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Mapping Human Landscapes in Muscat, Oman, with Social Media Data

Ludovica Tomarchio

Abstract

The paper presents a mapping process to define activity patterns and reveal the localisation of different city users in Muscat, Oman, using social media data. The paper has two aims: to present a methodology to map activity patterns in the city in the Omani context, using social media data; to interpret the data and extract valuable narratives for the case study of Muscat. As various social media have penetrated into the daily life of people, these become one important and effective data source to understand how people use the spaces of the city. There is a series of questions related to big data and urban space that emerge such as: can social media data be “mined” in Muscat, Oman, to create design-relevant spatial information? What information about the use of urban space in the context of an Arab city can be extracted from social media data? The case study deals with Muscat, the capital of Oman, a city with peculiar socio-demographic, cultural aspects, influencing the use of the space, particularly when relating to open and public spaces. The proposed study uses data extracted from Twitter and Instagram to perform an analysis of the city of Muscat: The analysis looks at three scales and presents four thematic layers: one layer of generally finding hotspots of activities; two layers of investigating different patterns of activities during the day-night, weekdays-weekends and one layer of looking into the languages spoken in different areas of the city. This results in the mapping of how different social-linguistic groups possibly move and interact in Muscat. The first part of the paper will present the methodology, from data collection to visualisation. The second part will look in detail at some selected areas and exemplify the narrative so that planners and designers can extract data from this approach and methodology.
Introduction

The growing number of subscribers to social media as well as their increasing geo-located interactions observed have provided new opportunities for the collection, processing and returning of data through maps. The rise of social media has a particular meaning in the Gulf Area and in Oman, where social interactions in the spaces of the city might be undergoing a process of transformation. This paper intends to understand how to interpret the geo-located information the social media data provided in the Omani context. This crowd-sourced mapping is a powerful and dynamic real-time tool for planners to source information about the use of spaces in the city.

The research revolves around the larger question of interpreting emergent social media data in order to understand urban space. This “big-data” question needs to be specified in the context of the proposed research to address the following research questions:

– Can social media data be “mined” in Muscat, Oman, to create design-relevant spatial information?
– What information about the use of urban space, in the context of an Arab city, can be extracted from social media data?

After an initial literature review about the growing references dealing with the topic of social media mining to understand urban phenomena and a short overview of the use of social media in Omani society, we will present the methodology used to collect and visualise the data. Finally, a paragraph will contain comments on the results obtained in the visualisation and insights into the use of the space of the city of Muscat.

Social Media

The popularity of social media is a recent phenomenon with a history of less than twenty years and closely connected to technological development. According to Boyd and Ellison¹, social media are “web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system.” The material shared in social media could be public: the user decides to share it with the general public without privacy restriction. In return, the website allows other users to visualise the material and, possibly, collect it. The materials shared become user-generated data or crowd-sourced data, which could be used in social science and other disciplines to ground research.² The visualisation of the data could be used as a

support for decision-making processes regarding the city. The data, even if public, is not readily available to download. Instead, it has to be collected, using software or a script, to crawl the information via an Application Software Interface (ASI). This interface allows communicating with the central database of the social media as well as requesting and obtaining results. Each ASI shows a technical restriction in respect of data acquisition: the interface data to be collected by specifying geometric areas to observe such as rectangular or circular areas. The data should then be streamed and stored as the softwares usually cancel old data, which are replaced with new ones.

Social Media Urban Analysis

The possibility to observe urban phenomena using social media data, is now explored by several scholars who created the theoretical background for a bottom-up user-generated mapping process or extracted valuable patterns and information about the city use through ground breaking visualisation of social media data. As Zook & Graham noticed, traditional methods used to register city users’ activities in the cities and their use – like surveys and ethnographic reports – seem to be inadequate to meet the need of information on contemporary society mainly because they require a considerable amount of time. On the other side, the use of digital technologies such as tablets, mobile phones, smart watches and similar devices together with commercial software are creating a huge amount of data. There are emerging new types of linkages between online activities and offline locations in which Internet users associate meaning to specific sites in the physical world. For instance, people sharing pictures and comments about places create geo-located data; this data can be combined into information and knowledge: it provides an innovative means for studying the spatial settings where virtual interactions happen. Using geo-tagged data collected from the Internet, we demonstrate that the measuring and mapping of online references can provide important new insights into spatiality and how “online representations are simultaneously products and producers of offline social processes”. This data collection and analysis produces a shift in terms of the speed at and the timeframe within which it is collected. Furthermore, it is guided by the notion that otherwise unrelated datasets might be cross-referenced and analysed to produce some meaningful insights.

