengths. An unambiguous method of specifying the transmission speed is to specify the dot duration as, for example, 50 milliseconds.

Specifying the dot duration is, however, not the common practice. Usually, speeds are stated in words per minute. That introduces ambiguity because words have different numbers of characters, and characters have different dot lengths. It is not immediately clear how a specific word rate determines the dot duration in milliseconds.

Some method to standardize the transformation of a word rate to a dot duration is useful. A simple way to do this is to choose a dot duration that would send a typical word the desired number of times in one minute. If, for example, the operator wanted a character speed of 13 words per minute, the operator would choose a dot rate that would send the typical word 13 times in exactly one minute.

The typical word thus determines the dot length. It is common to assume that a word is 5 characters long. There are two common typical words: "PARIS" and "CODEX". PARIS mimics a word rate that is typical of natural language words and reflects the benefits of Morse code's shorter code durations for common characters such as "e" and "t". CODEX offers a word rate that is typical of 5-letter code groups (sequences of random letters). Using the word PARIS as a standard, the number of dot units is 50 and a simple calculation shows that the dot length at 20 words per minute is 60 milliseconds. Using the word CODEX with 60 dot units, the dot length at 20 words per minute is 50 milliseconds.

Because Morse code is usually sent by hand, it is unlikely that an operator could be that precise with the dot length, and the individual characteristics and preferences of the operators usually override the standards.

For commercial radiotelegraph licenses in the United States, the Federal Communications Commission specifies tests for Morse code proficiency in words per minute and in code groups per minute.[50] The Commission specifies that a word is 5 characters long. The Commission specifies Morse code test elements at 16 code groups per minute, 20

words per minute, 20 code groups per minute, and 25 words per minute.[51] The word per minute rate would be close to the PARIS standard, and the code groups per minute would be close to the CODEX standard.

While the Federal Communications Commission no longer requires Morse code for amateur radio licenses, the old requirements were similar to the requirements for commercial radiotelegraph licenses.[52]

A difference between amateur radio licenses and commercial radiotelegraph licenses is that commercial operators must be able to receive code groups of random characters along with plain language text. For each class of license, the code group speed requirement is slower than the plain language text requirement. For example, for the Radiotelegraph Operator License, the examinee must pass a 20 word per minute plain text test and a 16 word per minute code group test.[28]

Based upon a 50 dot duration standard word such as PARIS, the time for one dot duration or one unit can be computed by the formula:

$$T = 1200 / W$$

Where: T is the unit time, or dot duration in milliseconds, and W is the speed in wpm.

High-speed telegraphy contests are held; according to the *Guinness Book of Records* in June 2005 at the International Amateur Radio Union's 6th World Championship in High Speed Telegraphy in Primorsko, Bulgaria, Andrei Bindasov of Belarus transmitted 230 morse code marks of mixed text in one minute.[53]

Farnsworth speed

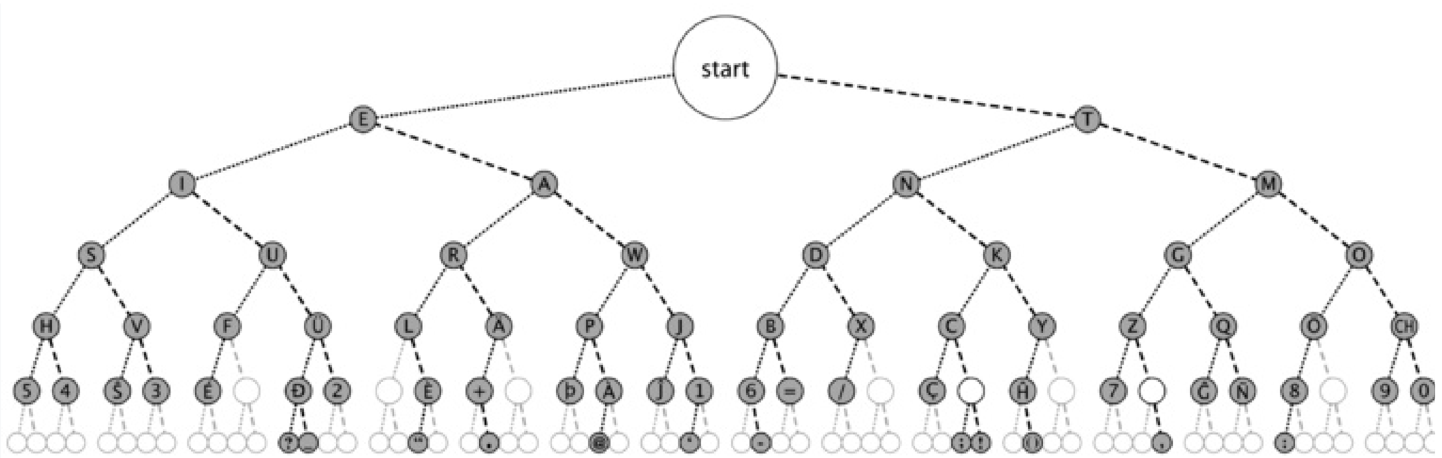
Sometimes, especially while teaching Morse code, the timing rules above are changed so two different speeds are used: a character speed and a text speed. The character speed is how fast each individual letter is sent. The text speed is how fast the entire message is sent. For example, individual characters may be sent at a 13 words-per-minute rate, but the intercharacter and interword gaps may be lengthened so the word rate is only 5 words per minute.

