Epigraphic Database Heidelberg – Data Reuse Options

Summary

The "Epigraphic Database Heidelberg" (EDH) is one of the longest running database projects in digital Latin epigraphy with a start as early as 1986. In 1997 the website of the "Epigraphic Database Heidelberg" has gone online: All inscriptions, images, bibliographic and geographic records can be searched and browsed online. In the last years a growing number of researchers asked for direct access to EDH data: Consequently an "Open Data Repository" has been added to the EDH website (https://edh-www.adw.uni-heidelberg.de/data) and improved continuously since then. Options for accessing data include simple CSV downloads, an API returning JSON responses, a SPARQL endpoint, an IIIF API and access via a Distributed Text Services API. This article describes the data in the EDH repository, the various ways of how users can reuse this data for their own research and when to choose which option.

Project History

The Epigraphic Database Heidelberg (EDH) has been established 1986 by Geza Alföldy, from the very beginning as a digital database project to create a resource for all Latin inscriptions of the ancient world.[1] Since 1993 the Epigraphic Database Heidelberg is a research project of the Heidelberg Academy of Sciences and Humanities.[2]

One of the key principles has always been to provide ancient epigraphic sources to the scientific community in an as complete and reliable version as possible: For this the working method of EDH is that readings are not simply accepted from already published editions and secondary literature. As much as possible these readings are verified at least on the basis of drawings or photographs – in the case of the latter these belong in large part to the records of the EDH image database – or ideally through autopsy.[3] In short: It's not simply a matter of copying & pasting data from other publications into the EDH database, instead it's a matter of scientific expertise and scholarly work, sometimes improving the understanding of ancient inscriptions beyond existing standard publications.

Another EDH key principle is to record as many metadata in the database as possible to increase findability of inscription on the website allowing for diverse search questions beyond the narrow scope of epigraphers. Added to this is a strong focus on international collaboration with the scientific epigraphic community.[4]

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[1] For the history of the project see e.g.: Feraudi-Gruénais (2010), p. 12ff; Feraudi-Gruénais (2014); Feraudi-Gruénais / Neubert (2015).

[2] https://www.hadw-bw.de/forschung/forschungsstelle/epigraphische-datenbank-roemischer-inschriften-edh.

[3] A detailed description of the working process can be found at https://edh-www.adw.uni-heidelberg.de/projekt/konzept.

[4] For a recent review of the Epigraphic Database Heidelberg website and search engines see Hartmann (2018); for an overview of digital tools (including EDH) for Roman studies, see Bagnall / Heath (2018).
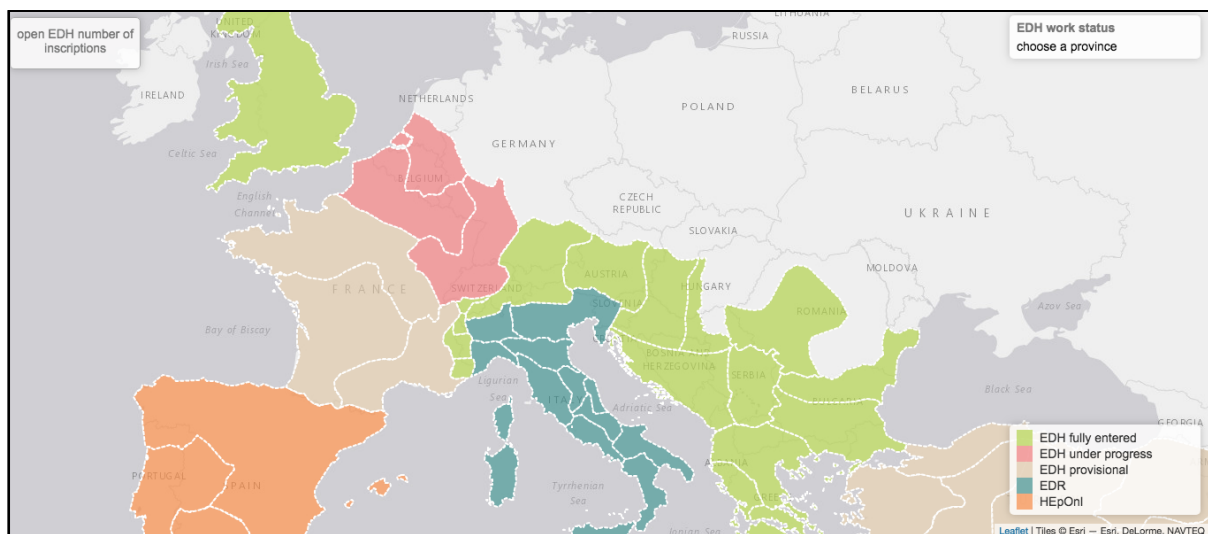
Since 1997 the EDH database is online at https://edh-www.adw.uni-heidelberg.de. A set of four online search engines allow for querying the growing data pool of transcriptions and metadata of inscriptions, bibliographic records and image metadata.

