GeoWebAnnotations

Extending the W3C Web Annotation Data Model to annotate geospatial data

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Introduction

- Annotations are an important part of the scientific discourse
- Support for annotations on geospatial data have not been properly formalized
- How can annotations be represented for geospatial linked open data?
- Which components and variants of annotations are needed for different geospatial data?

Why GeoWebAnnotations?

- Annotations in the GIS world are often implementation-dependent
- Interoperability between annotations made in systems capturing similar data is not guaranteed
- Geospatial data might be controversial: Scholars might want to capture a discussion about the identity/usage of a certain location
- We need to formalized scientific discourse and make the results visible

Annotation data vs. geodata attributes

Geodata attributes in GIS geodatabases are usually required to be:

- Factual
- Long-term
- Observable

Geodatabase data == Annotation data?

Annotations may also include subjective data such as opinions, perceptions or personalized ratings

Annotations for geospatial data

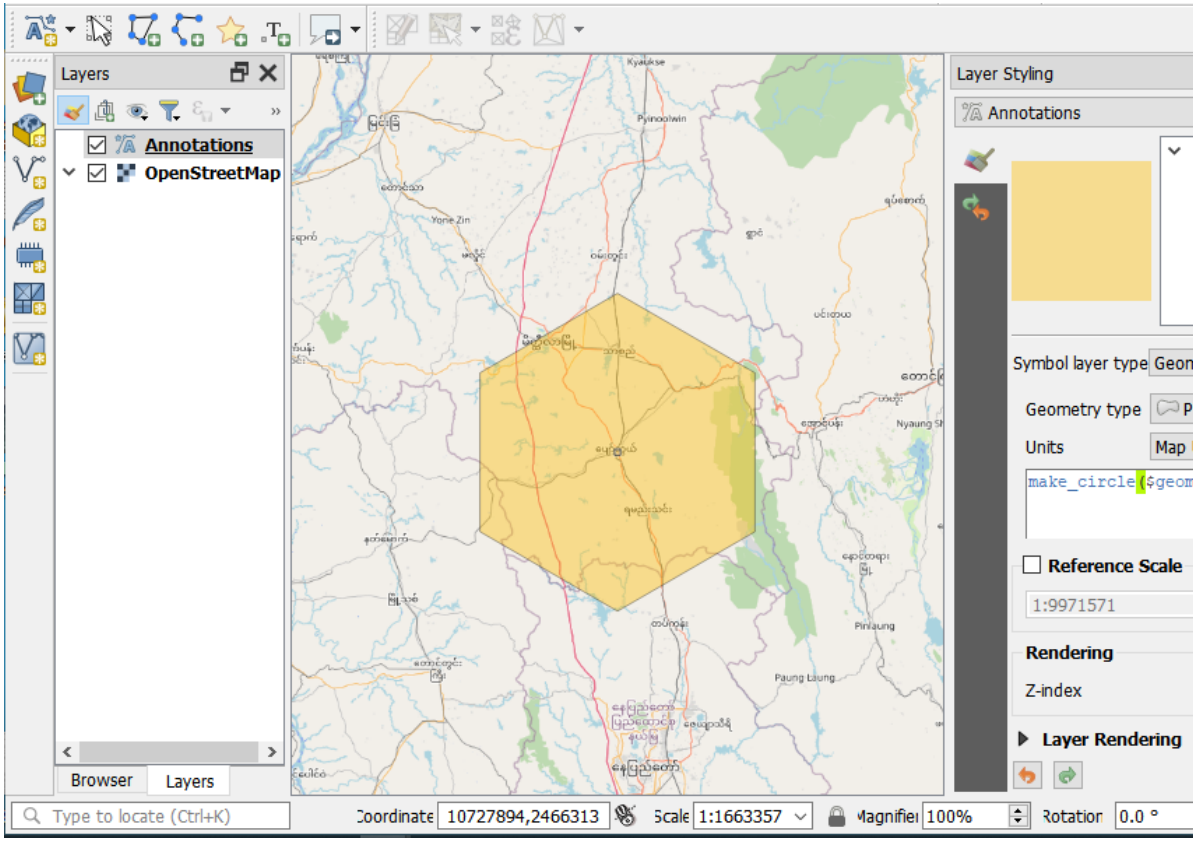
- Opinions on data
- Subjective observations (e.g. dangerous, not dangerous)
- Discussions about geodata captured in markings

