# 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 337 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.

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

```
Paccos offax ar affarry door doro offeres of 1602 doorso
     Cos Faths Faths are Fath Willam Fill o Fo Faths ofoos
     OS UNIBSOS SSOND OF OBLIVE BOD ON DELO PO OPLIVE FILED
    Callo 90 GIIA GIIAS 910209 Sooto pooto GIIO
    8017-9 ccca? ctally ctall 6015
    980701259
    920 Fo.2 (1.08) office of the coeffice of the coeffice of the coefficient of the coeffici
    8011 2005 ctog 2009
[T2, 10]
    psooff So Gras
[P3, 11]
    Sagabosta obos Proffe osts Sago Prosats Probe Y
    UNDER 629122 Crosoco Collo 20216 CV2/1016 60291 02910
    tog effecy fosarry effect effects arrived the ogsarry s
     Said only cros osand crosand cros offand sad after fos
    8a110 detheog too coop dog coop coop lot cag
    to cros todal lity licy sof crosall to lices
900 flower ochlard the $9898 offer 8aroffer
    Stepths Grasses grants established san etters
     8cca? &cotta 110 olla 117 ccco Pcco tollog ctros 8aoctla
    coll coop crop sand office
[T3, 21]
    GIII 2010
    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 llollarry otorog llasorg sag
     Soco dos locas etto ollaro loco loco sas allo
    To Tox Toll Tollo Tollo
```

#### 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

The cold to tag cross ethors sangle the cold to tag cross ethors sangle of the cold to tag cross ethors early considered to tag cross ethors early crosses ethors e

[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
```

[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 arr offar after 89

[P2, 12] officeo2 ctg tollar cfftg 908a110 cttg 2 cto7 occ2 o7 tollof cros effeos floragoso 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

```
[P1, 1] Toodann dotto the control of the control o
```

[P2, 0]

[Recognized to those control colored to the control c

#### Folio 7, Verso

```
[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
```

#### Folio 8, Recto

```
[P1, 1]
Those coop officers croffs — those crofs do those chose ch
                      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 Mccoar coot salv
                      8000 8a118
                     Through the faces face - ofaces staces the sall the
                      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 16 [P3, 16]
    . . goves horollog ordes horo — docarrel other east ^{\circ} . ^{\circ} ^{
 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
```

#### Folio 8, Verso

```
CHOOS COOCHE - COS cos offer cos offercallo gos - Offersons 800th
                        chille positions for the set form — Pas authority
                     7089 \text{ creas} \text{ Co} - 709 - 709 \text{ crea} \text{ 
                     of the paper of th
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 टीटिं० राव११०
                     80927 czaf czal ososso — czafazo
                    Grasos
 [P2, 12]
                       Para are for sag — tag are are offarre are sarre
                       Partie office office of the start of the sta
 \frac{1}{2} choose sollarly — choose log cear effect florg effects
                    69 for fleer from form - other less som \frac{1}{5}0
                     GIVES on 6280n font 60216 — EDON EDON LOS
                     8017 cccaf 80117
```

#### Folio 9, Recto

```
[P2, 6]

Theoand efficiently offant offices office the sold of the second offices offi
```

#### 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
```

```
Theor offices tottor office oretross the area with sanning the same of the sam
```

#### Folio 10, Recto

```
[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
```

#### 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]

floar? cettored office office office oction

[P1, 2]

offo tollog ceodag office of ctog ceoffo

[P1, 3]

tollog tollod ceg office officed

[P1, 4]

og2 cecg offo2 oared office toctog

[P1, 5]

tollog dared
```

#### 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 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.

(P1, 8)

collano?

sanno offano.

optano offano.

optano.

op

#### Folio 15, Recto

```
[P1, 1]

The or decy therapy — deg cettoge decy sand

[P1, 2]

ofteror toteror ogg — offer deg those

totan to toter the first the first many offer deg those

totan totan totan totan totan of the first many offer deg

[P1, 4]

Cercan to ecosan totan offer of deg cettan to deg

[P1, 5]

totan respectively offer of deg totan offer offer
```

#### 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 is the control of the control of the figure of the figure

[P3, 10]

To Po P daggdag of the free of the off of ag [P3, 11]

Colleg to log the offe of the off of the off

#### Folio 16, Verso

```
[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
```

[P2, 7]
To cotte of the policy of the offer of

#### Folio 17, Recto

```
[P1, 1]

**Theody da?as gda?ccos ofgdg gfod ccof office dodg ogdeffeg
[P1, 2]

gda.? ccolly ollety toda? effects do? office todeffeg od?

