# Walking up “Scenic” Hills: Towards a GIS Based Typology of Crowd Sourced Walking Routes

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## 1. Introduction

### 1.1 Overview

This research project presents a method of classifying walking routes with spatially referenced attribute data. Cluster analysis was then implemented to aggregate the routes into a series of categories which form a typology of routes. It is envisaged that both the variables collated and the aggregate typology would assist users when searching for places they may enjoy walking in the context of a consumer orientated service, or, provide stakeholders of walking routes (conservation, tourism etc) decision support information. For example, linked transport data might demonstrate those routes which are within proximity of a bus stop or train station. The routes could also be profiled for attributes such as “views”, altitude or other metrics including the type of walking environment, nearness to water or “remoteness”.

Previous use of GIS (excluding mobile) in applications related to walking have emerged over a variety of scales, for example, examining human “emotional responses” to different parts of trails in relation to landscape characteristics (Chhetri, Jackson, and Arrowsmith 2004), spatial modelling of the 'recreational potential' of areas, management of National Parks (Chhetri and Arrowsmith 2008), and the creation of national indicators such as measures of “wilderness” of a particular areas (Carver, Evans, and Fritz 2002).

This project has extended the use of GIS in this area by developing a classification of individual walks using a GIS model, taking into account a series of composite spatial contextual indicators for a series of crowd sourced routes.

### 1.1 Data and methods

The walking routes used in this project are crowd sourced by subscribers of the services provided by Walkingworld Ltd (http://www.walkingworld.com). The Walkingworld routes are generated from GPS data collected from users who tag waypoints along a route, and for each stop, attach photographs and written descriptions that illustrate these paths for other walkers. These routes are assembled into a large spatial database, with a number of access methods provided including a web portal and partner mobile services. When a route is downloaded by a new user, a small royalty is paid to the person who designed and illustrated the route.

Although numerous data could be considered as relevant parameters to the description of walking routes, in this initial proof of concept, data has been obtained for the altitude, distance to the coast, distances from railway stations and bus stops, and also other crowd sourced data concerning how scenic areas are in the form of "scenic" ratings compiled from various photographs posted on the website ScenicOrNot.com (See Figure 1 and Table 1). These data sources were appended to each of the walking routes waypoints, thus enabling the route as a whole to be characterised. These data were assembled with a coverage of the UK, thus enabling all existing, and any new routes to be tagged with these spatially referenced attributes.

**Table 1.** Illustrating the data used

| **Accessibility** | **Physical Data** | **Scenic or not?** |
|---|---|---|
| NaPTAN (Department for Transport 2012) data from the government website. CSV files provides bus and train information. | UK Coastline data freely available in shapefile form from Cloudmade. (CloudMade 2012)<br><br>GPS Visualizer API (Schneider 2012) web app returns the altitude of a given set of coordinates | A freely available (mySociety 2012) tsv file of all the ratings for each Scenic or not location. Gives the average rating for each photograph. |

