Beinecke MS 408

A Transcription Based on a Revised Version of Takeshi Takahashi's Transliteration

Alexander Max Bauer

1 Introduction

In Section 2, mainly to promote easier readability and comparability, a transcription of Beinecke MS 408 is currently being developed, based on a transliteration by Takahashi (1999). To achieve this, Takahashi's transliteration is obtained in an automatically capitalized version of the European or Extensible Voynich Alphabet (EVA), using the Interlinear Transcription Archive Extractor by Schwerdtfeger (2004). It is then converted back into glyphs using a font by Bettencourt (2019).

Using the manuscript's reproduction in Clemens (2016) and the scans provided by Yale University's Beinecke Rare Book and Manuscript Library (2004), Takahashi's transliteration is compared with what I am able to make out of the manuscript. In total, I made changes in 300 places of Takahashi's transliteration. Changes to Takahashi's reading are highlighted in orange:

- Glyphs that I interpret in another way than Takahashi or that I add to the corpus are printed in orange, showing my interpretation.
- When a glyph has been deleted by me without replacement, this is indicated by \varkappa .
- Removed spaces are marked with \sim and added spaces are indicated by \sim .
- Added paragraphs are represented by ¶.

Especially the recognition of spaces in running text is, as Takahashi has already noted, sometimes very difficult. Therefore, my adjustments in this—just as in any other—regard should be taken with a certain amount of caution. Note that places where the writing is interrupted by illustrations are marked by em dashes (—).

Each line of the transcription is preceded by a locator in square brackets, informing about the element a line is part of (i.e., paragraph, title, or label) and assigning the line a number. For example, a line located at [P2, 9] is part of the page's second paragraph (P2) and is counted as the overall ninth line (9) on this page.

Additionally, in Section 3, some basic analyses are presented. First, in Section 3.1, glyph frequencies are counted. In Section 3.2, then, entropy is calculated.

¹ Schwerdtfeger (2004) builds on an online archive of Voynich transcriptions maintained by Jorge Stolfi (1998). For a general overview of transcription efforts, see Zandbergen (2023).

2 Transcription

Folio 1, Recto

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Paccos offax ar affarry door doro offeres of 1602 doorso
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    8011 2005 ctog 2009
[T2, 10]
    psooft So Gras
[P3, 11]
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    to cros todal lity licy sof crosall to lices
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    Stepths Grasses grants established san etters
     8cca? &cotta 110 olla 117 ccco Pcco tollog ctros 8aoctla
    coll coop crop sand office
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    os os es essent es essenta essentantes essentantes estas
    Feath 2022 Fab Unia Past Sab Rash Unas 2020 Cross
    coso farro coarro offog sarro far ctoog sarro ctoogsar
     gorceg ollag ollg sarry olloreg lollarry otorog llasorg sag
     Soco dos locas effe offers for for sag affor
    To Tox Toll Tollo Tollo
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Folio 1, Verso

[P2, 5]
Tollog clos sand choose— sad cucy flosy offician decay follog chose sand choose — sad cucy flosy offician decay choose choose choose considerate points are choosed considerated as a considerate choosed considerated considerate choosed considerated considerated choosed considerated choosed considerated considerated choosed considerated considerated considerated choosed considerated consid

Folio 2, Recto

to office one sand ortho

Folio 2, Verso

Folio 3, Recto

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[P2, 11]

**Teccos & cos Cos & cos &

[P3, 15]

**The coard of the co

Folio 3, Verso

[P2, 7]

Theor offeray cror etern 2

[P2, 8]

offero fleor cror eethor offa

[P2, 9]

offercar offer ethosoary cror ethop

offercar offer ethosoary cror offa

[P2, 10]

ocror sann tolletor sann cror offa

from the cross offer theory cross offa

(P2, 11)

cto choeffer etho fleor cross offa

(P2, 12)

oct cross offer fleor fleor fleas

(P2, 13)

ctar chiann tollers offs ethas cells

[P2, 14]

sand chean offers

Folio 4, Recto

Folio 4, Verso

Folio 5, Recto

[P1, 1]

Notice of the open open of the op

Folio 5, Verso

[P1, 1]