[P2, 4]

**Theos dog tollog to? oga... ofgdg — Zos gferg gfa.s

[P2, 5]

gocelleg effeg co? do? effec? effects og da.? effect tode

[P3, 7]

If de to tollec to cogde meteg

Bace dogera? Zoca? gferg

Zog ceffec o da? ccgferas

Bace dogera? dogeras

Bace dog
```

#### 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 90130 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 cffcg 80sllo 9as Fosllo posllo

#### Folio 18, Recto

```
[P1, 1]

**Totacop da of goa? offices and o of cecting—oction day

[P1, 2]

offices totacop certifices offices danned annotation to the operation of the operat
```

#### 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]

Throoffing molfoann of meccol offices docann ?

[P2, 6]

moccol officer foffices meccy sann meson solution annotation most solution of mecol solution of mecol solution measurements.

[P2, 7]

omogened sann moffices mos sos dos offann

[P2, 8]

Comosan meson of mecols

[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
```

#### 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]

Top oper fecoses the start offs allows sall offers 2 octes

[P1, 2]

or old tops o lot tollerox sall offall offers sall effects

[P1, 3]

tollox sollarly offers sall offers sall

[P3, 7]

Moros dos socos ello cesoso offarro of — offero etas

Boros offo sarro theoso tollo confarro confero — sorro secos

Boros offo sarro effecos ofarro

[P4, 10]

| force and sand affected sace and follow of the order order of the order order

## Folio 22, Verso

```
[P2, 6]

Thoo to the following the proof of the proof of
```

## Folio 23, Recto

[P2. 4]

tollogog ollariz ollariz ollariz ollariz ollariz ollariz ollariz ollariz

getor tollariz ollariz ollariz ollariz ollariz ollariz ollariz

getor tollariz ollariz ollariz

[P3, 6]

Thereographically offs and offs series sand offers seas?

[P3, 7]

offar operar tanno tollerog sar tollerog santo r og sanno agg

[P3, 8]

tolleroge car sanno tolland ogog toand offers 2 — sing offers

[P3, 9]

offog off to tollog so — sog stee tolleres og ogo — sanno sag

[P3, 10]

toll offand elleroge - offers osag erag so — sar offand

[P3, 11]

offollo sagoro

## Folio 23, Verso

```
[P1, 1]
Toda Pox oda Ny coardo of those of the or the followard of [P1, 2]

follooffor the older of follower of the or the of th
```

## Folio 24, Recto

[P1, 1]

107079 cco7 ofca7 &c cco9 8a110 o7 totally of obard offartheas offartheas offartheas 9 cttca? cttcax olfox tottar cttcg 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 ceces too cear offeas S 208 20 Sosso Sosostao ट्टंबर जीटबर ठवर ठवर ठवर ollo posto pato pollo estis  ${\displaystyle \mathop{\mathsf{o}}_{\scriptscriptstyle{[P1,\,19]}}}^{\phantom{\dagger}}$  cros cros 8a11) cros 8 909 for crop tog offarteg Sagczoggo

## Folio 24, Verso

```
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]
                    Poclo cotto cos Savo
 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
```

# 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]

Toccall tolly do sall totals offered total colors
[P1, 2]

Seco? etto? ero? sall offered tollow sall etters sall

ore fero? erox sall deetto? sall setes sall

p1, 3]

ore fero? erox sall deetto? sall setes sall

polloll tolloll tollol etcox sall etcox sall etcox

p1, 4]

tolloll tollol setes? setes sall etcox sall sall

p1, 6]

tollol ? oeg tollol tollolax — ero\* erall secall?

p1, 7]

odo ettoy sallo sall ettex — oreall

## Folio 26, Recto

```
[P1, 1]

Toticolly obanny tog — others confirmed offices and — conforcates green sand according to the confirmed offices of the confirmed offices of the confirmed offices of the confirmed of the confirmed offices of the confirmed of the confirmed offices of the confirmed of the co
```

[P2, 7]

Theo tolless sar theo states 2 — all — tates of the sages of the sare of the same of the same of the sare of the sare

## Folio 26, Verso

#### Folio 27, Recto

```
[P1, 1]

[P0, 2]

89 coard tog sard sar togard togard they selected selected togard togard togard they selected togard to
```