Using different character and text speeds is, in fact, a common practice, and is used in the Farnsworth method of learning Morse code.

Alternative display of common characters in International Morse code

See also: Huffman coding

Some methods of teaching Morse code use a dichotomic search table.



Graphical representation of the dichotomic search table. The graph branches left for each dot and right for each dash until the character representation is exhausted.

Link budget issues

Morse Code cannot be treated as a classical radioteletype (RTTY) signal when it comes to calculating a link margin or a link budget for the simple reason of it possessing variable length dots and dashes as well as variant

timing between letters and words. For the purposes of Information Theory and Channel Coding comparisons, the word *PARIS* is used to determine Morse Code's properties because it has an even number of dots and dashes.

Morse Code, when transmitted essentially, creates an AM signal (even in on/off keying mode), assumptions about signal can be made with respect to similarly timed RTTY signalling. Because Morse code transmissions employ an on-off keyed radio signal, it requires less complex transmission equipment than other forms of radio communication.

Morse code also requires less signal bandwidth than voice communication, typically 100–150 Hz, compared to the roughly 2400 Hz used by single-sideband voice, although at a lower data rate.

Morse code is usually heard at the receiver as a medium-pitched on/off audio tone (600–1000 Hz), so transmissions are easier to copy than voice through the noise on congested frequencies, and it can be used in very high noise / low signal environments. The transmitted power is concentrated into a limited bandwidth so narrow receiver filters can be used to suppress interference from adjacent frequencies. The audio tone is usually created by use of a beat frequency oscillator.

The narrow signal bandwidth also takes advantage of the natural aural selectivity of the human brain, further enhancing weak signal readability. This efficiency makes CW extremely useful for DX (distance) transmissions, as well as for low-power transmissions (commonly called "QRP operation", from the Q-code for "reduce power").

The ARRL has a readability standard for robot encoders called ARRL Farnsworth Spacing[54] that is supposed to have higher readability for both robot and human decoders. Some programs like WinMorse[55] have implemented the standard.

Learning methods

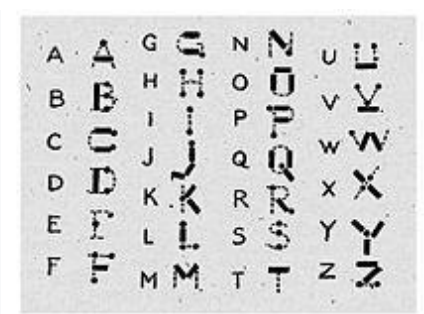
People learning Morse code using the **Farnsworth method** are taught to send and receive letters and other symbols at their full target speed, that is with normal relative timing of the dots, dashes, and spaces within each symbol for that speed. The Farnsworth method is named for Donald R. "Russ" Farnsworth, also known by his call sign, W6TTB. However, initially exaggerated spaces between symbols and words are used, to give "thinking time" to make the sound "shape" of the letters and symbols easier to learn. The spacing can then be reduced with practice and familiarity.

Another popular teaching method is the **Koch method**, named after German psychologist Ludwig Koch, which uses the full target speed from the outset but begins with just two characters. Once strings containing those two characters can be copied with 90% accuracy, an additional character is added, and so on until the full character set is mastered.

In North America, many thousands of individuals have increased their code recognition speed (after initial memorization of the characters) by listening to the regularly scheduled code practice transmissions broadcast by W1AW, the American Radio Relay League's headquarters station.[citation needed]

Mnemonics

Main article: Morse code mnemonics



Scout movement founder Baden-Powell's mnemonic chart from 1918

Visual mnemonic charts have been devised over the ages. Baden-Powell included one in the Girl Guides handbook[56] in 1918.

In the United Kingdom, many people learned the Morse code by means of a series of words or phrases that have the same rhythm as a Morse character. For instance, "Q" in Morse is dah-dah-di-dah, which can be memorized by the phrase "God save the Queen", and the Morse for "F" is di-di-dah-dit, which can be memorized as "Did she like it."