In 2003 an agreement has been reached under the leadership of the Commissione epigrafia e informatica of the AIEGL (Association Internationale d'Épigraphie Grecque et Latine[5]) to create the international epigraphic database confederation EAGLE (Electronic Archives of Greek and Latin Epigraphy[6]). Since then EDH focuses on the inscriptions of the Roman provinces. The inscriptions of Italy which had already been entered into EDH were transferred to the Epigraphic Database Rome (EDR).[7] All inscriptions originating from nowadays Spain are now accessible via the database Hispania Epigraphica Online (HEpOnl)[8] while late period Christian inscriptions from Rome can now be found in the Epigraphic Database Bari (EDB)[9].

In 2012 a fourth EDH database has been added for the precise geographic findspots of inscriptions; these data, including geographic coordinates and links to external gazetteers, are utilized for showing maps of the exact findspots of inscriptions on the EDH website.

A first attempt to combine data from major epigraphic databases was conducted by the EU funded project europeana-EAGLE (2013-16)[10] which made available hundreds of thousands of inscriptions and their images to the Europeana Collections repository[11] and established also a basic search engine for inscriptions and their metadata originating from all content providers[12].

As of June 2019 most of central and south-eastern European provinces are fully entered into the EDH database, while current work now focuses on entering inscriptions from the Germanic provinces and Gallica Belgica[13]:

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[5] https://www.aiegl.org.

[6] http://www.eagle-eagle.it.

[7] http://www.edr-edr.it.

[8] http://eda-bea.es.

[9] http://www.edb.uniba.it.

[10] https://www.eagle-network.eu.

[11] https://www.europeana.eu.

[12] https://www.eagle-network.eu/basic-search.

[13] For the geographic overview of Roman provinces and responsibilities within the EAGLE network and current status quo of work on the EDH database see https://edh-www.adw.uni-heidelberg.de.

Past years have seen a number of new epigraphical databases and projects on the web: To avoid double work, to enhance collaboration between these and to provide a solution for long term preservation of data created by projects with a funding period of usually only a few years the idea of a collaborative environment for all epigraphic projects worldwide has been proposed under the name of *epigraphy.info*.[14]

EDH - A Set of Multiple Databases

Three distinct constituent databases have been established at the very beginning of the project, one each for inscriptions (transcriptions and metadata), bibliographic entries and images, followed by a fourth database for geographic data in the year 2012.
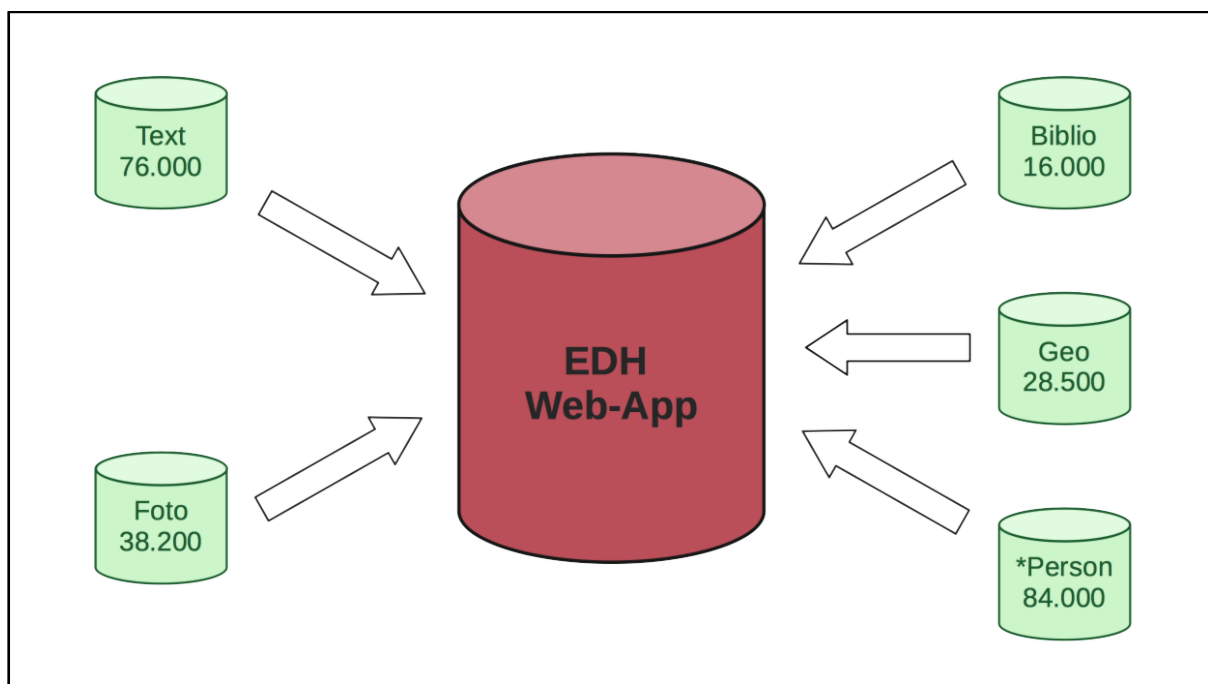
The core of the EDH is formed by the **Text Database** which holds both the Latin transcriptions and up to some 50 metadata fields per record (total of 79.200 records[15]). Mandatory fields for each record are the transcription of the inscription, its language, the ancient province and modern country in which the inscription has been found and bibliographic notes. Some 50 more metadata fields can be specified including those for more detailed find circumstances, type of inscription & monument, engraving technique, chronological data, commentary and person data.

