

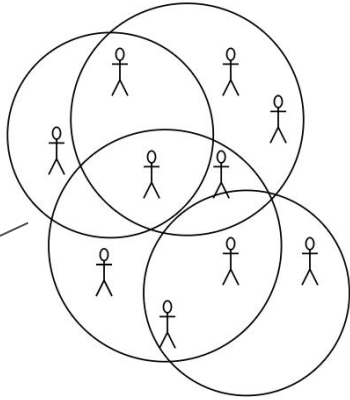
Ciphers at the Edge of Language Design

Trithemius' Secret Word Lists and the Voynich Manuscript, Perhaps?

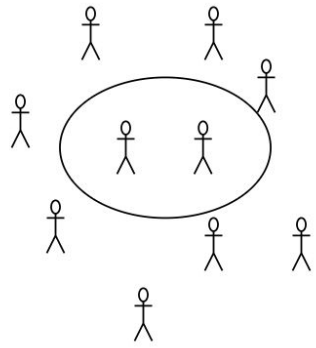
Jürgen Hermes – IDH – University of Cologne

Different Types of Language modeling

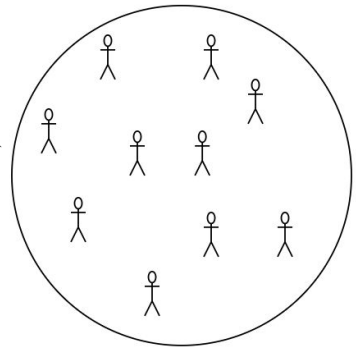
Initial State



Cipher Design



Universal Language Design



Structure of the Talk

➤ A brief view on Artificial Languages

➤ The Universal Language Concept of John Wilkins (1614-1672)

➤ The Cipher Tables of Abbot Johannes Trithemius (1462-1516)

➤ An Assumption about the Voynich Manuscript (1450?)

➤ (If there is still time) Experiment: Operational Similarity

Artificial Languages

➤ Classifications (following Bausani 1970):

○ Degrees of freedom (syntax, words, morphology, phonology)

○ Sacrality vs. profanity

○ Naturalness vs. rule-basedness (a posteriori vs. a priori)

➤ Triggers:

○ Retreat of Latin as the language of science

○ Introduction of logographic scripts (Chinese)

○ Redeeming adamitic language

○ Combinatorics (Kabbalah, Lull)

○ Taxonomies (Aristoteles, Becher, Dalgano, Wilkins)

○ Science (Leibnitz: thinking = calculating)

Real Characters (Wilkins 1668)

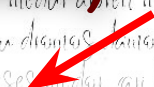
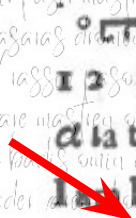
Yassul wasant damu medou mastiell abro masti pasin fain cadafu; pason dromes xre dias medou yassen fains abul yassel pasas medou yassen masarin pasan pasus thant damu
meda yassul pasi dien bades pasun an adui abien badi damus masties masariat pasul fare dromat pasu yassu masarie xros cadafen damul draf yasson masaren pasil pasas abro fain
ome mesos dromel xns cadafu; pasel fains dho mastiell pasu fare damon xre x cadafan mastiell xras omu mesa fains fain abul masties masariat damu abien damus damul damu mada
mesel auf masariet abun dret dret pasen die yassul fain damu yasse masarie pasu dromu damu masties; xre x pasu pasan damus pasu pasant abien masti mastiell omes damu
pasun cadafu abien mede abie fain abies die cadafu; pasu dromas mastiell fare die badat pasu cadafu mastiell fain pasan damu medou abien madaf omes pasu; yassen xrox mastie
fain xre cadafan madafabu badu pase abus yassen pasari thant yassit yassel masariat abius yassul badux abun die dromit damu dromas damus badi x yassul masarien pasu xre
madaf omes damu fli x madafabu pasu mastie fain xre masti pasari fare yassu dromel pasel medus; xras adu yassen masariat pases medou an bades abu omu omis pasu; cadafu x
an x meson dien damu badi; masariat abun die; madafabu medou badu fain damus mastiell yasso dromen mede yassel masaren damu medou fains pasu medu madafabu omu yasse
damus medes flit madafabu damu yassu pasu thant badu dia; pasun yassu dromel pasel medus; xras adu yassen masariat pases medou an bades abu omu omis pasu; cadafu x
badi; baden damu dret yasso xre mastiell omes abus mesu masariat damu fain; masariat omes abus mesu masariat pases medou an bades abu omu omis pasu; cadafu abien mastiell mastiell; fain an
abien badi; masariat pasu medu badi; omu abien damu dromat damu fare; yassu masariet pasu pasu thant damu yassu pasu; xre x dromes; mede flit; pasu masariat damus badi; masariat damu

I am believing God the Father Almighty Maker of Heaven and

of Earth, and in Jesus Christ his Son only our Lord, who was
conceived by the Holy Ghost, born of the Virgin Mary, suffered
and died under Pontius Pilate, crucified, dead, and buried, and descended into hell, the third day he rose again from the dead, and ascended into heaven, and sitteth on the right hand of God the Father Almighty, and he cometh to judge the living and the dead. His Kingdom shall have no end.

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and died under Pontius Pilate, crucified, dead, and buried, and descended into hell, the third day he rose again from the dead, and ascended into heaven, and sitteth on the right hand of God the Father Almighty, and he cometh to judge the living and the dead. His Kingdom shall have no end.

Real Characters (Wilkins 1668)



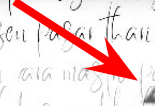
I believe God the Father Almighty Maker of Heaven and

of Earth, and in Jesus Christ his Son only our Lord, who was

conceived by the Holy Ghost, born of the Virgin Mary, suffered

Background text in a constructed language, likely a cipher or a very early form of a world language, consisting of various syllables and characters.