## Folio 27, Verso

```
[P1, 1]
Tocol col co do 2009 dos offico? ofco? fleoreo?
[P1, 2]
8cg colla? offico do sca sca? cosa officos do sca sca?
[P1, 3]
Ifaco fleo scollag scol sca? cosa officos do sca fleo soccos
[P1, 4]
offico co flecos cos cos flos — o offico soccos
[P1, 5]
tollo defico 2cosa? defos — coffico soccos
[P1, 6]
sho fleo to 2cosa? defos — cofficos
[P1, 7]
do do offico deso — sca cos — cofficos
[P1, 7]
do do offico deso — sca — collas
officos officos fleos
```

## Folio 28, Recto

[P1, 1]
Toosar dos coctos ofcos sanno — officos costo segente officor officor

## Folio 28, Verso

```
[P1, 1]

| ltdog toolld col tdolld cttteg tollg sg ctolg

[P1, 2]

glecogg tollg ceg sg tollcog ceol tleg tollcosg ceol o

[P1, 3]

ceol ceog ceg ceolld
```

[P2, 4]

Theory acor acor o all tollog acog acor sarry tollog acog acor sarry tollog acog arry tollog acog sarry all arry acord tollog acog sarry acord acord tollog acog sarry sarry acord acord tollog acog sarry acord acor

## Folio 29, Recto

```
[P1, 1]

To2a11 & call off and total off and total off according [P1, 2]

8 of graph of and off and according and for any form total off and for all off according and for all off according and form of according to for according to for according to for according to according to
```

## Folio 29, Verso

## Folio 30, Recto

[P2, 8]
of trop of circles decree decree of trage — series decree of trage of trage — series decree decree

## 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]

acoffac &coffaco faco faco

[P1, 8]

ogac acoffog atcop &cocg

[P1, 9]

toffaco? aco? &cocg &cocg

[P1, 10]

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

[P1, 11]

Cog acoffaco? &a\d d)

laco&g

Cocg acoffaco? &a\d d)

laco&g

Cocg acoffaco;

&cocg&g

Cocg acoffaco;

&cocg&g

Acocg

Cocg

#### Folio 31, Recto

offco? arrefteg

```
Probable to the same of the sa
         80000 January Collect S and collect tot
tolleg ecco sand tolleg fant eccles sand seg
tota? ccg 8a? 90? a? ccccg 16ccg ccc89 to16cg [P1, 5]
         90010t 0800055 (111B
         Theolicoso tolicos tolicos ecctar ecoso ? and sag
per, 7]
glice da? Zarri cocofficos cocos folicos glicedo cocos gos
[P2, 8]
cocos folicos cocos cocos folicos cocos cocofficos
[P2, 9]
         80117 Ecco Ecttog offcog
[P3, 10]
        Those and offices tolless tolless tolless sar acording
oxéccox follows dax oncy does long llocy ollarity offices [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

```
[PI, I]

Toolid deglicos salvos salv — do too off too
             .2020 Potor Cocord clip sas — 8ctobar follo
   tollcrof crof ettrog crog sog — scrcosand sand
  toffers toffers sand
[P2, 6] fcco fccs
   offox dox ox dan?
  †oa? 8a\\V 8a8
   8011cco2 8a29
[P2, 10]
8cto? cffco 8a\\\\
[P2, 11]

cto2 cccffcox \(\bar{V}\)

[P2, 12]
           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

```
[P1, 1]

| forcosann con floor fotann sannows — o cotocoso
| p1, 2]
| sanno osar con sanno con floor floor gs9 — sanno floor
| p1, 3]
| ctor sanno cotton sto sanno con sanno con floor
| p1, 4]
| or cor cor sor canno fotano reg — sco sanno
| p1, 4]
| colors sanno con con fo flanno sanno sors
| p1, 6]
| of can con ctan santte
```

[P2, 7]

Ilito cto? to tecanno officero? san — tetto ? osav

[P2, 8]

office san office

## 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

[P2, 7]

\*\*Thicks of the solution of the solut

#### Folio 34, Recto

```
[P1.1]

Taccoctacy oral or ofters offers offers offers and orally safe offers

The coctacy oral oral oral offers offers offers offers offers offers offers offers

The cost offers orally areas of offers offers offers offers of offers

The cost offers orally areas offers

The cost offers orally areas offers

The cost offers orally oral oral oral offers

The cost offers

The cost
```

2a17 acla ? collo &cl — acosacos tollos oll accosactes

#### 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]

cffroo? crops cffrs croffs cra? 39

[P1, 2]

tollicann crollann tollicas anno

scanno cffrcs tollicus flann cffro?