Currently the EDH Text Database comprises 1.4 million metadata fields (at an average of more than 18 metadata fields per inscription). Two search engines on the EDH website allow for querying the data: a simple[16] and an advanced search[17]. Search results are presented in a short form showing a map

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[14] Feraudi-Gruénais / Grieshaber (2016); Feraudi-Gruénais / Grieshaber / Cowey / Lougovaya-Ast (2018); for news and ongoing workshops see also http://epigraphy.info.

[15] Numbers of records as of June 2019.

[16] https://edh-www.adw.uni-heidelberg.de/inschrift/suche.

[17] https://edh-www.adw.uni-heidelberg.de/inschrift/erweiterteSuche.

of the findspot of each inscription, the transcription, geographic, chronological and bibliographical data plus images if available; for each inscription record there is also a detail view which displays the full set of metadata.

This Text Database is complemented by the **Photographic Database** which currently has ca. 38.700 images with corresponding metadata; images are stored in TIFF format and converted on the fly into JPG for the EDH website by the IIIF image server. In addition to this, there are also a **Bibliographic Database** with 16.200 entries, and a **Geographic Database** which holds detailed information, including geographic coordinates, about the findspots of inscriptions (29.400 records).
A fifth database is in preparation: A **Person Database** describes people mentioned in the Latin transcriptions of inscriptions, and disambiguates them if possible by aligning entries to wikidata or the SNAP:DRGN gazetteer[18].

EDH Technical Infrastructure

The technical infrastructure has changed a lot through the last 30 years. Starting with an offline Oracle database, moving towards the first online website in 1997 by migrating to an IBM DB2 relational database, to the current complex web application built around a dedicated search index server; the high level overview of the current infrastructure looks like this:
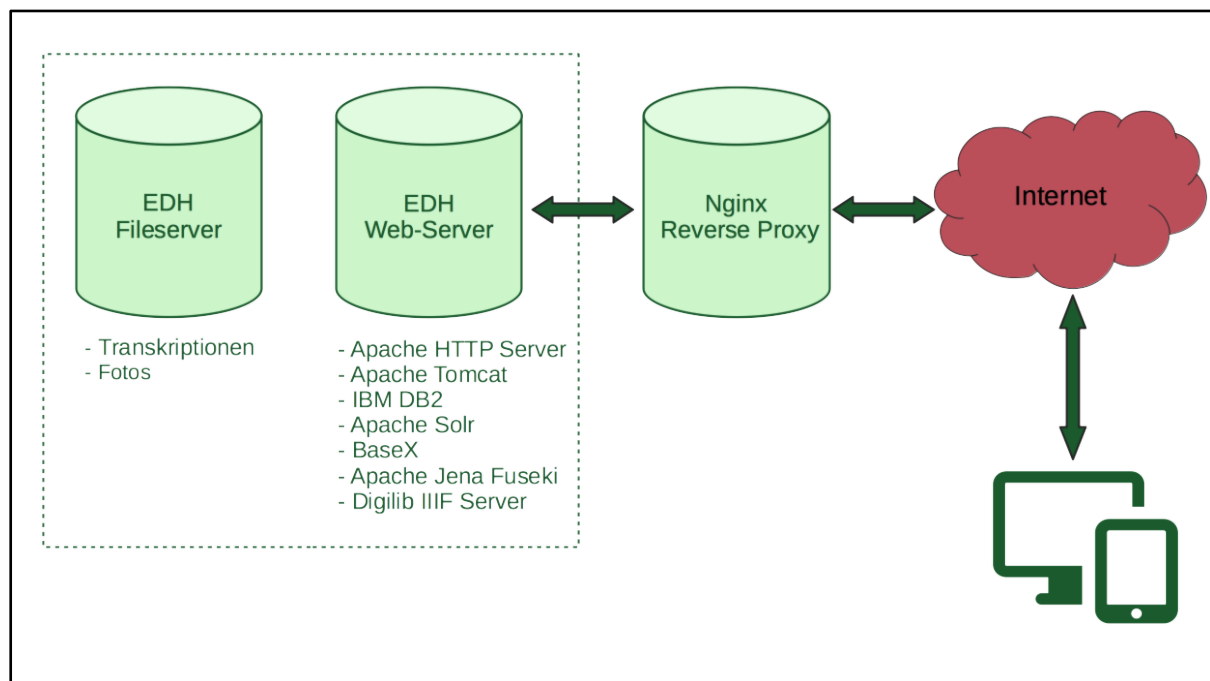
A reverse proxy, in this case an Nginx server, receives queries from the internet and dispatches those to the two main servers of the EDH web application; the EDH fileserver holds basically all the Latin transcriptions and the images of inscriptions, while the EDH web server hosts a collection of databases and services: The EDH webpage is served by a combination of the Apache HTTP server and the Apache Tomcat Application server. The relational database, an IBM DB2, is the repository

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[18] For SNAP:DRGN see Bodard / Cayless / Depauw / Isaksen / Lawrence / Sebastian Rahtz (2017).

for data entry, but the searching in EDH data is done by an Apache Solr search index which is updated on a daily base.

For some data groups/exports there are dedicated databases, like e. g. a BaseX XML database for the EpiDoc XML data exports, or the Fuseki Triplestore for the RDF data exports.