Real Characters (Wilkins 1668)

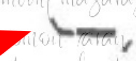


1 2 3 4 5 6 7 8 9 10 11

α la tealti dab e-ετα αλ ε'εαλbais la dad na
I am believing God the Father Almighty Maker of Heaven and



12 13 14 15 16 17 18 19 20 21 22
la dady na dadd he cobas εσopas hα' laba αα
of Earth, and in Jesus Christ his Son only our Lord, who was

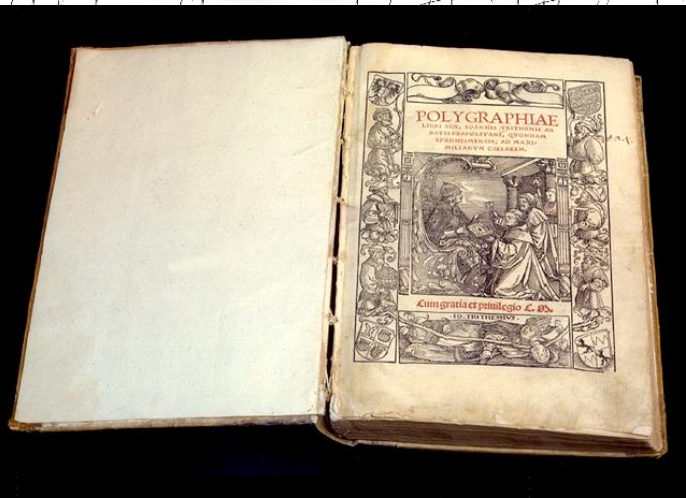
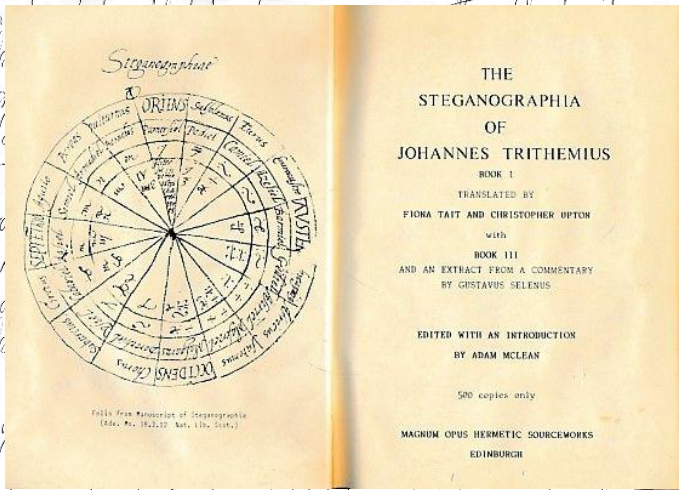


23 24 25 26 27 28 29 30 31 32
εαmbab la αl Dag εαmbele αl codad βεmt
conceived by the Holy Ghost, born of the Virgin Mary, suffered

Johannes Trithemius (1462-1516)

Steganographia (1499/1500)

Polygraphia (1506)



Polygraphia I: Ave Maria (Hale Mary) Cipher

POLYGRAPHIAE

A Deus	A clemens
B Creator	B clementissimus
C Conditor	C pius
D Opifex	D piissimus
E Dominus	E magnus
F Dominator	F excelsus
G Consolator	G maximus
H Arbitr	H optimus
I Iudex	I sapientissimus
K Illuminator	K inuisibilis
L Illustrator	L immortalis
M Rector	M aeternus
N Rex	N sempiternus
O Imperator	O gloriosus
P Gubernator	P fortissimus
Q Factor	Q sanctissimus
R Fabricator	R incomprehensibilis
S Conferuator	S omnipotens
T Redemptor	T pacificus
V Auctor	V misericors
X Princeps	X misericordissimus
Y Pastor	Y cunctipotens
Z Moderator	Z magnificus
W Salvator	W excellentissimus

A creans	A coelos
B regens	B coelestia
C conferuans	C supercoelestia
D moderans	D mundum
E gubernans	E mundana
F ordinans	F homines
G ornans	G humana
H exornans	H angelos
I constituens	I angelica
K dirigens	K terram
L produccens	L terrena
M decorans	M tempus
N stabiliens	N temporalia
O illustrans	O aeternum
P intuens	P auiterna
Q monens	Q omnia
R confirmans	R cuncta
S custodiens	S vniuersa
T cernens	T orbem
V discernens	V astra
X illuminans	X solem
Y fabricans	Y stellas
Z saluificans	Z vitam
w faciens	w viuercia

LIBER L 50

A sanctis	A coelis
B electis	B coelestibus
C predelectis	C supercoelestibus
D sanctissimis	D aeternum
E iustis	E perpetuum
F iustificatis	L sempiternum
G predestinatis	G secula seculorū
H angelis	H aeternum sanctum
I archangelis	I saeculum
K amatoribus	K regno caelorum
L cultoribus	L altissimis
M amicis	<i>fuis in</i> M excelsis <i>amen</i>
N apostolis	<i>fuis in</i> N paradiso <i>amen</i>
O prophetis	O olympo
P discipulis	P paradyfiacis
Q martyribus	Q olympicis
R sanctificatis	R fulgoribus
S dominationibus	S felicitate
T dilectis	T felicitatibus
V ciuibus	V gloriosis
X feruis	X honore
Y famulis	Y magnificentia
Z ministris	Z luce perpetua
w confessoribus	w patria celesti

A im

G 3 A Ma

Polygraphia I: Ave Maria (Hale Mary) Cipher

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L produccens	L terrena
M decorans	M tempus
N stabiliens	N temporalia
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S custodiens	S vniuersa
T cernens	T orbem
V discernens	V aftra

LIBER I 50

A sanctis	A celis
B electis	B coelestibus
C prædilectis	C supercoelestibus
D sanctissimis	D æternum
E iustis	E perpetuum
<u>F iustitiam</u>	L sempiternum
G prædestinatis	G sæcula sæculorũ
H angelis	H æuum sanctum
I archangelis	I sæculum
K amatoribus	K regno cœlorum
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M amicis	<i>suis in</i> M excelsis <i>amen</i>
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Q martyribus	Q olympicis
R sanctificatis	R fulgoribus
S dominationibus	S foelicitate
T dilectis	T foelicitatibus
V ciuibus	<u>V gloriõis</u>

secret: Conservator magnus conferuans cuncta iustis [suis in] felicitibus [amen].

