The Way of Saint James in Galicia: technical and historical characterization by means of geospatial indicators

VARELA GARCÍA, FCO. ALBERTO
MARTÍNEZ CRESPO, GONZALO
JIMÉNEZ BERNAL, JOSE MARÍA
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2. Methodology
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4. Results
5. Conclusions and prospects
1. Objectives and context
2. Methodology
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1. Objectives and context
The Way of Saint James: Development and context

1. Objectives and context
## The Way of Saint James. Development and context

<table>
<thead>
<tr>
<th>Century</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>9th century</td>
<td>Origin of the tomb</td>
</tr>
<tr>
<td>12th century</td>
<td>First splendor in the time of Compostellean bishop Diego Xelmírez</td>
</tr>
<tr>
<td>12th century</td>
<td><em>Liber Sancti Iacobi</em>, preserved in Santiago within Codex Calixtinus</td>
</tr>
<tr>
<td>14th to 18th</td>
<td>The Way of Saint James falls into oblivion</td>
</tr>
<tr>
<td>20th century</td>
<td>Recovery of The Way: Elías Valiña, <em>Priest of O Cebreiro</em></td>
</tr>
<tr>
<td>1993</td>
<td>First Xacobeo Plan: the beginning of institutional promotion of The Way in Galicia</td>
</tr>
</tbody>
</table>
### 1. Objectives and context

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1962</td>
<td>The Way of Saint James is declared <em>Bien de Interés Cultural</em> (Heritage of Cultural Interest), the highest heritage protection in Spain</td>
</tr>
<tr>
<td>1992</td>
<td>First official demarcation of the official route</td>
</tr>
<tr>
<td>1993</td>
<td>The Way of Saint James is registered on UNESCO’s World Heritage List</td>
</tr>
<tr>
<td>2007</td>
<td>Beginning of the Study of the Historical Territory linked to the Way of Saint James in Galicia, to give fulfillment to the 1996 law</td>
</tr>
<tr>
<td>2010</td>
<td>New route: second official demarcation</td>
</tr>
</tbody>
</table>
2007  Beginning of the **Study of the Historical Territory** linked to the Way of Saint James in Galicia, to give fulfillment to the 1996 law
SHT: Preparation of the **Study of the Historical Territory** linked to the Ways of Saint James covering the analysis and necessary previous information to prepare the proposal of demarcation of the route and its protection areas.
1. Objectives and context

SHT: Preparation of the **Study of the Historical Territory** linked to the Ways of Saint James covering the analysis and necessary previous information to prepare the proposal of demarcation of the route and its protection areas.

- Identification and description of historical routes of the Way of Saint James.
- Study and description of the historical territory linked to the Way from different perspectives: Culture, Territory, Urban Development, Society, Economy and Environment.
- Analysis of the territory under study, considering its Potentials and Weaknesses.
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1. Objectives and context

SHT: Preparation of the Study of the Historical Territory linked to the Ways of Saint James covering the analysis and necessary previous information to prepare the proposal of demarcation of the route and its protection areas.

Successful bidding companies: BAU and SIGNO.

Cartolab was contracted to do the following jobs:

- Study of the origin of the different routes of the French Way in Galicia.
- Historical development of the route.
- Preparation of the cartography and processing of all the geographical information.
- Characterization and inventory of the routes.
Various routes of the Way of Saint James
1. Objectives and context

Various routes of the Way of Saint James
Various routes of the Way of Saint James
The Way of Saint James. Development and context

1. Objectives and context

Various routes of the Way of Saint James

Marked route
Various routes of the Way of Saint James

Marked route

Official alternative trace
The Way of Saint James. Development and context

1. Objectives and context

Various routes of the Way of Saint James

Marked route
Official alternative trace
UNESCO alternative trace
Various routes of the Way of Saint James

- Marked route
- Official alternative trace
- UNESCO alternative trace
- Other historical trace
Various routes of the Way of Saint James

Marked route
- Official alternative trace
- UNESCO alternative trace
- Other historical trace
The Way of Saint James. Development and context

1. Objectives and context

Various routes of the Way of Saint James
When Cartolab got down to doing the characterization of the routes, we came up against two major difficulties:

1. Enormous amount of available information, and field work collection. It is necessary to design analysis tools to summarize the information and present it in a clear and orderly way.