And, finally, for reusing images from the EDH image database, there is a IIIF server and API based on the Digilib software.

Authority Control & Controlled Vocabularies

For data consistency the EDH database makes use of a number of controlled vocabularies; another benefit from using authority control is disambiguation of entities by using unique identifiers (URIs), which later can be used to create Linked Open Data applications where EDH data can be enriched with data from external sources, and where EDH data can be interlinked with resources from other projects, so overcoming restraints of data silos.

Epigraphic entities like e.g. material, type of inscription or type of monument, are modelled by reusing controlled vocabularies from the Europeana EAGLE project.[19]

For geographic entities we reuse Geonames[20] and Pleiades[21] gazetteer URIs. The chronological data is modelled by the Periodo gazetteer[22] for periods like "Roman Republic" or "Augustean", and by the evolving GODOT gazetteer for ancient dating systems[23], while for people wikidata[24] and SNAP:DRGN[25] URIs have been reused.

These various URIs for entities form also the base for the Linked Open Data RDF data modelling.

Data Reuse Options

Reuse Option I: CSV Download

The most basic form of downloading data from the EDH Text Database is to create a simple query on the EDH website, and then click on the Excel Download Icon on the top right of the search result page. The CSV data then can be opened in any Spreadsheet program like LibreOffice Calc, MS Excel or Google Spreadsheet. One record of the search results forms one row in the table; each field is separated by the tabulator character, the first line describes the contents of each column. Data thus exported includes i. a. ancient province, modern country, the exact findspot both ancient and modern, chronological data, bibliography and transcription of the inscription text.

These CSV data exports can also form the base for creating statistical diagrams. As an example these are the steps to create a pie chart showing the distribution by ancient Roman province: Using Google Spreadsheets, after importing the CSV file into the sheet, the pie chart can be created by opening menu "Insert… Chart". As first steps the chart type and the data range needs to be specified in the

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[19] https://www.eagle-network.eu/resources/vocabularies.

[20] https://www.geonames.org.

[21] https://pleiades.stoa.org.

[22] http://perio.do.

[23] https://godot.date.

[24] https://www.wikidata.org.

[25] http://snapdrgn.net.

Chart Editor - a first version of the pie chart is automatically displayed and its properties can now be customized:

Reuse Option II: URI Patterns

Another option to access data is to address single resources by their URI: For this a number of URI patterns have been installed, one each for every EDH database: text, foto, bibliography and geography database.

Entity	URL (HTML Representation)	Alt. Representation
inscription	https://edh-www.adw.uni-heidelberg.de/edh/inschrift/HD012345	.xml; .json; .ttl
foto	https://edh-www.adw.uni-heidelberg.de/edh/foto/F012345	.xml; .json
bibliography	https://edh-www.adw.uni-heidelberg.de/edh/bibliographie/B012345	.json
geography	https://edh-www.adw.uni-heidelberg.de/edh/geographie/12345	.json; .ttl; .kml

These URI patterns follow a scheme that consists of the following parts: It starts with the domain of the server, followed by the database name ('inschrift', 'foto', 'bibliographie' or 'geographie'), and finally the identifier of the resource. If opened in a web browser the user receives a HTML representation; for an alternative representation file extension can be added to the URI, like e. g. ".xml" to an inscription resource URI to get the EpiDoc XML representation of the specified inscription record.

Opening URIs in the web browser like this is one option, making use of *content negotiation* is another: Content Negotiating means serving different representations of a document at the same URI according to settings of the client which could be a computer script or a tool like *curl* in the terminal; for this the client's "Accept" HTTP header will be parsed by the EDH server infrastructure and the requested response will be sent back to the client accordingly, like in the following query for the turtle RDF representation of an EDH geographic record:

```
frank@edh1:~$ curl -H "Accept: application/x-turtle" https://edh-www.adw.uni-heidelberg.de/edh/geographie/25348

@prefix dcterms: <http://purl.org/dc/terms/> .
@prefix geo: <http://www.w3.org/2003/01/geo/wgs84_pos#> .
@prefix osgeo: <http://data.ordnancesurvey.co.uk/ontology/geometry/> .
@prefix geosparql: <http://www.opengis.net/ont/geosparql#> .
@prefix gn: <http://www.geonames.org/ontology#> .
@prefix lawd: <http://lawd.info/ontology/> .
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix skos: <http://www.w3.org/2004/02/skos/core#> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .

<http://edh-www.adw.uni-heidelberg.de/edh/geographie/25348> a lawd:Place ;
  gn:countryCode "RO" ;
  skos:closeMatch <http://sws.geonames.org/667441> ;
  skos:exactMatch <http://pleiades.stoa.org/places/216748> ;
  skos:broader <http://edh-www.adw.uni-heidelberg.de/edh/geographie/900056> ;
  dcterms:date "2014-04-11"^^xsd:date ;
  geo:location [ geo:lat 44.3932266 ; geo:long 28.071282699 ] ;
  rdfs:label "Capidava, bei (Seimeni) "@de .
```

Reuse Option III: Open Data Repository

In the year 2017 there was a large addition to the EDH website: Publishing the EDH Open Data Repository[26] means that users now can reuse EDH data for their own projects under the CC BY-SA 4.0 licence[27].

