

Digital Transformation of Cultural Heritage: Exploring and Curating Historical Resources



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Large surveys with small telescopes: Past, Present, and Future
(Astroplate III)



Bamberg
11.-13.03.2019

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@DHDarmstadt

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Check-in



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The Turing (@turinginst) twitterte um 4:17 nachm. on Di., März 05, 2019:

“All data is historical data: the product of a time, place, political, economic, technical, & social climate. If you are not considering why your data exists, and other data sets don’t, you are doing data science wrong”. - @melissaterras
#TuringLectures <https://t.co/mjjGwl7GZu>
<https://t.co/zKrQYIYAko>

<https://twitter.com/turinginst/status/1102951379507789826?s=09>

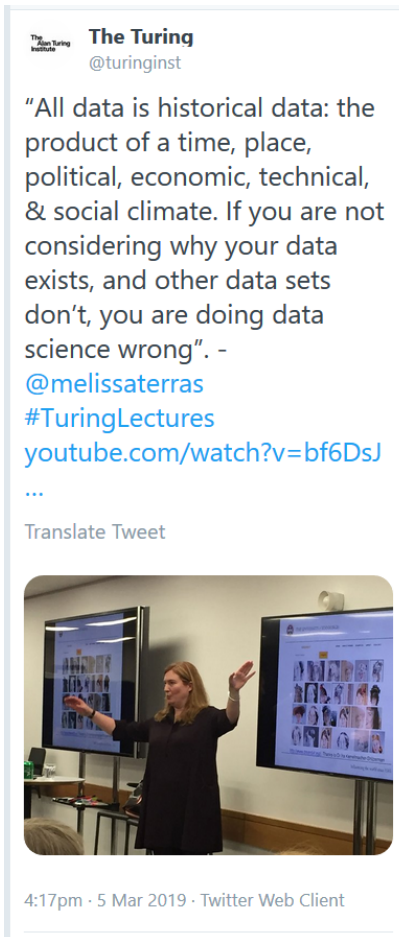


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- Example II: Letters of Brothers Grimm, Savigny & Bang
- Conclusion

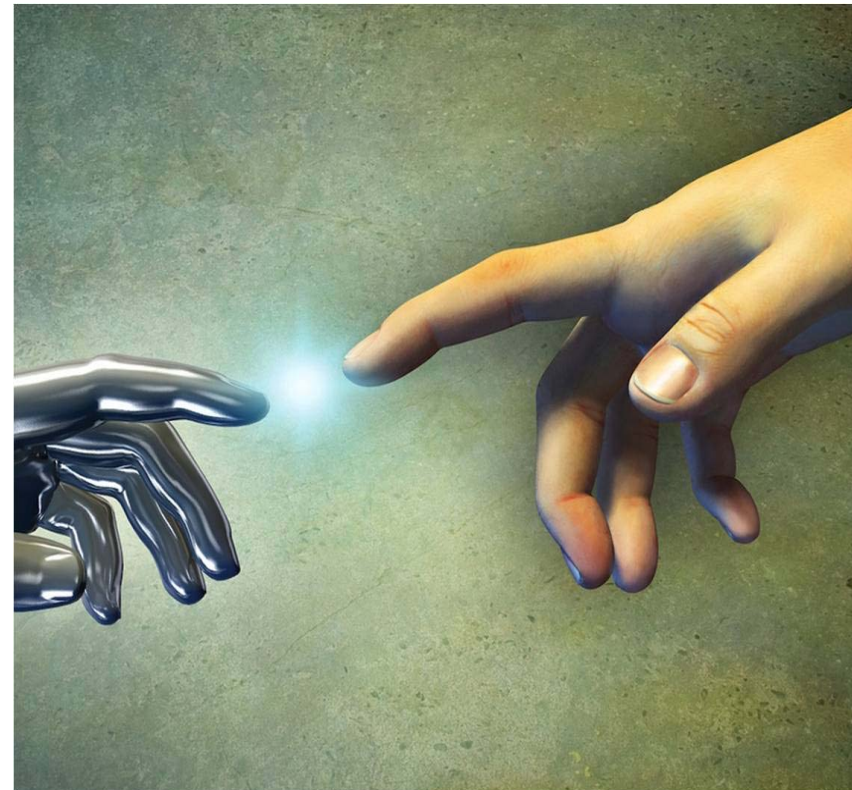


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The History of Digital Humanities: Humanities Computing



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Google books Ngram Viewer

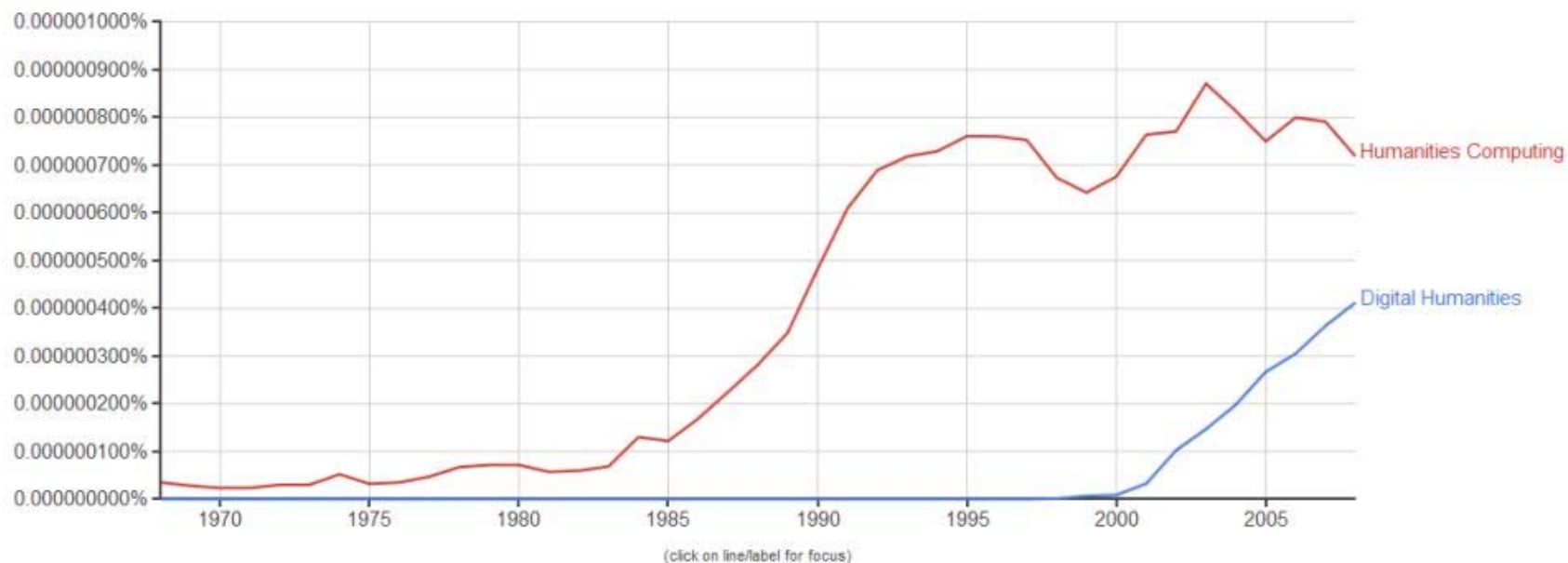
Graph these comma-separated phrases: case-insensitive

between and from the corpus with smoothing of [Search lots of books](#)

[Teilen](#)

[Tweet](#)

[Embed Chart](#)



The History of DH: Humanities Computing



Humanities computing is precisely the automation of every possible analysis of human expression (therefore, it is exquisitely a "humanistic" activity), in the widest sense of the word, from music to the theater, from design and painting to phonetics, but whose nucleus remains the discourse of written texts.

During World War II, between 1941 and 1946, I began to look for machines for the automation of the linguistic analysis of written texts. I found them, in 1949, at IBM in New York City. Today, as an aged patriarch (born in 1913) I am full of amazement at the developments since then; they are enormously greater and better than I could then imagine. *Digitus Dei est hic!* The finger of God is here!