A well-known Morse code rhythm from the Second World War period derives from Beethoven's Fifth Symphony, the opening phrase of which was regularly played at the beginning of BBC broadcasts. The timing of the notes corresponds to the Morse for "V", di-di-di-dah, understood as "V for Victory" (as well as the Roman numeral for the number five).[57][58]"

"

https://en.wikipedia.org/wiki/Morse_code

McCRONE™
ASSOCIATES, INC.
850 Pasquinelli Drive • Westmont, Illinois 60559-5539
630-887-7100 • Fax: 630-887-7417

1 April 2009

Mr. Kevin Repp
Curator of Modern European Books and Manuscripts
Beinecke Rare Book and Manuscript Library
121 Wall Street
New Haven, CT 06511

Subject: Materials Analysis of the Voynich Manuscript Re: Mccrone Associates Project MA47613

Dear Mr Repp:

We have completed our analysis of the Voynich Manuscript, which we examined and sampled at the Sterling Library conservation laboratory on 14 and 15 January 2009. This work was performed under authority of the purchase order dated 11/28/2008 from ProOmnia Film & Video Promotion GmbH.

EXAMINATION

The manuscript, a codex, is 23.5 cm high by 16.2 cm wide by about 5 cm deep and is in fair condition. Bound in vellum with vellum pages, it is approximately 240 pages long, and consists of text, which is currently undeciphered, and illustrations.

The writing is in a brownish-black ink of variable darkness. The sizes of the letters vary from page to page, but are generally consistent within a particular page. The writing appears to have been written with a quill pen.

When examined with ultraviolet radiation, the paints appear quite dark, and the writing is a deep velvety purple-black, suggesting an iron gall ink. Ultraviolet examination of Folio 1R revealed the presence of a signature, probably that of Jacobj a Tepenece. Other, undeciphered writing was seen as well. Many parts of this page exhibit a blotchiness consistent with chemical staining which, it was said, had been applied in order to enhance the writing. It may also have had the long term result of washing away some of the original writing.

SAMPLE COLLECTION

Samples of ink and paint were taken from locations recommended to us by Dr. Alfred Vendl, Institutsvorstand, Institut fClr Kunst und Technologie, Universitat fClr angewandte Kunst in Vienna, Austria, and in consultation with ProOmnia representatives.

The samples were collected using an extremely fine-pointed tungsten needle and a microscalpel. The subjects sampled and their locations are summarized in Table I.

During the sampling, photomicrographs of each of the sampled locations (with the exception of Sample 16) were made with a stereomicroscope, usually at 1X magnification with a 2.5X photo-eyepiece. The photomicrographs are included as figures in this report.

PREPARATION

A portion of each sample was mounted onto a glass microscope slide for polarized light microscopy (PLM) analysis, onto a beryllium planchet for energy dispersive X-ray spectrometry (EDS) in the scanning electron microscope (SEM), onto glass pins for micro X-ray diffraction (XRD), and onto a potassium bromide substrate for infrared spectroscopy analysis (IR) of the media.

ANALYSIS

The samples were analyzed by a combination of PLM, IR, XRD and EDS in the SEM. The results of our analyses are also summarized in Table I, and the spectra generated during the analyses are included as Figures 1B through 20F in this report.

EXAMINATION OF THE BLACK INKS

All of the ink samples were examined by PLM. All of the inks examined, text, drawing, page number, quire number and the "a" on Folio 1 Recto, had similar microscopical characteristics. The particles were consistently a brownish-black color, although there was considerable variation in the opacity (darkness) of the inks; the opacity correlates roughly with the amount of iron present in the EDS spectra. The particles are transparent, isotropic flakes with irregular or conchoidal fracture, and with refractive indices lower than 1.662. Some of the particles were adhered to the vellum substrate, in which case they also often included small particles of anisotropic calcium carbonate. Calcium carbonate is normally found on vellum and was used in its manufacture. Sample 16 also included several very dark opaque particles of more concentrated ink,

and Sample 20 included a red-brown particle with characteristics consistent with burnt sienna, a common iron oxide.

Most of the ink samples are chemically quite similar to one another, based on their elemental analyses as performed by EDS in the SEM. Largely, the inks contained iron, sulfur, calcium, potassium, and carbon in major amounts, with trace amounts of copper and occasionally zinc. Iron gall inks normally contain iron, sulfur and carbon, and

frequently potassium. Small amounts of copper and zinc are a little unusual. Sources for these elements may be as minor contaminants in the iron source, or possibly due to the use of a brass inkwell; the actual source is unknown.

X-ray diffraction provides information about the crystal phases present in a sample. In Sample 2, it identified three crystalline materials, potassium lead oxide, potassium hydrogen phosphate and syngenite, a basic potassium calcium sulfate. Interestingly, the EDS spectrum shows no lead at all, but the other base elements, potassium and oxygen, are present. This issue may require further study if deemed of importance.