Annotations in GISScience

- Traditionally: Create an annotation layer
- The annotation layer is matched with the to-be-annotated layer by geolocation
- The annotation layer is shared in e.g. QGIS projects with the target audience
- Annotation layers only live in their respective (QGIS) project context
- Subjective contents are often shared in separate databases which may or may not expose data using APIs

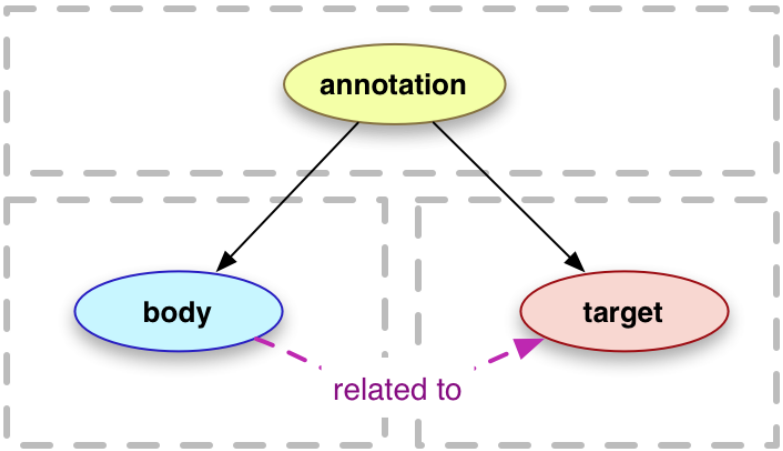
Annotationlayers in GISScience

- Contents of annotation layers are not formalized
- Annotation layers as colored geometries with a specified legend
- Goal: Making these annotation layers interoperable



Web Annotations

- Annotation Body: Contains Annotation contents
- Annotation Target: Description of the Annotation Target as a URI
- Annotation Selector: Selects parts of the annotation target if necessary



Web Annotations: Selectors

- Annotation target selectors
- Annotation Target: Description of the Annotation Target as a URI
- Annotation Selector: Selects parts of the annotation target if necessary

```
1  {
2    "@context": "http://www.w3.org/ns/
         anno.jsonld",
3    "id": "http://example.org/anno27",
4    "type": "Annotation",
5    "body": {
6      "type": "TextualBody",
7      "value": "This is the best part
           of my image"
8    },
9    "target": {
10     "source": "http://example.org/
           myimage",
11     "selector": {
12       "type": "SvgSelector",
13       "value": "<svg:svg> ... </svg:
             svg>"
14     }
15   }
16 }
```

Geospatial data in Annotation bodies

- Geospatial information in annotation bodies to describe a concept
- Does not allow for the description of parts of a feature
- No real support for CRS

```
{
  "@context": "http://www.w3.org/ns/anno.jsonld",
  "id": "http://example.org/anno27",
  "type": "Annotation",
  "body": {
    "type": "TextualBody",
    "value": "{"type":"Point","coordinates:"[0,0]}"
  },
  "target": "http://example.org/mytarget"
  }
}
```

Annnotation geospatial context

How to access the geometry?

Three cases:

1. The geometry to be annotated is available by a distinct URI
2. The geometry to be annotated is NOT available by a distinct URI
3. Only a collection of geometries is available by a distinct URI

When are these cases relevant?