The History of DH: Index Thomisticus



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- Starting with punchcards: 13 mio cards, 1 for each word with 12 lines of context on the backside: 90 m long, 1.20 m height, 1 m depth, wight 500 tons
- Magnetic Tapes: 1.800 tapes, each 2.400 feet long, all in all 1.500 km, way Paris-Lissabon or Milano-Palermo
- Publication: 20 tapes as setting copy, 20 mio lines, 65.000 pages, 56 items in encyclopaedec format = the printed *Index Thomisticus*
- Digital publication began 1987 with preparing data for a CD-ROM edition published in 1992, 1.36 GB
- Today: www.corpusthomisticum.org



Roberto Busa with Pope Paul VI
presenting the printed edition

The History of DH: The Busa Archives



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- Busa's female operators
(here Livia Canestraro)



- Melissa Terras: <http://melissaterras.blogspot.de/2013/10/for-ada-lovelace-day-father-busas.html>
- Julianne Nyhan: <http://archelogos.hypotheses.org/127>

The History of DH: www.corpusthomisticum.org



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CORPUS THOMISTICUM
INDEX THOMISTICUS
by Roberto Busa SJ and associates
web edition by Eduardo Bernot and Enrique Alarcón
English version

Search:

[concordances](#) [terms](#) [works](#) [options](#) [new search](#)

Instructions:

You may type in any number of terms. By default, it is assumed that you want to search for all of the given terms within each of the textual units contained in the whole Index Thomisticus database, and that the given terms may appear in any order whatsoever with the only restriction that they be contiguous. However, you may override these settings by pressing the **options** button and modifying the defaults, or by using the advanced expression syntax given below. Having typed in the desired terms or expression, you can always press any of the following buttons:

concordances To read occurrences of the given terms (or expression) in their respective context.

terms To refine word selection for each given term by checking or unchecking individual forms, and to examine statistical information regarding their occurrence in the works that are selected.

works To examine statistical information concerning the occurrences of the given terms or expression in all listed works.
Notice: You can press this button at any time to select which works (individually or by category) will be included in the search.

Terms:

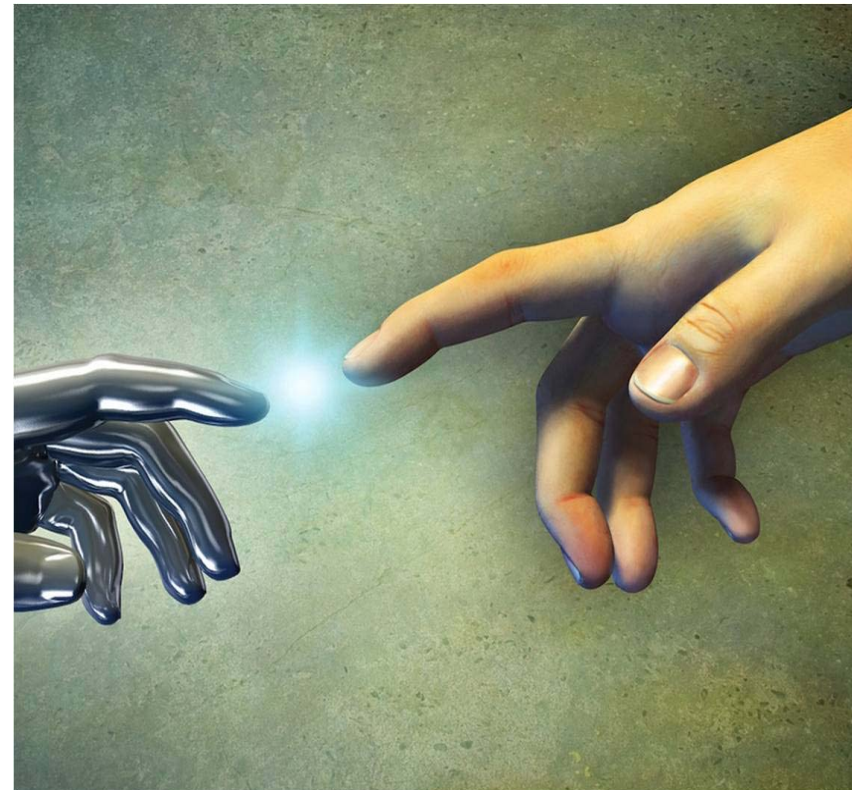
Search terms may be expressed in three different manners: by supplying the desired word form, by supplying a lemma entry code (preceded by the # symbol) in order to select all of its forms, or by supplying a word form (preceded by the = symbol) that will serve as a sample for the selection of all of the forms belonging to the same lemma entry.

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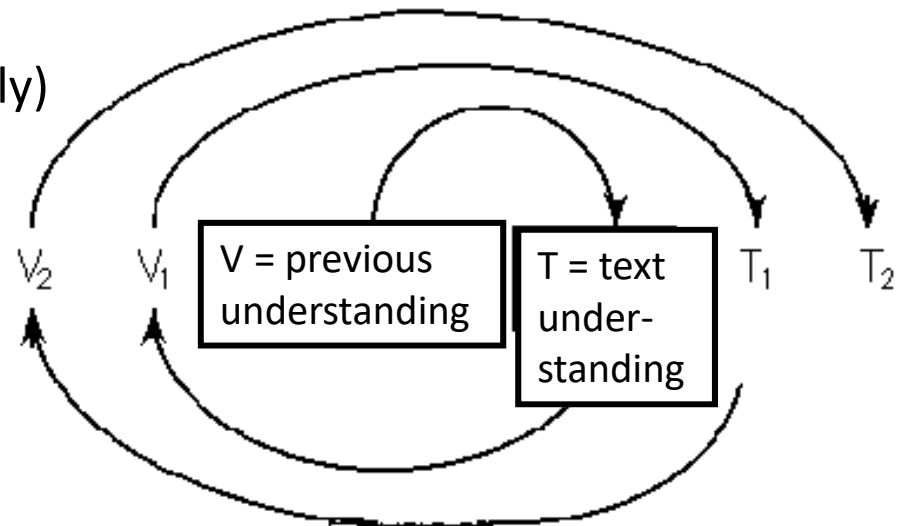
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Humanities Research Cultures – the Hermeneutic Approach



- Acquisition and representation of cultural products of humankind (in the broadest sense)
 - Preserve & archive (but also discard, forget & destroy)
 - Copy, share, update & change
 - recording & disambiguate
 - Editing, commenting & explaining
 - Analyze & evaluate (also quantitatively)
 - Interlink & network
 - Interpret & understand
- A fundamentally unfinished and always to be renewed process



Hermeneutic circle

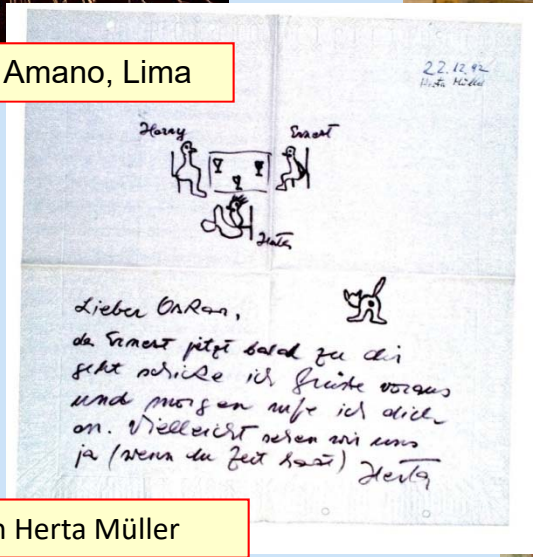
Diversity of Cultural Heritage



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Inka-Quipu, Museo Amano, Lima

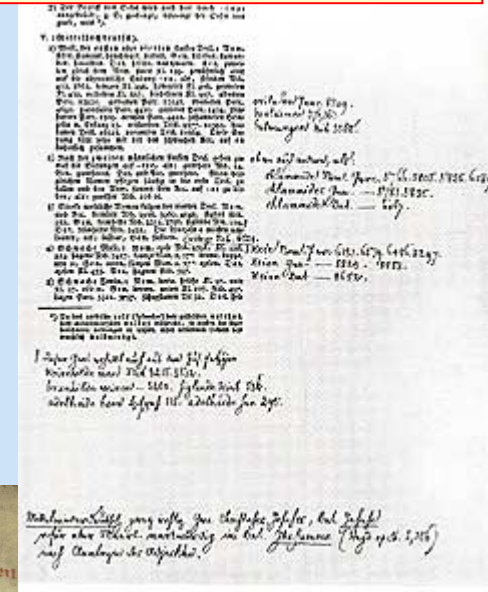


Letter from Herta Müller

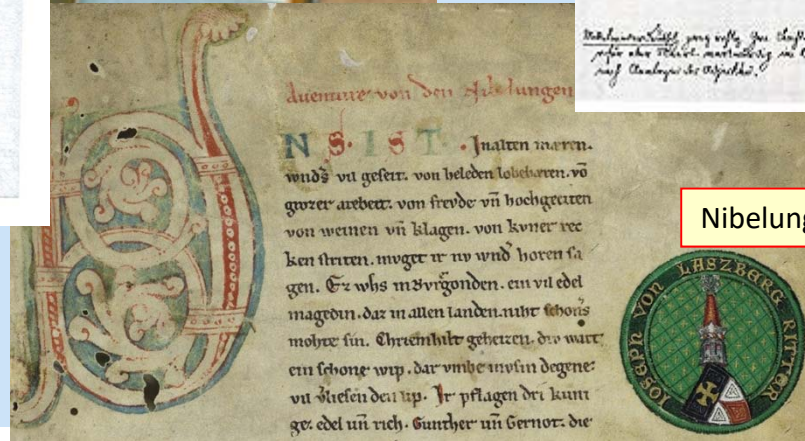


Phaistos disc

slip boxes & Grimm's personal copy of the Grimms' Dictionary



Nibelungen C (BLB)



Fragility of Cultural Heritage



Das digitale Historische Archiv Köln

Das DHAK wurde wenige Tage nach dem Einsturz des Historischen Archivs der Stadt Köln im März 2009 gegründet. Aus der als Nothilfe gedachten Idee entwickeln wir den digitalen, kollaborativen Zugang zum Archiv.

