How efficiently did they walk? An essay on the characterisation of traditional routes by Least Cost Path analysis and non-dimensional variables

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The Least Cost Path (LCP) analysis has been widely applied in landscape research from the very first period of GIS applications in Archaeology (Llobera 2000). Even there is a previous literature about the calculation of optimal routes in Archaeology by non-computational procedures. A certain number of algorithms have been used in Archaeology: Naismith rule (Frizt and Carver 1998), Pandolf equation (Pandolf et al. 1977) or Tobler's hiking function (Tobler 1993). In spite of this, some authors have compared the results from these methods, the reality is that a little work have been done on testing the modelling routes against traditional routes.

Our work has focused on the landscape of Tagus basin, in the surroundings of Alconétar's River Ford, whose role as a ford has remained stable over the past, since it strongly depends on the topographical and geological setting of the region. One of the main aims of the project is to reconstruct the patterns of movement in the surroundings of the ford, since it can help to explain the distribution of certain number of archaeological sites, ranging from megalithic monuments to roman sites.

We understand routes as a landscape feature produced by agents, who determine not only the track of the route, but some aspect that are socially accepted as the time invested in cover it, and, of course, the cognitive experiences of the travellers. Although experiences are a factor to not be forgotten in landscape configuration, time and effort are the solely variables that we can model through LCP. Comparing these pseudo-objective variables from pre-industrial routes with that obtained from LCP analysis could be a way to test the suitability of LCP when analysing past landscapes. We have faced the research in three directions:

1. Research on computing LCP in GIS. We have programmed our own module in GRASS GIS (r.paths) to compute the routes the different algorithms in a common background, easing the task to perform calculations with several algorithms jointly. One of the advantages is that our module has been designed to perform the "Moving without Destination" approach to model random movement (Fábrega and Parcero 2007).

2. A non-dimensional way to characterise the internal complexity of the routes.

Being not just enough the results of the comparisons between modelled and traditional routes, we have computed variables such as length, sinuosity or fractal dimension to validate these comparisons. We see it as an advance to objectively describe the results of different LCP methods with non-dimensional parameters, rather than with lengt
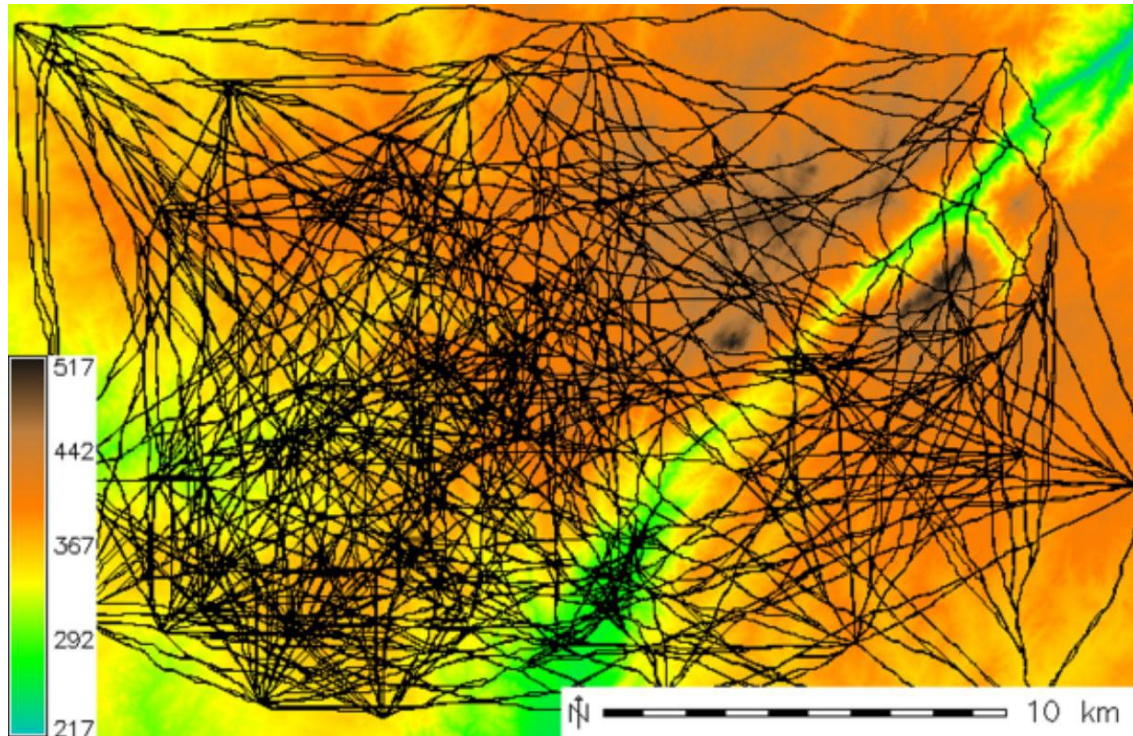
and slope dependent variables as time or energy costs are. A brief statistical analysis of the methods regarding to the internal complexity that they use to produce the routes will be presented.

Fig. 1. An example of routes produced by our r.paths GRASS GIS module in the surroundings of Araya fault, south of Alconetar's River Ford, where several megalithic sites have been identified.

3. Historic research on landscape. In our area of work we count with a rich historical cartography and literature dating back from the 16th to 19th centuries, whose routes are expressed in leagues, that is, the track of the route an individual can cover in an hour. We have gathered all the historical information and we have observed that distances are not altered over the time or the kind of cartography (civil or military), what can denote a social consensus when perceiving the journeys. A simple comparison between the information from these sources and the variables derived from the modelled routes by LCP can offer a insight on what LCP method adapts better to traditional paths.

To sum up, we offer a perspective of how LCP can help to explain the structure of archaeological landscape in our study region, specially regarding to the distribution of prehistoric sites.

Notes:

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