2. Existence of many variants of historical routes. An objective method of compared study of traces is required

Solution to the problem: design of a methodology of technical and historical characterization for a unique way with big cultural and patrimonial value that nowadays preserves its functionality.

Result: production of four geospatial indicators.
Geospatial Indicators

• Design criteria:
  • Simplicity of production and calculation. Value ranges between 0 and 10
  • Faithful Representation of the reality of the Way
  • Extensive application to all the traces
  • Accuracy: calculation every 10 meters

• Four key subjects of study:
  - Historical interrelationship
  - Territorial visibility
  - Perceived quality
  - Road safety
1. Objectives and context

2. Methodology

3. Geospatial Indicators

4. Results

5. Conclusions and prospects
Initial information

Documentary search

• Bibliography and historical archives
• Historical cartography
• Toponymy

Study of all existing routes:

• Marked route (Dr. Elías Valiña, AGACS, Xacobeo, Diputaciones Provinciales)
• Official route: resolution of 1992
• Registered route on UNESCO’s World Heritage List
• Historical or traditional routes

Field work

• Walking tour of all the routes
2. Methodology

Initial information

- Documentary search
- Bibliography and historical archives
- Historical cartography
- Toponymy
- Study of all existing routes:
  - Marked route (Dr. Elías Valiña, AGACS, Xacobeo, Diputaciones)
  - Official route: resolution of 1992
  - Registered route on UNESCO's World Heritage List
  - Historical or traditional routes

Field work

- Walking tour of all the routes
Initial information

2. Methodology

Field work

• Walking tour of all the routes

• Data collection: 266 km, 4,295 points, 4,523 photographies.

• Technical parameters
  • Paving material
  • State of preservation
  • Way width
  • Type of platform
  • Type of way
  • Possibilities of use
  • Way limits
  • Visibility from the way
  • Singular elements
  • Perceived aesthetic appraisal

• Generating points every 10 meters. Extracting field data to a series of equally spaced points
Initial information

2. Methodology

- Stairs: 0.09%
- Ford: 0.20%
- Underpass: 0.24%
- Square: 0.33%
- Bridge: 0.55%
- Street: 13.51%
- Road: 38.61%
- Path: 46.48%

- Paving stone: 0.41%
- Flag stone: 3.63%
- Stone: 4.50%
- Concrete: 3.98%
- Asphalt: 34.76%
- Soil: 43.54%
- Aggregate: 9.08%
- Others: 0.11%
Information processing

2. Methodology

- Information at each point:
  - Technical parameters under study
  - UTM coordinates
  - Photography

<table>
<thead>
<tr>
<th>VALOR</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>TIPO_CA</td>
<td>CP</td>
</tr>
<tr>
<td>PLATAF</td>
<td>PI</td>
</tr>
<tr>
<td>VISIB</td>
<td>TI</td>
</tr>
<tr>
<td>PAVIM</td>
<td>R</td>
</tr>
<tr>
<td>CONSE</td>
<td>MIR</td>
</tr>
<tr>
<td>REGU</td>
<td>MP</td>
</tr>
<tr>
<td>LIM_D</td>
<td>MP</td>
</tr>
<tr>
<td>LIM_E</td>
<td>NO</td>
</tr>
</tbody>
</table>
2. Methodology

Information processing

Custom development with Open Source GIS: XAEL: “Advanced Linear Entities Generator”
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5. Conclusions and prospects
### Composition of indicators