Mapping projects based on social media data have been performed both by university research groups and independent scholars. In this short bibliography review, we intend to concentrate on the projects focusing on the urban scale, including analysis on the use of the space of the city and perceptions of the people. There is a large set of research with a particular focus on location-based applications, such as check-in data gathered from

2 Zook and Graham, “Mapping DigiPlace: Geocoded Internet Data and the Representation of Place”, 2007.
social media such as Foursquare. These studies aim to depict the “true” dynamic of a city usually by mapping landmarks and hotspots. But they typically ignore the temporal nature of the data. Lupi, G., Patelli, P., Simeone, L. sketched a methodology for interpreting social media data to extract information on where political and public discussions are going on in Italian cities during election time on the basis of real-time text mining and conversational analysis methods.

In previous research, one of the authors created a methodology to consider different city users and understand their movements and use of public space. Researchers try to map cultural boundaries of the different city users and find almost new sets of neighbourhoods based on the cultural affinity of city users using their social media data. Other studies focused on finding patterns of people mobility and visual impressions of cities. Further examples include sentiment analyses to map feelings in the different locations of the city or variations in the daily pattern of the keyword use on Twitter across geographical locations. In this paper, we intend to extract temporal narratives about the use of space from social media data in the Arab and Omani contexts.

Social media in Oman and its relation to the spaces of the city

Social media have found a fertile ground in Arab society. Facebook is generally the most attractive social media channel. In Oman, for example, Facebook is used by 82.73% of the active social media population and Twitter ranks second with 16.3%. In 2014, in Oman, with a population of 3.2 million, there are 860,000 active social media users with a penetration of 27% and 720,000 are mobile social media users. Youth represents the majority of social media users in the Arab world; as of June 2013 the percentage of total users between 16 and 34 years was 77%. Also, in May 2014 the percentage of total Facebook users between 15 and 29 years old amounted to 67%. 88% of the Middle East online population uses social media sites daily. English and Arabic are the most commonly used languages on social media platforms used by 48% and 45% of social media users. The usual age of social media users is a key factor for the social media analysis: the target of our analysis will consist mainly of young inhabitants, usual users of the technology considered.

According to the Arab Social Media Report, social media in the Arab world are perceived as a technology with numerous positive aspects that enhance the quality

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6 for example see Cranshaw et al., “The Livehoods Project: Utilizing Social Media to Understand the Dynamics of a City”, 2012.
10 Hochman and Manovich, “Zooming into an Instagram City: Reading the Local through Social Media”, 2013.
of life of individuals, business profitability and governmental interaction with the public. Users, however, believe that social media have negative effects on the local cultures and traditions.\textsuperscript{15}

In the last years, we observed the potential of social media in the Arab context as a medium available to create public platforms, which are virtually uncontrolled public “spaces” to exchange ideas. Then the episode of Arab Spring protests: a movement of discontent that started in Tunisia followed by Egypt and spread to countries in North Africa, such as Morocco and Algeria and other parts of the Arab World, including Yemen, Bahrain, Syria and Oman. According to several scholars, the Arab Spring was possible only thanks to the spreading of information through social media\textsuperscript{16} by facilitating and mediating the spreading and the organisation of the movement.

To explain these phenomena we can refer to Tierney who identified several spheres of publicness. The public staged in public spaces and the one we can access with social media. According to her, public spaces and communication technologies are now a new contemporary stage of publicness where the actions and encounters fluidly navigate between physical places and social media, we can access through our technologies.\textsuperscript{17}

Social media or, in general, the networked publicness represents now a new platform for society to engage in common activities. This claim has a particular relevance considering the Omani traditional attitude toward public spaces or the public sphere of the city. In the Arab and Omani societies, public spaces have not traditionally represented the spaces of common interest and social interaction that they represented for Western society: different socio-cultural and political situation relegated to private spheres, the usual space of interaction and discussion. In this traditional context, social media appear like an alternative platform where to socialise and also where to engage in a discussion: an alternative where there is (apparently) more freedom, more security and users can filter their engagement. For example, it has been observed that some Arab women like to use social media to socialise as they can decide between different levels of publicness: they only contact other women to see pictures and a wider audience for feeds and texts.\textsuperscript{18}

Although studying social media as an alternative platform for public life is an interesting topic, the current paper does not have the purpose to prove or further develop this statement. The current discussion is useful to understand the importance of social media in the Omani society.