Samples 9 and 17 also contained small amounts of mercury, but the other constituents are similar to the rest of the writing and drawing inks. PLM examination of the samples did not show the presence of vermilion (mercury sulfide), a common red pigment, so its origin remains unknown.

All of the inks used for text or drawing were identified as iron gall inks. The variability of the amounts of iron present is not unusual in iron gall inks. We found no significant differences between the writing inks and the drawing inks used throughout the document and tentatively conclude that the text and drawings were most likely created contemporaneously. We did find one example in which paint was clearly over the writing; see Figure 7A.

The other black inks do show some differences.

Bulk analysis of Sample 15, the page number from Folio 26 Recto, includes elements common to the other inks but in different proportions (see Figure 158). It also has a larger amount of iron than any of the text or drawing inks (see especially Figure 15C). This ink is an iron gall ink, but appears to be of a different formulation than the text and drawing inks.

Sample 19, the quire number, is a high carbon, very low iron ink. Microscopically, it appears as a transparent, light brown material without the particulate material suggestive of a carbon ink, and thus it is consistent with an iron gall ink of particularly low iron content. While a carbon ink cannot be completely ruled out, it is our conclusion that the ink present is simply an iron gall ink of particularly low iron content.

Sample 20 is from the "a" on Folio 1 Recto. The letter is somewhat faded, and the amount of ink available for sampling was very small. It is also a high carbon, very low iron ink. Again, its microscopical characteristics are consistent with an iron gall ink. Photomicrographs were made using both white light and ultraviolet fluorescence, which provided more contrast and readability (Figures 20A-1 through 20A-6). However, it

does contain a number of larger particles; see Figures 20C through 20E. Figure 20C shows large amounts of calcium and phosphorus in roughly the same proportions, consistent with a particle of bone black. The other particles appear to be of mineral origin. The IR spectrum indicates the presence of a protein, not a gum. We suspect that the sample was contaminated with the proteinaceous substrate. A proteinaceous binder is unlikely.

Samples 19 and 20 appear to be different inks, although the small amount of material available from Sample 20 lowers the level of confidence in any conclusions we might wish to draw from the available data.

MEDIUM IDENTIFICATION

Infrared spectroscopy identified the binding medium of the writing and drawing inks as a gum; see the reference spectrum for gum Arabic (Figure 1D). The spectra include several sharp peaks in the region 1100-1000 cm^{-1} that are not expected for a gum as per the spectra in our library. This suggests the possibility of other constituents, which remain unidentified as of this date. Most recipes for iron gall inks include gum, usually gum Arabic, as an ingredient.

Gums were also identified as the binding media in the green paints. The blue and red-brown paints were not tested, but, as watercolors, gum would be likely.

BLUE PAINT

The blue paint was unambiguously identified as ground azurite with minor amounts of cuprite, a copper oxide. The red-brown particles visible in Figure 4A, the blue flower, are cuprite; PLM, EDS in the SEM and XRD were all in agreement on this identification. Infrared spectroscopy was not performed on either of the two blue paint samples, but a gum binding medium is the most likely, as consistent with the other samples tested.

CLEAR/WHITE PAINT

Sample 12, the clear/white material, was identified as proteinaceous (Figures 128 through 120), with a large amount of calcium carbonate present. A mixture of glair (eggwhite) and calcium carbonate is likely.

GREEN PAINT

The green paint was tentatively identified as a copper and copper-chlorine resinate, most likely produced as a salted copper corrosion product. PLM indicated the presence

of both isotropic green-stained transparent material consistent with copper resinate, and smaller amounts of anisotropic green particles. The presence of chlorine in the EDS spectrum suggests that the crystalline material might be atacamite or other copper-chlorine compound. In all cases, the amount of copper is in significant excess to that of chlorine, and something like a copper resinate, that is, a copper-containing amorphous organic material, is likely. X-ray diffraction of the sample produced no pattern whatsoever, strongly suggesting that the bulk of the material is non-crystalline.

None of the classical resins were found in this sample by IR spectroscopy, only the gum binding medium as was identified in all of the other paints and inks. Figures 3E and 3F are IR reference spectra for pine resin and mopa-mopa resin, respectively. It could well be that an excess of gum may be overwhelming the signal of a resin.

There are numerous medieval recipes for preparing a green copper pigment using common salt, such as Theophilus' *viride salsum*[1,2].

RED-BROWN PAINT

The red-brown paint was identified as a red ochre by PLM and EDS in the SEM. XRD characterized the crystal phases present as consisting of hematite, iron sulfide, possibly minor amounts of lead sulfide and palmierite (a lead-potassium-sulfur compound (see Figure 8D) in, most likely, a gum medium.

CONCLUSIONS

- In all probability, the ink used for the text is the same as that used for the drawings; both are iron gall inks.
- In all probability, the other three inks, the one used for the page number, the quire ink, and the ink used to write the Latin alphabet on page 1R are all different from the text/drawing ink and from one another. Sample 15, the page number, is an iron gall ink; Sample 19, the quire number, is most likely an iron gall ink of low iron content, as is Sample 20, the "a".
- The blue paint is ground azurite.