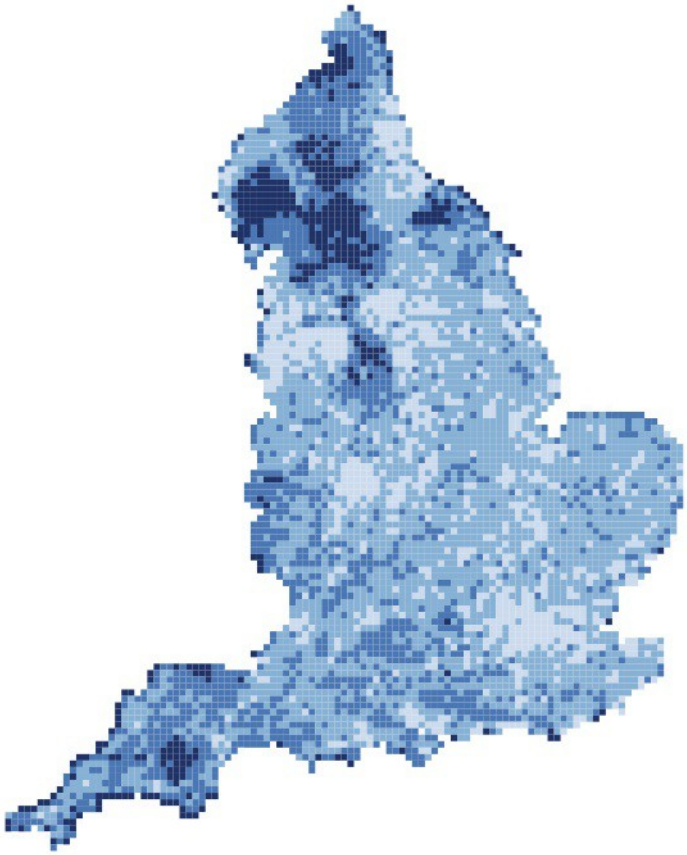

**Fig 1:** A map of the average scenic or not ratings (Singleton 2012)
A darker square indicates a higher rating.

### 1.3 Linking the walks with the data

Once the data were assembled, these were append to waypoints associated with each of the Walkingworld routes . The proximity of the waypoints was calculated to the coast, bus stops, railway stations, and also the nearest set of scenic scores. A nearest neighbour algorithm (Dunham 2003) iteratively calculated distances between points (waypoints and attribute points) and returned a specified k-number of closest items. For the sets in this study, k=1 was chosen (to find the nearest one item) for all attributes apart from the scenic or not set, where k=3 was chosen so that an 'average scenic rating' for an individual walk point could be calculated.

## 2. Results

After data collection and analysis, attributes were assembled into a table (see Table 1 for an extract), with each row corresponding to a waypoint associated with a route, and each column representing the following information:

- Walk ID
- Latitude and Longitude
- Walk ID

- Altitude
- Distance to coast
- Average Scenic Rating (out of ten)
- (closest) Bus stop name
- Distance to closest bus stop
- Bus stop location (Latitude and Longitude)
- (closest) Rail station name
- Distance to rail station
- Rail station location (Latitude and Longitude)

**Table 1**: The table below illustrates the records for a sample walk waypoint with the lat, long, easting and northing columns omitted.

| Walk ID | ... | Altitude (m above sea level) | Distance to coast (m) | Avg Scenic Rating | Bus stop name | Dist to bus stop (m) | Rail station name | Dist. To rail station |
|---|---|---|---|---|---|---|---|---|
| Walk_464_Step_1 | ... | 2.7 | 150.38956 | 5.6250 | Freshwater Bay | 184.9538 | Lymington Pier Rail Station | 9761.070 |
| Walk_464_Step_2 | ... | 115.4 | 136.26675 | 3.8889 | High Down Inn | 601.4652 | Lymington Pier Rail Station | 10224.300 |

The utility of these data can be illustrated in Figure 1. This graph demonstrates how the descriptive attributes can be combined to improve descriptions of routes by showing how ”scenic” the route is perceived to be linked with the relative altitude of each of the walk steps. The y axis shows the altitude as you move through the walk. The colour indicates the average scenic rating: the lighter the blue means more “scenic” spots are nearby.

