Master Geo-Information Science & Remote Sensing

Internship report GRS00000

Building a web-based Geo-visualizati
Fieldnames in Drenthe

Wageningen Universiteit

Waag Society, Project; Heritage & Location

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Acknowledgments

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Abstract

Keywords

Abbreviations

H&L Heritage and Location Project CH Cultural Heritage GIS Geo Information System ICH Intangible Cultural Herit

voor Cultureel Erfgoed

Chapter 1. Introduction

The amount of geospatial data has increased rapidly. Geospatial data is created and used increasingly every day in maps, satellite navigation systems, websites, services and Apps. (MacEachren & Kraak, 2001; Tensen, 2014) Almo geographically referenced (Hahmann & Burghardt, 2013). Next to that, the modern computer technologies provide be institutions, organizations and citizens to create and use geospatial data. (Cartwright, Miller, & Pettit, 2004; Tensen, 2 range of domains, use geo information systems [GIS] for management and decision-making purposes and the fields o expanding.

The magnitude and complexity of data sets with geospatial reference are a challenge in information science. How t into information and subsequently into knowledge? Data is a product of research, creation, collection and discover often boring, incomplete or inconsequential. It is not yet valuable as communication, for it is not a complete messa are presented with data instead of information. {see figure # DIKW pyramid} According to Nathan Shedroff, succes do not present data. Transforming data into information by organizing it into a meaningful form, presenting it in an communication context is the process to get the story to the audience. (Shedroff, 1999) The use of the enormous to inform the general public is also still in development. (Tensen, 2014) Geo-visualization is one of the tools to turn geo data volumes from information into knowledge. (MacEachren & Kraak, 2001) Geo-visualization integrates sc cartography, image analysis, information visualization, data analysis and geographic information systems to provide n visual exploration, analysis and presentation of geospatial data. (MacEachren & Kraak, 2001)

The web is being used to produce new visual applications, going beyond the status of maps and other representations of geographic information. The World Wide Web has become an extremely efficient channel for transferring data, and also, has great visual capabilities. (Cartwright et al., 2004) There is a need for creating user-centered geo designs to ensure that usable geospatial products are created and delivered. (Cartwright et al., 2004) This raises the interest for geo-visualization in publishing geo-refer the web and getting the enormous amount of available data to the general public (Lin, Gong, & Wang, 1999; Tense methodologies specifically directed and web geo visualizations emerge which emphasized the scientific infor techniques as a way to handle these very large and complex data sets. New visual forms and practices emerge, but h differ from the more conventional cartographic forms?

Figure 1. DIK

(Shedroff, 19

In this research, web geo-visualization is explored through a case study in the field of cultural heritage[CH].

There is a big relevance of using geospatial data and geo information systems for the field of cultural heritage conserva
2010) Safeguarding and exploiting CH is high on the agenda and includes the use of digital management systems. (M
Perrin, Durand, & Drap, 2007) Before this was a hand-made task, but with the growing computer science there a
digital preservation, innovation and updating cultural heritage data. (Deal, 2014) The next step is to document cultural
geographic space to preserve and safeguard the amount of cultural heritage data on another level. More and mo
authorities responsible for cultural heritage use GIS as one of the main infrastructure components when digitalizing C
Meyer et al., 2007; Petrescu, 2007)

For cultural heritage data, the issue of the representation of the results of inventories in mapping systems and updating
data, remains open. (Martin, Reynard, Pellitero Ondicol, & Ghiraldi, 2014) Web-mapping applications can be used to
easy to use formats, for the assessment and promotion of heritage data. (Martin et al., 2014) Web-mapping is a suitab
and updating geo heritage data. In general, much of the spatial data being created and shared is strongly visua
photographs, video, maps and art (Elwood, 2011) As stated by Deal:

> *Visualizations have the potential to greatly improve search and discovery for online collections, transformi*
> *digital collections. Furthermore, changing technology is making it easier than ever to incorporate visualiza*
> *and websites. The time is ripe for cultural heritage institutions to begin experimenting with data visualizatio*

In the cultural heritage field, the temporal dimension plays an important role to explore data. (Cerasuolo, Cutugno, & L
temporal data visualization assumes and important role in the data presentation to users. The three dimensional d
(spatial, temporal and descriptive) helps users understand and gain knowledge in the discovery process.

This research is part of an internship at Waag Society for the project of Heritage & Location. (see chapter $$$) This
work and the results from the development of a web-application for the project Heritage & Location.

Because a web-application will be build to visualize geographically referenced intangible cultural heritage [ICH] data
oriented research. The context is a dataset of field names that were used by the local citizens around 1800 to refer t
fields or areas, in Drenthe, the Netherlands. The information about the landscape that is hidden in the names g
information. Yet, noticeable is that this data is only know to a few selected historians. (Spek, Elerie, & Kosian, 2009) T
by the *Rijksdienst voor Cultureel Erfgoed* and based on the book *“van Jeruzalem tot Elzelakker, levende veldnamen*
(Spek et al., 2009). More about the data will be described in chapter $$

The research will be build up in 3 parts; first the possible visualization techniques will be explored through literature st
techniques, the application will be build, for which certain design goals and requirements will be defined. In the en
shortly be evaluated.

0.1. Design goals

1. The goal is to preserve the living heritage names of Drenthe, which are mostly stored in people's memory an
2. Give people the possibility to explore them, discover them. For names cannot be found in the real surroundi and now given a place to *exist*.
3. Getting the stories out of the raw data and show people the surprising knowledge that stays hidden. Help peo heritage and so the history of the Dutch landscape. Engage people in something interesting about the landsc

We will do this by building an attractive web-application for the project Heritage & Location to show its potential of visu
and preserving them. A big part of the web application will be a geo-visualization of the intangible cultural heritage o
names from Drenthe. The interactivity of the web application, will give users the possibility to discover the names the
the environment. The focus is on revealing hidden meaning of the raw data, to the general public.

0.2. Target group

The target group will be defined as the common citizen, living in Drenthe and show an interest in their direct envi
discover something about its history. It will not specifically be targeted at children or elderly but to a general publi
language is Dutch.

0.3. The objectives

The target group must feel:

1A. Attracted to use the application 1B. Attracted to stay and play around with the application 1C. Challenged to explo

The target group must be able to:

2A. Discover the meaning of the field-names in relation to their environment 2B. Discover interesting stories and surp
field-names 2C. Understand the field-names and their value

The application must be:

3A. Intuitive and simple to use, so it shows quick and surprising results on the actions of the target group 3B. Tech
efficient and error-safe way. User friendly.

Chapter 1. Background

In this chapter, the field names are further explained and their role in the cultural heritage field. Therefore, Also the fie is explained and its categories. Because this research was conducted in the scope of the Heritage and Location proj this will also be elaborated on. Also some background information on geo-data and the combination with heritage is g

0.1. Field-names in Drenthe

A field-name is a toponym used for a small area of land or a certain surrounding. Mostly arable land, pasture lands, was areas, hills, valleys, woodlands and swampy areas. The names are thought up by the local inhabitants for practical u and spatial orientation. A field-name is often only existing in oral form and originates, develops or disappears w changes. This makes field-names living heritage (see next section) and it exist only in people's memory. There away from daily lives and disappear with new generations. Written documentation of field-names date from the century. Some names live through because they were taken up into official cadastre documentations or other landsc Nowadays, a new interest arrises for field-names as they can tell us how the landscape used to look in the 18th ce field-names was gathered by assessing peoples memories, old cadastre documents, maps and other collections. Thi made tangible, by documenting as much as possible and digitalizing them into a GIS system.