Excelsus
A

Aim

G 3 A Ma

Polygraphia III: The Artificial Language Mimic

1	2	3	126
A Abra	A mada	A badar	1
B Abre	B mada	B badar	2
C Abri	C madi	C badir	3
D Abro	D mado	D bador	4
E Abru	E madu	E badur	5
F Abra	F madas	F badan	6
G Abres	G mades	G baden	7
H Abri	H madis	H badin	8
I Abros	I mados	I badon	9
K A brus	K madus	K badun	10
L A bran	L madan	L badas	11
M A bren	M maden	M bades	12
N A brin	N madin	N badis	13
O A bron	O madon	O bados	14
P A brun	P madun	P badus	15
Q A bral	Q madal	Q badal	16
R A brel	R madel	R badel	17
S A bril	S madil	S badil	18
T A brol	T madol	T badol	19
V A brul	V madul	V badul	20
X A brax	X madax	X badax	21
Y A brix	Y madix	Y badix	22
Z A brix	Z madix	Z badix	23
w A brox	w madox	w badox	24
	Ff 3	Aca-	

	P.III-1	P.III-2	P.III-3	P.III-4	P.III-5	P.III-6	P.III-7
a	abra	mada	badar	cadalan	pasa	adam	lora
b	abre	mada	bader	cadalen	pase	adem	lore
c	abri	madi	badir	cadalin	pasi	adim	lori
d	abro	mado	bador	cadalon	paso	adom	loro
e	abru	madu	badur	cadalun	pasu	adum	loru
f	abras	madas	badas	cadalas	pasan	adas	loraff
g	abres	mades	bades	cadales	pasen	ades	loreff
h	abris	madis	badis	cadalis	pasin	adis	loriff
i	abros	mados	bados	cadalos	pason	ados	loroff
k	abrus	madus	badus	cadalus	pasun	adus	loruff
l	abran	madan	badan	cadalap	pasas	adan	loras
m	abren	maden	baden	cadalep	pasas	aden	lores
n	abrin	madin	badin	cadalip	pasas	adin	loris
o	abron	madon	badon	cadalop	pasas	adon	loros
p	abrun	madun	badun	cadalup	pasas	adun	lorus
q	abral	madal	badal	cadalar	pasal	adar	loran
r	abrel	madel	badel	cadaler	pasal	ader	loran
s	abril	madil	badil	cadalir	pasal	adir	lorin
t	abrol	madol	badol	cadalor	pasal	ador	loron
v	abrul	madul	badul	cadalor	pasal	adur	lorun
x	abram	madax	badax	cadalax	pasar	adal	lorat
y	abrem	madex	badex	cadalex	pasar	adel	loret
z	abrim	madix	badix	cadalix	pasar	adil	lorit
w	abrom	madox	badox	cadalox	pasar	adol	lorot

3 damus badu x rasset masaien pasu are
 in an badel abru omi omis pasu cadale x
 in medu fars pasi medu mada baf omi rasset
 idis fariot damer dia fana!! medu maduf abru
 u cadafu abren mastren mastria!! fariot an
 dan baduf pasaf an adu masaint damer
 fariot damu abren rasset damis an dies
 asan masaris damer badis masaris damu
 ni pasen medus pasu rasset masaria pasaf
 us dromu pasul an ades rasset masari
 an rasset rasset anis pasaf thaw mastias
 rel pasaf medus an x adu anis mesul dies
 dromu damu mada baf medus medu rasset
 pasaf fariot medu mesi medu rasset pasen
 i amon damus badu pasaf abru di abren
 edus an x mada baf rasset masaria an x
 asties masaru pasaf fariot fari pasul drom
 faren mesa badan amon an medu pasen
 an rasset damu pasis medus an aduf anis
 leban medu medu pasu medu mastren an
 fariot mesaf mastie rasset an abia di abru

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V Abri	V madul	V badul	20
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Y Abri	Y medex	Y badex	22
Z Abri	Z madix	Z badix	23
w Abri	w madox	w badox	24

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f	abras	madas	badas	cadalas	pasan	adas	loraff
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q	abral	madal	badal	cadalar	pasal	adar	loran
r	abrel	madel	badel	<u>cadaler</u>	pasel	ader	loren
s	<u>abril</u>	madil	badil	cadalir	pasil	adir	lorin
t	abrol	madol	badol	cadalor	pasol	<u>ador</u>	loron
v	abru	madul	badul	cadalul	pasul	adur	lorun

secret: abril madu badir cadeler pasu ador

w	abrom	madox	badox	cadalox	pasor	adal	lorat
						ader	loret
						adir	lorit
						ador	lorot

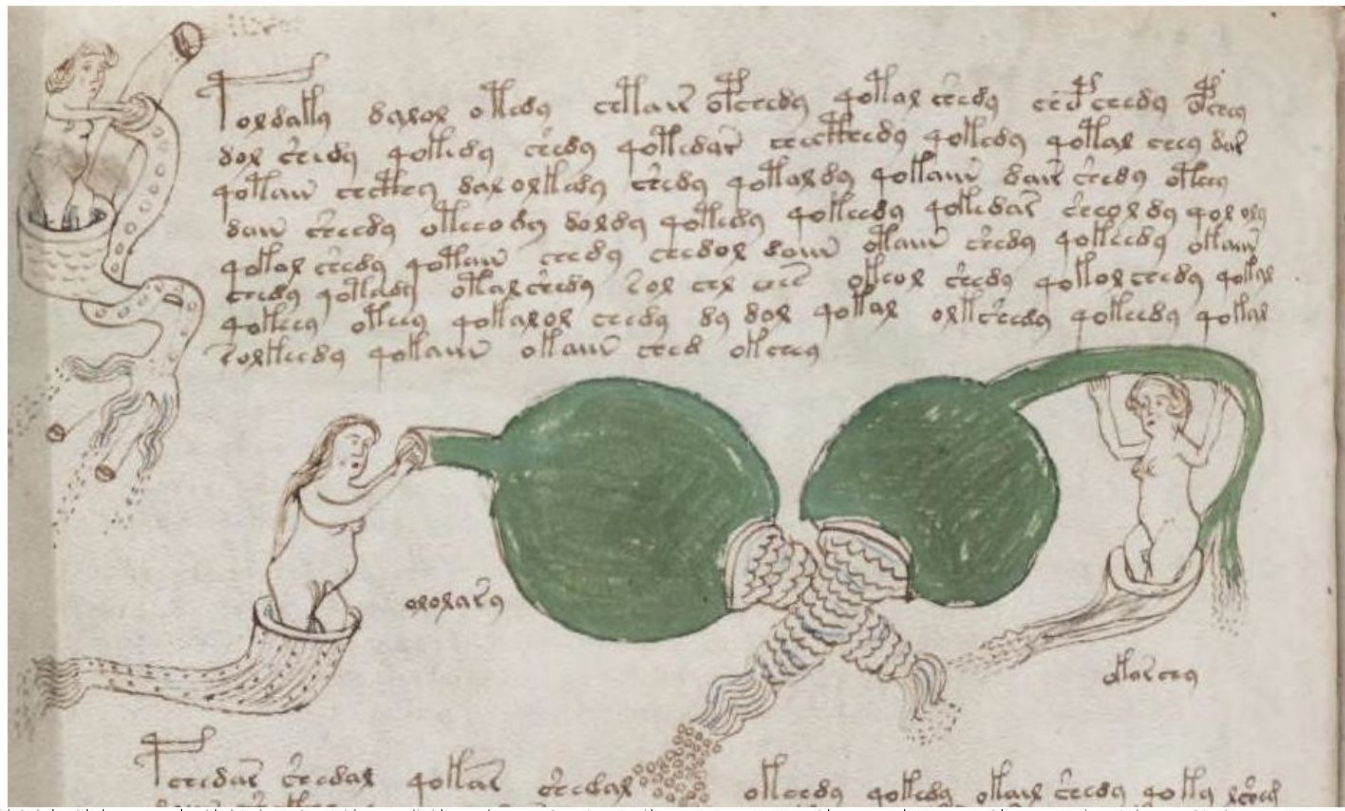
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R Abri	R madel	R badel	17
S Abri	S madil	S badil	18
T Abri	T madol	T badol	19
V Abri	V madul	V badul	20
X Abri	X madax	X badax	21
Y Abri	Y madex	Y badex	22
Z Abri	Z madix	Z badix	23
W Abri	W madox	W badox	24