\textsuperscript{15} TNS, “Arab Social Media Report”, 2015. 
\textsuperscript{17} Tierney, The Public Space of Social Media: Connected Cultures of the Network Society, 2013. 
\textsuperscript{18} Abokhodair and Vieweg, “Privacy & Social Media in the Context of the Arab Gulf”, 2016.
Public spaces in Oman – understanding public spaces as leisure

The definition for public space in Oman needs further elucidations, as it should be discussed against the backdrop of the specific cultural context and tradition. For example, the public spaces in Oman cannot be defined as spaces for community enactment or active citizenship, which is usually reflected in other homes or private settlements. According to Richthofen “Yet, the country offers a model of enlightened rulership that is open for a cultural debate. On the tribal level Arab culture knows forms of discussion and exchange that are indeed similar to political processes in direct democracies. The discussion amongst the tribal leader inside a semi-public room in a private house – the majlis – inform delegates of the Sultan about current opinions.” Similarly, it cannot be defined by terms of ownership (public, private) or access: many people experience privately owned spaces as public ones. In these terms a shopping mall, quasi-private, constructed and controlled by enterprises, where young Omani like to spend time, converse with friends or family and take casual walks should be considered a public setting, as well as more traditional ones. The accessibility of the above-mentioned spaces could be partially controlled or limited by economic status, religion, social inequalities (gender, race). But as Mitchell points out public space is “subject to usage by an appropriate public that is allowed in”. We consider a definition of public space, which carries along social inequalities present in contemporary societies, with explicit or implicit, community imposed rules to regulate the access and activities allowed in the spaces. Public space in Oman, for the purpose of this research, is opposed to the private space of the house and considered as a space of leisure, in particular of community experience of leisure, shared leisure in public, which could be enacted together with consumption, praying, community building. Those spaces as previously explained could be outdoor or indoor, public or private, accessible only by car or to certain religion groups, subjected to gender or race discriminations, places of multiple activities. Opponents could reject those spaces as genuine public sites, yet Smith and Low argued “truly public space is the exception not the rule”.

Case study: Muscat

Muscat is the capital of Oman. In this paragraph, we intend to sketch quickly the socio-geographical features and some extra information to illustrate the specific conditions of the case study and to illustrate factors that will influence some choices in the methodology and in the interpretation of the data. First of all, Muscat is a territory poor of data. Census

data is aggregated to a low resolution and urban spatial data is often not available at large scale or is outdated or biased. Although the government together with international and national institutions have made some efforts to create an available data source, the situation is still underdeveloped. The GeoPlatform, which is an online resource to query and visualise geo-data. The platform, still to be further implemented, “is a first launch that will allow for a limited number of geospatial data accesses and services with few metadata”. Spatial data of Oman is not fully available and transparent. In any case, any mapping is definitely an additional resource to the planning capabilities of Oman and the municipality of Muscat. This paper, proposing to make some socio-geographical information derived from social media data public and accessible, acquires, under those circumstances, an extra value. The metropolitan territory of Muscat Capital Area spans approximately 3,500 km² and includes six provinces called wilayat. Muscat is located at the Eastern tip of the Arabic peninsula between the Hajar Mountains and the Indian Ocean. “The capital Muscat has remained the political and economic hub of the country during this on-going period of growth that began in the 1990s. Two-thirds of Oman’s population now either live in Muscat’s catchment area or in the narrow al Batinah coastal plain that stretches along the Indian Ocean.” “From an urban planning perspective, the development that has occurred in Oman thus far is functional and automobile-friendly.”