Field-names tells us how the landscape used to look, which soil types, vegetation types or animals occurred. They link or environmental characteristics of the direct village surroundings. The origin and meaning of field-names are mai geography of its direct environment, like water bodies, streams, soil properties and altitude in relation to its surrou used for landscape design and planning, knowledge for historical research and inspiration source for artist. (Spek et a - Encyclopedie Drenthe Online," n.d.)

0.1.1. Living heritage

The field-names in Drenthe are called living heritage, which is one of the 4 kinds of cultural heritage categories acc institution;

1. The physical environment. Including monuments, archeology sites and cultural landscapes.
2. Paper heritage; Stored in archives and libraries in the form of paper documents, maps and books.
3. Object collections, owned and displayed by museums. Only focusing on objects.

4. Living heritage; habits, traditions, religions and cultural events that people experience. From: (“volkscultuur,”

Categories 1,2 and 3 are tangible substances while category 4 is intangible heritage. UNESCO introduces the c heritage data in 2003, to safeguard the importance of intangible cultural heritage and distinct it form tangible heritage (“UNESCO Culture Sector - Intangible Heritage - 2003 Convention :,” n.d.-a)

The Convention of UNESCO introduces five domains of ICH:

- oral traditions and expressions including language as a vehicle of the ICH
- performing arts (dance, music, theater)
- social practices, rituals and festive events
- knowledge and practices concerning nature and the universe
- traditional craftsmanship, meaning the skills and knowledge involved rather than the craft product itself

The boundaries between those domains are extremely fluid (“UNESCO Culture Sector - Intangible Heritage - 2003 b). In the scope of the H&L project this research will focus on the connection of place and time in intangible cultur be shortly explained as all traditions and rituals of normal life, (Zeijden, 2011) which gives people a sense of identity is transmitted from generation to generation and can be constantly recreated by communities due to interaction wi (“UNESCO Culture Sector - Intangible Heritage - 2003 Convention :,” n.d.-b) Intangible heritage is strongly depende space and influenced by the space. Of course these traditions, habits , etc., have a place where they take place. Or th have a spreading, an origin, a continuation, can cover multiple places, through time. (Karavia & Georgopoulos, 2013) for the field-names in Drenthe, which is oral living heritage. Originated with a strong influence of the direct environmen

0.2. Waag Society

For this research takes place in the scope of the Heritage and Location[H&L] project at Waag Society, they both will b

Waag Society is a Institute for art, science and technology. They develop technical interventions for relevant social they conduct creative research in the form of projects, creative care lab, creative learning lab, future heritage lab, futu design lab and open wetlab. The Heritage & Location project (see next section) is part of the future internet lab [FIL] the development of big and open data, making internet technology accessible and research the impact of the internet (“Waag Society,” n.d.)

0.2.1. Heritage and Location project Waag Society

The project H&L is owned by the Rijksdienst voor het Cultureel Erfgoed [RCE] , and at Waag Society a historical-geo
are developed. The H&L project aims to develop a uniform system to link CH collections to existing geometries, w
indicators in the metadata of the CH data. One of the tools is a historical-geocoder, to make heritage data, geo locate
and space to other heritage data sets and enrich knowledge. It combines multiple geo data sets with a time compon
easily to locate heritage data with a place notification. Big heritage collections with a place indication, though no geo
to geometries. The goal of the H&L project is to know every place, administrative boundary, building and address th
Netherlands. Figure $$ shows the overview of the whole H&L project. Now focusing on the historical geocoder and
n.d., "Erfgoed & Locatie," n.d.)

Figure 1. Sheme of Hertiage and Location project. Products and Services.

0.3. Cultural heritage data & GIS

There is a big relevance of using geospatial data and geo information systems for the field of cultural heritage co
(Droj, 2010) Explained here are several reasons why a GIS system is beneficial for digitalizing CH data; One, digi
web GIS system can serve the goal to preserve the CH, by presenting the digital records in the form of focusing o
Geographical information systems have proved their potential to present and exploit cultural heritage data. (Karavia &
Meyer et al., 2007) Second, such a system can be used for research aims. (Karavia & Georgopoulos, 2013) Impleme
spatial correlation of the CH data. The geographical relation and connection among various cultural heritages can be s
evolution through time and space and relationships between different datasets.((Karavia & Georgopoulos, 2013; Lai,
So GIS can help to correlate and exploit heritage spatial relations and enrich the knowledge already existing. (Kara
2013) This is also the third and the main goal of the Heritage & Location [H&L] project, for which this research is inten
datasets, by linking it in space and time to other datasets, which do not contain exact location data but do contain a
thematic data description. By doing so, it is possible to improve the information access and improve the richness o
cultural heritage institutions. ("erfgoedenlocatie.nl," n.d.) Assumption is that the place referred to in historical docume
the identical real-world place if they are related in name.

Digitalizing heritage as linked data contains the following key aspects:

1. Identification, making the objects unique and identifiable.
2. Make it accessible through the Internet

3. Searchable, making it possible to index by search engines.
4. Re-usability. Linked-data makes it easy to use the data.

("DEN I DE BASIS vindbaarheid," n.d.)

0.4. Geo data

Geospatial data is data with a location, a connection to a location and oriented by their geographical relationships. G of threefold: spatial, temporal and descriptive. (Mennis et al., 2000) The spatial dimension can be used to interpret th and relation of data entities, an absolute and enclosed *space* wherein the geographic phenomena exists. The tempo used to interpret the change in the data through time. The thematic dimension is to interpret what the data is about be measured and assigned. (Mennis et al., 2000) The data component only concerns the raw observational data, w attributes. (Mennis et al., 2000) These three characteristics will be explained in detail in the next sections.

0.4.1. Spatial dimension

Geo data is different from other data because it is inherently structured with a spatial dimension. An X and Y locatio dimension. This contains the *where* of a particular phenomenon. Spatial objects can be physical, real objects in the w phenomena, like administrative boundaries. Continuous data fields cover large areas with no clear boundaries, like ra A single object on the earth is discrete; they have sharp boundaries, like a house. But also the spatial structure phenomena, is it random or regular clustered. The general assumption of spatial correlation tells that close things are far apart things.

0.4.2. Temporal dimension

The time of happening of phenomena can be divided into 3 forms, it can happen/exist as a point in time, a period i interval in time. Also time can be classified into the four measurement classes, nominal ordinal discrete or continuous would be; the 90ties, Christmas or the WWII. Ordinal contains relative order time statements like; before, after. seconds, minutes , etc.

Another differentiation is liner versus cyclic time ordering. Linear time is ordered along a path. Cyclic time follows a phases. Like seasons, day and night. Serial periodic data is periodic time represented on a linear path.

0.4.3. Thematic dimension

The theme or attribute of a phenomena. The 'what' is happening in the world. This data is often stored in the attribu then one attributes can exist. This data can be qualitative or quantitative, nominal ordinal discrete or continuous.

0.5. Static geospatial visualization

Geo data has three basic symbols to represent the data, points, lines and polygons. Selecting the right graphic c display is a challenging issue. Effective symbolization requires human creativity and judgment. (Dibiase et al., 1992) for cartography is Bertin's theory. This provides a classified system with four levels of data measurement and a list of can be assigned to the visual variables. See figure $$. Bertin's theory was designed in the context of static maps but and seems applicable to the design of dynamic maps. (Dibiase et al., 1992)

Figure 2. Bertin's theory

Alt text *(Dibiase et al., 1992; Bertin, 2000)*

After Bertin, other researchers have added to this method. Morrison added more specifications on color, existing c and value. MacEachren (1995) added the term clarity, build up from crispness, resolution and transparency. Caivar dimensions on texture. Defining directionality, size and density of texture. Deciding the right graphic variable to be a type of data, helps the viewer in defining the perceptual properties. For example, ordinal data needs the percepti quantitative data of being proportional. While nominal data needs to be perceived as distinct categories.