	P.III-1	P.III-2	P.III-3	P.III-4	P.III-5	P.III-6	P.III-7
a	abra	mada	badar	cadalan	pasa	adam	lora
b	abre	made	bader	cadalen	pase	adem	lore
c	abri	madi	badir	cadalin	pasi	adim	lori
d	abro	mado	bador	cadalon	paso	adom	loro
e	abru	madu	badur	cadalun	pasu	adum	loru
f	abras	madas	badas	cadalas	pasan	adas	loraff
g	abres	mades	bades	cadales	pasen	ades	loreff
h	abris	madis	badis	cadalis	pasin	adis	loriff
i	abros	mados	bados	cadalos	pason	ados	loroff
k	abrus	madus	badus	cadalus	pasun	adus	loruff
l	abran	madan	badan	cadalap	pasas	adan	loras
m	abren	maden	baden	cadalep	pasas	aden	lores
n	abrin	madin	badin	cadalip	pasis	adin	loris
o	abron	madon	badon	cadalop	pasos	adon	loros
p	abrun	madun	badun	cadalup	pasus	adun	lorus
q	abral	madal	badal	cadalar	pasal	adar	loran
r	abrel	madel	badel	cadaler	pasel	ader	loren
s	abril	madil	badil	cadalir	pasil	adir	lorin
t	abrol	madol	badol	cadalor	pasol	ador	loron
v	abrol	madol	badol	cadalor	pasol	ador	loron
				cadalax	pasar	adar	lorat
				cadalex	paser	ader	loret
				cadalix	pasir	adir	lorit
				cadalox	pasor	ador	lorot

cheese: pasi pasin pasu pasu pasil pasu

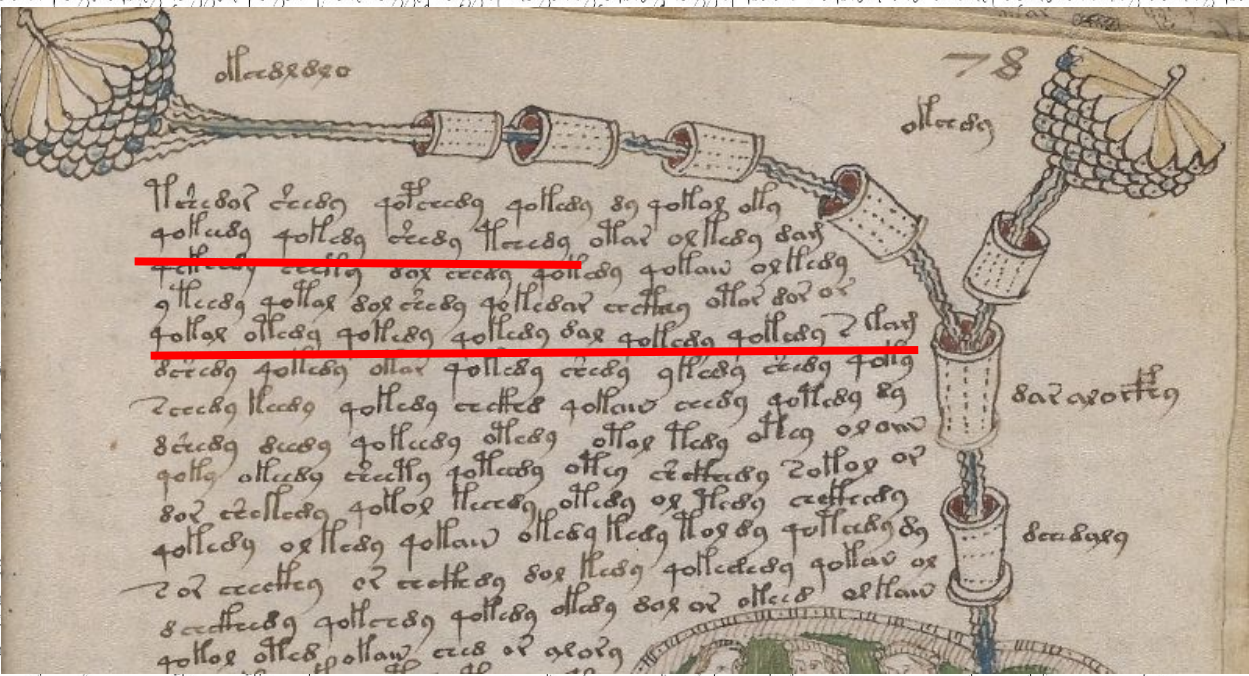
The Voynich Manuscript: Still an unsolved Mystery