Notice? The first of the stands of

Folio 6, Recto

Folio 6, Verso

```
[P1, 1]

Noa? 9 2a? accila? toa? co? attag 2 aca? aa? offag

[P1, 2]

occ2 aco? actteg toclaa? aca2 obarro lace aco? acar.

[P1, 3]

toar? attg acox ooacoattg aclasog attg offox ?gaco?

[P1, 4]

g dettg gfacog 2o2 g babg bag bag offox offobg

garb da cobay bay offor offg boxboy
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[P2, 6] 1 cost coeffice coeffice 9000 90009 8a110 ctros 809 9000 000 01000 tolog occo 809 cto7 cto8 S 10 (cc. 20)

tollarod gazar lasg

[P2, 11]

gor are offer offer sq. officeo2 ctg tollar cfftg 908a110 cttg 2 cto7 occ2 o7 tollof cros effeos flerasoso coeffeg S oS crg Savo o? oceg cttar cttar cttar cttag 9 ccarro ctrag ctrosas 39 officer officer and affect octogg fleto etg 807 gocco? coo? octtag

Folio 7, Recto

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[P1, 1] Toodann dotto the control of the control o
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[P2, 0]

[Recognized to those control colored to the control c

Folio 7, Verso

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[P1, 1]
Toggico cico theoso total office offices of dann theodoso
[P1, 2]
croses ettes dann tollo cretters dann ettes ettes ettes
tollous dollous critico letes is if do do crees or creos do
[P1, 4]
crofficed occar croses dann croffice cross docar
[P1, 5]
decodann tollous trees
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Folio 8, Recto

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[P1, 1]
Those crop official crofts — those cross described the choses cross of the choses cross 
                        Tictle of the case of office of the sand as
   _{\text{[P1, 4]}}^{\text{coba}} cto ^{2} γ ^{2} cto8a\\^{2} cto8a\\^{2} cto8a\
    tothor cror cror charge — scrop charges and frages _{	ext{P1, 5]}}
                        offeco 80 ? ecces 89 lfg - Zero elfg elfooarry ero ffarry
                        Tot offices of total of the court of the cou
cooto Parol coot 8a VI
                        8000 8a118
                       Through the faces faces of the state of the faces faces for the faces faces for the faces faces for the faces for the faces faces for the face
                        8arry cross gos son — ce costro office sos sarra
 ctor crossing sand so — offices cross cross offarno
 olollcross
                        effice offices and possible of the sook of the contraction of the cont
 . Screg effect crop crop field — crop cffoda 110 dog da 111 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 110 
    . . goves horollog ordes horo — docarre offes bar_{	ext{P3,17]}}^{	ext{.}}
 ctor 8009 follar ctr — and ctcal off otar ctand _{[P3, 18]}
 ola? ctaii) craii cq — 8aii cro? cra ?creaqeray
                        Part cecard ctoop 8a? - coop llarry coop llarry sarllag
 Scrop Sars
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Folio 8, Verso

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CHOOS COOCHE - SOS coop offer coop offercally offsally
        chille positions for the set form — Fas authority
       7089 \text{ creas } 7089 \text{ creas} 
       schop chop sag creal effeat cheaps sall crafs
crop crop 8a? — official chair cofficient 8a? _{[P1,\,6]}
       Sallo Cital — offices coop fallo dalla
       Éco Paros — 8a7 Eco Ettar cootlavo 79
       offerog that — crop crop crop offer 1) sand
       द्रे०६ ०२८६ — टा०ीटि ट ८०६ टीटि ट ८०१०
       80923 — occoso Marco tag charos
       Grasos
[P2, 12]
        Para are for sag — tag are at all all are sall
        Partie office office of the start of the sta
\frac{1}{2} choose sollarly — choose flor cras effects flore effects
       69 for fleer from form - other less som \frac{1}{5}0
       GIVES on 6280n font 60216 — EDON EDON LOS
       8017 cccaf 80117
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Folio 9, Recto

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[P2, 6]

Theoand efficiently offant offices office the sold of the second offices offi
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Folio 9, Verso

```
[P1, 1]

Tocco? oforoso off coo? sand toferoffero tofor chor chor sand
[P1, 2]

Seco? toand celland effect cror cro? effect so — off tolland so
[P1, 3]

glico cro? gliand sand effect offand off — occo? sand
[P1, 4]

glico fleeg lland effect offor off florso
[P2, 5]

Teco? gfecces toffor gfect orethory fle — ar — cells sand
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Theor offices tottor office oretross the area with sanning the same of the sam
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Folio 10, Recto

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[P1, 1]

To cotting on other of octors to obey on the series of the seri
```

```
[P2, 6]
gocoo che coo cheann tocheogo so — coo than coo cheann tocheogo so — coo than coo cheann cheann to chean coo cheann to chean coo cheann to chean coo chean chean
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Folio 10, Verso

[P1, 1]

Tand dand coo foces follo dand officer offodo cand
[P1, 2]

dand dand officer ocottoor ocond follo ocodand officer dand
[P1, 3]

does office foces officer ocos do

[P2, 4]

totagtage con sand totage cottes of of sand

[P2, 5]

co office sand totage totage con sand totage

con office sand totage

con office sand totage

con office con con totage

Folio 11, Recto

[P1, 1]

Therog zeroag etg ct goda \ \lambda \ etg ccg theody cooffg

[P1, 2]

Zocthody todo? g they dann offer gotherolly theog dann

[P1, 3]

tothy cros ethy do? gligery crothy dann crann dann ded

derog cry they do? gligery

[P2, 5]

There is the start of the start of

Folio 11, Verso

[P1, 1]
Topderody cicting cools to the cools of the cools of the day of [P1, 2]
chools do cicting cicting day of day of group day day offerod day for the cools of the cools o

Folio 12

Folio 12 is missing from the manuscript.

Folio 13, Recto

[P2, 5]

choroso de flee flee steep total offers etros so
[P2, 6]

fleer sor sor sor sor offers offers offers offers sor

sees tollo eros so tolles sors — offers soarry

sees tollo eros so tolles sors — offers soarry

[P2, 8]

choece tolles flores fleets — 2 offers sarry

orso checo eros sorry offers — offers sars

[P2, 9]

orso checo eros sorry offers — offers sars

[P2, 10]

20fles flees offers

Folio 13, Verso

[P1, 1]
| Noar? cettorry offices office offices
| P1, 2]
| office to flow ceodage offices offices cettoge ceoffs
| P1, 3]
| to flees to flood cess offices offices
| P1, 4]
| oge cecss office oarry offices to office
| P1, 5]
| to flos darry

Folio 14, Recto

Folio 14, Verso

[P1, 1]

Toganon No offodan offodo of offano? Sann log offano?

oliano? Sang that only and attention offano?

oliano? Sang that only and attention offano?

open of offano offano offano?

offano offano offano?

offano offano?

offano offano offano offano offano

(P1, 6)

totto attention offano offano offano offano

(P1, 6)

optano offano offano offano offano offano

(P1, 7)

optano offano offano offano offano offano

optano offano offano offano offano

(P1, 8)

collano offano offano offano offano

sano offano

optano offano

sano off

Folio 15, Recto

[P1, 1]

The cor tees thereof to go offer to go offer to flow offer to flow of the cor offer of the cor offer to flow of the cor offer offer of the cor offer offe

Folio 15, Verso

[P1, 1]
To Por orchy connot offer or so [P1, 2]
**cor or oro or annothing than offer or so [P1, 3]
cftor sand tollor offer offer offand
[P1, 4]
sond collo con tollo tollor offer or offer or cor offer or cftor offer or cftor offer or cftor offer or cor offer or cftor offer or cor offer or cftor or offer or cor or offer or or or or offer or or or or offer or or or or offer or sand
[P1, 8]
offer or cor or or only off cor sand
[P1, 9]
offer or cor cor cor cor cor offand
[P1, 10]
Cor cor cftond cftor tolland
[P1, 11]
Corond cftor cor cor sand find
[P1, 12]
sand cftor cor cor cor