0.6. Dynamic geo-visualizations

Kobben and Yaman define a few categories of cartographic animation that show dynamic phenomena. First phenomena, a static map or a series of static maps can be used. But why use static maps for dynamic data? The dy divided into 2D and 3D animations. In this research we only work with 2D animations because of limited technology. A frame work we will leave this out of consideration. The two categories are temporal animation and non-temporal ar animation, display time and world time are directly related. While for non-temporal, no direct relation between display t present. (Köbben & Yaman, 1996) Kraak and Klomp give a slightly different categorization, but can be compared to th Kraak & Klomp talk about time-series, successive build-up and changing representations. See table #.

Table 1. Categories of possible animations for dynamic phenomena.

Köbben & Yaman		Kraak & Klomp	
Temporal	Direct relation between world time and display time	Time-series	World time
			Aggregate
			Database
Non - Temporal	No direct relation between world time and display time	Successive build-up	
		Changing representations	

Information from (Köbben & Yaman, 1996; Kraak & Klomp, 1996)

Dibase states that dynamic variables can be used to emphasize the location of a phenomenon, emphasize the a change in the spatial, temporal or thematic dimensions. (Dibiase et al., 1992)

Animated maps contain dynamic variables. Scene duration, rate of change, scene order. (Ormeling, 1996)

Dynamic visualization variables are identified by Dibiase et al. 1992, MacEachren 1994 Kobben and Yaman …. and E

Kobben and Yaman defined the following dynamic visual variables:

- moment
- duration
- frequency
- order
- rate of change
- synchronisation

They state that the dynamic visual variables will only give the right results when combined with the traditional st (Köbben & Yaman, 1996)

Blok provides a framework for animated representation of dynamic geo-spatial phenomena. (Blok, 2000) She provide visualization variables to be used for monitoring purposes of spatial temporal relationships. Blok's framework more ai use of visualization while this research, aims at the display and communication part of the geo-spatial phenomena Though, this author finds that Blok's dynamic visualization variables can be applied for both purposes. As Blok also sta is to contribute to the development of representation methods and interaction tools, which are also found in the exp forms. Blok describes the next dynamic variables: In the spatial domain:

- Appearance/disappearance
- Mutation
    - nominal level
    - increase/decrease ordinal, interval ratio
- Movement
    - along trajectory
    - boundary shift

In the temporal domain

- moment in time
- pace
- duration
- sequence
- frequency

cycle trend 'world time' vs 'display time' (Blok, 2000)

Chapter 1. Method

This research will be a design-oriented research, trying to fulfill the design goals and objectives. By taking the objecti goals will be fulfilled. There fore the objectives are given numbers and letters, to easily refer to them, when they are c for an overview of the working procedure and where the specific objectives are addressed. The whole process will b chaotic then the overview shows. Most creative choices and decisions will be taken by the researcher and her prefere

Figure 3. Methodology overview

Once the general goal was established; making a web-based geo-visualization, the case study in the field of cultura defined. This, because the internship is conducted for the project Heritage&Location at the Waag Society. In the pro institutions take part, and so came into contact with possible data providers. After explaining the general goal of this st needed for this report was provided by *Rijksdienst voor Cultureel Erfgoed*. With the data, the subject of the research t

The report will be build up in 3 parts; first geo-visualization and web-application techniques will be explored through the found techniques, the web-application will be build, for which certain design objectives will be defined. In the end t tested according to the set objectives and found literature.

0.1. Theoretical framework

Three things will be looked at in the literature research. First, a literature research is done into geo visualization tec available methods. Going from the conventional cartographic techniques to the modern techniques. Including animat to cover objective 1a, to make the application attractive, and 2c, understanding the geo-data. Second, literature abo applications and the available techniques will be consulted. To cover objectives, 2a, 2b, 2c and 3a. Adding knowledge preceding research. Last, will be looked at some frameworks explaining how to build an efficient, attractive and intera in general. Covering objectives, 1a, 1b and 1c.

This will all be summarized into the theoretical framework which can be found in the results chapter. The found li to make decisions while building the main application. Therefor the focus of the chapter will be on the field-nar characteristics and visual variables.

0.2. Building the web-application

After exploring the field-names dataset, a choice of story and way to visualize the data is made, which will be expla
This will immediately be implemented into building a web-based geo-visualization. The focus will be on building the
finding the best way to visualize the data. While doing this, decisions and choices will be made on the developed fran
several things that will be taken into account during this stage.

Section $$1

- The idea and design Section $$2
- Techniques needed to make the web-application. (O 3a, 3b and 3c)
- Techniques for geo support. (O 2 and 3)
- Visualizing of the geo data. (O 2) Section $$3
- Designing the webpage. (O 1a)
- Writing the information in text, that is needed in the web page. (O 2a and 2c)

Both the design and technical building will be done by the researcher.

0.2.1. The idea

Because the origin and meaning of fieldnames are mainly influenced by the geography of its direct environment, like w
soil properties and altitude in relation to its surroundings. In order to visualize this relation, as stated in objective
surrounding in relation to the name has to be shown. Becuase the fieldnames are allready categorized by a previo
distinction can be made.

Several ideas came up to do this, as many characteristics are of influence. The main goal for the visualization can be

Visualize the meaning and origin of the field name by showing its relation with its direct environment.

The first ideas:

- Showing soil related field names on a soil map. This can be a current or old soil map.

- Showing height related field names on a height map.
- Showing ground water levelds in relation to field names about water, swomps and soil types.
- Vegetation types, present on a field in the current situation vs what the fieldname tells us about the historic ve
- Showing names with relation to wind direction, in their position relative to the closest town or city

Main idea

Eventually one of the ideas was chosen. Namely, showing the field names on a height map. By doing this, it include to water and swamps, for lower areas are more wet then higher areas. Also vegetation types, dependent on wet or included for their is a relation.

Figure # shows some fields with names related to height. Though less clear then the examples above, some fiel increases or decreases in the in relation to the area around. The Bult and the Hooge Akker are clearly on higher grou the West. Where de zwarte kuil indicates that it is a lower field.

Figure 4. Field-names example of names with height indication on the height map

Though, field-names are only related to its direct environment, as far as the naked eye could see, for it is human inve a field with a name can only be shown in relation to the direct environment, and not on a general overview map. For e 'Bultakker' (bump field) tells up that this field lies higher then its surrounding fields, not what the exact altitude it is. In in the visualization, showing the polygons on a map won't be sufficient. Chosen is to draw a transect of the height o names of the fields on this.

// tekeningetjes

Interactivity will be added to the transect line, letting the user define the transect line themselves and explore the diff on and around the transect line.

For this is needed:

Webpage

A map showing the area, where a line can be drawn to locate the position of the transect line. A area where the define drawn and can be explored. A explanation about how the application works. Other interactive features to navigate thro

Data

Data about the height of the study area and all the field-names with its categories. Additional stories and explana meaning and origin of the field-names. Additional pictures of the landscape characteristics.

Backend

Linking the data with the webpage. See paragraphs $$$$.

Variations on Main idea

For also on this main idea some variations can be made, these will be shown here.