Residential areas are separated from production areas but shopping malls and mosques are spread all over the built environment. Since every young Omani, when turning 21, is given a piece of property where he has the full potential to build a house Muscat sprawling rapidly. Thus, the typology spread in contemporary Omani landscape is the landed Omani villa that young locals build on the assigned properties. On the other hand, foreign inhabitants who represent in any case a significant percentage of the population are generally renting or buying in restricted or “controlled areas”, as the majority of the land is currently being assigned to Omani families and it is undergoing a process of privatisation. Oman economy heavily relies on immigrants: almost half of the population comes from different countries. The relevant number of immigrants, combined with their reduced accessibility to the land market, creates segregation processes in Muscat: neighbourhoods are almost totally inhabited by locals and, on the other side, areas are totally devoted to rent or foreign investments. The government is in constant search for uncharted territories to assign it to the local population and thereby gradually urbanises new areas. The whole process follows certain phases: road and infrastructure construction, some limited public facilities (mainly a mosque and a shopping area within reach), and then the division and assignment of the plots. Some areas are currently undergoing this transformation: in Oman it is easy to see large portions of territory being urbanised and, for the purpose of this paper, it is possible to select and observe areas, which are at different stages of this process to note their differences but also to understand their evolution in time. The mapping done

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26 Oman National Spatial Data Infrastructure (ONSDI) 2017
within a study of the ETH Studio Basel about Muscat called “Muscat’s many cities” traced the urban use of different ethnic groups: Omanis, West Expats, Indians, Pakistani and Bangladeshi. Although the study is quite extensive and complete, it is not clear how they collected and classified the data to produce the map. Before that, Fred Scholz produced another interesting map: in the city of Muscat, he located low-income and high-income population groups, evolving in time, showing developed and under-development areas. The map introduces a dynamic dimension to the representation, but again the source of the data is not totally clear. Probably it is based on surveys, questionnaires, and interviews.

Methodology and layers of the analysis

The social media data are collected through open APIs of Instagram and Twitter. Instagram is a mobile application that enables online photo sharing, together with text annotations and comments. Users take a picture, apply a digital filter and share it, usually with the location of where the sharing occurred unless this function is specifically disabled. Therefore, a majority of these feeds are geo-tagged. Twitter is a micro-messaging application, enabling the user to share short messages with followers. Twitter feeds are not automatically geo-tagged; therefore the majority of feeds do not contain a location. We only considered feeds that have a geo-location. Using Instagram’s and Twitter’s official API we crawled Instagram photos and Twitter feeds and their metadata (user ID, longitude, latitude, comments, number of ‘likes’, date and timestamp and user–assigned tags). Even if the most used social media in Oman are WhatsApp and Facebook, Twitter and Instagram are quite widespread, being used by more than 40% of the active social media population and moreover they have some features that allow a location-based analysis, embedding the data with geographic information. In both Instagram and Twitter, location is not the main purpose of the social interaction provided by the software, the information about the places is implicit: the user’s location is somehow a side effect and the users can choose to embed the feed with latitude and longitude information. Under those circumstances, we can consider these kinds of digital footprints as spontaneous patterns registering of the truly most attended places by social media users: these are the actual venues where people spend their urban lives. We created dynamic maps: the data aggregate at the scale of buildings and open spaces, neighbourhoods and territorial scale, giving us the possibility to understand patterns of activities in the different neighbourhoods. When analysing how the feeds aggregate in the city of Muscat we should always consider that the precision of the GPS embedded in our mobile phone has a threshold of 30 m. Thus, we tend to consider buildings with a buffer of 30 m to define their area of interest. For the purpose of this study, the data has been collected for one month (March 2016). We intend, in the future, to expand the research by adding real-time data. We decided to create different layers or

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29 German University of Technology in Oman and Eidgenössische Technische Hochschule Zürich, Studio Basel, “Muscat and Oman - Engineered Land, a Territorial Research”, 2015.
maps to compare and understand the activity patterns in Muscat regarding specific social groups or time stamps.

Total. In first place, we observe the total number of contributions on a specific area, defining hotspots (locations where a significant number of feeds is concentrated) or, on the contrary, areas with lower contributions.