<table>
<thead>
<tr>
<th>Compound Indicator</th>
<th>Name</th>
<th>Simple Indicator</th>
<th>Name</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IHC</strong></td>
<td>Historical interrelationship</td>
<td>IHTO</td>
<td>Toponymy linked to the Way</td>
<td>![Formula for IHC](IHC = 0.4 \cdot IHTO + 0.3 \cdot IHPM + 0.3 \cdot IHIT)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IHPM</td>
<td>Contemporary heritage to the way</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>IHIT</td>
<td>Historical routes</td>
<td></td>
</tr>
<tr>
<td><strong>IVT</strong></td>
<td>Territorial visibility</td>
<td>IVTC</td>
<td>Borders of visibility</td>
<td>![Formula for IVT](IVT = \frac{\ln(2 \cdot (1 + IVTE)) \cdot IVTC}{10})</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IVTE</td>
<td>Visible Territory</td>
<td></td>
</tr>
<tr>
<td><strong>ICC</strong></td>
<td>Perceived quality</td>
<td>ICCL</td>
<td>Limits and environment</td>
<td>![Formula for ICC](ICC = 0.3 \cdot ICCL + 0.3 \cdot ICPA + 0.4 \cdot ICCT)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ICPA</td>
<td>Platform suitability</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ICCT</td>
<td>Technical perception</td>
<td></td>
</tr>
<tr>
<td><strong>ISC</strong></td>
<td>Road safety</td>
<td>ISCM</td>
<td>Morphology of the Way</td>
<td>![Formula for ISC](ISC = 0.4 \cdot ISCM + 0.3 \cdot ISPA + 0.3 \cdot ISPE)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ISPA</td>
<td>Platform of the route</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ISPE</td>
<td>Route slope</td>
<td></td>
</tr>
</tbody>
</table>
1. Historical interrelationship
2. Territorial visibility
3. Perceived quality
4. Road safety

3. Geospatial Indicators
Historical interrelationship indicator

It evaluates the degree of historical relationship between the route of the Way and the territory it goes through, thanks to fact that the Way has created its own space.

It consists of:

1. Toponymy associated with ways
2. Contemporary heritage to the Way (Middle Ages)
3. Coincidence with historical itineraries
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Historical Interrelationship

3. Geospatial Indicators
3. Geospatial Indicators

### Historical Interrelationship

- Santiago de Compostela
- O Pino
- Arzúa
- Melide
- Palas de Rei
- Monterroso
- Portomarín
- Paradela
- Sarria
- Samos
- Triacastela
- Pedrafita do Cebreiro

#### Number of Toponyms

<table>
<thead>
<tr>
<th>Toponym</th>
<th>Nr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Santiago de Compostela</td>
<td>77</td>
</tr>
<tr>
<td>O Pino</td>
<td>9</td>
</tr>
<tr>
<td>Arzúa</td>
<td>23</td>
</tr>
<tr>
<td>Melide</td>
<td>164</td>
</tr>
<tr>
<td>Palas de Rei</td>
<td>34</td>
</tr>
<tr>
<td>Monterroso</td>
<td>50</td>
</tr>
<tr>
<td>Portomarín</td>
<td>25</td>
</tr>
<tr>
<td>Paradela</td>
<td>46</td>
</tr>
<tr>
<td>Sarria</td>
<td>75</td>
</tr>
<tr>
<td>Samos</td>
<td>18,9</td>
</tr>
<tr>
<td>Triacastela</td>
<td>29,8</td>
</tr>
<tr>
<td>Pedrafita do Cebreiro</td>
<td>9,3</td>
</tr>
</tbody>
</table>

#### Longitude [km]

<table>
<thead>
<tr>
<th>Toponym</th>
<th>Length [km]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Santiago de Compostela</td>
<td>19,9</td>
</tr>
<tr>
<td>O Pino</td>
<td>17,7</td>
</tr>
<tr>
<td>Arzúa</td>
<td>14,1</td>
</tr>
<tr>
<td>Melide</td>
<td>29,8</td>
</tr>
<tr>
<td>Palas de Rei</td>
<td>29,8</td>
</tr>
<tr>
<td>Monterroso</td>
<td>5,6</td>
</tr>
<tr>
<td>Portomarín</td>
<td>18,6</td>
</tr>
<tr>
<td>Paradela</td>
<td>9,3</td>
</tr>
<tr>
<td>Sarria</td>
<td>29,4</td>
</tr>
<tr>
<td>Samos</td>
<td>40,2</td>
</tr>
<tr>
<td>Triacastela</td>
<td>14,1</td>
</tr>
<tr>
<td>Pedrafita do Cebreiro</td>
<td>15,9</td>
</tr>
</tbody>
</table>
Historical Interrelationship

3. Geospatial Indicators
Historical Interrelationship

3. Geospatial Indicators
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3. Geospatial Indicators

Historical Interrelationship
Historical Interrelationship

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Historical Interrelationship
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Historical Interrelationship

3. Geospatial Indicators
3. Geospatial Indicators

Historical Interrelationship
1. Historical interrelationship

2. Territorial visibility

3. Perceived quality

4. Road safety
The visibility vertebrates and connects the territory in an immaterial way. The perceptive matter is intrinsic to the definition of the identity of each place.