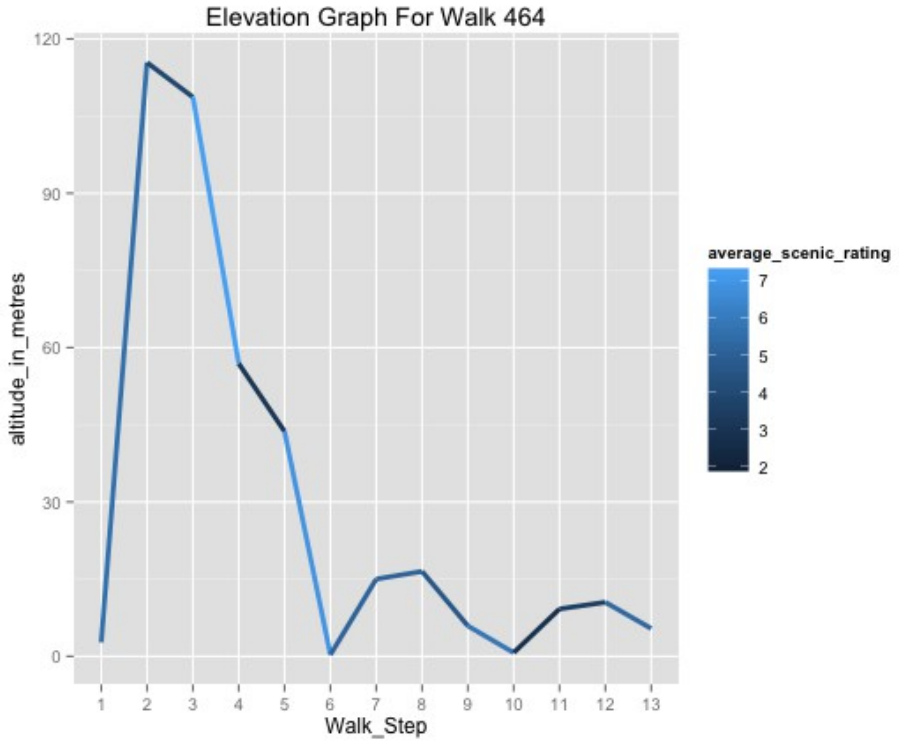


**Fig 2:** Graph of altitude, where the colour indicates the average scenic rating of nearby Scenic or not photographs.

The distance between each walk way point and the train stations and bus stops was calculated, thus enabling proximal station and bus stops to be associated to the walking routes and also the distances which provide an accessibility measures for each waypoint. The results indicate that most of the walks in the database were located near to a bus stop. For each walk, the average distance to the nearest bus stop was calculated, as the average over all associated waymarks. Over 70% of the walks were found to be within 1 km of a bus stop.

Train stations were not so proximal which is unsurprising given that train station density is far lower than that of bus stops. That said, there are quite a lot of train stations near to the walks, with many walks within 10 km of a train station.

The two graphs below (Figure 3 and Figure 4) illustrate the average (median) distances for each walk to the nearest bus stop and train stations.