[P1, 4]

tollicus chilicus cffros crocs sanno sanno

[P1, 5]

offro? cho flacces crocs sanno sanno

[P1, 6]

cranno cra? crad sanno

[P1, 7]

chollicus flanno sanno

[P2, 9]

tanno cranno cffro cracs cracs sanno

[P2, 10]

o anno cranno cffro cracs cracs sanno

[P2, 11]

chaccanno cros cffranno scanno scan san san san asso o

[P2, 12]

oso? cra cranno cra flanno flanno flanno

[P2, 13]

tollono cranno tollicus offro? sanno cffranno

[P2, 14]

cffros cros anno tollicus offro? sanno chos tollanno

[P2, 15]

ocro? 2 crnno sanno offano? sanno chos tollanno

pre, 15]

ocro? 2 crnno sanno offano
```

## Folio 35, Verso

```
fa? cco? ccocffcg ?oa\\dagger a?
totlarg offaceg llaco? offa
  Boro For collo sally
[P1, 4]
offce toffce deep effective [P1, 5]
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 gard cellago ceogo
  8 000 Polices Possibot Pinas
  Scrolleg gloog crog sall
80110 CO2 CO2
```

## Folio 36, Recto

## Folio 36, Verso

```
[P1, 1]
Tocalaly totology coannil therey exetting offannil efteal sannil
total engress sannil offannil totology offan octol exetty efteal son
[P1, 3]
sergificing offor 2 — offannil totology offan offerannil
[P1, 4]
totherol off to so — sannil efteal
```

```
[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

```
[P1, 1]

1 foctog cannot tollor of cor off coro sanno offos or [P1, 2]

9 flonn cftcor offanno tollor offos tolland co offanno foctog tolland cftcor offanno
```

[P2, 4]

Toollary barry offers bar are barry - 98

[P2, 5]

glig tollary tollaror allog offogg

[P2, 6]

chor chor tollary tollogody — barry barry

[P2, 7]

Zor areg 107 tollor barry

[P3, 8]

No.10 ccorosg tollarid ctorg offag — ctor ctcor sar

[P3, 9]

gliccosg tollarg gliarid ccg tollor—sg — office gog sarid

tollo officector scor ccg ctg sarid — goccg flog sarir

officer sarid cffcg sard sarid

## 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? cocifies — olfs croind olfaces ogg olfs
[P1, 2]

olfaces crosso? — offerid offering crolleto?

[P1, 3]

tolfo? olfand — offerid tolfaces crolleto?

[P1, 4]

garolf cres creft — crs crife? osand sand 29

[P1, 5]

olfo? cres fand — cro? offer sand offers

[P1, 6]

garo croins — sand olfos crocso? sand
```

## 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 cc089 2a\\D o? a\\D to 1a\\D of 1a\\D of 168a\\D of 168

9 of 1cc9 cc089 ccc0? a\\D of 1689 cc08ax 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 cc0 cf 1689

x 11c89 of 1cc9 &c0? \tag{10} 1a\ \D of 1689 cc0 cf 1689

x 11c89 of 1cc9 &c0? \tag{10} 1a\ \D of 1689 cc0 cf 1689

x 11c89 of 1cc9 &c0? \tag{10} 1a\ \D of 1689 cc0 cf 1689

x 11c89 of 1cc9 &c0? \tag{10} 1a\ \D of 1689 cc0 cf 1689

x 11c89 of 1cc9 &c0? \tag{10} 1a\ \D of 1689 cc0 cf 1689

x 11c89 of 1cc9 &c0? \tag{10} 1a\ \D of 1689 cc0 cf 1689

x 11c89 of 1cc9 &c0? \tag{10} 100 \ta

### 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 ollg — 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 or they — the dead tanks of the second tanks of the second
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

```
Costa to otalia patracetto offices forca?
 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 . . <del>1</del>089 ctcoccg offarry ccg 16cc2 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

```
8chcg flowg g llowg colleg ctg 8al - 8al offog 8all
                        أوه ما الله و الله عنه من الله عنه الله على الله عنه الله على الله عنه الله عنه الله علم الله علم الل
 †offceg celloeg 2a2 8g — o8arrs — glloeg ollog 83
 collector coco collar - of - of - of - or collar collar - of - of - or - of - or - of - or - or - of - or 
 offcollear creotlerar — 29 — Zarri ctrar 8ag
colf decolfeg flees \mathbf{8} — are fleezedg _{[P1,\,8]}
                        GIIDS RDBOS
                       Total of the state of the state
                        \mathcal{S} cos offers \mathcal{S} of \mathcal{S} or \mathcal{S} or \mathcal{S} or \mathcal{S} or \mathcal{S}
to all tolless less energy offcos -8 — they feall 8 _{[P2,\ 12]}
 coffeecy cox ox early officered — either flaxly 9 _{\rm [P2,\ 13]}^{\rm [P2,\ 13]}
to acq floof they accounting savid — acolling savid
 tother one that the constant of the constant 
                        حزهاادع حرمع ماادع
                        02280 Follo
```