Folio 16, Recto

[P2, 5]

There of the continuous force of the figure of th

[P3, 10]

To Po Po Sagger of the force of the following o

Folio 16, Verso

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[P1, 1]

Terranno offeror enterox entercy 2 teroetly

[P1, 2]

offeror of the enterox followether tory

pland by enough total end to the end of the end of
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[P2, 7]
To cotte of the policy of the offer of

Folio 17, Recto

```
[P1, 1]

Thooso saray osarcon otoso otos cot others soso oxsettes
[P1, 2]

osarr collo olicto tosar etheoso sor others tosettes osc
[P1, 3]

crox or cro tosan ollor cror olicron

[P2, 4]

thereon chos tollon tor oxarri others

[P2, 5]

occilica ethe cror chor etheor etheory

[P3, 7]

licteo tollero cronsecto methes

secure soccer reales

[P3, 8]

Secure soccer reales

[P3, 9]

Cog crette o sar crotters

[P3, 10]

sar crear secer saro of sore
[P3, 11]

offero ether olicror sore sarry

sar
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Folio 17, Verso

occes less ctodas olos obarro ollas 0,000 lloco? Pocos oftos osocios ollocos gcros cros 80scrccg Hcros 8a7 cHzg $_{[P1,\,6]}$ 8 G//210 90 G//210 90 90120 6112 So Fosso S110t posts Fos †ollcog llca? og 89 crog8a112 29 general feros erostanos os [P1, 10] ogto7 olco7 ola7 olog 80117a8 †ollaco †ollovi? attacog acog 00 ct09 loarry crefteg of ct07 9 1/co? cros cros ctos ctos cros cto? ctos oro ? officeox crosarry officer ffcro?9 . 90007 cthg accellg acco othor othogo [P1, 16] offercos cros offcos effcos offercosos toand Saf to sox to fearn cottoo Sus fo for cos gos ao follo 8ail ccco toail cttod ccox ccox 9/cc9 offcc9 cco7 ccox co 98a110 Jus Fossits of Eccept Fosos Fosos †016cc 8a7 ccc9 16cc07 cccc09 cffccc9 cffc9 80sllo 9as Fosllo posllo

Folio 18, Recto

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[P1, 1]

**T87a\789 8a708ct* 90a7 916cox 8a7 0 8 cectes octeo? 8ax

[P1, 2]

otteox tolecox cestes olecax 8a\1) 89 ceox 8\1\0

**Tolecor ceor cettes oreces tolecox 89 9thear 8

[P1, 4]

cor etteor oleor ottoox ola\0
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[P2, 5]

Theore took effective effective engage engages of the solution of the second effective of the solution of the second effective of the solution of the second effective of the second of the second effective ending the second of the second of the second effective ef

Folio 18, Verso

Folio 19, Recto

Folio 19, Verso

[P2, 8]

Thog there to see to here? sor

[P2, 9]

getor ollo etor offer etor ollo ssor

[P2, 10]

Sann cor sann ollo of ssor

[P2, 11]

totor sor olletor sann effer offer

foffer olletoses sann or offer

[P2, 12]

offer olletoses sann or offer

[P2, 13]

gec offer offer offer offer

offer olletoses off offer

offerogetann offer

Folio 20, Recto

[P1, 1]

Notice of the control of th

[P2, 5]

Throoffig molloanny of meccy of may docanny?

[P2, 6]

mocco offmod toffog meccy sanny may monny sanny

[P2, 7]

omogenos sanny moffeog mog sog etog offanny

[P2, 8]

Comosan mecco of mecos

[P3, 9]

Toodec dodg tollarg tollarg toetig arollogdg

[P3, 10]

octoall aro? Codg taodall arollodg arollogdg

[P3, 11]

datod tollarodg glarg tollarg datall arogodg

[P3, 12]

aroll arollodg ollarg ollarg tollarg tollarg datall

octoll aro? aro? arceg targ

Folio 20, Verso

```
[P1, 1]

tarrow and office of totocco office to to to together office of the control of the cont
```

[P2, 5]

There for to get of the dog to the order of the square for the square fo

Folio 21, Recto

[P1, 1]
Theor occoeffics of gency offeres to the code offer of gency of the code of the co

[P2, 4]

Toology dann offern offern forces for the force of the force

[P3, 8]

The older offor the operation of the objective of the objective ofform office office

Folio 21, Verso

[P1, 1]

Those of a color of the control of the con

Folio 22, Recto

[P1, 1]

To go oxity through those offers offer offers and offers

[P3, 7]

Marox took officed the crooks officed that [P3, 8]

Sacor off sail offices follo croffail continuous soil sacor [P3, 9]

osail sail office officer orally

[P4, 10]

| fccop cco? 3a\\\) cfco\\\) 8cco? ccc9 to fog 39 ofccop og 3a\\
| 80\\\\) goffco39 to fccop offg offg 39 of 8cccq 3a\\\\)
| 80\\\\) goffco39 to fccop offg 30 offg 30 of 8cccq 3a\\\\)
| 80\\\\) cffco39 to fccop fccop 3ccop 3a\\\\)
| 8cco\\\ 393a\\\\) to ffcop offg 3fog offa\\\
| 8cco\\\ 393a\\\\) to ffcop offg 3fog offa\\\\

Folio 22, Verso

```
[P1, 1]

**ToZarrior of car of flee offs 202 ct of tos

[P1, 2]

**Sarrior offs flee offes secor geg

**Sarrior offs flee offes offes offs

[P1, 4]

**Offs flee offs tolfs Zarrior offs

**Political Color offs

**Political
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Theorem the following following the following the following following the following foll
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Folio 23, Recto