- soil properties as colors of the fields. Or pattern of the specific soil type. Like stones, clay, sand etc. Giving c according to the soil property. Like a stonefield or redfield.
- Pop-ups with explanations and texts. Linking field-names to textual explanation, adding pictures of the characteristics. Vegetation types, animal occurrence.
- Adding pictures or symbols of vegetation types and animals on the transect line. As well as houses to ind bodies as blue dips in the transect line.Give more explanation per category or field-name type. Include pictu animals with which the field name is connected.
- Creating a small 3d landscape by adding multiple transect lines, stacked in front of each other
- Link stories provided to the line, so popups with provided stories from the book.

Mood board

For design ideas and color use a mood board was made. Pictures from the Internet combined with fonts. Search terms cultural heritage, transect , old transect map and more. One of the main inspirations was the following image:

Figure 5. Inspiration Picture

Source: https://commons.wikimedia.org/wiki/File:1832_Erie_Canal.jpg

Complete mood board; see appendix $$$

0.2.2. The data

Field-names

From the *Rijksdients voor Cultureel Erfgoed* of the Netherlands a dataset with living field-names in Drenthe was supplie field geometries that have a field-name, a name or toponym given to the plot or area by the people living in the neigh 1830. These field-names were derived from studies by Naarding and Wieringa, together with het *Drenthse Archie Instituut*. Old toponyms on old maps, tell us a lot, but here they used another source; the memory of the local inhabitar after generation the field names keep on living. The polygons where drawn by hand or the names were assigned to pl maps from 1830.

These field-names contain a lot of information about how the landscape used to look. Because most field-names direct environment. The most important factors influencing the forming of field-names are ; natural relief, natural wate structure. (Spek et al., 2009) This information is highly important for nature conservation and heritage preservation. (S

Further reference about the field names in Drenthe can be found in the book “Van Jeruzalem tot Ezelakker, Levende de Drentse Aa”. (Spek et al., 2009)

The dataset contains in total 1747 polygons with a field-name. Projection Rd new. EPSG28992

Table 2. Field-name Amounts per source

Amount	Source
459	cadastre topographic map from 1832
452	Landjouw
278	Wieringa
18	Kadaster
515	Drents Archief

This results in the following coverage of field names:

Figure 6. All fields with a field name.

Based on this the total research location is determined, consisting of the municipality's Aa en Hunze, Assen, Noord
All located in the watershed of the Drentse Aa.

Figure 7. Research area, location in the Netherlands and the municipalities

The field names are already categorized in a previous study by the RCE by $$$. The categories give a meaning
environmental characteristic was of influence on the name creation. These categories are given in table $$#. In the
overview of the categories and the names and alternative names can be found.

Table 3. Field-name categories

Code	Category	Count old	Count new
A	Altitude	116	1109
B	Soil type	79	551
C	Water related names	33	199
D	River valleys and swamps	270	926
E	Forest	175	3146
F	Drift-sand fields	59	223
G	Wild animals	38	181
O	Miscellaneous	0	85
W	Wind direction	0	165
Total		770	6585

AHN

The AHN2 tiles covering the research area were downloaded from nationaalgeoregister.nl to show the relation of
the environment. The AHN has proved useful for historical research. Small differences in the landscape can be se
already historians and archeologist use it to discover old settlements that cant be discovered with the naked eye. (Ac
Nederland, n.d.)

The raster data has a resolution of 5 meters and a precision of systematic and stochastic error of max 5 cm the pr
EPSG28992). (Actueel Hoogtebestand Nederland, n.d.)

The maximum and minimum values of the total area are 29.5 and -1.9 meters respectively.

Figure 8. AHN2 from the research area

See appendix for table with all the tiles used.

Kadaster parcels 1830

Data from the cadastre were also supplied by the RCE, showing the plots and parcels as they were in 1830. And car
fieldnames to. The dataset is in projection RDnew(EPSG28992).

Water bodies

The water bodies are downloaded from the open data PDOK.nl. The Top10NLactueel contains all topology of the Ne
of 1:25.000. From this dataset only the water polygons are used and clipped to the research area. So the names of
be included into the application. ("TOP10NL | Publieke Dienstverlening Op de Kaart Loket," n.d.) EPSG28992

Table 4. Map sheets Top10NL downloaded

Top10NL_17O
Top10NL_1rW
Top10NL_1rO
Top10NL_1rW

0.2.3. Pre-processing the data

Fieldnames

All the data was delivered separate .DAT files and scattered over several folders and sources. All the possible data
names were collected and displayed in one view. So this results in different sources saying something about the name
in plots with multiple names, some differed slightly, some were totally different.

In order to work with the files in Qgis all the files needed to be converted to shape-files. This was done in R. See s
Qgis, manually the attribute names needed were changed in one standardized name in order to merge all the data tog

Figure 9. Flowchart field-name dataset processing

Alt text

Code Snippet 1. SQL adjustments

```
-- UPDATE veldnamen3 SET naam = naam_2 WHERE naam IS NULL;
-- UPDATE veldnamen3 SET atoto_co_3 = code_3 WHERE atoto_co_3 IS NULL;
-- UPDATE veldnamen3 SET atoto_co_2 = code_2 WHERE atoto_co_2 IS NULL;
-- DELETE FROM veldnamen3 WHERE naam IS NULL;
-- ALTER TABLE veldnamen3 DROP COLUMN naam_2 CASCADE;
-- ALTER TABLE veldnamen3 DROP COLUMN code_1_ CASCADE;
-- ALTER TABLE veldnamen3 DROP COLUMN code_2 CASCADE;
-- ALTER TABLE veldnamen3 DROP COLUMN code_3 CASCADE;
-- ALTER TABLE veldnamen3 DROP COLUMN code_4 CASCADE;
-- ALTER TABLE veldnamen3 RENAME COLUMN atoto_co_1 TO code_1;
-- ALTER TABLE veldnamen3 RENAME COLUMN atoto_co_2 TO code_2;
-- ALTER TABLE veldnamen3 RENAME COLUMN atoto_co_3 TO code_3;
```

Because this resulted into a lot of overlapping areas, instead, the field-names were all linked to the Kadaster dataset fr
layer of polygons with multiple names is the result. This was done by spatially joining the datasets, or joining by the
most of the datasets contained. The ID contained; municipality, sheet map number, parcel number.

Eventually, the field-names that had no category assigned had to be classified as well. The cadastre field-names and
in the previous reseach by the RCE, but were added here, to have more coverage and amount of field-names.

The classification was done in R. See appendix for the script. $$ A field-name can consist out of multiple words with
and multiple categories and lemmings can be assigned to one field name. The classification provided by the RCE was
per category, different codes and alternative words that signifies the same.

The script runs through all the field-names and all the possible categories, to match which category was applicable.

While reading few of the names, new ideas for a category came up and added. The category wind direction W.

Figure 10. Amount of field names with a specific category, before and after categorization in R

AHN

The AHN is measured with laser altimetry or LIDAR. Laser beams shot from an airplane and localized with GPS. several time periods and merged in the end to get a detailed measurement of the height. The eventual end product c to ground level.(maaiveld) So vegetation, buildings and other object do not appear. (Actueel Hoogtebestand Nederlan areas are given no-data values.

For use in the application, the transect line looks best when not containing any gaps. Therefore, the no-data value no-data tool of Qgis. This takes an average of around 100 pixels to calculate the average height of the missing pixels.