Day-Night. The day-night analysis is designed in order to understand the use of the spaces of the city, considering its dynamic nature. The day contributions include only the feeds from Instagram and Twitter published from 7 am to 7 pm, while the night contributions include the feeds published during the rest of the day. The nocturnal and diurnal patterns reveal different usages of urban space. The possibility to aggregate the data to the level of the buildings lets us better understand the use of the spaces in the city of Muscat and the activities they host. When aggregating the day-night data at the scale of the buildings we can identify hotspots of activities: shopping, working during the day, leisure and free time at night. As previously explained, the Omani society does not have a long tradition in spending free time in public spaces, preferring activities in private buildings, thus, those indicators appear to be quite revealing, showing possible new trends in the use of the space.

Weekdays-Weekend. The second comparison map reveals the dynamics of change in the spaces of the city: we compare how the contributions differ on weekdays and weekends (Friday and Saturday in Omani society). Currently, the visualisation represents the whole amount of data, thus the weekdays contribution is $\frac{5}{2}$ of the weekends. Patterns during the working day follow the full range of activities: work, leisure and commerce, while the weekend hotspots represent the religious and leisure landscape of Omani society.

Arab-English. The third comparison map directly tries to represent the actual social composition of Omani society. As it has been previously explained almost half of the population of Oman consists of expats.\[32\] The official language is Arabic, the usual language the Omanis tend to use to communicate. Mapping the locations of the city where people tend to comment and tweet in Arabic means mapping the areas of the city where the Arabic population concentrates. On the other side, the English-speaking population includes a percentage of expats, but also tourists, who visit the beautiful capital of Oman. Different social group landscapes emerge, defining cultural borders in the city.

With the comparison of the four layers, we intend to fulfil multiple goals: from the day-night and weekdays-weekend comparison, together with the analysis of the total feeds we can easily map the contemporary spaces of leisure of Omani society. With the combination of the layers, we can understand the social composition of different neighbourhoods and also define how attractions are spread in the urban fabric. We can measure the potential attendance of planned facilities (for example planned parks) and record the success of unsuspected ones (for example hotels). While the collection and visualisation of the data is a quantitative operation, the proposed interpretation is based on the sensibility of the

authors, balancing in each case the results in a valuable urban narrative. The proposed analysis is not the only one possible for the specific urban context, but it is the one that according to the authors is quite wide and gives new and valuable insights.

Visualisation and analysis of the focus areas

The data collected has been visualised in a GIS platform, creating an online map. The final representation has been done in Carto DB, an open software for the representation of geographical data where it is possible to perform some analysis through the Structure Query Language (SQL). In that sense, the online map and the data can be browsed and accessed via the links below. It is possible, at any time, to visualise the data considering any locations within the city of Muscat. For the purpose of this paper, we have selected certain locations to focus on and interpret the results; the selection of the locations is part of the methodology: the case study of Muscat defines a specific context of urbanization, in which it is particularly interesting to look at certain areas and aspects.

The mapping happened at three main scales:
- The first scale is an overview of the municipal area of Muscat: at this scale, it is possible to observe where the data aggregate and to spot differences among the neighbourhoods of the city (Fig.1, Fig. 2, Fig. 3).
- The second scale is the scale of the neighbourhoods: we selected some neighbourhoods to be discussed in this paper; the selection includes those areas, which, for social compositions or historical development, have a specific status to observe.
- The third scale is the scale of the buildings: again, the data is aggregated and observed generally in all the buildings of Muscat, but for the purpose of this paper we comment and observe some buildings, in particular relevant to understand the evolution of public life in Muscat.

33https://cartodb.com/
34https://ludovica.cartodb.com/viz/3c23076a-1d75-11e6-a4f8-0e31c9be1b51/public_mapand https://ludovica.cartodb.com/viz/da30fd50-2eb8-11e6-95c6-0e31c9be1b51/public_map
Figure 1: Day-night Comparison, overview of the Municipal Area of Muscat Oman
Figure 2: Weekdays-Weekends Comparison, overview of the Municipal Area of Muscat, Oman
With regard to the largest scale, for example, we can observe how generally the English-speaking population concentrates more on the East side of Muscat (Qurum, Mutrah, Madinat al Sultan Qabous), while some Arabic hotspots are still present on the West side. The majority of daily activities are in al Kuwair and Ruwi; we can also notice the portions of the Muscat beach accessible by the public and how they have quite high contributions during the night and the weekends.
Considering the scale of the neighbourhoods we selected

- The area of Mutrah-Muscat (Fig. 4, Fig. 5, Fig. 6)

Figure 4: Day-Night Comparison, Mutrah- Muscat, Muscat, Oman.