rassul wasanl damu medon mastiel abro masti pasu lain cadafu; pasun dromes rare dias medon rassu laus abul rassel pasas medon rassu masam pasan pasus thant damu
meda rassot pasi dien bades pasun an adui abien badi damus mastis masarat pasul fare dromat pasu rassu masare rous cadafan damul diaf rasson masaren pasil pasas abro fait
ome mesos dromel rous cadafu; pasel faras dia mastiaf pasi farel damon rare x cadafan mastiaf rous omu mesa farus laum abul mastis masarat damu abien damus damaf damu mada
mesel anu rassot abul fait diet pasen medu rassu an damu rassu masare pasu dia an damu cadafu; medu rassu masare damu bades masarat abro masti mastis farus damu
rasson cadafu; abien medu abro faru abies omu cadafu; rous dromes mastiaf fare, an bades pasu cadafu; mada abro fait pasu damu medu abien masti rous pasu rassu an x masti
faran an cadafan mada
madaf omu damu pler
an x meson dien damu ba
damus medes pler mada
bades bade damu diet
abien bades masan pasu
cadafu; cadafes pasun
pler sit damu rassu mas
medus rare adu rassu pa
mastiu abien mastiu
pasas dromes an medu
omus abien damu dia meda
damu bade masare pas
pasul masti pler sen dan
dromel pler sen masare
faran rassu damu adu
pler sit abien fait abu mas
pasu fait abien rassu
rassu an x rasse masare
mesel diaf damu bades ma
mede madaf damu madaf omu

rassu masaren pasu an
u omu omus pasu cadafu;
si medu madaf omu rassu
diaf farul medu madaf abul
mastien mastiaf fait an
al an adu masarat damu
u rassu damu an dies
ames bades masare damu
pasu rassu masarat pasas
an x adu rassu masan
rassu pasu thant mastiaf
an x adu anu mesul dies
bades medus medu rassu
u mesi medu rassu pasu
adui pasel abul dia abien
pasu rassu masare an x
pasul fare laum pasul drom
an omu an medu pasu
pasu medus rare adu rous
pasu medu mastien rare
rassu an x abia dia abien

An Odd Property of Voynichese: Repetitiveness



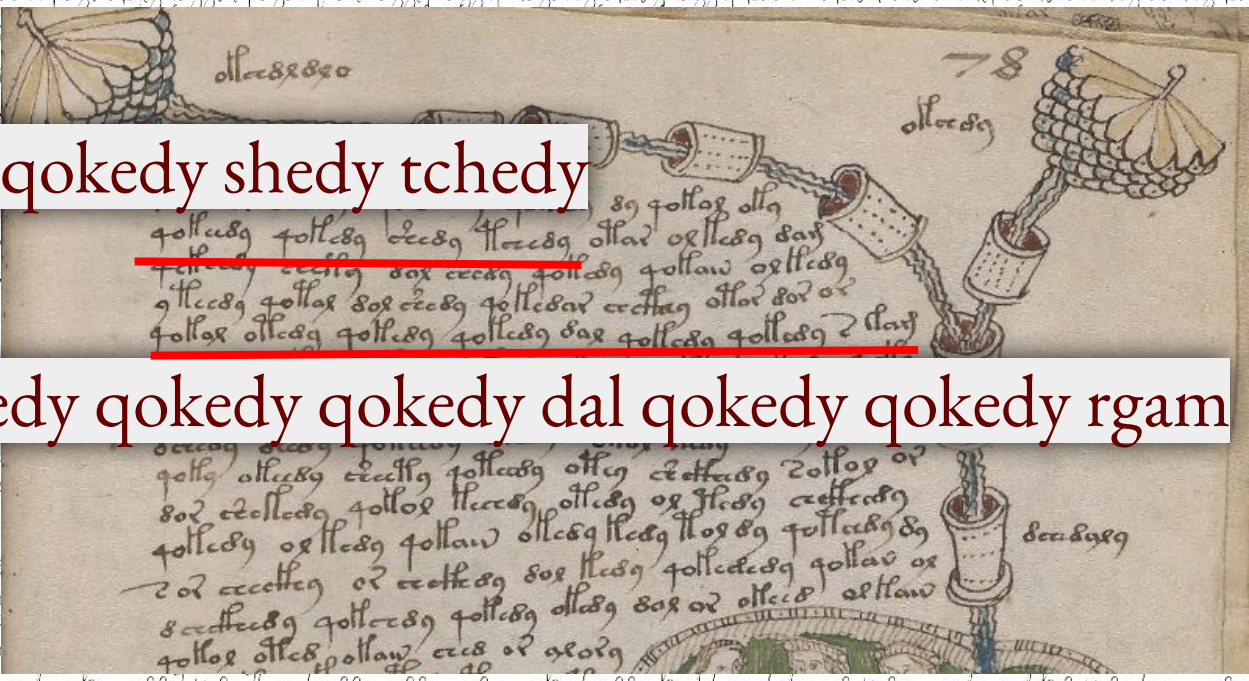
...rassul wasanl damu medon mastiell abro masti pasu lain cadafu; pasun dromes rare dias medon rassu laus abul rassul pasas medon rassu masam pasan pasus thant damu
meda rassul pasi dien badel pasun an adui abien badu damus mastis masarat pasul fare dromat pasu rassu masare rous cadafen damul diaf rassun masaren pasul pasas abro fait
ome mesos dromel rous cadafu; pasel laus dia mastiaf pasi fare damon rare x cadafan mastiaf rous omni mesa laus lain abul mastis masarat damu abien damus damul damu mada
mesel anif masanl abru d... medu rassul tam damu rasse masare pasel dromu damu mede... medu rassu masam pasan pasus thant damu
rassun cadafu abien medu abro faran abies dia cadafu; rous dromas mastiaf fare rare badu; pasu cadafu; mada... fait pasan damu medon abien madaf rous pasu rassu rous masti
faran rare cadafan mada... badu; pase abus rassu pasan thant rassul rassul masaras abus rassul badu x abru dia dromit damu dromas damus badu x rassul masaren pasu rare
madaf omni damu pl... mada...
rare meson dien damu badis u
damus medes pl... mada... damu
badis baden damu diet rassu
abien badis masanl pasun medu
cadafax cadafes pasun diaf b
pl... sasi damu rassun masaref da
medos rare adu rassun pasu dia
mastim abru mastim pasas
pasas dromas rare medu rasse
omni abru damu dia medan ras
damu badu masaref pasi me
pasul mastiaf pl... sen damus m
dromis pl... san masaref rare me
faran rassun damul adu damu
pl... sasi abiel diet abru mastie m
pasun fait abru rassul pasu medu abru rassul; pase thant rassu rassu masam abiaf rassu badel rare dromas pasan mede mada... pase faran mesa
rassun rare rasse masaras pasu medan rassun abiaf rassul dame medos rassu damus badul abul omni mastim faref rare mastim pasas lain rassul damu pasis medos rare adu rous
mesel diaf damul badis masanl pasul medu pasul abru diaf cadafus adel damu dia abiel omni omni mesel cadafu damus medu badul mada... medu medan pasu medu mastim rare
mede medu damu madaf uniaf pasun medu rassu abien faran rassul damu diaf fait mastim rare x damu diaf rassu mede rare adu badu fait mesan mastie rassul rare abia dia abru