[1] Eastaugh, N. *et al,* "Atacamite" in *Pigment Compendium,* a *Dictionary of Historical Pigments,* Elsevier F004 }, page 27

Theophilus, "Salt Green," Book I, Chapter 35, *On Divers Arts*, Dover Publications, New York, (1979), page 41

- The green paint is a mixture of copper-stained amorphous organic material optically consistent with copper resinate, and copper-chloride compounds consistent with atacamite or similar compounds. No resins were identified in the green paint.
- The binding medium for all of the inks and the green paint is gum. The binder for Sample 20 is undetermined.

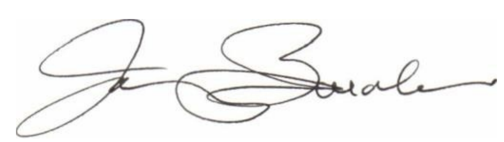
DISPOSITION OF THE SAMPLES

The samples taken from the manuscript were forwarded to Mr. Andreas Sulzer on 27 February 2009. We have retained the microscope slides and other specimen preparations in the event you may require further analysis.

Included with this report is a CD-ROM with the Adobe™ Acrobat file of this report.

Thank you for consulting with Mccrone Associates. If you have any questions concerning any portion of this report, or should you require further analysis, please do not hesitate to call.

Sincerely,



Joseph G. Barabe
Senior Research Microscopist
Director of Scientific Imaging

JGB:jc
Enclosures

Ref: MA47613; retainer and Purchase Order dated 11/28/2008

TABLE I

Constituents Identified in *The Voynich Manuscript*

No.	Color & Item	Sample Locations: Vertical	Sample Locations: Horizontal	Constituents Identified	Figures
1	Folio 26R Black ink from text	3.5 cm from top	10.2 cm from right	- Iron gall ink - Gum binder	1A-1D
2	Folio 26R Black ink from drawing	7.3 cm from top	5.5 cm from right	- Iron gall ink - Potassium lead oxide - Potassium hydrogen phosphate - Syngenite - Gum binder	2A-2D
3	Folio 26R Green leaf	14.2 cm from top	6.7 cm from right	- Copper-organic complex - Atacamite (possible) - Calcium sulfate - Calcium carbonate - Gum binder	3A-3F
4	Folio 26R Blue flower	2.3 cm from top	4.0 cm from right	- Azurite - Cuprite (minor)	4A-4C
5	Folio 26R Red-brown root	18.7 cm from top	9.1 cm from right	- Red ochre (hematite) - Lead oxide - Potassium compounds	5A-5C
6	Folio 47R Black ink from text	8.4 cm from top	12.6 cm from right	- Iron gall ink (low iron) - Calcium sulfate - Calcium carbonate - Gum binder	6A-6D
7	Folio 47R Green leaf	4.3 cm from top	5.4 cm from right	- Copper-organic complex - Atacamite (probable) - Gum binder	7A-7C
8	Folio 47R Red-brown root	0.8 cm from bottom	8.8 cm from right	- Red ochre (hematite) - Iron sulfide - Palmierite	8A-8D
9	Folio 78R Black ink from text	3.6 cm from top	12.7 cm from right	- Iron gall ink (low iron) - Calcium sulfate - Mercury compound (traces) - Gum binder	9A-9D
10	Folio 78R Blue water from pipe	7.4 cm from top	2.8 cm from right	- Azurite - Cuprite (minor)	10A-10C