[P2. 4]

tollogog ollariz ollariz ollariz ollariz ollariz ollariz ollariz ollariz

getor tollariz ollariz ollariz ollariz ollariz ollariz

getor tollariz ollariz ollariz

[P3, 6]

Thereographically offs and offs seech sallage say offer george
[P3, 7]

offar operar tally tollerog sar tollerog salvo r og salvy agg

[P3, 8]

tolleroge car salve tollally ogoge toally offers 2 slig offers

[P3, 9]

offoge off to tolloge so soge seech tollerer og salvy offers

[P3, 10]

tollollally effers 2 offerr osage erage so sar offall

[P3, 11]

offollo sagoro

Folio 23, Verso

```
[P1, 1]
Toda ( For oda ) ( ) ( ) coases often off of og cuttes follera? 2

[P1, 2]

totle off of our offerases for foller og offer og cuttes offered

[P1, 3]

gero offa ( ) offere cuc ogsa ( ) offeror say offereg

[P1, 4]

offereg san? Losos ogsas offeror sar

[P1, 5]

sor cucar Lor sog ogsas?
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Folio 24, Recto

[P1, 1]

107079 cco7 ofca7 &c cco9 8a110 o7 totally of obard offartheas offartheas offartheas 9 cttca? cttcax olfox totta? cttc9 of cectleago ettea? coo? cecce 8a 1807 cro 7 crcg cttg cttc 1608 occco2 ctlco7 otlag toctlcog tollg *162 cc162 ccc02 cttog todog octo7 2 08 toca7 8a110 tollcog 08a110 clicar toda1 the soc dag 7. 07 cta? co? 2 a8 ccotla/10 89
[P1, 11]
[P1, 11]
[P1, 12]
[P1, 1 tollers tollers flog flos effes Soco of S crop croft Saso too ccco too ccar offcas S 208 20 Sosso Sosostao ट्टंबर जीटबर ठवर ठवर ठवर ollo posto pato pollo estis ${\displaystyle \mathop{\mathsf{o}}_{\scriptscriptstyle{[P1,\,19]}}}^{}$ cros cros 8a11) cros 8 909 for crop tog offarteg Sagczoggo

Folio 24, Verso

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Horosar crockes ofor those crokes of those of the solution of the second of the secon
 ossilo sossilo Sossil
 octtog oscocco occarco ollas coctto
 98ag & olfog olfarry 08arry 890S
                   090 900 110 Accas 090
  [P2, 6]
                  Mocros coo characo
 .
gczcog da\d da? ogog
[P2, 8]
                    Pocly cotty cox Savi
 9009 cros of crofos
offoco? cffcco8 cco9 ffcog
 98a110 ccco? todog oloda110 [P2, 12]
                   lico toa? etto do tolle ollege
 occes acor as odo? Lo do offorodag _{[P2, \ 14]}
 80117 ccco8a8 to to 89
offcog 08a118
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Folio 25, Recto

[PI, 1]

Tooges cooks sand office toos sand occors ofters of conformation office toos of compassion office office

Folio 25, Verso

[P1, 1]
Toccarry tolly deg sarry tollecg offeco tolleco tolleco coc
[P1, 2]
Seco? effeo? ero? sarry 2 offeco offeco tolleco sarry
oreco feco? erox sarry defeo? sarry secto sarry
oreco feco? erox sarry defeo? sarry secto sarry
tollorry tolleco deox sarry effeca? effeox sarry effeca?
[P1, 4]
tollorry tolleco deox sarry effeca? effeox sarry sarry
sar erofleco seco? seco? tolleco tollorax erox erary secarry colleco?
[P1, 6]
tolleco ? oeco tolleco tollorax erox erary secarry colleco?
[P1, 7]
odo erfecy sarrox sarry deethe offecarry

Folio 26, Recto

[P1, 1]

The colly osant top of toos coffees of the so and coffee the so
[P1, 2]

Second sand ascess of ceffees aces of the so so acethers of the so of the solution of the so

Folio 26, Verso

Folio 27, Recto

Folio 27, Verso

[P1, 1]
Tomot mot mo to copy top offeror of more ferore.

[P1, 2]
8 mg mlar offers to to say say stay larg mus say say
[P1, 3]
If may smollers sto say most of the cost of the say
[P1, 4]
offero my flaces my moy hos o offer some call of the some cost
[P1, 5]
tolly these costs they mothers aftersore
[P1, 6]
sto larrer offers smollers call of the some costs
[P1, 7]
to to to show the

Folio 28, Recto

[P1, 1]

Tooda? Los cocto of cox sann officer copto sop
[P1, 2]

officer officer officer officer sor sor called sop
[P1, 3]

tofficann correction officer correction floward
[P1, 4]

coofficer officer officer officer officer officer
[P1, 5]

officer officer conficer officer officer
[P1, 6]

tofficer tosann officers sor sor tofficer officer
[P1, 7]

coofficer tosann officers sor sor sor sor sor sor
[P1, 8]

occofficer sorticer coofficer officers sor sor sor
[P1, 8]

occofficer sorticer flow son sorticer
[P1, 9]

officer sorticer sorticer sorticer sorticer officers
[P1, 9]

Folio 28, Verso

[P2, 4]

The only acor acor of office acor acor sand tothe acor acor sand tothe acor acor sand tothe acor acor sand tothe acor acor sand acord tothe acord a

[P3, 7]

Totog 0117 crog thoo sarry to the cro cetters sar? as

[P3, 8]

ollard crad crard etter sard of con sarry of construction of con sarry of construction of const

Folio 29, Recto

```
[P1, 1]

To2all decorate off off of the profession of the control of the control
```

Folio 29, Verso

```
[P1, 1]

Moon No too? cellers orare togethers offe of togethers to the sand tollerand enough of the sand tollerand enough of the sand enough enough
```

Folio 30, Recto