Figure 5: Weekdays-Weekends Comparison, Mutrah- Muscat, Muscat, Oman.
Mutrah is on the East side of Muscat. It faces the harbour and its main resource is commerce and tourism: it is the location of the old bazaar, now particularly attractive for tourists, some traditional forts and it conserves the old Omani urban design pattern with narrow streets and medium height buildings.\textsuperscript{35} The urban pattern of Mutrah follows traditional rules to defend the inhabitants against the heat. The proximity to the harbour and the traditional bazaar made Mutrah one of the main touristic amenities of Muscat. Along the harbour a panoramic walk, called cornice, is one of the few pedestrian amenities in the city of Muscat, accompanying the visitors with art installations and shadow facilities. The centre of Muscat with the Palace of the Sultan is a similar touristic attraction. The political and administrative centre has recently been rebuilt: it does not have a historical value. Public administration and cultural buildings occupy the whole area, with almost no residential and commercial units. When looking into the Arab-English map (Fig. 6) we can observe that the market in Mutrah has the same attractive power to Arabic and English speaking users: trying to interpret the results we can imagine that the English speakers are tourists while the Arabic ones might be both tourists and locals. The bazaar, thus, could still work as meeting points also for young locals. The Old Watch Tower, a sightseeing point facing the bazaar, has only English contributions: it responds to its call as a touristic hotspot with no other interesting activity going on for the local community. The Old Watch Tower is the end of a pedestrian walk, the Corniche, imagined as a panoramic walk and also a possible amenity for local people: generally, the cornice and the tower do not get a high number of

\textsuperscript{35} Richthofen, “Space and Politics of Urbanization in Muscat Capital Area”, 2011.
contributions, showing some limitations in their planning strategy. Regarding the area of Muscat, the administrative centre, there are some surprises. The palace confirms its mainly representative function, being also a touristic attraction: more English contributions rather than Arabic and more contributions during the day rather than the night (Fig. 4). Generally, the area shows reduced nightly contributions following its vocation as an area for offices and governmental institutions with almost no residential units. The only contributions recorded during the night come from a Best Western hotel located there. The hotels have a specific role in an Arabic context: they usually have the licence to sell alcoholic drinks and therefore also become spaces of leisure mainly for foreign expats living in Muscat. This activity is confirmed in the pattern of the data: higher near the hotel at night and during the weekend with mainly English-speaking contributions.

- Madinat As Sultan Qaboos (Fig. 7, Fig. 8, Fig. 9)
Mapping Human Landscapes in Muscat, Oman, with Social Media Data

Figure 8: Weekdays-Weekends Comparison, Madinat as sultan qaboos, Muscat, Oman.

Figure 9: English-Arabic speakers Comparison, Madinat as sultan qaboos, Muscat, Oman.
The area is located in the central Eastern part of Muscat near Al-Khuwair, Shatti Al-Qurm and Qurum. It is situated less than one kilometre from the sea and is well connected to the rest of the city by the arterial highway, Sultan Qaboos Street. Until the 1990s, Madinat Qaboos was the most expensive residential area in Muscat. It is also a popular choice of residence for expatriate workers in Muscat, particularly Westerners. The area hosts an important shopping centre, also with outside restaurants and facilities and it includes some schools and educational facilities. The expensive rents and the Western-inspired typologies of housing, including landed, detached, semi-detached houses, made of Madinat As Sultan Qaboos an area traditionally inhabited by higher class expats.

Looking into the social media analysis, as expected, there are more English speaker contributions rather than Arabic speaking ones in the district with 183 against 95 contributions (Table 1). The area south of Sultan Qaboos Street has more English than Arabic contributions, that have a hotspot in the central commercial area, while the area south of Madinat As Sultan Qaboos street, does not have a significant number of contributions distributed in the residential environment, except for the two shopping facilities (the SPAR and the centre point) that probably have a wider catchment area for clients. The weekend as well as the night contributions are mainly focused in the shopping mall area. This shows a trend in the expat population shopping activities: at night and on the weekend. This is an interesting hint at the composition of the expat population we could further analyse with socio-demographic data: they belong to the working class and are most of the time not accompanied by the family, thus they can only go shopping after working hours.