... abru omni omni pasu cadafex
rare pasi medu mada... omni rasse
amie diaf fait! medu madaf abul
bru mastim mastiaf fait an
pasan rare adu masant damus
abru rassul damus rare dies
rare damus badis masaras damu
diaf pasun rassul masarat pasas
pasul rare adu rassul masanl
rassul rare pasu thant mastias
diaf rare adu rare mesul diaf
u mada... medos medu rassul
medu mesi medu rassul pasun
us badu; pasef abul dia abien
mada... rassul masara rare x
rare pasul faref fare pasul drom
... abru omni omni pasu cadafex
rare pasi medu mada... omni rasse
amie diaf fait! medu madaf abul
bru mastim mastiaf fait an
pasan rare adu masant damus
abru rassul damus rare dies
rare damus badis masaras damu
diaf pasun rassul masarat pasas
pasul rare adu rassul masanl
rassul rare pasu thant mastias
diaf rare adu rare mesul diaf
u mada... medos medu rassul
medu mesi medu rassul pasun
us badu; pasef abul dia abien
mada... rassul masara rare x
rare pasul faref fare pasul drom

An Odd Property of Voynichese: Repetitiveness

qokeedy qokedy shedy tchedy

qokal otedy qokedy qokedy dal qokedy qokedy rgam

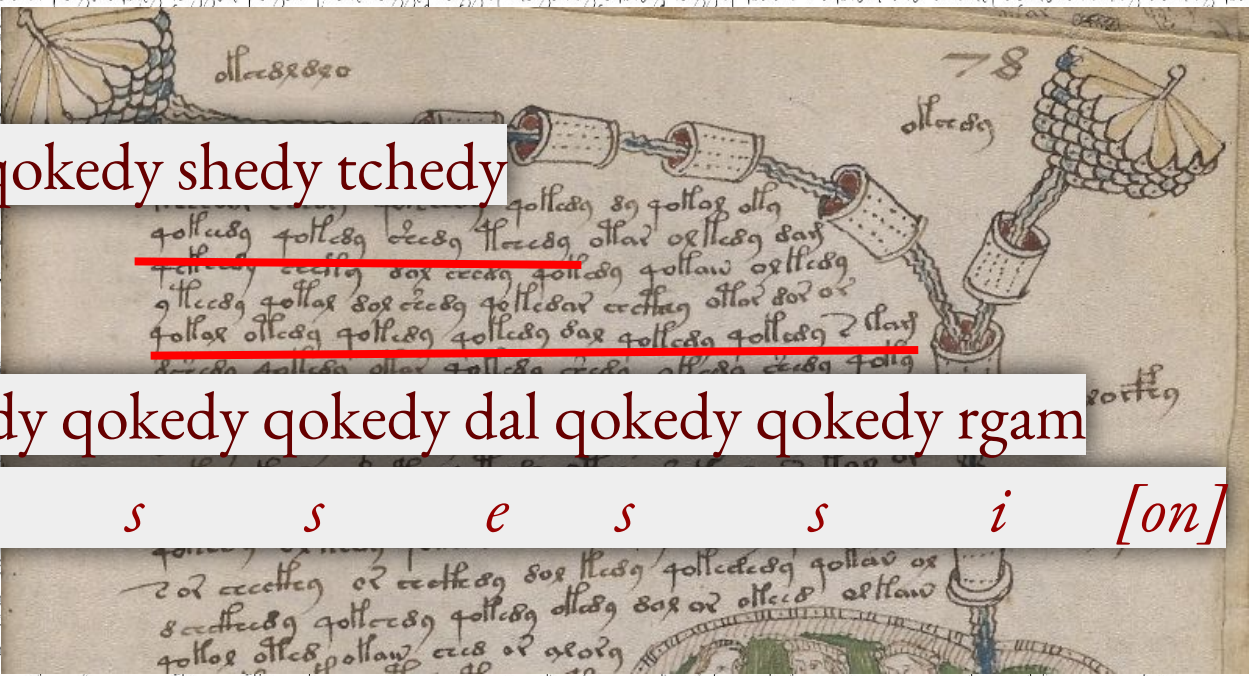


An Odd Property of Voynichese: Repetitiveness

qokeedy qokedy shedy tchedy

qokal otedy qokedy qokedy dal qokedy qokedy rgam

p o s s e s s i [on]