Users have basically three options to access EDH data: Downloading data dumps, accessing the public API or using the SPARQL endpoint.

Data Dumps (https://edh-www.adw.uni-heidelberg.de/data/export)

The data dumps are static files which are updated periodically. The most popular downloads are the EpiDoc files: These incorporate the latin transcriptions and a large subset of metadata fields from the EDH database, using aforementioned controlled vocabularies. After downloading the ZIP files and unzipping them, users can open single XML files e.g. in Oxygen Editor and make corrections or additions, enrich them with various additional data and links to further resources on the web. For building up larger applications it is also possible to load all EpiDoc files into an XML database like eXist-db or BaseX.

Besides EpiDoc XML there are data dumps available for the metadata of images in the CIDOC CRM data format, the records of the EDH bibliographic database can be downloaded as a BibTeX file and the EDH Geographic Database offers a (Geo)JSON[28] download.

As for Linked Open Data, all EDH Latin transcriptions and a small subset of EDH metadata can be downloaded as RDF data dump - this could be reused e.g. by loading into a triplestore like Apache Fuseki. In addition to this generic RDF export, there is another RDF export specifically created for the Pelagios Commons project.[29] This specific download (comprising of geographic and periodic

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[26] https://edh-www.adw.uni-heidelberg.de/data.

[27] http://creativecommons.org/licenses/by-sa/4.0.

[28] http://geojson.org.

[29] http://commons.pelagios.org.

annotations of EDH inscriptions plus IIIF manifest links) enables searching and browsing EDH data on the Peripleo website.[30]

REST like API (https://edh-www.adw.uni-heidelberg.de/data/api)

While the data dumps are updated only periodically, the JSON application programming interface (API) allows access to the most recent version of documents in the EDH database. Users communicate with this API by using HTTP URIs with a defined set of parameters following the REST design pattern[31], results are returned as a JSON response. There is an API for each of the four constituent databases: inscription, foto, bibliography and geography, documentation of all parameters and the response format can be found in the online documentation of the API[32].

As an example, let's query for all inscription records in the EDH database that have "votum solvit" in the Latin transcription, that have been found in any of the two Germanic provinces and that can be dated to 200 AD or later. For this the query URI looks like this:

https://edh-www.adw.uni-heidelberg.de/data/api/inscriptions/search?
province=ges&province=gei&transcription=votum%20solvit&year_not_before=200

The corresponding JSON response is as follows (only first hit is shown in JSON):

---

[30] http://peripleo.pelagios.org.

[31] https://en.wikipedia.org/wiki/Representational_state_transfer.

[32] https://edh-www.adw.uni-heidelberg.de/data/api.

```
{
    "items" : [
        {
            "country" : "Germany",
            "people" : [
                {
                    "gender" : "male",
                    "status" : "Augustales",
                    "person_id" : "1",
                    "nomen" : "Hedius",
                    "name" : "C. Hedius Silvanus",
                    "cognomen" : "Silvanus",
                    "praenomen" : "C."
                }
            ],
            "findspot" : "Jahnstraße / Humboldtstraße, Ecke",
            "type_of_monument" : "altar",
            "depth" : "(44) cm",
            "findspot_ancient" : "Colonia Claudia Ara Agrippinensium",
            "present_location" : "Köln, Röm.-Germ. Mus.",
            "language" : "Latin",
            "edh_geography_uri" : "https://edh-www.adw.uni-heidelberg.de/edh/geographie/30226",
            "last_update" : "2018-06-26",
            "diplomatic_text" : "[ ] O M E[ ] / MATRONIS / PONTEM / C HEDIVS SILVA / NVS IIIIIIVIR /
AVG / V S L M L D D D / / I O M E[ ] / MATRONIS / PONTEM / C HEDIVS SILV / ANVS IIIIIIVIR / AVG /
V S L M L D D D",
            "not_after" : "0300",
            "literature" : "AE 1984, 0654. (B); B. Galsterer - H. Galsterer, in: EpStud 13 (Köln
1983) 174-177, Nr. 5; Abb. 5a u. 5b. - AE 1984.; B. Galsterer - H. Galsterer, Die römischen
Steininschriften aus Köln, IKöln (2.; Aufl.) (Mainz 2010) 102-103, Nr. 94; Fotos.",
            "findspot_modern" : "Köln",
            "work_status" : "checked with photo",
            "province_label" : "Germania inferior",
            "material" : "limestone: rocks - clastic sediments",
            "responsible_individual" : "Feraudi",
            "height" : "(98) cm",
            "year_of_find" : "1979",
            "not_before" : "0201",
            "letter_size" : "5-10 cm",
            "fotos" : [
                "https://edh-www.adw.uni-heidelberg.de/fotos/F002448.JPG",
                "https://edh-www.adw.uni-heidelberg.de/fotos/F028470.JPG",
                "https://edh-www.adw.uni-heidelberg.de/fotos/F037093.JPG"
            ],
            "commentary" : " Erste Dedikation gemeinsam an Iuppiter und Matronen. Stein war wohl auf
Brücke aufgestellt, vermutlich daher die beidseitige Beschriftung. (B): Phantasietext, d.h.
Mischung aus beiden Texten hinsichtlich der Zeilenfälle und erhaltenen Buchstaben.",
            "geography" : "data available",
            "trismegistos_uri" : "https://www.trismegistos.org/text/208726",
            "modern_region" : "Nordrhein-Westfalen",
            "width" : "(55) cm",
            "type_of_inscription" : "votive inscription",
            "uri" : "https://edh-www.adw.uni-heidelberg.de/edh/inschrift/HD001266",
            "religion" : "names of pagan deitiescult functions, pagan",
            "id" : "HD001266",
            "social_economic_legal_history" : "data available",
            "transcription" : "[I](ovi) O(ptimo) M(aximo) e[t] / Matronis / pontem / C(aius) Hedius
Silva/nus IIIIIIvir / Aug(ustalis) / v(otum) s(olvit) l(ibens) m(erito) l(ocus) d(atus) d(ecreto)
d(ecurionum) // I(ovi) O(ptimo) M(aximo) e[t] / Matronis / pontem / C(aius) Hedius Silv/anus
IIIIIIvir / Aug(ustalis) / v(otum) s(olvit) l(ibens) m(erito) l(ocus) d(atus) d(ecreto)
d(ecurionum)"
        },
        { … }
    ],
    "limit" : "20",
    "total" : 106
}
```