[Erfahren Sie hier mehr zum Projekt](#)



[Blog](#) [Links](#) [Impressum](#) [Kontakt](#)

Municipal Archive Cologne (Köln)

- 65.000 charters (since 922)
- 26 kilometers of records
- 104.000 maps & plans
- 50.000 posters
- 818 estates & collections

Collapse 3.3.2009

- 90% buried
- 85% recovered
- 200 conservators
- 30 years
- 370 mio. Euro
- only some individual items digitized

Fragility of Cultural Heritage



Ancient city of Palmyra

- destroyed october 2015 by IS
- reconstruction based on 3D records
- 3D-print of a (downscaled) replica 2016

Buddha statues in Bamiyan

- destroyed march 2001 by Taliban
- no „real“ reconstruction possible
- reconstruction based on 2D and 3D records
- hologram replica

Necessity of Context



Rosetta Stone (196 BC)

- text in 3 languages and 3 script types: hieroglyphic-demotic-greek script
- cartouche with proper names = the key for (re-)deciphering

Phaistos Disc (1850-1550 BC?)

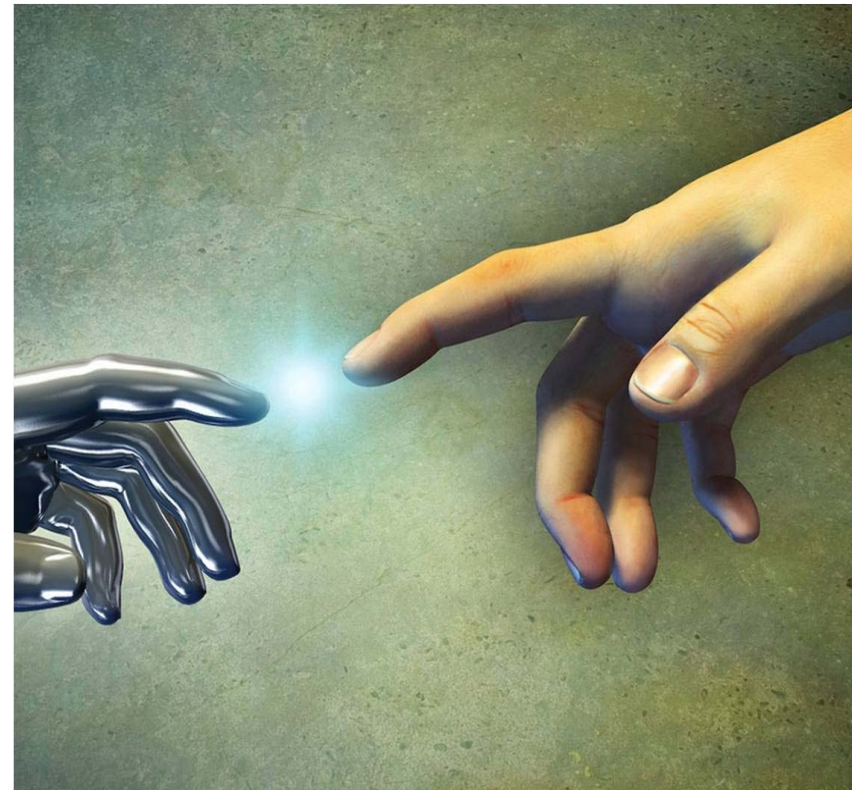
- individual item, unknown language & script
- 45 distinct single signs & text outline elements
- not decipherable due to lack of context

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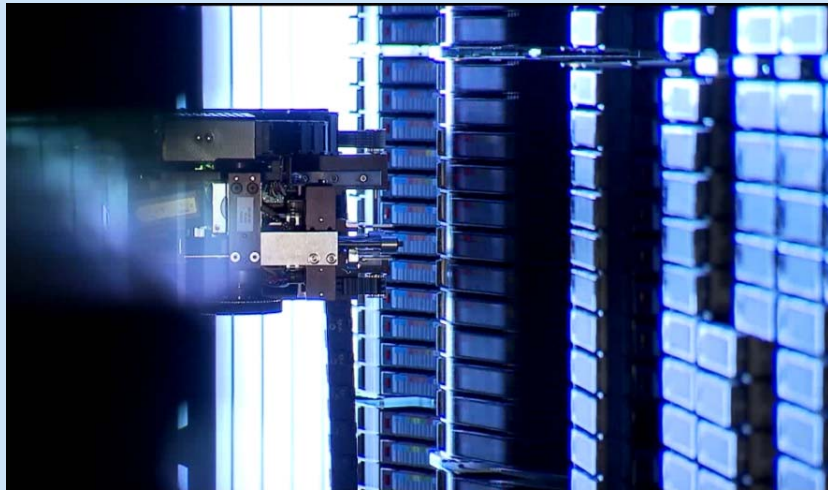
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Diversity of Cultural Heritage Data



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DARIAH-DE-Stakeholdergremium
„Wissenschaftliche Sammlungen“: Oltersdorf,
Jenny und Schmunk, Stefan. 2016. „Von
Forschungsdaten und wissenschaftlichen
Sammlungen“. *Bibliothek Forschung und Praxis* 40
(2). <https://doi.org/10.1515/bfp-2016-0036>. S.181.

DARIAH-DE

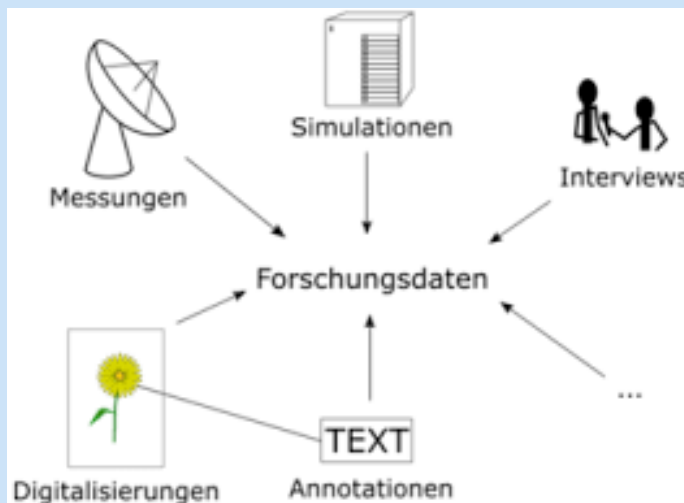
“Data, without regard to their provenance, become digital research data in the context of a humanities and cultural research question, once it has been collected, described, evaluated and / or generated and stored in machine-readable form for the purpose of traceability of research results and for archiving, citability, and further processing.”

Diversity of Cultural Heritage Data



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Humanities research data: all digital data resulting from experiments, measurements, simulations, source references, transcriptions, editions, surveys, excavations, directories, recordings, etc.