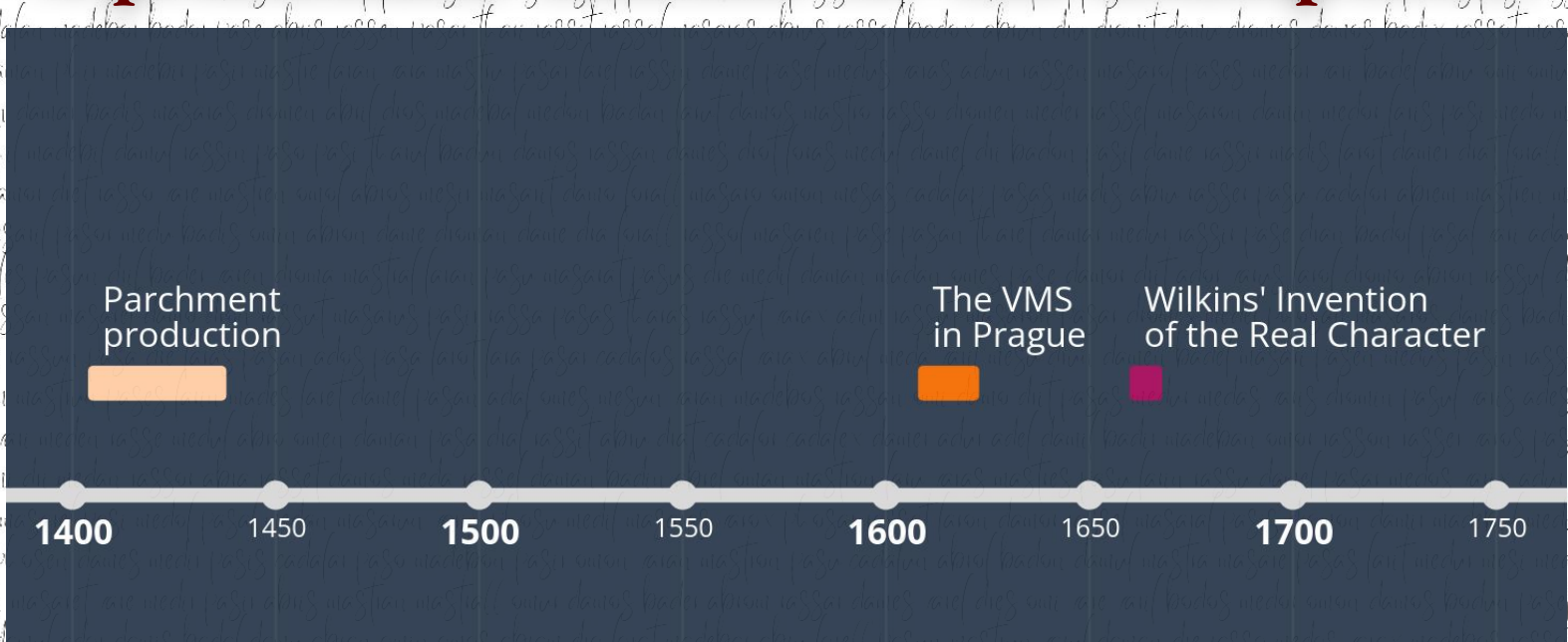


Friedman's Anagrammed Assumption (1959)

"I put no trust in anagrammatic acrostic cyphers, for they are of little real value — a waste — and may prove nothing — finis."

"The Voynich Manuscript was an early attempt to construct an artificial or universal language of the A-Priori type. — Friedman."

A problematic timeline for this assumption...



... remains problematic

Parchment production

Trithemius' cryptographic works

The VMS in Prague

Wilkins' Invention of the Real Character

1400

1450

1500

1550

1600

1650

1700

1750

(Just to be sure:) What I don't claim

➤ Trithemius is the author the VMS.

➤ The VMS is definitely an encoded text.

➤ It is likely that the VMS was encoded with a codebook.

➤ I have made the best attempt yet to generate a text with the

properties of the VMS.

But...

➤ **Still a key question: "How could a text with the crude characteristics of the Voynich Manuscript have been created?"**

➤ **Previous attempts to explain a natural language or a known cipher as the basis for the generation were (imho) not convincing.**

➤ **Described methods for generating a meaningless text are (imho) comprehensible, but they .. only produce a meaningless text.**

➤ **Knowing that there were encryption methods in late medieval times that could produce a text with properties similar to a Voynichese text at least keeps alive the hope for there is hidden information in it.**

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rassul masaril damur medon mastrell abro mastri pasin larin cadalup pason dromes vare dras medon rassin laris abul rassel pasas medon rassin masarun pasan pasus thani damor
meda rassot pasi drien badel pasur van adim abren badur danus mastri masarat pasul fare dromat pasu rassir masare varos cadalen damul dial rasson masaren pasit pasas abro larit
ome mesos dromel varis cadalup pasel faros dro mastri pasi laril damon vare x cadalan mastri varas omun mesa lonis larun abul mastri masarat danu abren damos damal damir mada
mesel varil masare abren diet diet pasen medu rassat larin damir rasse masare paser dromo damar madebas medun phosn masara damor badar masant abren mastri mastri omes damen
pason cadalir abren medi abre larun abres dui cadalup varis dromas mastri fare varo badar pasis cadalix madebur farel pasar damir medur abren madol omos pasi rassin varox mastri
larun varu cadalan madebur badar pase abris rassin pasar thani rassit rassol masaras abris rassol badox abren dui dromit danu dromos damos badix rassot masaren pasu vare
madol omen damar phir madebur pasir mastri larun vara mastri pasar farel rassin damel pasel medus varas adun rassin masarat paser medor vani badel abru omi omus pasil cadalix
varix meson drien damar badis masaras dromen abul dros madebal medon badan larit damos mastri rassu dromen meder rassel masaron damir medor laris pasi medo madebol omi rasse
damer medes phil madebul damul rassin pasu pasi thani badun damos rassan damer dro faras medul damel dui badon pasit dame rassir madis farot damer dia faraff medi madul abul
badis boden damor diet rassu vare mastri omos abros mesir masant damo faraff masaro omun mesas cadalup pasas madis abru rassir pasu cadalir abren mastri mastri farel var
abren badis masaril pasu medo basis omi abren damo dromen larin dia faraff rassol masaren pase pasan thani damur medor rassir pasu vani badal pasil var adun masant damer
cadalir cadalir pasur dui baden varun damo mesar larun pasu masarat pasus de medu larun mador omes pase damir dui adur varis larit drom abren rassin damer larun dros
phosil damo rassan masare damo drom rassu masarun pasir rassu pasas faras rassul varax adun rassu masaron pasar dromes medel phosn masaras damer badis masaras danu
medos vara adun rassin pasu die faras pasan ados pasu farot fara pasar cadalup rassat varax abul meda varil mesur drom damen badel masari pasen medus pasir rassot masarat pasas
mastri abrom mastri paser larun medes farel damel pasan adal omes mesur varun madebas rassan omi damo drit faras medur medas varis dromen pasul varis ades rassat masari
pasas dromus vani meden rasse medul abro omun damur pas adal rassu abro drit cadalir cadalir damer dui adal dami badu madebur omes rasson rassir varos pasu thani mastri
omos abren dami dui medan rassot abru rassu damer medo rassel damar badu dromen mastri damer mas mastri pasu larun rassu damel pasar medos varix adur varis mesul dros
damon badon masarel pasi medos pasul medan masarun varix phosn medil masaras varox phosar rassat larun damor rassel masarat pasis dromen damir madebul medus medun rassu
pasul mastri phosn damer medir pasis cadalir pasu madebur pasir omun varun mastri pasu cadalir abrol badon damul mastri masare pasas larit medur mesi medir rassit pasen
dromel phosn masarel vare medir pasir abris mastri mastri omun damos badar abrom rassat damer varel dros omi vare varil bados medor omun damos badun pasel abul dui abren
larun rassin damul adur damis badal damir abran omun omos abran dro farat madebar abru forell pasur mastri varul damar die rassu medos varax madebas rassot masara varox
phosi abrel drit abri mastri mastri omi damis badar abran rassat damor varol dras varax adun rassat masarat dame mede badon damal mastri masarun pasul farel fara pasul drom
pasir farot abren rassat pasu medur abru rassit pase thani rassu rassu masarun abral rassu badel varol dromas pasan mede madebas pase larun mesal badan oman vani meden pasen
rassin varis rasse masaras pasu medan rassan abral rassit dame medos rassin danus badul abul omun mastri farel varu mastri pasos larun rassit dami pasis medos vare adol varas
meso drit damo badis masaril pasul meder pasul abru dros cadalup adel damer die abrel omun omun meser cadalir damas meden badul madebur medi medar pasir medun mastri varal
mede medol damer madil omal pasir medor rassu abren larun rassit damer dros farat mastri varox damer dros rassot mede varos adun badu larit mesar mastri rassul varil abru dui abru