The principle JSON structure of a response consists of several keys describing the query results:

total: the total number of hits the query generated

limit: the number of hits per result page (maximum: 100; default: 20)

offset: defines start point in search result set (default: 0)

Per default results are returned in pages of 20 items each, to change this the parameter limit can be set to a maximum of 100; to browse to the next result page the offset parameter can be used. So a combination of offset and limit parameters allows for browsing the complete search result set.

The actual result data can be found in the items key of the JSON response: In it there is a list of results, each consisting of a set of simple key / values pairs describing the EDH data, with the exception of people and foto data which is yet another list of entries, one for each person/foto.

Cross-Origin Resource Sharing (CORS) is enabled, so users have permission to access resources from a server at a different origin (cross-origin HTTP requests) and reuse EDH data for their own web application, no authentication is needed.

SPARQL endpoint (https://edh-www.adw.uni-heidelberg.de/data/sparql)

The last option to access data in the EDH Open Data Repository is via the SPARQL endpoint: users can choose between the following result formats: text, JSON, XML, CSV and TSV. The RDF data modelling isn't yet feature complete, and still somewhat beta; as a simple example the following SPARQL query searches for inscriptions that have been reused to build a wall around the church "S. Urlich" in the modern town Höflein in Austria in the vicinity of the ancient town of Carnuntum, a findspot that is listed in the EDH geographic database as https://edh-www.adw.uni-heidelberg.de/edh/geographie/28191; the result set also includes information about the type of inscription, if available:

```
prefix dcterms: <http://purl.org/dc/terms/>
prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#>
prefix skos: <http://www.w3.org/2004/02/skos/core#>
prefix xsd: <http://www.w3.org/2001/XMLSchema#>
prefix nmo: <http://nomisma.org/ontology#>
prefix epi: <http://edh-www.adw.uni-heidelberg.de/lod/ontology#>
prefix dc: <http://purl.org/dc/terms/>
prefix lawd: <http://lawd.info/ontology/1.0/>

select *
where { ?HDNo lawd:foundAt <http://edh-www.adw.uni-heidelberg.de/edh/geographie/28191> .
optional { ?HDNo <http://edh-www.adw.uni-heidelberg.de/edh/
ontology#representsTypeOfInscription> ?TypeOfInscription }
}
limit 100
```

This results in the following triples (JSON as result format):

```
{
  "head": {
    "vars": [ "HDNo" , "TypeOfInscription" ]
  } ,
  "results": {
    "bindings": [
      {
        "HDNo": { "type": "uri" , "value": "http://edh-www.adw.uni-heidelberg.de/edh/inschrift/
HD074057" } ,
        "TypeOfInscription": { "type": "uri" , "value": "http://edh-www.adw.uni-heidelberg.de/
edh/type_of_inscription/votive_inscription" }
      } ,
      {
        "HDNo": { "type": "uri" , "value": "http://edh-www.adw.uni-heidelberg.de/edh/inschrift/
HD074056" }
      } ,
      {
        "HDNo": { "type": "uri" , "value": "http://edh-www.adw.uni-heidelberg.de/edh/inschrift/
HD074055" } ,
        "TypeOfInscription": { "type": "uri" , "value": "http://edh-www.adw.uni-heidelberg.de/
edh/type_of_inscription/epitaph" }
      }
    ]
  }
}
```

Inscription records are addressed by a referencing URI; this is also true for the type of inscriptions - each entry of this controlled vocabulary is defined by a URI. To find out which values exist in any of the controlled vocabularies the following SPARQL query pattern can be used:

```
prefix dcterms: <http://purl.org/dc/terms/>
prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#>
prefix skos: <http://www.w3.org/2004/02/skos/core#>
prefix xsd: <http://www.w3.org/2001/XMLSchema#>
prefix nmo: <http://nomisma.org/ontology#>
prefix epi: <http://edh-www.adw.uni-heidelberg.de/lod/ontology#>
prefix dc: <http://purl.org/dc/terms/>
prefix lawd: <http://lawd.info/ontology/1.0/>

SELECT ?type
WHERE { ?s <http://edh-www.adw.uni-heidelberg.de/edh/
ontology#representsTypeOfInscription> ?type }
group by ?type
```