Ref: MA47613
Page 1 of 2

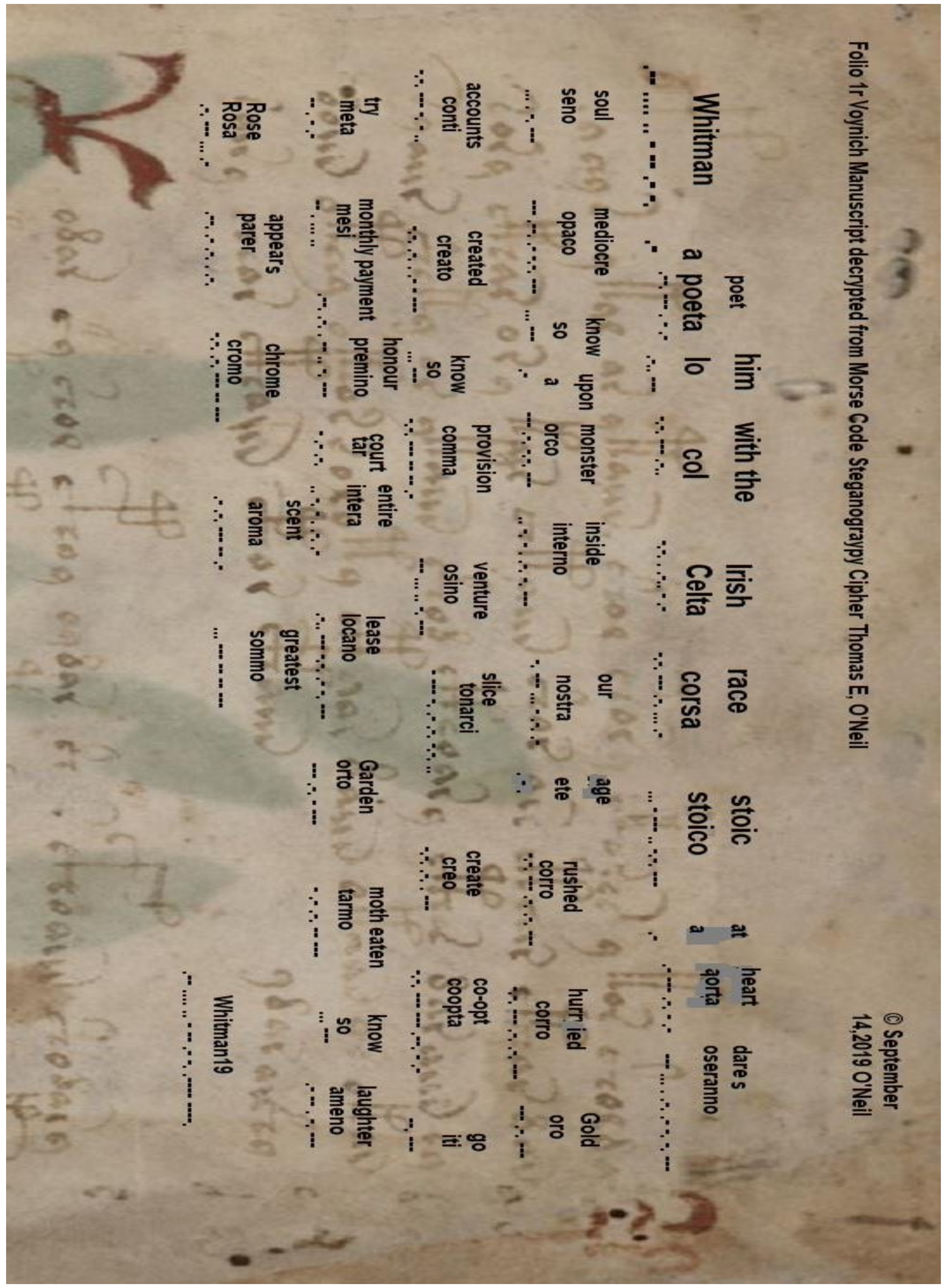
NIcCRONE™
ASSOCIATES, INC.

TABLE I - continued

Constituents Identified in *The Voynich Manuscript*

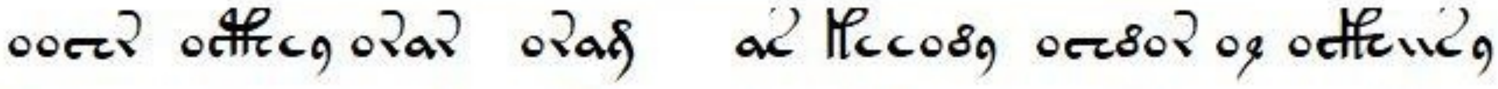
No.	Color & Item	Sample Locations		Constituents Identified	Figures
		Vertical	Horizontal		
11	Folio 78R Green pool	3.6 cm from bottom	4.8 cm from right	- Copper-organic complex - Atacamite (probable) - Tin and iron compounds - Gum binder - Azurite and cuprite (traces)	11A-11C
12	Folio 78R Clear material from headdress of bather	3.6 cm from bottom	4.9 cm from right	- Calcium carbonate - Proteinaceous material, possibly eggwhite	11A, 12A-12D
13	Folio 86V Black ink from text	2.5 cm from top	6.7 cm from left	- Iron gall ink - Potassium compound - Calcium sulfate - Calcium carbonate - Gum binder	13A-13C
14	Folio 86V Black ink from drawinQ	4.0 cm from top	1.0 cm from right	- Iron gall ink (low iron) - Gum binder	14A-14C
15	Folio 26R Black ink from page number (26)	0.8 cm from top	0.8 cm from right	- Iron gall ink (high phosphorus and iron) - Gum binder	15A-15D
16	Folio 116V Black ink from text	6.9 cm from top	2.9 cm from left	- Iron gall ink (high iron) - Gum binder (no photograph recorded)	16A, 16B
17	Folio 70V Black ink from drawing (woman's face)	12.5 cm from top	14.3 cm from left	- Iron gall ink - Mercury compound - Titanium compound - Tin compound (particle) - Gum binder	17A-17F
18	Folio 70V Clear-white paint from drawing (woman's face)	12.5 cm from top	14.3 cm from left	- Proteinaceous - Carbohydrate-starch (traces)	17A, 18A, 18B
19	Folio 8V Black ink from quire mark on bottom right	0.2 cm from bottom	12.8 cm from left	- Iron gall ink (very low iron) - Gum binder	19A-19C