```
office of acq do racq facosq deg that acr so deg per, 2]

garosq acq affecq the facor acor deg de the cosoq og garosq acq affecq the facor acor deg de the cosoq og per, 3]

acosann acor acq sonn car to facor accq facoq facoq per, 4]

tother tothe tother of acor and tother and acord for acord to form secoq sheer accords no acord accords and acord secoq sheer acords and acord so records and acord so reand attention of acord so reand attention accords and accords and attention accords and accords and attention accords and accords and attention accords and attention accords accords and attention accords accords and accords and attention accords accords and attention accords accords accords and attention accords a
```

[P2, 8]
of trop of the control of the control of trop of trop

Folio 30, Verso

[P1, 1]

cftc2cftca\d &co2a\d cocftcg &co act fag &co? &ca\d d)

[P1, 2]

toffaco? ag &c llaco? aco? llco? og ag &a\d cftco&&g

[P1, 3]

acoffacos &a\d cftcos &o\d d) &a\d collco? &as atforthy

offacog &a\d co? accoftcg toffaco& &a\d d)

[P1, 4]

offacog &a\d doff action offaco&&g

[P1, 5]

&a\d &coffaco? acoffog offo? acog&g

[P1, 6]

toffaco? acoffog acoffaco&g &a\?g

[P1, 7]

cooliag &coffaco faco doco

[P1, 8]

og&g acoffaco? aco? &cog &co

[P1, 9]

toffaco? aco? &cog &co

[P1, 10]

&co &cog&g offaco? &a\d d)

[P1, 11]

Cog acoffaco? &a\d d)

laco&g

Cooliag &coffaco? &a\d d)

laco&g

Cooliag &coffaco? &a\d d)

Cooliag &coffaco? &coffaco? &a\d d)

Cooliag &coffaco? &coffaco? &coffaco? &a\d d)

Cooliag &coffaco? &coffaco?

Folio 31, Recto

offco? arrefteg

```
Probable to the South following the followin
                80000 January Collect S and collect total
tolleg ceco sand tolleg fant cecles Sand seg
tota? ccg 8a? 90? a? ccccg 16ccg ccc89 to16cg [P1, 5]
                90010t 0800055 (1118
                Theolicoso tolicos tolicos ecctar ecoso ? and sag
per of the state o
 [P2, 9]
                80117 Ecco Ecttog offcog
[P3, 10]
               Those and offices tolless tolless tolless sar acording
 oxéccox tollers dax ency decy lety lees offarrid splecy _{[P3,\ 12]}
†οαινθ 9σες ο Μεδο δες σες σεςδαινθ δα?
 obsolo Gilbe obsos so Silos
octobar choog collo ollobar
```

Folio 31, Verso

[P1, 1]
Toda \ ? &ccess offices offices toffogetee 2 a ? a? offices offices age
[P1, 2]
officeo octives officeo eccoss offices focoss sand eccoss focoss
[P1, 3]
officeo sand &csos offices offices offices offices offices
[P1, 4]
san? effices toffoss offices eccoss offices ag octives offices
[P1, 5]
office eccoss a? and

P2, 6]

Toccoso tot occos occition of occitions of occit again of a theo offar

[P2, 7]

og ficeday occi occi ficeog occition offag offag offa occided offar

[P2, 8]

off and occided offaces occided offaces occided offag

[P2, 9]

officecog occided offaces and antificed occided occided offaces

[P2, 10]

sar occided offaces occided offaces offaces offaces offaces

[P2, 10]

sar occided offaces occided offaces offaces offaces offaces

[P2, 11]

Zand offaces occided offaces offaces offaces

Folio 32, Recto

```
·4
ollof ollcrof ccof clfrg 8ag 8cco8af follcrog
   tollcrof crof ethor crop dor decrosand sand
  2000 8000 91100 8avi 8avi cco88ag
              toffers toffers sand
[P2, 6]

Laco Hace aces
   offor sox ox sar?
  †oa? 8a\\V 8a8
   8011cco2 8a29
[P2, 10]
ट्टें08a110 ट्रीं08
             office of sand sand cttog
 [P2, 14]

Cocco toll occo sand offer
 tollary tollog 80117 og [P2, 16]

Tollarog acco 2019
   [P2, 17]
  حدهالاده الادمال المراقع المر
los scros sas
```

Folio 32, Verso

[P2, 7]

If to cto? to tecanno officeo? san telles? I osad

[P2, 8]

officeo sand sand toffand offices star

[P2, 9]

toffices the office tecanology sand the sand

[P2, 10]

to look to took took took sand

[P2, 11]

or to tecanology sand

or took took

Folio 33, Recto

P1, 1]

The sar desor detects of costs of orders of the so offeres offeres sand

places to the cells of the sast of the sast of the costs of the cos

Folio 33, Verso

[P1, 1]

That at sann grant colleges of the same of th

[P2, 7]

**Thicks of the so the so offers of sann off of the solution of the s

Folio 34, Recto

[P2, 5]

totlccog accog accog or olice at oxilacog otices and accomp

otices according of according to according of accord

[P3, 11]

Thereo operation ogo offeres are taga?

[P3, 12]

Tolleg & laggarrow are the order offeres are tagas

Tolleg & laggarrow are the order offeres are the order at the order are tagas are the order are tagas are the order are the order are tagas are the order are tagas are the order are the order are tagas are the order are the or

Folio 34, Verso

[P1, 1]
[Pcc39 cc39 ccttcg cc39 totas cc3939 cc3axc39 gtc39 ccttc39 cttc39 cttc39 cttc39 cttc39 cttc39 cttc39 cttc39 ccttc39 cttc39 ccttc39 cc

[P2, 6]
There da? Aca? to licedy to liced encog of the danni encog of are encoded in the control of the control

Folio 35, Recto

```
[P1, 1]

cffcoo ? cross cffcs croffs cra? 39

[P1, 2]

tolccand crolland toffces dand

Becand cffccs toffces fland cffco?