It consists of:

1. Borders and limits of visibility
2. Extent of the visible territory
3. Geospatial Indicators

Territorial visibility
Territorial visibility

3. Geospatial Indicators
1. Historical interrelationship
2. Territorial visibility
3. Perceived quality
4. Road safety

3. Geospatial Indicators
Perceived quality

Perceived quality Indicator

The perceived quality is the set of elements that characterize the Way morphologically and allow the walker to appraise its value as such.

It consists of:

1. Limits and environment
2. Platform and pavement suitability
3. Technical perception and assessment
3. Geospatial Indicators

Perceived quality

Way boundaries

Platform suitability

Technical perception
1. Historical interrelationship
2. Territorial visibility
3. Perceived quality
4. Road safety
Road safety Indicator

Qualities that the path provides to walk on.

It consists of:

1. Morphology of the Way
2. Platform of the route
3. Longitudinal slopes
3. Geospatial Indicators

Road safety

Platform suitability

Route platform

Longitudinal slopes
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5. Conclusions and prospects
4. Results

Examples of specific results

**Historical Interrelationship, highly rated (green) due to toponymy and medieval church**

**Territorial visibility, very lowly rated (red) because the way is inside a forest**

**Perceived quality, highly rated (green) for being a traditional way in a natural environment**

**Road safety, lowly rated (orange) because the way goes along a shoulder**
Examples of specific results

4. Results

**Historical interrelationship indicator**

Low rate in red shades and high rate in green shades
Examples of specific results

4. Results

Territorial visibility indicator
Low rate in red shades and high rate in green shades
Examples of specific results

Perceived quality indicator
Low rate in red shades and high rate in green shades
Examples of specific results

Road safety indicator

Low rate in red shades and high rate in green shades
4. Results

Historical interrelationship indicator

Distribution for all the traces
Distribution only for UNESCO trace

Historical interrelationship
4. Results

Historical interrelationship

Historical interrelationship indicator

- Indicator average for all the Way
- Indicator average for each municipality
4. Results

Territorial visibility indicator
Perceived quality indicator

- Distribution for all the traces
- Distribution only for UNESCO trace

4. Results
4. Results

Road safety

Road safety Indicator
1. Objectives and context
2. Methodology
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### Synthesis of indicators

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Historical interrelationship</td>
<td>Positive results, although its composition can be improved.</td>
</tr>
<tr>
<td>Territorial visibility</td>
<td>Acceptable results, but it would be advisable to improve the calculation with more factors and higher precision.</td>
</tr>
<tr>
<td>Perceived quality</td>
<td>Very representative results, and simple improvement prospects.</td>
</tr>
<tr>
<td>Road safety</td>
<td>Very positive results.</td>
</tr>
</tbody>
</table>
Conclusions

• The characterization methodology is positively valued. Especially because we worked with equally spaced points to characterize linear elements.

• The indicators are a right tool to synthesize the characterization of a historical way.

• Using GIS allows improve the number and complexity of the analysis.

• The improvement of indicators and the study of historical ways by means of predictive models and GIS tools opens an important field of research.

• Prospects: this methodology will be applied for two other ways in Galicia: the English Way of Saint James, and the way to Compostela that origins at a junction with the Silver Way.
Acknowledgements

We thank all the companies that cooperated in the study of the historical territory of the French Way: BAU, SIGNO, PAST and GEAMA

We also thank Eduardo Yoldi, Daniel Díaz, Sabela Lorenzo, Adrián Eirís and all the CARTOLAB team for their steady support

This project has been possible due to the enormous effort made by the Dirección Xeral do Patrimonio Cultural da Xunta de Galicia, which always guaranteed the consultation and exploitation of the existing information about the French Way
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