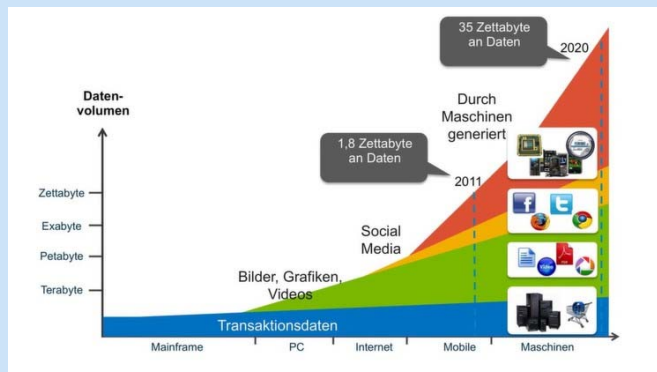
Formats, Media, Multimodalities

- ✓ texts, images, multi-dimensional models, audio, video, tables, databases, software (source code and applications)
- ✓ technical and device-specific raw data
- ✓ documentation
- ✓ software required for their understanding
- ✓ discipline-specific in different aggregation levels & mostly in different special digital formats

Big data – long data

Big data

Amounts of data that are too large, too complex, too fast-paced, or too weakly structured to be evaluated using manual and traditional methods of data processing.



Long data

Datasets of historical significance that provide not just a snapshot, but a comprehensive picture, drawing the evolution and the evolution of processes and interactions over long periods of time because long data provides context.

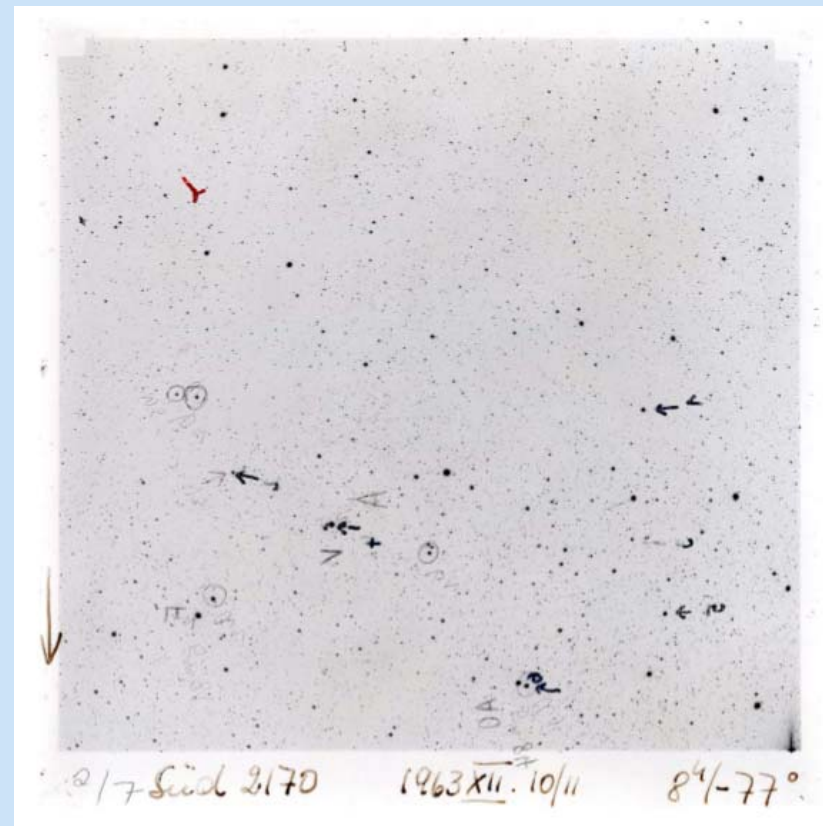


Long data



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By “long data”, I mean datasets that have **massive historical sweep** — taking you from the dawn of civilization to the present day. (...) Because as beautiful as a snapshot is, how much richer is **a moving picture**, one that allows us to see how **processes** and **interactions** unfold over time? (...) — because long data provides **context**. (...) Want to see more clearly how knowledge is preserved? Use copies of a text created over a thousand years. (...)



Samuel Arbesman: Stop Hying Big Data and Start Paying Attention to ‘Long Data’, 01.29.13 9:30 AM
<http://www.wired.com/opinion/2013/01/forget-big-data-think-long-data/>

<https://www.plate-archive.org/applause/>

Digital Transformation of Cultural Heritage



Humanities Collections

„[...] the **creation of digital objects** [...] is a crucial part of humanities research. [...] This is a fundamental difference between data-bases as they are used in the humanities and those that are used in the natural sciences. The **way** in which inscriptions are **photographed** or in which text corpora are **transcribed and encoded**, is **crucial for the way in which these research objects will be studied in the future.**“

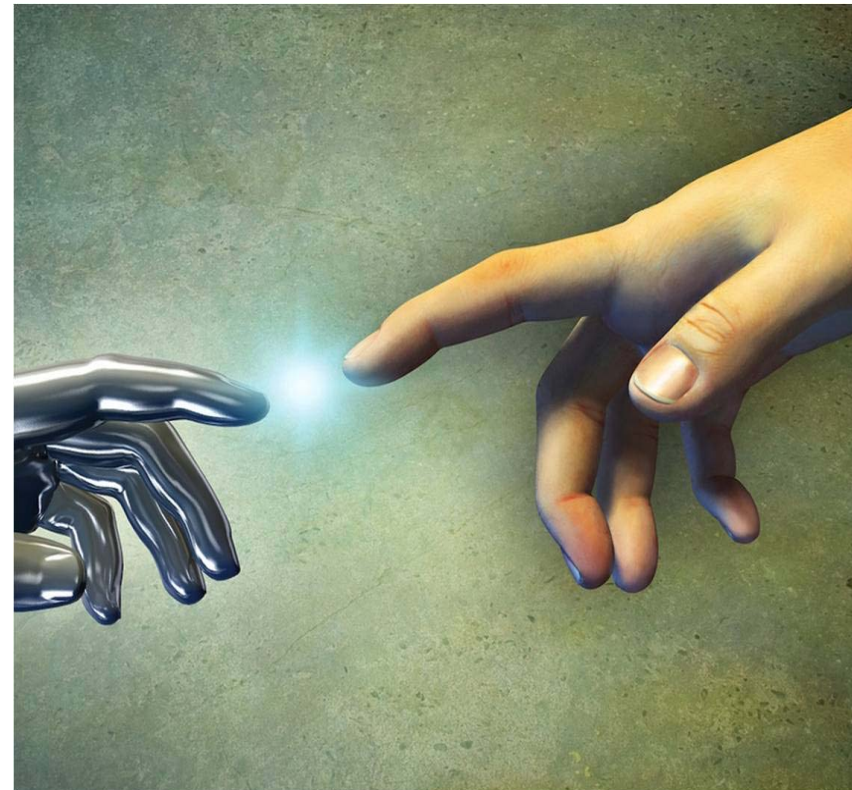
Peursen, Wido T., van . “Editorial.” *Text Comparison and Digital Creativity*. Ed. Adriaan H. van der Weel, Ernst Thoutenhoofd, Wido T. van Peursen. Leiden: Brill, 2010. 11. Print.

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Example I: Organizing Variations of Hieratic Script



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3000 years of written culture in Egypt: hieroglyphs



Sarg des
Djeddjehutiufanch
Turin
(4. Jh. v. Chr.)

Sog. „Weiße Kapelle“
12. Dynastie
Pharao Sesostris I.
(ca. 1900 v. Chr.)