[P1, 4]

toffces deffces cffcos crees dand dand

[P1, 6]

Cocand cra? crad dand

[P1, 7]

choland ffco? crolls

[P1, 8]

tolccs 19 land dand

[P2, 9]

tand crea? and crea? cho? crand
```

[P2, 9]

Tand care and care took cand xx

[P2, 10]

o and cand office of care coores band

checand coop officend greand gray bas band asby d

[P2, 12]

ogod cas cand cas fland forces flogos cofficend

[P2, 13]

toffond cand tofficend gray goodage offices fland

[P2, 14]

office coop and toffice officed band check for toffand

[P2, 15]

occod cond and toffice officed band check for toffand

[P2, 15]

Folio 35, Verso

```
fa? cco? ccocffcg ?oa\\dagger a?
totlarg offaceg llaco? offa
 Boro For collo sally
[P1, 4]
offce folice see offe
Scroller croeffed creffed?
 Los flaces affecces actesive
 The golf os cos for Sarril
00110 Hero? to to the strong 8
9905 9aSon وعدماً
†offceccann ceosann
8000110 80110 8010 809 8
. og cta? oð a? ctca?
 Prica Salt of Par Said
olfog croog offerg ffer
98a110 offices 8a110
 Barry sary cellago crogo
 8 000 Polices Possibot Pinas
 Scrolleg gloog crog sall
80110 CO2 CO2
```

Folio 36, Recto

```
[PI, I]

Totaloan totan contag conn officer dann officer sand officer sand officer sand officer sand officer sand officer sand soperand
```

Folio 36, Verso

```
[P1, 1]
Totalalo totolog coann totolog cretters offand ctral sand
[P1, 2]
Totalal cros sand offand totolog offal octol cretter softal

total cros sand offand totolog offal officer softal

secoffices offal officer offal officer

total officer offal for so sand ctrol
```

[P2, 5]

Thereof effeon dann effecta?

[P2, 6]

Sann effeor sann sag sg2

[P2, 7]

Tolly leog offeror of ero can

[P2, 8]

offer goffer sog offes goff of goff of goffer goffer goff ero ero ero effect goff of ero effect gof

Folio 37, Recto

[P2, 4]

Toolog sann offers sar cros sann 98

[P2, 5]

919 tollog tollog cellos offoss

[P2, 6]

ctor cros tollog tollogoss scros sann

[P2, 7]

207 cros 107 tollor sann

Folio 37, Verso

```
[P1, 1]

| fictody toothey tothogogy croffsand cog [P1, 2]
| 80? crog ctro? o?cro cro? dann)
| folicrod cty crod dann dy decor defined decor decor dann)
| 8ctor defined decor dann
| P1, 6]
| golfor other offcand dann
| p1, 6]
| golfor other cannot offg
| p1, 7]
| tothcor dann
```

[P3, 14]

Thosand ctann ctropose

[P3, 15]

20110 ccollog sand sand

[P3, 16]

Tothor sand ccothand

[P3, 17]

201100 tothon dand sand osg

[P3, 18]

office sand sand osg

[P3, 19]

sand thond tothog sand

[P3, 20]

occothacy offor sand ctrope

[P3, 21]

occothacy offor sand ctrope

[P3, 22]

Tothog offord coothacy

[P3, 23]

Folio 38, Recto

[P1, 1]

Thoso? croctes one crown offers ore ore offers of crown offers ore offers of crown offers ore ore offers offers offers croffers c

Folio 38, Verso

Folio 39, Recto

[P2, 6] Tocos in the san to tocos of tocos of the san of the san to tocos of the san of the san to the san to the san of the san of

[P3, 10]

**Tecolor decolor are anterested and anterested anterest

Folio 39, Verso

[P1, 1]

#8a\? cc89 #8911a\D o? a\? &c911a\\\D o#c09 11a? o? a\\D &ox 119 o&&9

[P1, 2]

20? &g 110? cc0x totto 11cc89 ox 119 80? cc89 of 1a? ox 11c8a\\D o&9 89

8a\\D cc0? of 1a\D of 1a\\T cco89 2a\\D o? a\\D to 1a\\D of 1a\\D of 168a\\D of 168

9 of 1cc9 cco89 ccc0? a\\D of 1689 cco8ax of 1c89 to 1c89 8ax o? a\\D &f 1689

of 1c89 110? o? &c19 11a\D of 1a? o? a\\D of 1a\\D of 1a\\D of 1689

x 11c89 of 1cc9 &o? \tag{10} 1a\ \D of 1689 cco cf 1689

x 11c89 of 1cc9 &c0? \tag{10} 1a\ \D of 1689 cco cf 1689

x 11c89 of 1cc9 &c0? \tag{10} 1a\ \D of 1689 cco cf 1689

x 11c89 of 1cc9 &c0? \tag{10} 1a\ \D of 1689 cco cf 1689

x 11c89 of 1cc9 &c0? \tag{10} 1a\ \D of 1689 cco cf 1689

x 11c89 of 1cc9 &c0? \tag{10} 1a\ \D of 1689 cco cf 1689

x 11c89 of 1cc9 &c0? \tag{10} 1a\ \D of 1689 cco cf 1689

x 11c89 of 1689

Folio 40, Recto

```
[P1, 1]

Taco Ilcosar agsgsg — tollg ollag 289 oglicsg offace ar orsanni

tollar ollar ollar sar — glaco Ilanni ollor aces ollar aragor

[P1, 3]

29 tollag as gar — glar ollor and ollogar tollar ollar

[P1, 4]

or and acellos sar — tollog ollanni ollar ollg ollogsg og

[P1, 5]

gollar tollar ollar — ollog og aces tollar ar ar or sag

[P1, 6]

Thor or ar and ollor of — ogaces tollar area Ilar oranni

gand acelland oll — gaces
```

[P2, 8]

| Maco | Maco | Baco | Baco

Folio 40, Verso

```
[P1, 1]