Figure 11. Flowchart AHN2 raster processing

Alt text

- add field to water with value = 2
- rasterize water with celsize 5
- substract from AhN with raster calculator The water topology is .. into raster format. Giving pixel values of .. 1 calculator these values are subtracted from the AHN to lower the water bodies areas.

Kadaster parcels

No preprocessing needed other then explained in $$ preprocessing field-names.

Water bodies

Only processing was clipped to the research area. No other preprocessing needed other then was used for the AHN.

0.2.4. Back-end processes

First both client side and server side are build on one computer as a single seat set-up, in order to develop and test the desired result is achieved, the possibility to move it to a server will be regarded.

Figure $$ shows the overall setup of the system. On the web page a line can be drawn by LeafletDraw on the Leaflet r of this line are edited to a line string format and parsed into a SQL query. This query is exlpained in paragraph $$$. T the API wich requests the data from the PostGIS database. The response is a geoJSON array containing the heights of the line. This data is parsed back to the script of the website and used to draw the transect line and all the other ch The next paragraphs explain the database, the API, the SQL query and the website.

Figure 12. Back-end processes

Alt text

Setting up the database

The open source database PostgreSQL was installed with a PostGIS extension to create the needed database. It popular free and open source spatial database (Steiniger and Hunter 2013). The PostGIS extension enables geograpl files and rasters.

Everything was loaded in the dutch projected coordinate system RD new (EPSG:28992)

Figure 13. Loading data into the database

Alt text

Code Snippet 2. Loading data in the database

```
Shp2pgsql
➜  ~ shp2pgsql -s 28992 /<path name> /veldnamen.shp veldnamen | psql -U user -d veld

Raster2pgsql
➜  ~ raster2pgsql -s 28992 -I -C /<path name>/ahn2*.tif public.ahn2 | psql -d veldna
```

Setting up webserver or web API

A API or application programming interface, is needed to conect the web-application with the data in the PostGis datab Brianc node-postgres is used. Done with Node-Postgres for PostgreSQL client for node.js with pure JavaScript bindi a chunk of software code written

It supports parameterizes queries for PostgreSQL

So the functions are made to get from coordinates to a SQL query asking the height data from the AHN raster. https
node-postgres https://nodejs.org/about/

Code Snippet 3. Request & Response for transect line

app.get('/transect', function (req, res) { query(queries.transect, ['LINESTRING (' + req.query.linestring + ')'] , function
res.status(500).send(err); } else { res.send(result.rows.map(function(row) { row.geometry = JSON.parse(row.geometr
});

API SQL queries

After a line is drawn on the Leaflet map with Leafleat Draw, the coordinates of the line are inserted into the request ($
format. The line is in WGS84 (EPSG4326) and needs to be converted to RDNew(EPSG28992) in order to extract
other data at the right location.

Code Snippet 4. The line

```
    WITH line AS
  -- Create line geometry
  (SELECT ST_Transform(ST_GeomFromText($1 , 4326), 28992) AS geom),
```

The line is then cut into parts of 10 meter and points are generated with its percentage location along the line.

Code Snippet 5. Point and percentage at every 10 m along the line

```
linemesure AS
  (SELECT ST_AddMeasure(line.geom, 0, ST_Length(line.geom)) as linem,
  generate_series(0, ST_Length(line.geom)::int, 10) as i
  FROM line),

points2d AS
  (SELECT ST_GeometryN(ST_LocateAlong(linem, i), 1) AS geom, (i*100/ST_Length(linem))
percentage
  FROM linemesure),
```

This array of points is intersected with the AHN table to ext rat the height value for every point.

Code Snippet 6. Get height per point

```
AHN AS
-- Get DEM elevation for each
  (SELECT p.geom AS geom, ST_Value(ahn.rast, 1, p.geom) AS heights, percentage
  FROM ahn, points2d p
  WHERE ST_Intersects(ahn.rast, p.geom)),
```

Also the points are intersected with the field names table to see if a points falls into a field, and wchih name and cate
to.

Code Snippet 7. Get field name for intersecting points

```
fields AS
    (SELECT naam AS naam, code_1_ AS category1, code_2 AS category2, ST_Intersection(
veldnamen2.geom) AS geoms
            FROM veldnamen2, points2d p
            WHERE ST_Intersects(veldnamen2.geom, p.geom)),
```

Then the points are intersected with the water topology table to see if a points falls into a water body, and wich name
belongs to.

Code Snippet 8. Get field name for intersecting points

```
--Get Water inersects
waters As
(SELECT naamnl AS waternaam, typewater AS typewater, identifica AS waterId,
ST_Intersection(p.geom, water.geom) AS geomz
FROM water, points2d p
WHERE ST_Intersects(water.geom, p.geom)),
```

In the end all point that fall into a field or water body are joined to the total amount of points to contain the whole range

Code Snippet 9. Join all outcomes

```
points AS
(SELECT *  FROM AHN LEFT OUTER JOIN fields ON (AHN.geom = fields.geoms)),

points1 AS
(SELECT * FROM points LEFT OUTER JOIN waters ON (points.geom = waters.geomz))
```

This is all send back as one complete GeoJSON response.

Code Snippet 10. final GeoJSON response

```
-- Make points:
SELECT ST_AsGeoJSON(ST_MakePoint(ST_X(ST_Transform(ST_SetSRID(geom, 28992),4326)),
ST_Y(ST_Transform(ST_SetSRID(geom, 28992),4326)), heights))
AS geometry, naam, heights, percentage , category1, category2, waternaam, typewater,
FROM points1
```

Eventually the response of the request will be a GeoJSON. An example of the GeoJSON array is shown in code figur

Code Snippet 11. Example GeoJSON response

```
[
    {
        "geometry": {
            "type": "Point",
            "coordinates": [
                6.6089395293246,
                53.0818691708253,
                8.05700016021729
            ]
        },
        "naam": "Zuurpol (de)",
        "heights": 8.05700016021729,
        "percentage": 0.826035566357403,
        "category1": "A1",
        "category2": null,
        "waternaam": null,
        "typewater": null,
        "waterid": null
    },
    {…},
    {…},
    {
        "geometry": {
            "type": "Point",
            "coordinates": [
                6.62981923722014,
                53.0856490864126,
                4.8439998626709
            ]
        },
        "naam": "Gryze Steen",
        "heights": 4.8439998626709,
        "percentage": 55.5813292359005,
        "category1": null,
        "category2": null,
        "waternaam": null,
        "typewater": "meer, plas, ven, vijver",
        "waterid": "NL.TOP10NL.128375900"
    },
    {…},
]
```


0.2.5. Web design

Will be an inductive process. Mostly based on the researchers' preferences. The language in the product will be Dutc a part of the Netherlands and the target group is dutch. Internet mapping applications, is software that enables a dev view geodata and maps in a standard internet protocols and run in in a normal browser.

Licenses

Only use of free and open source software is used.

Map5

Technology

HTML, CSS to build the webpage and the interactivity with JavaScript .