Foto: T. Konrad

aus: Leclant, Ägypten III, Umschlag und Abb. 182

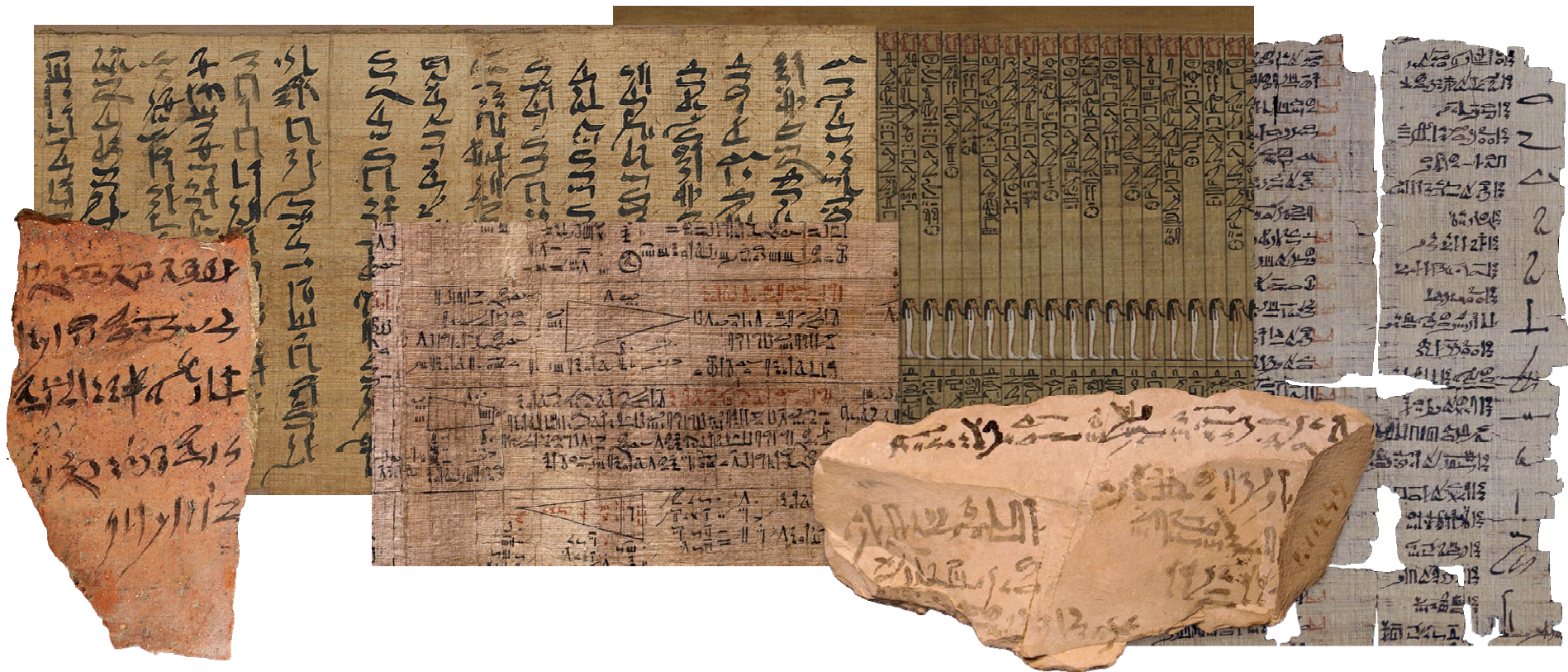
© AKU T. Konrad / S. Gülden + U. Verhoeven-van Elsbergen, K. von der Moezel, M. Leuk, C. Krause, A. Rapp. <https://www.blogs.uni-mainz.de/fb07-aku-eng/>

Example I: Organizing Variations of Hieratic Script



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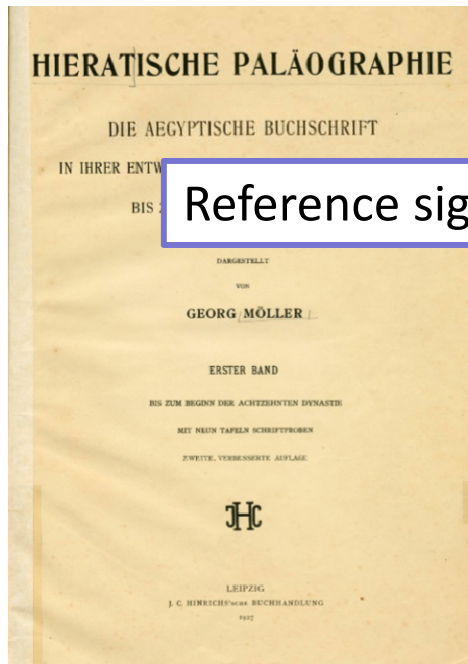
3000 years of written culture in Egypt: hieratic script (hand written, 'italic' script)



Example I: Hieratic Scripts – Printed Paleographies



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Reference sign

A. Männer.

	Phoebe	Elephantine	Heliopolis	Fara	Saqqara	Sakkara	Memphis	Waset	Sais
1. 196.									
2. Dyn. 3.									
3. B									
4. Dasselbe Zeichen, abgekürzte Form.									
5. 1, 2									

Source

196.

Dyn. 3. 1

B

Dasselbe Zeichen, abgekürzte Form.

1, 2

Date

I 189 - 196 B

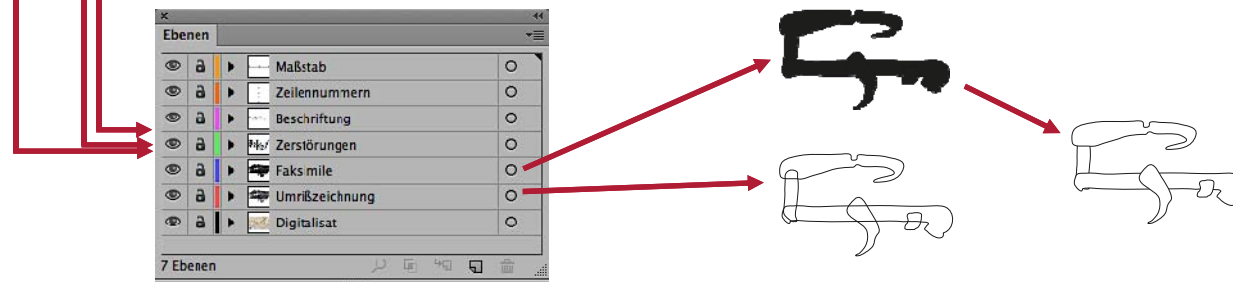
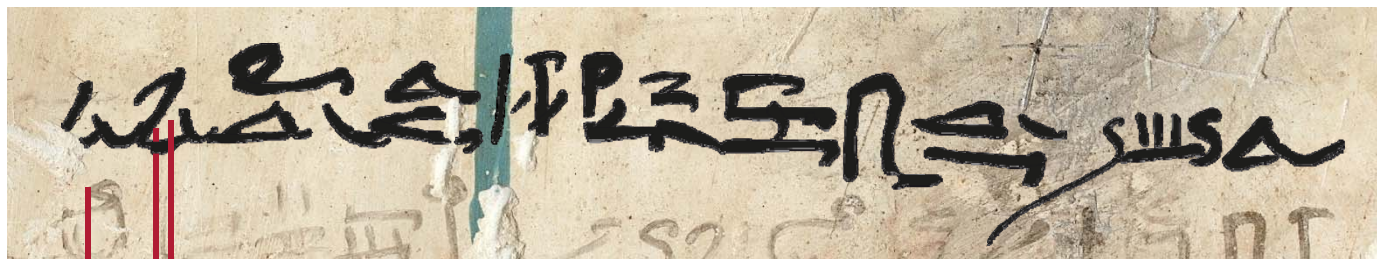
	Phoebe	Elephantine	Heliopolis	Fara	Saqqara	Sakkara	Memphis	Waset	Sais
1. 196.									
2. Dyn. 3.									
3. B									
4. Dasselbe Zeichen, abgekürzte Form.									
5. 1, 2									

Example I: Hieratic Scripts – Drawing Digital Faksimiles



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Vector graphics of ‚hieratograms‘

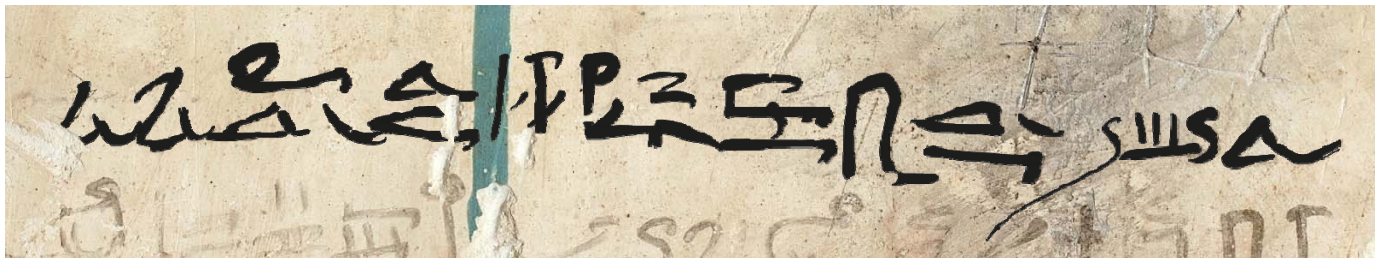


Example I: Hieratic Scripts – Drawing Digital Faksimiles



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Different formats



***.eps** ***.svg** ***.png**

The image shows a workflow for digitizing hieratic script. On the left, a menu titled 'Aktionen' (Actions) is displayed. The 'als in eps' option is circled in red, and a red arrow points from it to the first file explorer window. Below it, 'als svg und png speichern' is also circled in red, with a red arrow pointing to the second and third file explorer windows. The first window shows a list of files with the extension *.eps, the second shows *.svg, and the third shows *.png. Each window has a header with 'Name' and 'Größe' (Size) and contains a list of files with their respective names and sizes. Red arrows at the bottom point from the menu options to the corresponding file explorer windows.