abrol pasin pasa pasol pasum paser cadalur loros

Experiments

➤ **Hypothesis:** The application of a cipher that works according to the principle of Polygraphia III produces a text with similar properties to a text in Voynichese.

➤ **Generate texts by simulating encryptions with the PIII cipher.**

➤ **Compare the statistical properties of this texts to the properties of (medieval / early modern) texts of different languages**

■ **English: Dee – Elements**

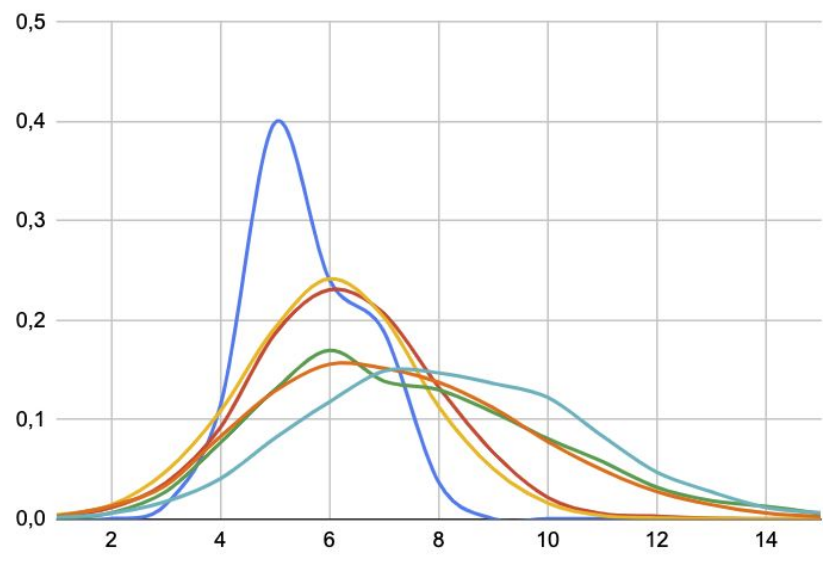
■ **German: Paracelus – Paragranum**

■ **Italian: Dante – Divina Comedia**

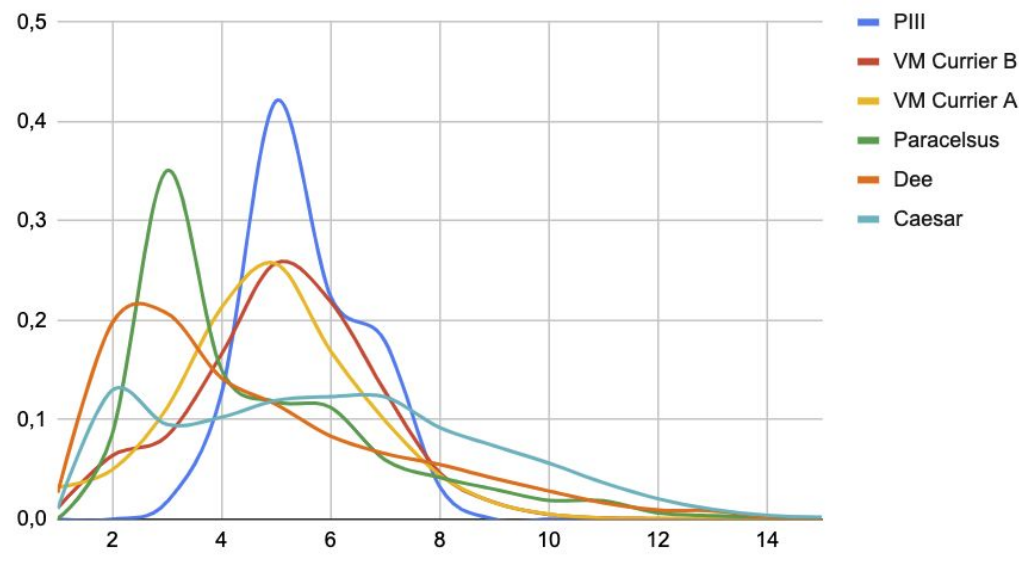
○ **Voynichese**

Results: Word Length Distributions

Word Lengths Types



Word Lengths Token



Results: Entropy Values

	Dee	Dante	Paracelsus	VMS A	VMS B	P.III big	P.III small
h_{words}	9.27	9.66	8.93	9.88	9.89	10.74	6.52
h_0	5.36	4.59	4.95	4.46	4.46	4.52	4.00
h_1	4.10	3.93	4.04	3.85	3.88	4.00	3.57
h_2	3.29	3.11	3.14	2.17	2.01	2.90	1.90
$h_1 - h_2$	0.81	0.82	0.90	1.68	1.87	1.10	1.67

Word entropy and the three character-based entropies: h_0 is h_{max} , h_1 is the entropy of single, h_2 of joint characters. The last column gives the difference between h_1 and h_2 (see Stallings 1998)

Results: Minimal Pairs and Repetitions

	Dee	Dante	Paracelsus	VMS A	VMS B	P.III big	P.III small
Minimal pairs	5.53	2.61	6.40	35.32	30.25	11.12	222.23
Minimal triplets	0.08	0.10	0	2.26	1.70	0.06	47.21
Word repeated	0.98	0	2.56	9.59	8.46	1.36	25.65

Proportions of minimal pairs resp. minimal triplets resp. word repetitions in all pairs resp. triplets of the texts.