Tocc8aN occtaNN 0989
        Mosa? tollarro og arag
S ars ard offarry offak
Tarann offand ceeff x9
         Ogallo Ollas ogo cectles
.
tocc8 arry og cc89 8arry
جرمع المع حدده 2 م
cco8a\\V ccllag gllc8g ollag
        They teroso terso Mat og
         Toollann Hoocog tollann ofann
       Sceedy tollog ceedy dago? atteg
         goodless ganno offanno
[P2, 13]
         Thous cross less of tolless — sarry cretary
to face tody of ann of and orthoperates the square that the s
ctor lless sor at ollar tolls lless 7-9tless tollaxs
```

Posos ofar ofar aloso

Thoces tollees tollarry offer tollar—offees ar offg 2arry offard ceetteg offar offar7 arox—tolleg offar9

Folio 41, Recto

```
[P1, 1]

Taco licoarco olico acilica — otaco otaco talalicos polico araco olico technologia polico araco olico licoarco — otaco otaco otaco araco olico ilcoarco otaco o
```

[P2, 6]

ctc8c9 forces folices acilic8g office — alianos offices forces acide8g

[P2, 7]

faras laces offices folice8g — offic8g acilic8g tolic8g aces folic8g

8arraces acilic8g acilic8g aces — folice8g tolices folices folice8g

[P2, 9]

folice8g offices acilic8g aces — acilice9g aces acilic8g

[P2, 10]

Caroli dec8g folice8g saces — office8g tolice8g folice8g

[P2, 10]

Caroli dec8g folice8g aces aces — office8g folice8g folice8g

[P2, 11]

office8 office8g aces aces aces — office8g folice8g folice8g

[P2, 11]

Folio 41, Verso

```
[TI, 1]
| Mcc2odag
| [PI, 2]
| Taccodo totaccito otado atechado — otacedo acetacito adacedo totas da?
| [PI, 3]
| Sacedo taceo 2 and acetaco otado otago — sand otago oficeo oficeo sas
| [PI, 4]
| totado otago totacodo oraceo electro otago — eleccodo totaceo otago acede
| [PI, 5]
| oaceo oraceo sand or aced otago oraceo oraceo oraceo oraceo otago otago oraceo otago otago
```

Folio 42, Recto

```
Costallo estacollo ostacos
 Osymbarry Cells offcarry carres
Tocto celleta ceollar cears &ag
 Fire Fab Siallow Fallow Fois
toldar croctly crotlor toldar
 807a17 cca?
 र्रिट० ८९ १८४० १० २०१४ १० ५००
octog crec2 ettog cto7 ctog ettog cra79
+ offceo? offceog cffco fceo8al cellceo?9
colfs dog lícico efferd offog efferg crog — crog da \sqrt{0} [P2, 11]
```

to like colf colary crosarry barry — 8ag $_{[T2, \, 15]}$ Tocoso offices sosarry

. Screeg crop chor crollann croelly scffg — sand sage $_{[P2,\ 13]}$

ੀ 98a \ \ \ ਦੇ co? ਦੇ a \ \ \ ੀ ਦੇ og ਦ 9 ਦੇ og 9 ctoffog ctog ceeffg 8a110 ceoffeeg cella110 . . 1089 ctcoccg offarry ccg llcc2 cco7 ard [P3, 19] So S \sim p $^{+}$ 5 o $^{+}$ 2 o $^{+}$ 5 o $^{+}$ 6 o $^{+}$ 7 o $^{+}$ 6 o $^{+}$ 7 o $^{+}$ 7 o $^{+}$ 8 o $^{+}$ 9 o $^{$ Log cros tollo ollos to cros tos cras ctos cros cros ctos ctorrilos Pora *0903 Charles Sos & crarid Sunspell soft soft

Folio 42, Verso

```
[P1, 1]

There effe decay force than it doop? — error error dand

[P1, 2]

Society there of there of the effect of the sail offer dand

do errolled error offer offer error — dr erethe offer

[P1, 3]

to errolled error offer offer error — dr erethe offer

[P1, 4]

foffer error offer dand — odancy — offer offer dand

errolled error error error offer error offer error

[P1, 6]

offer offer error offer error offer error

[P1, 6]

offer offer error offer error

[P1, 7]

colled to like offer offer error

[P1, 8]