20	Folio 1R Black ink from "a" under chemical stain	2.5 cm from top	0.6 cm from right	- Iron gall ink (very low iron) - Bone black - Titanium compound - Binder undetermined	20A-1-20F



Full Cipher

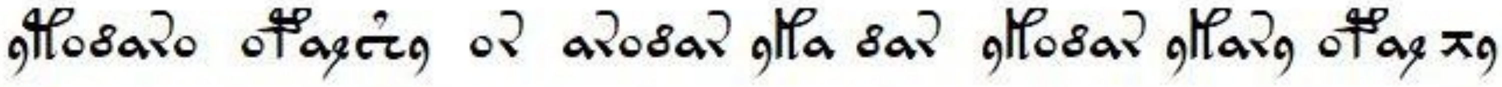
count	letter	Morse	count	letter	Morse	count	letter	Morse
25468	O	1 dot	[illegible]6	2	1 dot	148	U	
20227	C	1 dot	1752	N		96	6	3 dots and 4 dashes
17655	9	1 dot & 1 dash	1413	B	3 dots and 4 dash	74	Y	6 dashes & 2 dots
14281	A	1 dot & 1 dash	1046	J	5 dots & 3 dashes	52	K	
12973	8	4 dashes & 1 dot	[illegible]	Q	3 dots 6 dashes	31	G	
11008	S	1 dash & 4 dots	908	X	2 dots 7 dashes	[illegible]	L	
10471	E	2dots & 2dash	591	T		14	H	
10026	F	4 dashes & 1 dot	524	*		2	1	
6716	R	3 dash & 2dots	431	V	2 dots and 4 dashes	1	5	
5994	P	1 dash &2 dots	316	I	1 dash	1	0	
5423	4	5 dashed 1 dot	217	W	6 dashes & 3 dots			
4501	Z	3 dashes 4 dots	157	D	2 dash			
4076	M	4 dashes	156	3				



Settare estimo merlo 995 ne 330 merlons ce 500

[illegible]

Set estimate of battlements 995 of which, 330 merlons there is. 500



Armigero prossimo! so motorist morte! menano menagramo premono truppa!

[illegible]

men at arms near! Be aware, engineer dead! Deliver jinx, crush troops!

ⲭ = .-

Ros 2 Spiral Castle Text decrypted, Voynich Manuscript

By following an anagram approach, according to the Morse Code Cipher substitution method to Italian; I was able to produce a short narrative which grammatically is somewhat inconsistent to Italian. However my premise is that Wilfrid Voynich, who developed the cipher, was using an Italian dictionary from the aspect of English grammar. Voynich knew 18 languages albeit not that well. The narrative is very clear to the point conveying a battle and a possible ruse involved with medieval tactics regarding the swallow tail merlons.

"A possible historical cross reference from the Ros 2 Castle folio spiral text:

https://www.academia.edu/40410943/Ros_2_Castle_decrypted

After reconnoitring the English position, a council of war was held where the senior French officials, who were completely confident of victory, advised an attack, but not until the next day.[93] The army was tired from a 12-mile march, and needed to reorganise so as to be able to attack in strength.[94] It was also known that the Count of Savoy with more than **500 men-at-arms** was marching to join the French and was nearby.[95] (He intercepted some of the French survivors the day after the battle).[61] Despite this advice, the French attacked later the same afternoon; it is unclear from the contemporary sources whether this was a deliberate choice by Philip, or because too many of the French knights kept pressing forward and the battle commenced against his wishes.[96] Philip's plan was to use the long-range missiles of his crossbowmen to soften up the English infantry and disorder, and possibly dishearten, their formations, so as to allow the accompanying mounted men-at-arms to break into their ranks and rout them.[97][98] Modern historians have generally considered this to have been a practical approach, and one with proven success against other armies.[99]

"

MIT believes the Voynich Corpus to be in a Anagram format, list Italian a possible candidate!

"We then present an approach to decoding anagrammed substitution ciphers, in which the letters within words have been arbitrarily transposed. It obtains the average decryption word accuracy of 93% on a set of 50 cipher texts in 5 languages.