This query results in the following list of types of inscriptions as defined in the EDH controlled vocabulary:

```
-------------------------------------------------------------------------------------------
| type
|
===========================================================================================
| <http://edh-www.adw.uni-heidelberg.de/edh/type_of_inscription/defixio>
|
| <http://edh-www.adw.uni-heidelberg.de/edh/type_of_inscription/votive_inscription>
|
| <http://edh-www.adw.uni-heidelberg.de/edh/type_of_inscription/honorific_inscription>
|
| <http://edh-www.adw.uni-heidelberg.de/edh/type_of_inscription/label>
|
| <http://edh-www.adw.uni-heidelberg.de/edh/type_of_inscription/adnuntiatio>
|
| <http://edh-www.adw.uni-heidelberg.de/edh/type_of_inscription/epitaph>
|
...
```

Reuse Option IV: IIIF Image Server

For reusing images of the EDH Photo Database an International Image Interoperability Framework (IIIF)[33] API is available via the digilib Image server software[34] within the EDH infrastructure. These APIs allow reusing images without copying them from one server to the next, image sections can be chosen and zoom level specified by URL stable parameters, which makes citing these images in articles very easy and sustainable.

On the EDH website for each image in the Photo Database and for each inscription record with images in the Text Database a Manifest URI is given; by copying this URI into a IIIF viewer software EDH images are referenced from any website.

As an example, using the Mirador Viewer[35], the Manifest URI for all images of EDH inscription HD003764, which can be found at https://edh-www.adw.uni-heidelberg.de/iiif/edh/HD003764.manifest.json, holds i. a. the following information: metadata for all images like the label and description, license and attribution information and some basic describing metadata about the findspot (ancient Roman province, modern country, ancient and modern town names). For each image some information is given for photo credits and date of photograph and physical size of the image in pixel.

The IIIF viewer software parses this JSON file and presents the images on the viewer's context; on the Mirador viewer demo website, after providing the URI of the manifest, all images of HD003764 can be chosen in the list of objects and opened in the Mirador viewer page:

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[33] https://iiif.io.

[34] https://robcast.github.io/digilib.

[35] http://projectmirador.org.
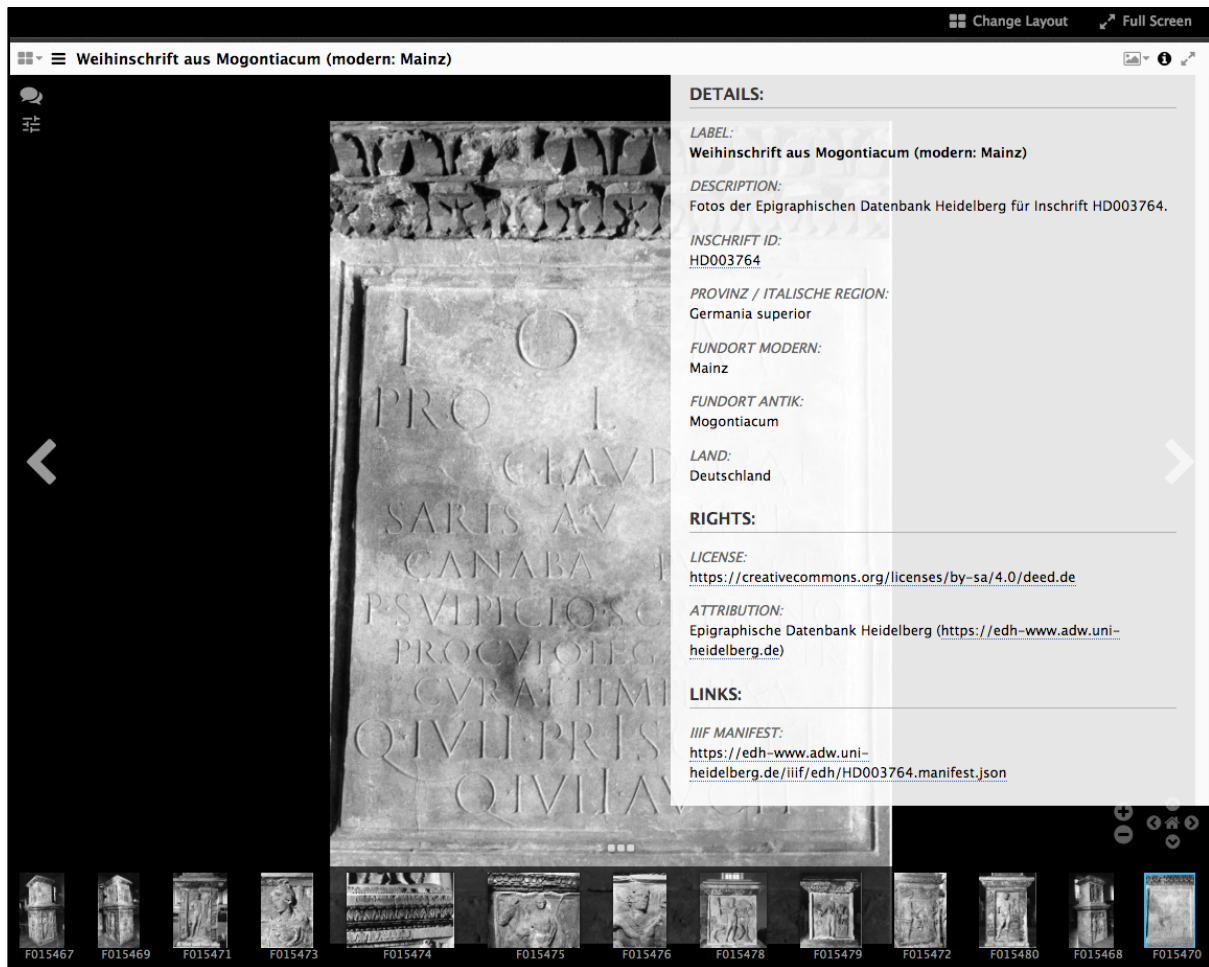
Reuse Option V: Distributed Text Services (DTS)