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Day</th>
<th>Night</th>
<th>Weekdays/daily</th>
<th>Weekends/daily</th>
<th>English</th>
<th>Arabic</th>
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<tr>
<td>Mutrah- Muscat al Amarat</td>
<td>552</td>
<td>294</td>
<td>258</td>
<td>81</td>
<td>74</td>
<td>193</td>
<td>145</td>
</tr>
<tr>
<td>Madinat As Sultan Qaboos the Wave</td>
<td>470</td>
<td>281</td>
<td>189</td>
<td>66</td>
<td>70</td>
<td>183</td>
<td>95</td>
</tr>
<tr>
<td>Ruwi</td>
<td>2422</td>
<td>1347</td>
<td>1075</td>
<td>346</td>
<td>347</td>
<td>894</td>
<td>1037</td>
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<td>77</td>
<td>42</td>
<td>27</td>
<td>15</td>
<td>61</td>
<td>23</td>
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<td>110</td>
<td>18</td>
<td>39</td>
<td>54</td>
<td>72</td>
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<td>277</td>
<td>66</td>
<td>94</td>
<td>158</td>
<td>192</td>
</tr>
</tbody>
</table>

Table 1: Comparison of social media contributions among the focus areas and the selected buildings.
- Ruwi (Fig. 10, Fig. 11, Fig. 12)

Figure 10: Day-Night Comparison, Ruwi, Muscat, Oman.

Figure 11: Weekdays-Weekends Comparison, Ruwi, Muscat, Oman.
Ruwi is a commercial hub and the main business district of Muscat, located further south than Mutrah. Ruwi High Street is the main commercial street in Oman and has a number of jewellery shops, electrical shops, gift shops etc. Ruwi is also quite a populated area of the Omani capital, the main inhabitants of which are local Omani. In the 1970s, the initial traditional architecture has been replaced by commercial complexes and residential units. Looking at the social media data, in first place, we observe the highest number of contributions among the selected focus areas (Table 1). There is a hotspot in the northern part: it aggregates a significant amount of feeds and it could be due to the presence of some Ministries.; The number of Arabic contributions is greater than of the English ones, confirming the presence of a facility, particularly significant for the local population. This hotspot, curiously enough, has an almost constant number of contributions during the day, the night, the working days and the weekends. This might aggregate the data coming from the ministries, some nearby hotels and embassy recording different activity patterns. The area has more Arabic contributions (1037 Arabic vs. 894 English). Besides the area of the ministries, in the remaining part of the selected focus area, we can observe more activities during the day and the working days rather than the night and weekends, confirming the attraction of the area, with several production and commercial buildings. Even the hotspots where the majority of feeds aggregate are shopping facilities, with significant activities during the day or during lunch, in case there are restaurants.
- Al Amarat (Fig. 13, Fig. 14, Fig. 15)

Figure 13: Day-Night Comparison, Al Amarat, Muscat, Oman.

Figure 14: Weekdays-Weekend Comparison, Al Amarat, Muscat, Oman.
Al Amarat is a Wilayat with its own Wali (lord mayor) office, meaning it is an independent municipality, with government offices. Its almost independent status might depend on its geographic positions being located south of the mountains, the natural border in the south of Muscat. The area is undergoing a transformation, becoming recently one of the most populated areas inside Muscat as lots of new territories have been assigned to young Omani families.

Looking at the social media analysis we can confirm the social composition (mainly Omani families) of the region: the Arabic-English feeds distribution shows 129 Arabic feeds versus 28 English feeds, a clear indicator of the composition of inhabitants we can find in the area. The feeds aggregate in private houses as well as in the usual hotspots: shopping facilities, usually located near the mosque, and gas petrol stations, hinting at the access of these spaces by car.

The area on the West side of Al Amarat Road, including 1903 Road has a distributed pattern of activities during the night.

The Amarat National Park, an amenity facility built on the east side of Al Amarat Road, does not have a too high number of contributions, although it is one of the few open amenities in the area. Another interesting aspect concerning the park is that it is located in a mostly Arabic-speaking area, while its contributions are mainly in English. This might hint at different ethnic usage patterns of public spaces: while tourists or foreign expats living in Muscat might be still attracted by the park, less Arab speakers and presumably Omani nationals use the park. One can also reflect on the reach of the park as attraction with in the larger area. The park probably has a city level catchment area rather than a local one.
Mapping Human Landscapes in Muscat, Oman, with Social Media Data

-The Wave (Fig. 16, Fig. 17, Fig.18)

Figure 16: Day-Night Comparison, the Wave, Muscat, Oman.