The properties and the dating of the manuscript imply Latin and Italian as potential candidates."

https://www.mitpressjournals.org/doi/abs/10.1162/tacl_a_00084

I just want to say to all those people out there that think I'm drinking the Kool-Aid regarding a nutty approach for the text to be in anagrams, they should contact MIT. If they are on to Italian they should check in with my cipher as it leans more towards a Polyalphabetic over substitution.

https://www.mitpressjournals.org/doi/pdfplus/10.1162/tacl_a_00084

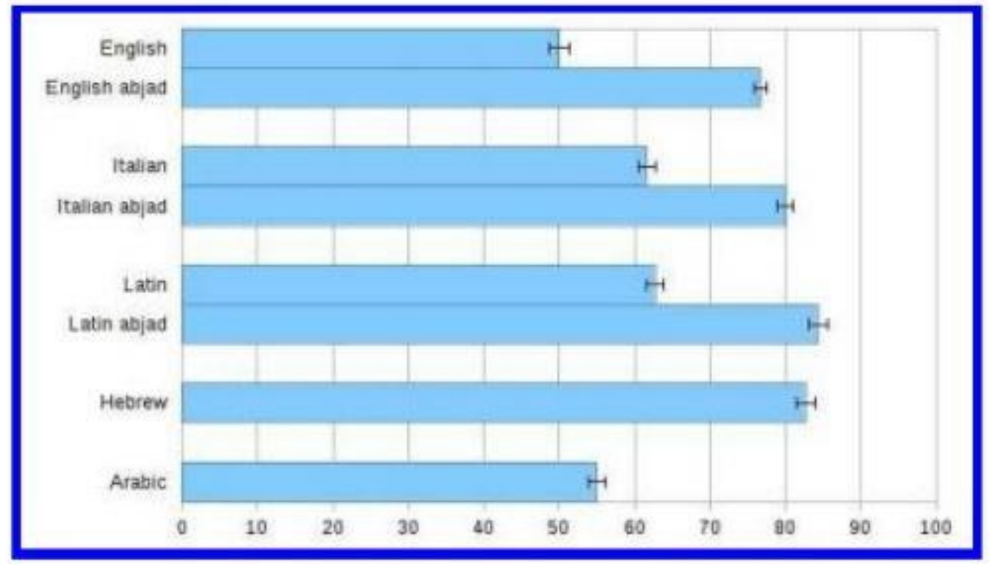


Figure 6: Average percentage of in-vocabulary words in the decipherments of the first ten pages of the VMS.

Folio 16r 1st paragraph marijuana decryption process achieved!

This was no simple task by a long shot, however I have done it. Wilfrid Voynich discusses his Garden maybe metaphorically as a Kingdom while high and how to plant his marijuana plants or meadow grass. His garden contains Myrtle which aids in pain suppression and poisonous Arum lilies. He also grows pears in his garden. The seeds I believe are placed 1.9 centimeters in the ground.
If you like follow my cipher and see how the sum of dots and dashes equal the Voynich vords as-well as the Italian words. The cipher never changes as it is established as bullet proof.
:)
https://www.jasondavies.com/voynich/#f16r/0.475/0.17/3.20

Vigorose marijuana oggetta menti reti norme.

Strong marijuana targets brains network normal.

Sante Uomo mio regni ventare nostrani pera.

Holy man , my kingdom boasts home-grown pears

Mirto pianta, aro canna con carnose prato

Myrtle plants, Arum lilies with a fleshy meadow.

Folio 16r Page 1 Tom E. O'Neil ©

Germine pianta metta a 1.9 aerino campo

Germinate plants, put at 1.9! Aerate field,

Ponemmo separano

plant separately!

Folio 16r Page 2 Tom E. O'Neil ©

Euganei Veneta ha multa sorgero circondante

Eugenean Venetia has fine springs surrounding

antico montante e se stata

.- -. - .. -.-. ---| -- --- -. - .- -. - .|. |... . |... - .- - .-

ancient uphills and in itself was

no etto drogo Uomo casomai

-.---|. -- ---| -.. .-. --- --. ---|..- --- -- ---| -.-. .- ... --- -- .- ..

no hectograms drugs. Man if anything

F16r Voynich Manuscript 2nd paragraph at top Tom O'Neil ©

ornato stia non ecco mietono seminava

attractive is not here, reap seeds,

Mettano con acqua dal Moor note zona

put with water from the Moor, note area!

End of 2nd f16r Paragraph Voynich Manuscript
Tom O'Neil ©

Canape aumento gettito sbuffarono

Hemp increased revenue, snorted

quotidiana datomi fumati tenteremmo

daily, given to me smoked! We would attempt

avere adori pento pia loda

to have worship, repent piously, praising

3rd paragraph at top f16r Voynich Manuscript © Tom O'Neil

esultarono pregano adorai pia

Exulting, praying, worshiping pious

esultammo battezzato con tuo prete

exultations, baptizing with your Priest.

End of Folio 16r Voynich Manuscript

Tom O'Neil ©

Proof