- Case 1: The case when exposing data using OGC API Features
- Case 2: For local data that has not yet been hosted
- Case 3: For data hosted as a file or using WFS services

GeoWebAnnotation: Idea

- Extend the Web Annotation Data Model with new Selector types to capture parts of geospatial vector data
- Encode coordinate reference systems of the annotation target and the selector
- Provide support for geospatial features only served via collection URIs
- Provide linked open data annotations which are downwards compatible to non-LOD formats

GeoWebAnnotation: WKTSelector

- Address the target with a URI
- If the target it a featurecollection, add a feature id to the annotation
- Create a Well-Known Text Definition to describe the part of a geometry that is to be annotated
- Specify the annotation CRS if it deviates from the geometry CRS

```
1     "target": {
2     "source": "http://example.org/
          myfeaturecollection",
3     "selector": {
4     "type": "WktSelector",
5     "targetFeature": "feature1",
6     "annoCRS":"http://www.opengis.net/def/
          crs/EPSG/0/4326",
7     "value": "POLYGON(...)"
8      }
9    }
```

GeoWebAnnotation: Relative Annotation

- Annotate a subarea of e.g. a Polygon
- The annotation does not need to include a CRS
- It is up to the interpreting software to resolve the annotation target and define the annotation area

```
{
  "@context": "http://www.w3.org/ns/anno.jsonld",
  "id": "http://example.org/anno27",
  "type": "Annotation",
  "body": "http://example.org/road1",
  "target": {
    "source": "http://example.org/myfeature",
    "selector": {
      "type": "WktSelector",
      "targetFeature": "",
      "value": "WKTLITERAL"
    }
  }
}
```

Annotations of grids: DGGS/raster data

- Annotations are also possible for
  - Rasters
  - 3D Meshes
- Annotations do no necessarily require a georeference right away
- CRS definition is important
- Annotation CRS might deviate from vector/raster CRS

```
1  {
2    "@context": "http://www.w3.org/ns/
         anno.jsonld",
3    "id": "http://example.org/anno27",
4    "type": "Annotation",
5    "body": "http://example.org/road1",
6    "target": {
7      "source": "http://example.org/
           mygridfeature",
8      "selector": {
9        "type": "XYZSelector",
10       "targetFeature": "",
11       "coordinateSystem": "WKTCS",
12       "value": "GRIDLITERAL"
13     }
14   }
15 }
```

GeoWebAnnotation in GeoJSON

- Convert web annotation data model selectors to special GeoJSON features with the following properties
  - Annotation URI
  - SelectorType
  - Selector target (the original annotation target)
  - The target feature if a feature collection is targeted
- Feature retains the annotation area
- Annotation body becomes part of the respective feature

```
1        {
2  {"type":"FeatureCollection",
3  "features":[
4  {
5  "type":"Feature",
6  "id":"http://example.org/anno27",
7  "properties":{
8      "annotation":"http://example.org/
           road1",
9      "type":"URL",
10     "target":"http://example.org/
           myfeaturecollection",
11     "targetFeature":"http://example.
           org/myfeaturecollection/
           myfeature",
12 },
13 "geometry":{
14     "type": "Point,
15     "coordinates":[1,1]
16 }}]}}
```

Annotation Webservices

Idea:
If annotations can be converted to GeoJSON features we can host them

- using an OGC API Features webservice
- Enable exploration of annotations to layers using Catalog Web Services
- Load linked layers from annotations