Packages needed for building the geo-application will be leaflet and d3.js. And possible leaflet plugins like, Leaf MiniMap. Leaflet is a JavaScript library for the creation of interactive maps by the founders of OpenStreetMap. Interes probably the focus on desktop and mobile web browsers, and its use of HTML5. (Steiniger and Hunter 2013)

Technological advancements, such as browsers that support scripting languages natively, and standards, such as Ca (CSS), Asynchronous JavaScript and HTML 5,

Leaflet

Code Snippet 12. Leaflet map initializing

```
var basemaps ={
  "_1830": L.tileLayer('http://s.map5.nl/map/gast/tiles/tmk_1850/EPSG900913/{z}/{x}/
  "_2015": L.tileLayer('http://{s}.tile.openstreetmap.org/{z}/{x}/{y}.png'),
  "Hoogte": L.tileLayer('http://s.map5.nl/map/gast/tiles/relief_struct/
EPSG900913/{z}/{x}/{y}.jpeg')
}

var map = new L.map('map', {
  maxZoom: 15,
  minZoom: 12,
  layers: basemaps._1830
});

map.setView([53.079529, 6.614894], 14);
map.setMaxBounds([
  [52.861743, 6.458972],
  [53.202277, 6.958035]
]);
```

D3, data driven documents.

Code Snippet 13. D3 request coordinates and drawing transect path

```
d3.json('transect?linestring=' + coordinates, function(json){
  console.log("requesting line from database");
  console.log(json)
  var line = d3.select("#line")
  line.selectAll(".transect")
    .data(linestring)
    .enter()
    .append("path")
    .attr("class", "transect")
    .attr("d", lineFunction(json))
    .attr("stroke", "#2B2118")
    .attr("stroke-width", 3)
    .attr("fill", "none");
```

0.3. Testing the web-application

Third, a small test will be held to see if the product complies with the set goals and objectives. During the whole proces visualization was adjusted and tested again until the project ends.

The final test will be conducted with a small questionnaire. About 20 people will be asked to open the web-applicati it and play around with it. Afterwards, 6 questions will be asked to see if the application lives up to the objectives se colleagues of the Waag Society, the heritage institutions of the Heritage and Location project and possible, classmat friends. This to have a broad general public. At least 20 people will be asked.

The statements. 1 The application is visually appealing. 2 I feel tempted to explore more about the fieldnames in th tempted to use this application multiple times.

4 The meaning and origin of the field-names are clear to me. 5 The stories and information is surprising and enriche uderstand the fieldnames and their importance.

7 The applicaiton is intuitive and simple to use. 8 Everything was working as it should. 9 The application layout was cl

Chapter 1. Results

0.1. Theoretical framework

First, a literature research is done into geo visualization techniques and already available methods which are applicab
Describing the field-name data in the kind of data it is and the visual variables which can be linked to them. This to c
make the application attractive, and 2c, understanding the geo-data.

Second, literature about building geo-web applications and the available techniques will be consulted. To cover objec
3 to add knowledge and experience from preceding research to the techniques which will be used here.

Last, will be looked at some frameworks explaining how to build an efficient, attractive and interactive web-application i
on a user centered design. Covering objectives, 1a, 1b and 1c.

0.1.1. Visualization of field-names

Geographical visualization can be used for 2 purposes; data exploration and information display. (Cartwright et al., 2
graphic representations new knowledge can be created and this can be distributed by visual communication. The
whiled visual communication is explanatory. (Dibiase, Maceachren, Krygier, & Reeves, 1992) Geo-visualization
communication, scientific information visualization, geographic information systems and cartography. (MacEachre
comes after the collection of data, transformations and analysis. From the real world we go to data and all the mod
Eventually the data will be visualized, either a computer or on paper. The perception of people will interpreted the da
into knowlegde. In general, every map is a selective representation of reality and subjected to the interpretation of the h
et al., 1992)

In figure $$$ the geo processing chain is combined with the series of visualization transformations. Showing tha
visualization as exploration and communication. Here we will focus on the visual information communication. To tu
understandable knowledge on the explanatory level with a user-centered design.

Figure 14. Geo processing chain and visualization series

The goal of the field-names is explanatory, while the interactivity makes the data exploratory. When looking at th
MacEacharen and Kraak, the field name application can be placed in the top corner. The application is about sha
general and broad public. While making it interactive and so exploratory. T

Figure 15. Map use cube from MacEachren and Kraak

Interactivity

the data sets are static data, but will be displayed dynamically and interactive. It will let the user explore, and re-disc
themselves, called *guided discovery*. (Nöllenburg, 2007) Interaction is considered as one of the key characteristics o
map is nowadays seen ans an interactive interface. Interactivity lets the user explore the geo-data and be in control a
the cartographer. Interaction empowers the viewer/user to modify the data display. (Dibiase et al., 1992)(Ogao & Kraa
2007)

Technical functionalities for a map:

- Interactive: Zoom, filter, preform queries, different level of details.
- Be able to navigate, zoom, scroll and pan.
- Change thematic data

interactive animation gives the control of the animation to the user, the level of detail displayed and the speed ca
information is less likely to be missed.

1. focussing: choosing a perspective, magnification and detail. Zoom pan rotate. Navigation controls. Select lay attributes.
2. Linking and Brushing. Linking means simultaneous highlighting of data items in multiple views. Brushing: sele objects by pointing on them or encircling them on the screen.

The full potential of interaction in geovisualization lies in linking multiple views of the same data on the screen.

Spatial temporal scenes

0.1.2. Web based geo visualizations & user centered maps

The user is no longer depended on what the cartographer puts on the map. (Ogao & Kraak, 2002) With electronic
navigate and explore the spatial data themselves with the given functionality. In a dynamic interactive visualization, th
between data presentation and exploration. (Ogao & Kraak, 2002) Knapp(1995) defined four visualization operation tas
identify, locate, compare and associate. Identify is describing an object, locate indicates the search for a object whose
know. Associate and compare is the ability to relate between two different objects.

Table 5. Visualization operators from Ogao & Kraak

Alt text *(Ogao & Kraak, 2002)*

A user interface for a web page should have the following basic components:

- Geo browser – the map. Spatial dimension. Let users navigate.
- Time bar – temporal dimension.
- Filters – selecting information, filter. Thematic dimension.

Technologies

Possible Web Map Frameworks:

- OpenLayers
- MapFish
- Leaflet
- TileMill (Steiniger & Hunter, 2013)

OpenLayers is a library for WMS (tiled layers) and WFS (vector layers). It implements a JavaScript API for visualiza the web browser. Without a server-side component. (Steiniger & Hunter, 2013) (http://openlayers.org/)

MapFish, is an open source web mapping framework for building rich web-mapping applications. MapFish provic creating web services that allows querying and editing geographic objects. (Steiniger & Hunter, 2013) (http://mapfish.

Leaflet is a web-map service WMS,that returns geo-referenced rasterized maps or tiles. In this context a map i dimensional visualization of features in the common formats jpeg or tiff. Leaflet is open-source JavaScript library (http://leafletjs.org)

Leaflet currently compete with OpenLayers only with respect to the display of map tiles, because OpenLayer functionality when it comes to interactive and vector-based map- ping tools. Also MapFish provides much more capa not needed for this application, the choice was made for using Leaflet, being light and simple.

0.1.3. User centered designs or Customer engagement

To engage the target group into the application, the hook model is followed. Trigger people to use it. External or int action for which they receive a reward. If they invest in the system they will go through the process again. Alt text

0.2. The web application

The web application can be found on: $$$$$ Some screenshots of how it looks:

Figure 16. Welcome screen

Screen Shot 2015 07 24 At 2.18.47 PM

Figure 17. Map status in beginning

Screen Shot 2015 07 24 At 2.19.22 PM

Figure 18. Map functionalities with mouseover.