Example I: Hieratic signs in XML-Code



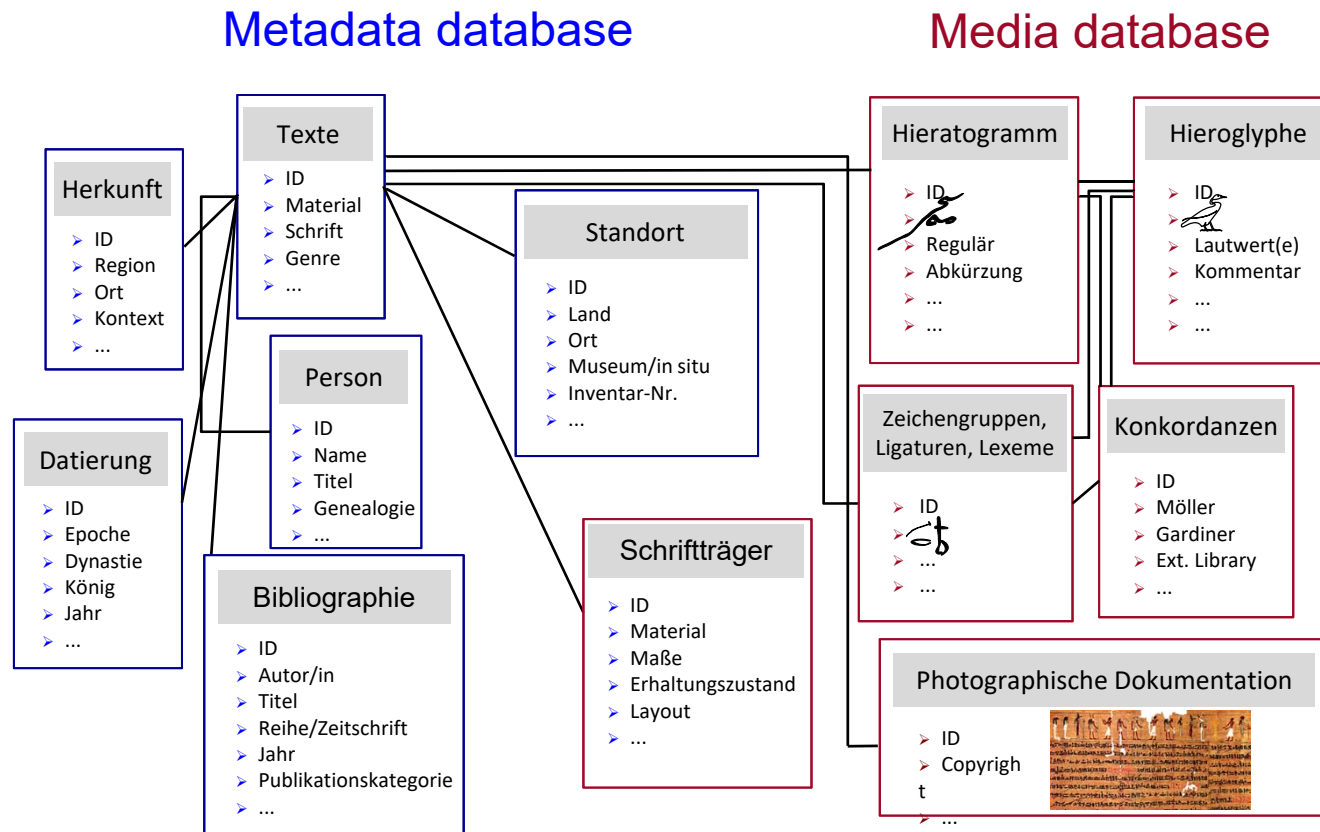
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Charactersize (Pixel x 2.54 cm) / 72 ppi = cm



```
<?xml version="1.0" encoding="utf-8"?>
<!-- Generator: Adobe Illustrator 16.0.0, SVG Export Plug-In . SVG Version: 6.00 Build 0) -->
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 1.1//EN" http://www.w3.org/Graphics/SVG/1.1/DTD/svg11.dtd >
<svg version="1.1" id="Ebene_1" xmlns:x="&ns_extend;" xmlns:i="&ns_ai;" xmlns:graph="&ns_graphs;"
      xmlns="http://www.w3.org/2000/svg" xmlns:xlink="http://www.w3.org/1999/xlink" x="0px" y="0px"
width="50.043px" height="29.552px" viewBox="0 0 50.043 29.552" enable-background="new 0 0 50.043 29.552"
xml:space="preserve">
  <switch>
    <foreignObject requiredExtensions="&ns_ai;" x="0" y="0" width="1" height="1">
      <i:pgfRef xlink:href="#adobe_illustrator_pgf">
        </i:pgfRef>
      </foreignObject>
      <g i:extraneous="self">
        <path fill="#1E1E1C" stroke="#1B181C" stroke-width="0.15" d="M5.452,10.883c0.08-
1.092,0.088-2.185-0.088-3.267
[...]
        <path fill="..."/>
        <path fill="..."/>
      </g>
    </switch>
```

Example I: Databases



Example I: Browsing & Searching Script Variations



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1 2 3 4 30 31

Datensätze 201 - 400 (Insgesamt 6124)

Hieroglyphe	Berlin P. 3073 (von -305 bis -30)	London EA 10188 [palimpsest new] (-311)	Berlin P. 3057 (P. Schmitt) (von -332 bis -30)	Berlin P. 13242 Ro (von -30 bis 14)	Leiden (Leemans) T 32 (65)	London EA 10672 (von -30 bis 283)	Berlin P. 7809 (von 101 bis 150)	Edinburgh A 1956.313 (P. Rhind 1) (-9)	Edinburgh A 1956.314 (P. Rhind 2) (-11)
	𐀀	𐀀					𐀀	𐀀	
	𐀁 𐀂			𐀁			𐀁 𐀂	𐀁	
	𐀃 𐀄	𐀃		𐀃		𐀃		𐀃 𐀄	
	𐀅	𐀅		𐀅					
	𐀆	𐀆						𐀆	𐀆

1 2 3 4 30 31

Datensätze 201 - 400 (Insgesamt 6124)