Codar Canno
```

[P2, 9]
Tockco? to tar? telleto follos— to telleto ?! to general policy to the control of the co

3 Analysis

3.1 Glyph Frequencies

Based on a transliteration by Takahashi (see Section 1), a first basic analysis of frequencies can be performed, by simply counting each Latin letter of the transliteration. This results in Table 1, listing all letters that are used.

Letter	Glyph	Count		
		Takahashi Takahashi/Bar		
0	0	25,468		
е	С	20,070		
h	5	17,856		
У	9	$17,\!655$		
a	а	14,281		
С	C	13,314		
d	8	12,973		
i	\	11,660		
1	۶	10,518		
k	ľ	9,996		
r	5	$7,\!456$		
n	J	6,141		
t	111	5,968		
q	1	5,423		
S	උ	4,501		
s	ተ ሪ የ	2,886		
p	#	1,406		
m	В	1,116		
T	Ħ	976		
K	ff	938		
f	₽*	425		
P	¥	224		
g	අ	96		
F	¥	80		
I	τ	72		
х	ᆽ	35		
V	٨	9		
Z	ъ	2		

Table 1: Letter frequencies in Takahashi's transliteration.

Determining what counts as one glyph, though, is in some cases an interpretative act. It seems straightforward to assume that σ and $\mathfrak c$ are one glyph (i.e., σ). Likewise, $\mathcal C$ and $\mathfrak c$ could be interpreted as another glyph (i.e., $\mathcal A$). Additionally, one might interpret instances of the, offe, of as representing σ (or $\mathcal A$), on the one hand, and $\mathfrak f$, $\mathfrak f$, or $\mathfrak f$, on the other. Concerning those "gallows" characters, as they have come to be called, it is not clear whether $\mathfrak f$ and $\mathfrak f$ or $\mathfrak f$ and $\mathfrak f$ are variations of the same glyphs, only diverging in one small loop (as Tiltman 1967 seems to have interpreted them). In the following, the four gallows will be treated as distinct glyphs, as has become customary. Accordingly, Table 2 gives frequencies for several σ combinations, taking into account four forms of "pedestalled gallows". The table also includes three instances that bear some resemblance to Latin abbreviations (also see D'Imperio 1978, p. 95).

Furthermore, while there are instances of a single ι , it is not clear whether instances like $\iota\iota$ and $\iota\iota\iota$ or combinations with ϑ like $\iota\vartheta$ or $\iota\iota\vartheta$ represent separate glyphs. Table 3

Letter(s)	Glyph	Count		
		Takahashi	Takahashi/Bauer	
ch	CC	11,008		
Sh	ત્ત	4,501		
cTh	c ¶c	950		
cKh	clfc	906		
cPh	ct c	216		
cFh	ctc	74		
С	C	143		
СО	CO	9		
су	c 9	7		

Table 2: Glyph frequencies in Takahashi's transliteration for several σ combinations.

gives frequencies for several of those χ combinations. Assuming there are three glyphs χ , $\chi \partial_{\lambda}$, and $\chi \chi \partial_{\lambda}$, it is of course difficult to determine when there actually is a $\chi \partial_{\lambda}$ or a $\chi \chi \partial_{\lambda}$.

Letter(s)	Glyph	Count		
		Takahashi	Takahashi/Bauer	
i	١	590		
ii	\\	195		
iii	111	10		
n	J	148		
in	٧)	1,752		
iin	611	4,076		
iiin	1119	154		
iiiin	61111	2		

Table 3: Glyph frequencies in Takahashi's transliteration for several v combinations.

This being said, I tentatively stipulate a set of 22 glyphs. Table 4 gives frequencies for those glyphs. They are counted according to the following rules:

- The glyphs a, δ , c, δ , τ , φ , δ , o, \uparrow , \uparrow , \uparrow , \uparrow , and φ are simply counted as before. Hence, frequencies are identical with Table 1.
- The glyph \mathcal{Z} is counted every time \mathcal{Z} and \mathfrak{c} appear consecutively.
- The glyph σc is counted every time σ and c appear consecutively, as well as in cases where there is #, #, #, or # between them.
- The glyph ff is counted every time ff or ff appears.
- The glyph If is counted every time If, If, or If appears.
- The glyph f is counted every time f or f appears.
- The glyph f is counted every time f or f appears.
- The glyph $\sqrt{3}$ is counted every time $\sqrt{3}$ appear consecutively without there being a preceding second $\sqrt{3}$.
- The glyph \mathcal{N} is counted every time \mathcal{N} , \mathcal{N} , and \mathcal{I} appear consecutively.
- The glyph ι is counted every time it is not part of $\iota \Im$ or $\iota \iota \Im$ as well as in instances of τ .

Letter(s)	Glyph	Count (Percent)		
	0.1	Takahashi		Takahashi/Bauer
0	0	25,468	(15.636)	
е	С	20,070	(12.322)	
У	9	$17,\!655$	(10.839)	
a	α	$14,\!281$	(8.768)	
ch	cc	$13,\!154$	(8.076)	
d	රී	12,973	(7.965)	
k	ľ	10,934	(6.713)	
1	9	10,518	(6.458)	
r	5	$7,\!456$	(4.578)	
t	11	6,944	(4.263)	
q	†	$5,\!423$	(3.329)	
Sh	ત્ત	4,501	(2.763)	
iin	110	4,232	(2.598)	
s	S	$2,\!886$	(1.772)	
in	61	1,752	(1.076)	
р	#	1,630	(1.001)	
i	\	1,240	(0.761)	
m	В	1,116	(0.685)	
f	₽*	505	(0.310)	
g	ද්	96	(0.059)	
x	ᆽ	35	(0.021)	
V	٨	9	(<0.001)	
		162,878		

Table 4: Glyph frequencies in Takahashi's transliteration

3.2 Entropy

Next, let's take a look at the manuscript's entropy. To this end, I utilize the conceptualization of information entropy by Shannon (1948), basically measuring the variability of glyphs in the manuscript. Entropy H can be defined as shown in (1), where p_z denotes the probability of z, with z being an element of the alphabet Z.

$$H = -\sum_{z \in Z} p_z \log_2 p_z \tag{1}$$

To calculate the entropy, I suppose the above stipulated glyphs to form alphabet Z (see Table 4). Accordingly, changes to the corpus are made so that each stipulated glyph has a single corresponding character in the transliteration. Changes are made according to the following rules:

- The glyph α is represented by Sh in EVA. For calculating the entropy, every time S and h appear consecutively, they are replaced by 1
- The glyph σ is represented by ch in EVA. Every time c and h appear consecutively, they are replaced by 2. Following the above stated rules for glyph counting, σ is also believed to be present when σ and c are separated by ff, ff, or ff, represented by ff, ff, or ff are also present. They are represented by ff, ff, or ff are also present. They are represented by ff, ff, or ff are also present. They are represented by ff, ff, or ff are also present. They are represented by ff, ff, ff, or ff are also present. They are represented by ff, ff, ff, or ff are also present.
- The glyph of, represented by z in EVA, is counted as ff, represented by k in EVA. Hence, every z is replaced by k.

- The glyph $\sqrt{3}$ is represented by in in EVA. Every time i and n appear consecutively, they are replaced by 4.
- Lastly, the glyph τ , represented by I in EVA, is counted as ι , represented by i in EVA. Hence, every I is replaced by i.

Calculating the entropy for this converted corpus results in H=3.866. As comparisons, Table 5 also offers the entropy values for the unconverted transliteration as well as for a randomly generated text consisting of 22 different characters and being 234,956 characters long (just as the converted transliteration).

Corpus	H
Takahashi	4.021
Takahashi (converted)	3.866
Takahashi/Bauer	
Takahashi/Bauer (converted)	
Random text	4.459

Table 5: Entropy (H) for different transliterations.

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