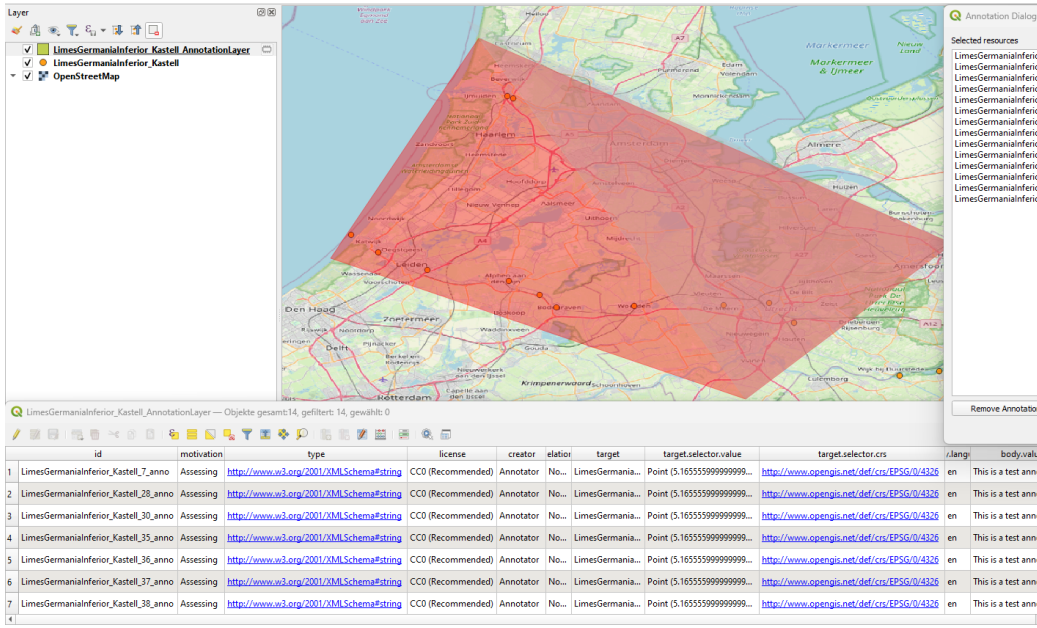
Statically hosted annotation layers

Idea: Host annotations as Linked Open Data Dumps:

- Create a HTML deployment that exposes GeoWebAnnotations as GeoJSON layers
- Create static OGC API Features descriptors which described annotation layers
- Access OGC API Features layers using software such as QGIS
- Implementation: SPARQLing Unicorn Ontology Documentation Script (Github) will be extended

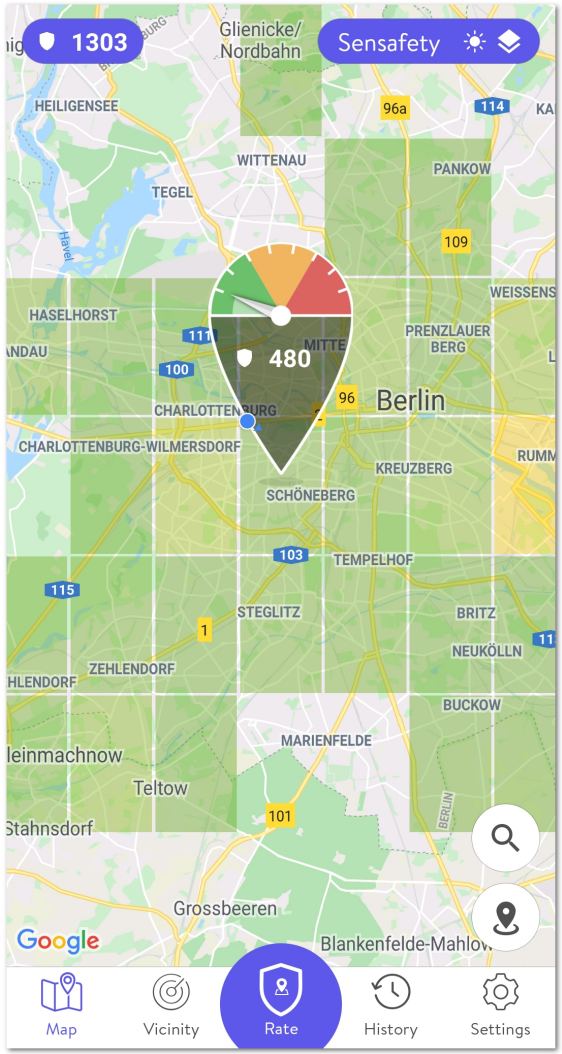
Proof of Concept Implementation: QGIS Plugin