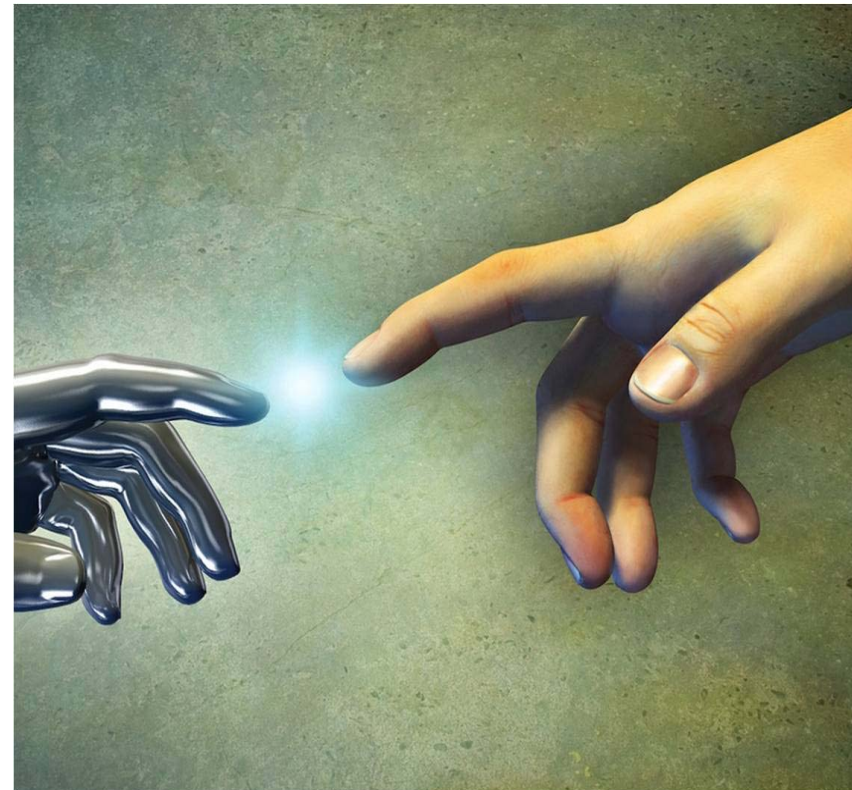
Design: T. Yousef

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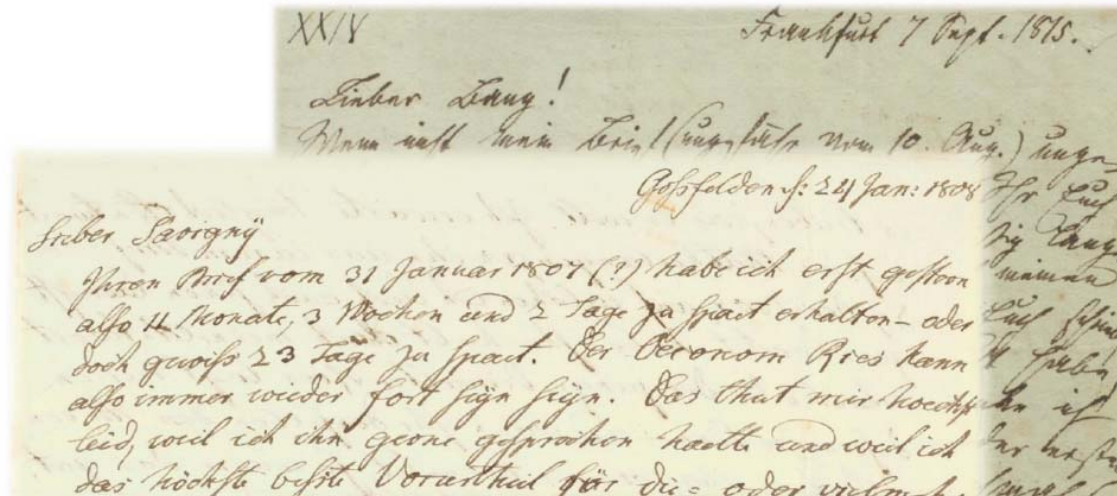


Example II: Letters of Brothers Grimm, Savigny & Bang



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- Jacob Grimm (1785-1863), founder of German philology and ancient studies
- Wilhelm Grimm (1786-1859), philologist
- Friedrich Carl von Savigny (1779-1861), founder of historical legal studies
- Johann Heinrich Christian Bang (1774-1851), parish priest, pedagogue, farmer

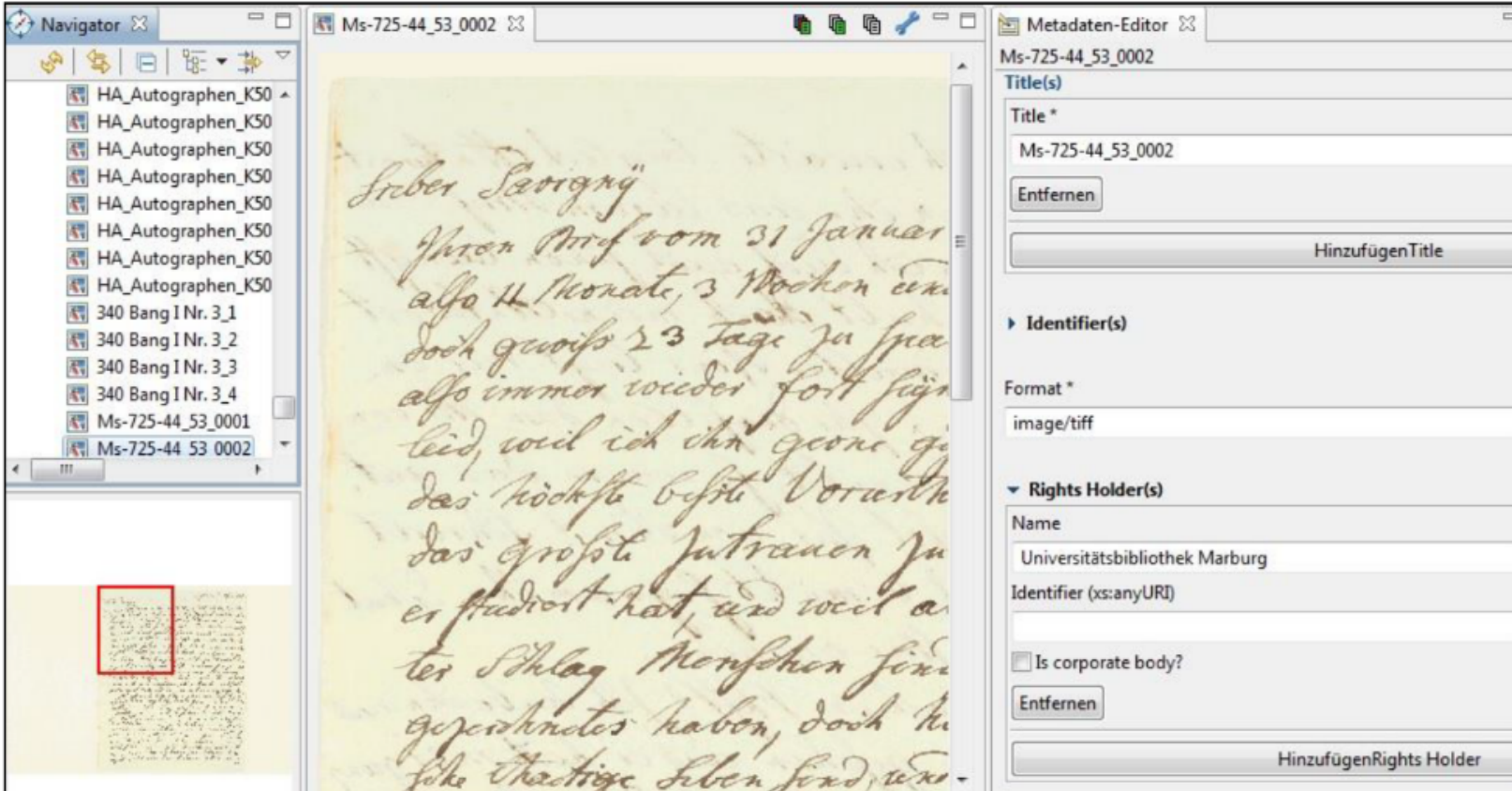


Editors:
Sabine Bartsch
Mareike Bassenge
Luise Borek
Franziska Horn
Rotraut Fischer
Andrea Rapp

<https://www.linglit.tu-darmstadt.de/index.php?id=2834>

Example II: Letters of Brothers Grimm, Savigny & Bang

Virtual Research environment TextGrid



The screenshot displays the TextGrid interface with three main panels:

- Navigator:** A list of files including 'HA_Autographen_K50' (multiple instances), '340 Bang I Nr. 3_1' through '3_4', and 'Ms-725-44_53_0001' and '0002'. A red box highlights the selected file 'Ms-725-44_53_0002'.
- Ms-725-44_53_0002:** A large window showing a handwritten letter on aged paper. The text is in cursive and begins with 'Lieber Savigny' and 'Ihren Brief vom 31 Januar also 11 Monate, 3 Wochen ein doch gewiss 23 Tage zu spa als immer wieder fort sijn leid, weil ich ihn gerne ge des höchsten Besitz Vorurthe das größte Vertrauen zu er studiert hat, und weil a ter Schlag Menschen für geschicktes haben, doch ke solche thätige Leben sind, we-
- Metadaten-Editor:** A metadata editor for the selected file. It contains the following fields:
 - Title(s):** Title * Ms-725-44_53_0002. Buttons: Entfernen, HinzufügenTitle.
 - Identifizier(s):** Format * image/tiff.
 - Rights Holder(s):** Name: Universitätsbibliothek Marburg. Identifier (xs:anyURI): [empty]. Is corporate body? Buttons: Entfernen, HinzufügenRights Holder.