Screen Shot 2015 07 24 At 2.20.01 PM Screen Shot 2015 07 24 At 2.19.42 PM

Figure 19. Map drawing a line funciton

Screen Shot 2015 07 24 At 2.20.20 PM

Figure 20. Example interesting spot

Screen Shot 2015 07 21 At 11.06.45 AM

0.3. Testing the web-application

0.3.1. Outcome questionnaire

$$ people were asked to use the application and fill in the small questionnaire. The graph below shows the outcor With 5 being positive and 1 being negative. Question 2 about if people were triggered to perform multiple actions wa positive. Also question 5 if the user found the information surprising and interesting scored high. Meaning that the appli interesting and the user lingered around to discover more. Question 8 got the lowest score, the functionality did not wo expect.

0.3.2. Remarks on the questionnaire

- "works logical, though information is missing"
- "Make the pop-up disappear when the mouse moves away"
- " I miss a total overview of the page"
- "Finish line, not working.. "
- " The elevation graph should follow the x,y of mouse instead of following just x"
- " text window sometimes conflicts with the layer selector"
- "cursor on the map synchronies with the moving circle on the line"
- "also point selection, not only line"
- Ugly button on the introduction page
- I would like to know more about the different map layers
- drawing button for the line is hard to find
- While waiting, put a waiting sign.
- You would expect the information about the field to pop up when the moving circle is on the field, instead of t

Chapter 1. Discussion

- Too much ideas for such a short time span. Not enough knowledge for the conducting researcher in this shor
- Not enough knowledge of design or technical construction.

Lack of professional knowledge about the data

Design Geo-visualisation is so broad and there are so many ways in which a dataset can be described that it is no framework in steps to follow.

Geo data visualisation Height is the recent height, is this still the same as in 1830?? A lot has changed since.

No temporal dimension added.

Scale is needed

Not the best way to visualize the correlation which the fieldnames have to their surrounding.

Chapter 1. recommendations

0.1. Website recommendations

Add more symbols and information behind it. Make the application suitable for multiple browsers. Let the user invest a field and add a field name. Implement more of the thought up ideas to make it more interesting.

Chapter 1. Conclusion

Chapter 1. References

Actueel Hoogtebestand Nederland. (n.d.). AHN - Actueel Hoogtebestand Nederland - homepage [overzichtspagina
2015, from http://www.ahn.nl/index.html

Bertin, J. (2000). Matrix theory ofgraphics. Information Design Journal, 10(1), 5–19.

Blok, C. (2000). Monitoring Change: Characteristics of Dynamic Geo-spatial Phenomena for Visual Exploration.
1(2000), 16–30. http://doi.org/10.1007/3-540-45460-8_2

Cartwright, W., Miller, S., & Pettit, C. (2004). Geographical visualization: Past, present and future development. Journ
49(1), 25–36. http://doi.org/10.1080/14498596.2004.9635003

Cerasuolo, F., Cutugno, F., & Leano, V. A. (2012). Visualization with a New Visual Metaphor for Hierarchical and
Domain. In S. D. Martino, A. Peron, & T. Tezuka (Eds.), Web and Wireless Geographical Information Systems (pp. 57
Heidelberg. Retrieved from http://link.springer.com.ezproxy.library.wur.nl/chapter/10.1007/978-3-642-29247-7_6

Deal, L. (2014). Visualizing Digital Collections. Technical Services Quarterly, (April), 30–30. http://doi.org/10.1080/073

DEN | Home. (n.d.). Retrieved May 6, 2015, from http://www.den.nl/

Dibiase, D., Maceachren, A., Krygier, J., & Reeves, C. (1992). Animation and the Role of Map Design in Sc
Cartography and Geographic Information Systems, 19(4), 201–&. http://doi.org/10.1559/152304092783721295

Droj, G. (2010). Cultural Heritage Conservation by GIS, 1–6.

Elwood, S. (2011). Geographic Information Science: Visualization, visual methods, and the geoweb. Progress in Huma
401–408. http://doi.org/10.1177/0309132510374250

erfgeo. (n.d.). Retrieved July 22, 2015, from http://erfgeo.nl/

Erfgoed & Locatie. (n.d.). Retrieved July 22, 2015, from http://erfgoedenlocatie.nl/

Hahmann, S., & Burghardt, D. (2013). How much information is geospatially referenced? Networks and cognition. Inf
Geographical Information Science, 27(6), 1171–1189. http://doi.org/10.1080/13658816.2012.743664

Karavia, D., & Georgopoulos, A. (2013). Placing Intangible Cultural Heritage. Researchgate.Net, 675–678. h
DigitalHeritage.2013.6743815

Köbben, B., & Yaman, M. (1996). Evaluating Dynamic Visual Variables. In Proceedings of the Seminar on Teaching Ar
Madrid, Spain: International Cartographic Association. Retrieved from http://cartography.geo.uu.nl/ica/Madrid/ormelin

Kraak, M.-J., & Klomp, A. (1996). A Classification of Cartographic Animations: Towards a Tool for the Design of Dy
Environment. In Proceedings of the Seminar on Teaching Animated Cartography. Madrid, Spain: International Carto
Retrieved from http://cartography.geo.uu.nl/ica/Madrid/ormeling.html

Lai, J., Luo, J., & Zhang, M. (2012). Design and Realization of the Intangible Cultural Heritage Information Manageme
Web Map Service. Springer-Verlag Berlin Heidelberg 2012, 605–612.

Lin, H., Gong, J., & Wang, F. (1999). Web-based three-dimensional geo-referenced visualization. Computers and G
1177–1185. http://doi.org/10.1016/S0098-3004(99)00076-X

MacEachren, A. M., & Kraak, M.-J. (2001). Research Challenges in Geovisualization. Cartography and Geographic
28(1), 3–12. http://doi.org/10.1559/152304001782173970

Martin, S., Reynard, E., Pellitero Ondicol, R., & Ghiraldi, L. (2014). Multi-scale Web Mapping for Geoheritage Visualis
Geoheritage, 6(2), 141–148. http://doi.org/10.1007/s12371-014-0102-3

Mennis, J. L., Peuquet, D. J., & Qian, L. (2000). A conceptual framework for incorporating cognitive principles into ge
representation. International Journal of Geographical Information Science, 14(6), 501–520. http://doi.org/10.1080/136

Meyer, É., Grussenmeyer, P., Perrin, J. P., Durand, A., & Drap, P. (2007). A web information system for the m
dissemination of Cultural Heritage data. Journal of Cultural Heritage, 8(4), 396–411. http://doi.org/10.1016/j.culher.20

Nöllenburg, M. (2007). Geographic Visualization. In A. Kerren, A. Ebert, & J. Meyer (Eds.), Human-Centered Visual
(pp. 257–294). Springer Berlin Heidelberg. Retrieved from http://link.springer.com/chapter/10.1007/978-3-540-71949-

Ogao, P. J., & Kraak, M.-J. (2002). Defining visualization operations for temporal cartographic animation design. Int
Applied Earth Observation and Geoinformation, 4(1), 23–31. http://doi.org/10.1016/S0303-2434(02)00005-3

Ormeling, F. (1996). Teaching Animated Cartography. In Proceedings of the Seminar on Teaching Animated Cartogr International Cartographic Association. Retrieved from http://cartography.geo.uu.nl/ica/Madrid/ormeling.html

Petrescu, F. (2007). the Use of Gis Technology in Cultural Heritage. October, (October), 1–6.

Shedroff, N. (1999). Information interaction design: A unified field theory of design. Information Design, 267–292.

Spek, T., Elerie, H., & Kosian, M. (2009). Van Jeruzalem tot Ezelakker, Levende valdnamenatlas van de Drentse Aa.