- Allows to annotate features in a vector layer
- Annotation selectors:
  - Polygon
  - Circle
  - Point
  - Line
- Freeform annotation:
  - Select an area with or without features to complement a feature layer



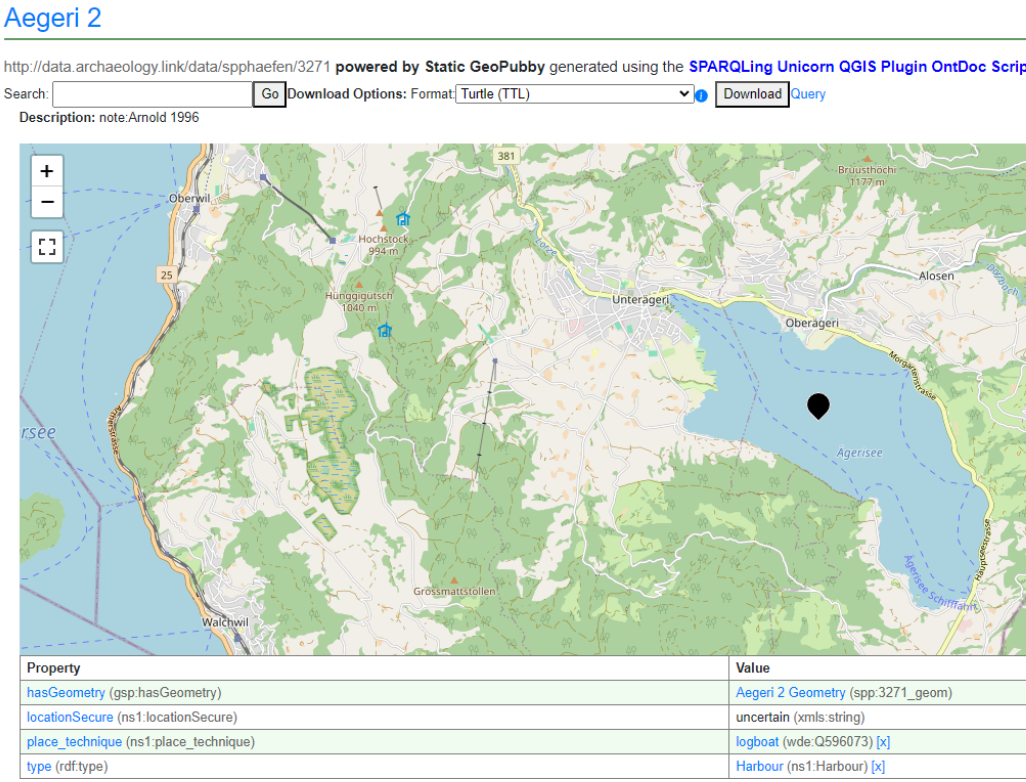
Example Use Case I: Safety Perception

- People perceive geospatial locations as more or less safe depending on:
  - Personal impression
  - Individual criteria
  - Hearsay
  - Media coverage (good or bad)
  - Positive or negative events
  - Visibility of police
- Perceptions are subjective data and may provide further insights when connected to other LOD resources



Example Use Case II: Certainty annotation

- Different opinions about a geospatial feature
- Is the polygon a house or a shed?
- When is the building's inception?
- Does the building exist in this location?



Conclusions

- GeoWebAnnotations can help
  - Capture opinions about geospatial data
  - Enable conversations about controversial geospatial data
  - Enable the analysis of the provenance of statements with additional knowledge graph-backed information
  - Enable easy sharing of previously only locally available annotation layers
- Many ways to represent GeoWebAnnotations build bridges between geospatial and the geospatial LOD community
- Backwards compatibility to established standards maximize reusability

Future Work

- Further development of the QGIS plugin (planned as a student project)
- Investigation of data formats for annotation integration beyond LOD (GML schema?)
- Visualization of annotations in Linked Open Data Dump HTML Deployments
- Engaging in a standardization discussion for GeoSelectors with W3C or OGC

Thank you very much for your attention!