The Distributed Text Services, based on and influenced by the Canonical Text Services, defines 'a Hypermedia-Driven Web API for working with collections of text as machine-actionable data'.[36] Comparable to the IIIF API it enables users to reference resources in the repository by URIs, in a machine-actionable, Linked Open Data way, but instead on images its focus is on text editions.

It defines three distinct API endpoints, two of those are already implemented at least partially on the EDH website: The Collection endpoint enables users to navigate the contents of the text collections of the repository, and the Document endpoint allows for retrieving complete or partial texts within the collection. Responses by the Collection endpoint will return JSON-LD following the W3C Hydra standard for APIs[37], while the Document endpoint returns TEI/XML of the requested document or text fragment.
The third endpoint, the Navigation endpoint for navigating within a specified single text document, also returning JSON-LD, is currently in preparation.

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[36] Specifications: https://github.com/distributed-text-services/specifications.

[37] http://www.hydra-cg.com/spec/latest/core.

EDH DTS Collections Endpoint

For the EDH Text Database there is only one DTS collection holding all textual resources (inscriptions, referenced by HD-Numbers), there's no need for further logical grouping or categorizing of documents.

EDH DTS Documents Endpoint

Addressing a single document is done by the document endpoint, e.g.:
https://edh-www.adw.uni-heidelberg.de/api/dts/documents?id=HD001827 will return the complete TEI/XML document of EDH inscription HD001827.

This inscription consists of two parts, divided by the double slash in the transcription, which gets translated to two <div> elements of type 'textpart' in the EpiDoc XML:

```
<div n="1" type="textpart">... </div>
<div n="2" type="textpart">... </div>
```

By using the URL parameter 'ref' it is possible to specify each part of the transcription, e.g. for the second part of the text:
https://edh-www.adw.uni-heidelberg.de/api/dts/documents?id=HD001827&ref=2

Addressing single lines of the inscription transcriptions can be done by specifying both the column/text part and the line number, separated by a period: *ref=column.line*, e.g.:

https://edh-www.adw.uni-heidelberg.de/api/dts/documents?id=HD001827&ref=2.2

The implementation of the navigation endpoint will follow thereafter.

Conclusion

In the past 30 year the Epigraphic Database Heidelberg has built one of the largest digital textual resources for Ancient Historians studying Roman history and culture based on the extent epigraphic material. Following the increasing focus on data and methods of the Digital Humanities more and more researchers have contacted EDH project members to gain direct access to EDH data - obviously having simple online search engines is not sufficient any more.
To support this growing need a great variety of interfaces have been added to the EDH website, which now allows users to get the data they need for their research so that they can transform it to their own specific wishes, to annotate and enrich it with more information and create new applications based on it, including i. a. annotating, text mining and machine learning algorithms, based on one of the most prolific text sources from antiquity: Latin Inscriptions.

When to choose which option?

Most users will be interested in data from the EDH Text Database, consequently most data reuse options focus on this repository.
The basic CSV downloads (I) allow for individual data downloads of specific user defined queries, results can then very easily be processed by spreadsheet applications like LibreOffice Calc, MS Excel

or Google Spreadsheets. One key benefit here is the option to create statistical diagrams like e. g. pie charts based on this tabular data.

Accessing EDH data by referencing URI patterns (II) enables users to embed in a flexible way information about single resources, either inscription, image metadata, bibliographic or geographic data, in a variety of different formats as XML, JSON and RDF, into their own applications.

To query for full data sets in a programmable manner is the principal task of the EDH Open Data Repository (III): Programmers gain precise control of the records in the result set and the data format. The IIIF API (IV) is the key to reusing images from the EDH Photographic Database, which by now is a widespread standard in the Digital Heritage community and GLAM institutions. The same holds true for the evolving Distributed Text Services API (V).

Overall, data reuse options I - V show an increasing complexity and need for computational knowledge.

EDH makes data as publicly available as possible, but this of course can only be the first step: Due to the very fragmented situation in Latin Epigraphy this is only the beginning, the next step would be to have all major stakeholders to publish their data in a similar manner and create a distributed infrastructure on top of this: that will allow for searching, editing and annotating across all data, an idea which has gained some momentum lately under the name of *epigraphy.info*.[38]

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[38] http://epigraphy.info.

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