### Folio 43, Recto

[P1, 1]

The Postannia of the state of the s

P3, 11]

Solve to the solve to

## Folio 43, Verso

[P1, 1]

\*\*T82!a!\?9 &axtlcoct9 &a &9 &ccctl of afosk & floo f!afa\\) offces9!o foxe9

[P1, 2]

\*\*Ccc89 octlog offces9 &ccc89 &af &cccl! ctlog offces9 offg offaxe9 flows offaf

[P1, 3]

\*\*Toog floces9 foll coctlog collog offg offa\\) occollog offa\(
0 \) offces9 flows offa

[P1, 4]

\*\*Sccc9 offces9 coccc a\\) ocg foctlog cocg follaf cocctlog offaf

[P1, 5]

\*\*Tolloces9 of agos9 offesox coctlog collog

[P2, 6]

Thos! there of the solic of the sol

[P3, 10]

That coop at assat cos sages could office !!office forces of office of the post of the post

# 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/Bauer	
0	0	25,468		
е	С	20,070		
h	τ	17,856		
У	9	17,655		
a	а	$14,\!281$		
С	c	13,314		
d	8	12,973		
i	\	11,660		
1	9	10,518		
k	ľ	9,996		
r	5	$7,\!456$		
n	Э	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	挈	224		
g	අ	96		
F	#	80		
I	τ	72		
x	ᆽ	35		
v	٨	9		
z	Ч	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  $\sigma$  and  $\tau$  are one glyph (i.e.,  $\sigma$ ). Likewise,  $\mathcal{C}$  and  $\tau$  could be interpreted as another glyph (i.e.,  $\mathcal{C}$ ). Additionally, one might interpret instances of  $\mathcal{C}$ ,  $\mathcal{C}$ ,  $\mathcal{C}$ , or  $\mathcal{C}$  as representing  $\sigma$  (or  $\mathcal{C}$ ), on the one hand, and  $\mathcal{C}$ , or  $\mathcal{C}$ , or the other. Concerning those "gallows" characters, as they have come to be called, it is not clear whether  $\mathcal{C}$  and  $\mathcal{C}$  and  $\mathcal{C}$  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  $\sigma$  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  $\iota$ , it is not clear whether instances like  $\iota\iota$  and  $\iota\iota\iota$  or combinations with  $\vartheta$  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 <del>¶c</del>	950		
cKh	clfc	906		
cPh	<del>ct</del> c	216		
cFh	c <del>l°</del> c	74		
С	C	143		
СО	CO	9		
су	<b>c</b> 9	7		

Table 2: Glyph frequencies in Takahashi's transliteration for several  $\sigma$  combinations.

gives frequencies for several of those  $\chi$  combinations. Assuming there are three glyphs  $\chi$ ,  $\chi \partial_{\lambda}$ , 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,  $\delta$ , c,  $\delta$ ,  $\tau$ ,  $\varphi$ ,  $\vartheta$ , o,  $\uparrow$ ,  $\uparrow$ ,  $\uparrow$ ,  $\uparrow$ , and  $\varphi$  are simply counted as before. Hence, frequencies are identical with Table 1.
- The glyph  $\mathcal{E}$  is counted every time  $\mathcal{E}$  and  $\mathfrak{c}$  appear consecutively.
- The glyph  $\sigma c$  is counted every time  $\sigma$  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  $\iota$  is counted every time it is not part of  $\iota \Im$  or  $\iota \iota \Im$  as well as in instances of  $\tau$ .

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  $\alpha$  is represented by Sh in EVA. For calculating the entropy, every time S and h appear consecutively, they are replaced by 1
- The glyph  $\sigma \epsilon$  is represented by  $\epsilon h$  in EVA. Every time  $\epsilon$  and  $\epsilon$  appear consecutively, they are replaced by 2. Following the above stated rules for glyph counting,  $\sigma \epsilon$  is also believed to be present when  $\sigma$  and  $\epsilon$  are separated by f, f, or f, represented by f, f, or f are also present. They are represented by f, f, or f are also present. They are represented by f, f, or f are also present. They are represented by f, f, or f are also present. They are represented by f, f, f, or f 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  $\tau$ , represented by I in EVA, is counted as  $\iota$ , 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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