Steiniger, S., & Hunter, A. J. S. (2013). The 2012 free and open source GIS software map – A guide to facilitate res and adoption. Computers, Environment and Urban Systems, 39, 136–150. http://doi.org/10.1016/j.compenvurbsys.20

Tensen, T. (2014). Master Thesis Geo-data animations in television journalism :, 1–87. TOP10NL I Publieke Di Kaart Loket. (n.d.). Retrieved July 13, 2015, from https://www.pdok.nl/nl/producten/pdok-downloads/basis-registratie-t actueel/top10nl

UNESCO Culture Sector - Intangible Heritage - 2003 Convention : (n.d.). Retrieved May 6, 2015, from http://www.ur index.php?lg=en&pg=00002

Veldnamen - Encyclopedie Drenthe Online. (n.d.). Retrieved July 22, 2015, from http://www.encyclopediedrenthe.nl/V

volkscultuur. (n.d.). Retrieved May 6, 2015, from http://www.volkscultuur.nl/

Waag Society. (n.d.). Retrieved July 23, 2015, from https://www.waag.org/nl/organisatie

Zeijden, A. V. D. (2011). Immaterieel erfgoed en musea, (35), 4–6.

Chapter 1. Appendix

0.0.1. AHN tiles downloaded:

ahn2_5_07cz1.tif ahn2_5_12en1.tif ahn2_5_07cz2.tif ahn2_5_12en2.tif ahn2_5_07dz1.tif ahn2_5_12ez1.ti
ahn2_5_12ez2.tif ahn2_5_11fz2.tif ahn2_5_12fn1.tif ahn2_5_12an1.tif ahn2_5_12fn2.tif ahn2_5_12an2.t
ahn2_5_12az1.tif ahn2_5_12fz2.tif ahn2_5_12az2.tif ahn2_5_12gn1.tif ahn2_5_12bn1.tif ahn2_5_12gn2.ti
ahn2_5_12gz1.tif ahn2_5_12bz1.tif ahn2_5_12gz2.tif ahn2_5_12bz2.tif ahn2_5_12hn1.tif ahn2_5_12cn1.ti
ahn2_5_12cn2.tif ahn2_5_12hz1.tif ahn2_5_12cz1.tif ahn2_5_17bn2.tif ahn2_5_12cz2.tif ahn2_5_17en1.ti
ahn2_5_17en2.tif ahn2_5_12dn2.tif ahn2_5_12en1.tif ahn2_5_12dz1.tif ahn2_5_12en2.tif ahn2_5_12dz2.t
ahn2_5_12fn1.tif ahn2_5_12ez2.tif

0.0.2. R Sript converting files to shapefile.

```
filenames <- list.files()
filenames <- list.files(filenames , pattern = "*.TAB" ,full.names = T)

## x = list of folder files # cat = category folder
exportToShape <- function(x, cat){
  for(i in 1:length(x)){
      name <- x[i]
      nr <- strsplit(name, "/")
      layer <- substr(nr[[1]][2], 1, nchar(nr[[1]][2])-4 )
      lemming <- substr(nr[[1]][2], 4, nchar(nr[[1]][2])-4)
      file <- readOGR(name, layer)
      file$category <- cat
      file$lemming <- lemming
      writeOGR(obj = file, dsn = "shape_vlak", layer = layer, driver = "ESRI Shapefil
overwrite_layer = T)
  }
}
exportToShape(filenames, "overig")
```

0.0.3. R script detecting categories

```
  library(sp)
  library(raster)
  library(rgdal)
  library(rgeos)
  require(RPostgreSQL)
  require(rgdal)


  setwd("/Users/waag/Documents/MGI_Stage/9_veldnamen/10_VeldnamenOrgineel/")

  # csv alle categorien en Lemmings
  categorie <- read.csv(file = 'Categorie_Alles.csv', header = T , sep=","   )

  # shapefile alle velden + namen
  velden <- readOGR(dsn = '/Users/waag/Documents/veldnamen.shp', layer = "veldnamen",
stringsAsFactors = F)

  # write shapefiel back
  writeOGR(obj = velden, dsn = "veldnamen_cat.shp", layer = "veldnamen_cat", driver =
Shapefile")

  # modififing shapefile
  velden$CODE_1[velden$CODE_1 != NULL] <- velden$ATOTO_CODE
  ## correctie
  velden$CODE_1[velden$CODE_1 == "D02"] <- "D2"
  velden$CODE_1[velden$CODE_1 == "E04"] <- "E4"
  velden$CODE_1[velden$CODE_1 == 'G03'] <- "G3"
  velden$CODE_1[velden$CODE_1 == "B03"] <- "B3"
  velden$CODE_1[velden$CODE_1 == "G06"] <- "G6"
  velden$CODE_1[velden$CODE_1 == "G07"] <- "G7"
  velden$CODE_1[velden$CODE_1 == "A01"] <- "A1"
  velden$CODE_1[velden$CODE_1 == "D03"] <- "D3"
  velden$CODE_1[velden$CODE_1 == "D06"] <- "D6"
  velden$CODE_1[velden$CODE_1 == "O08"] <- "O8"
  velden$CODE_1[velden$CODE_1 == "O02"] <- "O2"


  ## categorien toevoegen
  i <- 0
  j <- 0

  for( i in 1:length(velden$NAAM)){
    naam <- velden$NAAM[i]
    for( j in 1:length(categorie$Lemming)){
      CODE <- categorie$Lemming_Code[j]
      tekst <-  paste(categorie$Lemming[j],"|",categorie$amaltertieven[j] , sep = "")
      geld <- grepl(tekst, naam, ignore.case=T)
      if(geld){
        if(is.na(velden$CODE_1[i])){
```

```
        velden$CODE_1[i] <- paste(CODE)}
      else if(is.na(velden$CODE_2[i])){
        velden$CODE_2[i] <- paste(CODE)}
    }
    print(paste(naam, tekst, CODE, geld))
  }
}
```

0.0.4. Mood board

Alt text Alt text

0.0.5. Categories fieldnames form RCE

Alt text

Code	Count
A02	2
A04	3
A1	210
A10	13
A11	1
A12	39
A13	39
A14	18
A15	2
A16	4
A17	11
A19	1
A2	46
A20	499
A23	15
A24	2
A3	71
A4	58
A5	33
A6	7
A7	2
A8	2
A9	31
B1	80

B11	1
B2	3
B3	279
B4	15
B5	88
B6	2
B7	10
B8	46
B9	27
C1	88
C10	1
C13	1
C2	19
C3	14
C4	33
C5	15
C6	18
C7	4
C8	6
D01	2
D1	414
D11	1
D14	3
D15	5
D17	1

D18	6
D2	350
D3	18
D4	25
D5	13
D6	56
D7	23
D8	1
D9	8
E1	1588
E11	20
E13	118
E14	59
E15	7
E16	1
E18	1
E2	75
E21	775
E24	1
E3	61
E4	251
E5	48
E6	120
E7	9
E8	2

E9	10
F1	153
F2	23
F3	33
F4	2
F5	4
F6	1
F7	4
F8	1
F9	2
G01	1
G05	6
G1	28
G10	12
G14	14
G15	2
G17	1
G18	2
G2	13
G20	2
G21	4
G23	5
G24	11
G25	11
G26	9

G27	1
G28	1
G29	7
G3	4
G30	1
G31	2
G32	24
G34	3
G35	6
G6	9
G7	2
O05	17
O07	3
O09	1
O10	32
O12	1
O17	3
O18	4
O2	21
O5	1
O8	2
W1	121
W2	25
W3	8
W4	11

0.0.6. Questionairre for testing the application

Alt text