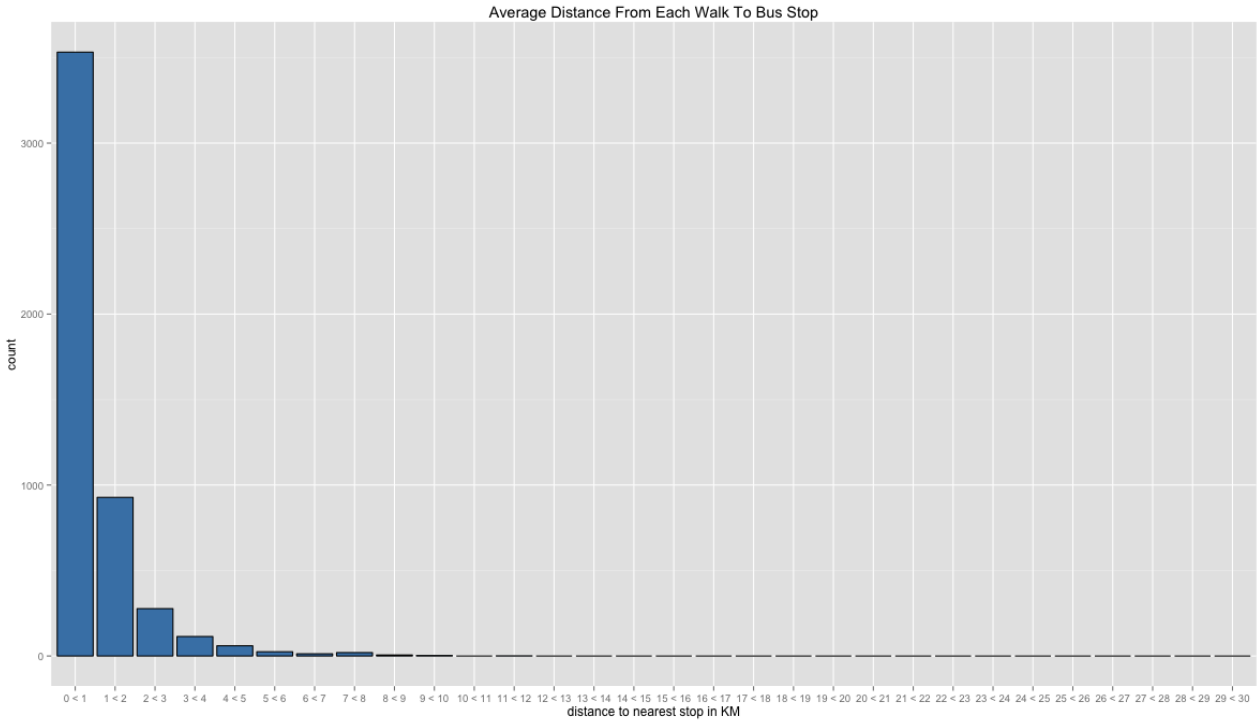


**Fig 3:** The number of walks with an average distance to bus stop of between 0 and 1, 1 and 2 km away etc.

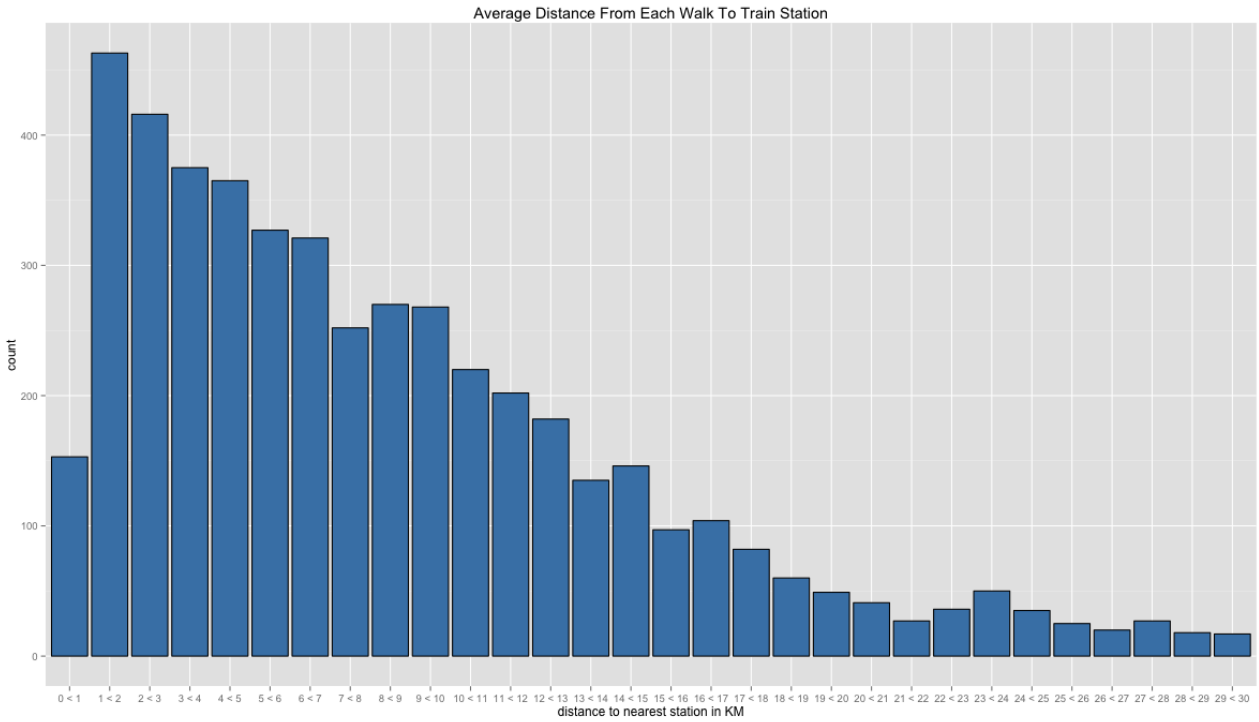


**Fig 4**: The number of walks with an average distance to train station of between 0 and 1, 1 and 2 km away etc.

## 4. Conclusions and further work

This work has illustrated a method through which walking routes can be categorised by association with third party attribute data, and integrated into descriptive measures that add value to the purely locational attributes of the current Walkingworld route co-ordinates.

It is intended that an expanded dataset will be used to build a typology of routes that will be integrated into both mobile and traditional online services; thus enabling users to explore the characteristics of walks both before are during they participate in them.

## 5. References


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*stakeholder*