Humanities Metadata Standards



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-
- Guidelines of the Text Encoding Initiative TEI
 - A Consortium that discusses and develops standards for different text / document types in an open and collaborative way
 - TEI Guidelines: <http://www.tei-c.org/release/doc/tei-p5-doc/en/html/>
 - TEI by Example: <http://tbe.kantl.be/TBE/TBE.htm>
 - Oxford Teaching Pages: <http://tei.oucs.ox.ac.uk/Talks/>

TEI-Modules

Module name	Formal public identifier	Where defined
analysis	Analysis and Interpretation	17 Simple Analytic Mechanisms
certainty	Certainty and Uncertainty	21 Certainty, Precision, and Responsibility
core	Common Core	3 Elements Available in All TEI Documents
corpus	Metadata for Language Corpora	15 Language Corpora
dictionaries	Print Dictionaries	9 Dictionaries
drama	Performance Texts	7 Performance Texts
figures	Tables, Formulae, Figures	14 Tables, Formulæ, and Graphics
gaiji	Character and Glyph Documentation	5 Representation of Non-standard Characters and Glyphs
header	Common Metadata	2 The TEI Header
iso-fs	Feature Structures	18 Feature Structures
linking	Linking, Segmentation, and Alignment	16 Linking, Segmentation, and Alignment
msdescription	Manuscript Description	10 Manuscript Description
namesdates	Names, Dates, People, and Places	13 Names, Dates, People, and Places
nets	Graphs, Networks, and Trees	19 Graphs, Networks, and Trees
spoken	Transcribed Speech	8 Transcriptions of Speech
tagdocs	Documentation Elements	22 Documentation Elements
tei	TEI Infrastructure	1 The TEI Infrastructure
textcrit	Text Criticism	12 Critical Apparatus
textstructure	Default Text Structure	4 Default Text Structure
transcr	Transcription of Primary Sources	11 Representation of Primary Sources
verse	Verse	6 Verse

<http://www.tei-c.org/release/doc/tei-p5-doc/en/html/ST.html#STMA>

Standards for Names, Dates, People, and Places



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- Encoding persons, places, organizations, time and date ...
- Can be stored as lists in the TEI-Header (or in separate files)
- Authority files (examples):
 - OGND (,Gemeinsame Normdatei') <http://swb.bsz-bw.de>
 - Catalogue of the German National Library (DNB) <https://portal.dnb.de>
 - ISO online browsing platform <https://www.iso.org/obp/ui/#search>
 - Language subtag lookup <https://r12a.github.io/app-subtags/>
 - Getty Thesaurus of Geographic Names®
<http://www.getty.edu/research/tools/vocabularies/tgn/>
 - FOAF (Friend of a Friend) <http://www.foaf-search.net>

Example II: Letters of Brothers Grimm, Savigny & Bang



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Metadata for physical object ‚letter‘

2. Beschreiben des materiellen Zustands

neue Beschreibung des materiellen Zustands

Art und Qualität des Beschreibstoffes: zartgrünes Papier

Stempel: Stempel auf der Rückseite UB Mbg. handschriftlicher Vermerk: Hs 725:524

Blattanzahl: 1 Blatttyp: double_leaf

Maße der Blätter in cm:
Höhe: 16,4
Breite: 12,6

Einschätzung des materiellen Zustandes des Briefes:
gut erhalten

Beschreibung der Gestaltung:
beidseitig beschrieben

```
<physDesc>
  <objectDesc>
    <supportDesc>
      <support>
        <material>zartgrünes Papier</material>
        <stamp>Stempel auf der Rückseite
          <mentioned>UB Mbg.</mentioned>handschriftlicher
            Vermerk: <mentioned>Hs 725:52</mentioned></stamp>
      </support>
    <extent>
      <measure unit="double_leaf" quantity="1"></measure>
      <dimensions unit="cm">
        <height>16,4</height>
        <width>12,6</width>
      </dimensions>
    </extent>
    <condition>
      <p>gut erhalten</p>
    </condition>
  </supportDesc>
  <layoutDesc>
    <layout>
      <p>beidseitig beschrieben</p>
    </layout>
  </layoutDesc>
</physDesc>
```

Example II: Letters of Brothers Grimm, Savigny & Bang



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XML transcript expatiating implicit informations & GND-IDs for persons

Wenn es Ihnen möglich wäre, lieber Bang, heute oder morgen herein zu kommen, so würden Sie mir dadurch einen großen Gefallen thun: ich habe einen <gestr.: B> wichtigen Brief von Br.² den ich den Sonntag beantworten muß, aber nicht ehe beantworten kann als bis ich Sie gesprochen habe. Mich hindert das Pockenfieber, zu Ihnen zu kommen. Auch der Magister³ wünscht Sie wegen seiner Sache zu sprechen.

Ihr
Sav

² Clemens Wenzeslaus Maria Brentano (1778-1842) an Friedrich Carl von

Nürnberg, Germanisches Nationalmuseum, Ms. XXXVII: Friedrich Carl von Savigny an Johann Heinrich Christian Bang, ohne Ort, ohne Datum.

```
<p> Wenn es Ihnen möglich wäre, lieber Bang, heute oder morgen herein zu kommen, so würden Sie mir dadurch einen großen Gefallen thun: ich habe einen <del hand="author" rend="overstrike">B</del> wichtigen Brief von <abbr> Br. <exp>Brentano</exp> </abbr> <note type="commentary" resp="RF" xml:id="c_2"> <persName key="118515055">Clemens</persName> Wenzeslaus Maria Brentano (<date>1778-1842</date>)
```

Example II: Letters of Brothers Grimm, Savigny & Bang



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DARIAH-Geobrowser: space-time-event visualization



```
<correspDesc>
  <sender>
    <persName key="116048778">"Bang,
    Johann Heinrich Christian"</persName>
  </sender>
  <addressee>
    <persName key="118605909">"Savigny,
    Friedrich Carl von"</persName>
  </addressee>
  <placeSender>
    <placeName>Goßfelden</placeName>
  </placeSender>
  <dateSender>
    <date when="1808-1-24">24.1.1808</date>
  </dateSender>
</correspDesc>
```

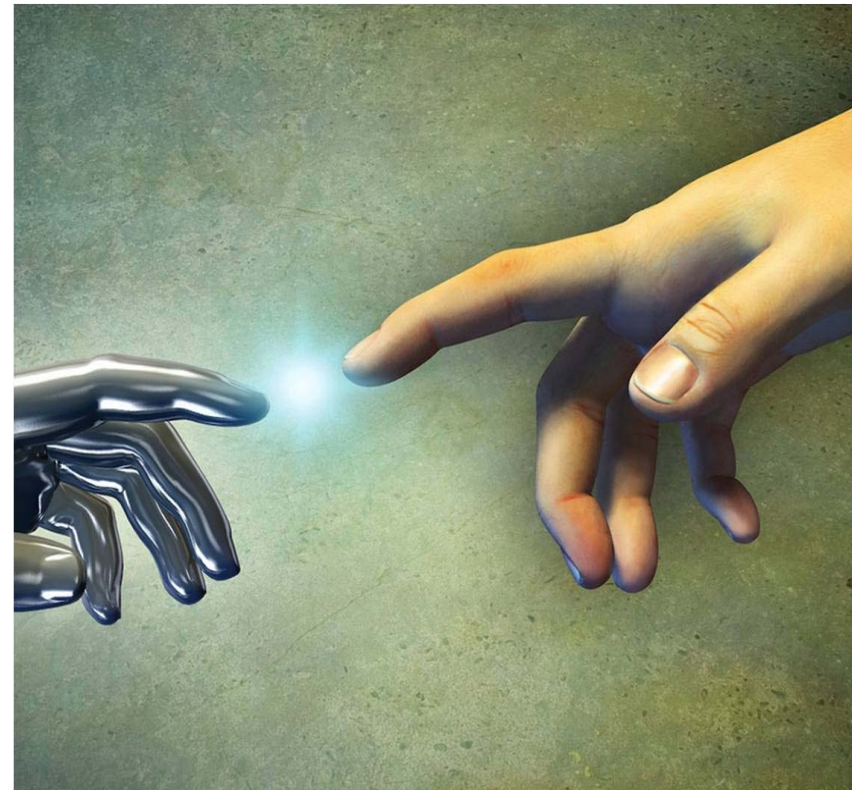
```
<correspDesc>
  <sender>
    <persName key="116048778">"Bang,
    Johann Heinrich Christian"
  </persName>
  </sender>
  <addressee>
    <persName key="118605909">"Savigny,
    Friedrich Carl von"</persName>
  </addressee>
  <placeSender>
    <placeName>Goßfelden</placeName>
  </placeSender>
  <dateSender>
    <date when="1817-03-12">12.3.1817</date>
  </dateSender>
</correspDesc>
```

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Conclusion



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“All data is historical data: the product of a time, place, political, economic, technical, & social climate. If you are not considering why your data exists, and other data sets don’t, you are doing data science wrong”.

- We need contextual data not only to save and conserve the cultural (and every) knowledge but also for all other (scientific) purposes.
- The challenges are the same in the different research cultures: in the (natural) sciences, engineering sciences, social sciences, arts and humanities ...

The Turing Institute
@turinginst

“All data is historical data: the product of a time, place, political, economic, technical, & social climate. If you are not considering why your data exists, and other data sets don’t, you are doing data science wrong”. -

[@melissaterras](#)
[#TuringLectures](#)
youtube.com/watch?v=bf6DsJ

...

Translate Tweet



4:17pm · 5 Mar 2019 · Twitter Web Client