Figure 17: Weekdays-weekend Comparison, the Wave, Muscat, Oman.
The Wave, located along 6 km of Muscat beach, is one of the few settlements in Oman, entirely relegated to foreign real estate investments. While the rest of the country is currently privatising land, giving the possibility only to Omani to buy properties, the Wave offers the possibility to buy and rent properties in Oman for foreign people. The price of properties does not follow the current market of the land prize in Oman. When looking at the social media data, quite surprisingly the English-Arabic speaking ratio is almost even. With the majority of the feeds aggregated in the public spaces of the “enclosed city” a sort of promenade with a series of cafés and bars; a unique observation in the mapping exercise of this research. The Wave has a different urban design, resulting in a new behaviour of city users regarding the space of the city: the hotspot, for the first time, is not a building, but rather a street with a series of facilities. The different neighbourhoods analysed offered an overview of the possible patterns observed in Muscat, but also of the potential outcomes of this kind of analysis. Table 1 shows the number of feeds aggregated in each district. The numbers refer to the focus area, considering almost the same scale; it is possible to do some comparisons and considering the ratio between the different layers to further confirm the above observations.
At the scale of buildings, we decided to analyse

- The city centre (Fig. 19, Fig. 20, Fig.21)

Figure 19: Day-Night Comparison, City Centre, Muscat, Oman.
Figure 20: Weekdays-Weekends Comparison, City Centre, Muscat, Oman.
One of the biggest and most famous shopping malls in Muscat located near the airport, where Omani and expats can have leisure, shopping and dining experiences in a temperature-controlled environment.

In terms of feeds, the most interesting aspect to notice is that the city centre has a slightly bigger number of feeds in Arabic. Local people do not only tend to go more often to the city centre but also probably consider the place quite interesting and decide to share their activities there with friends and families via their social media.
- The Sultan Qaboos Grand Mosque (Fig. 22, Fig. 23, Fig. 24)

Figure 22: Day-Night Comparison, Grand Mosque, Muscat, Oman.
Figure 23: Weekdays-Weekends Comparison, Grand Mosque, Muscat, Oman.
Built in 2001, imagined as a symbol of the sultan power, it is now one of Muscat’s major touristic attractions and clearly the most magnificent place of worship of the nation. The feeds regarding the mosque confirm its mostly touristic vocation, showing more English-speaking feeds in the nearby area than Arabic ones. Moreover, the feeds show a clear touristic pattern: more during the day rather than the night and during the working days, considering that on the weekend the mosque is closed for praying.

Figure 24: English - Arabic speakers Comparison, Grand Mosque, Muscat, Oman.
- Shatti beach and “Love Road” (Fig. 25, Fig. 26, Fig.27)

Figure 25: Day-Night Comparison, Shatti Beach, Muscat, Oman.
Figure 26: Weekdays-Weekends Comparison, Shatti Beach, Muscat, Oman.
Located near al Qurum neighbourhood, the Shatti Beach is a favourite beach for locals and expats to spend free time in an outside space. The beach is crowded during the day, being one of the few public beaches of Muscat, but also during the night, with coffee shops and the famous “love road”: a street with a beautiful view over the sea where the local people like to drive and meet each other during the weekend and the warm Omani evenings.

The focus of the analysis, in this case, is exactly the love road and the first part of Shatti beach, and we can observe that it gets more feeds from the Arabic speaking population, showing also new trends of Omani regarding the use of public outdoor space. Considering the ratio 5:2 the contributions during the weekend are more numerous than the ones during the working days, confirming the role of the area as a leisure outdoor space to
spend the free time. The comparison of the contributions among an indoor commercial space, outdoors leisure space, touristic attraction and space of worship show us how the Omani society behaviour and is evolving. (Table 1)

The three selected buildings work at the same scale, thus, it is interesting to make some comparisons: between the three places the one that gathers more social media data feed is Shatti Beach and Love Road, doubling the feeds of the city centre. The beautiful beach and the panoramic road attract much more visitors than the shopping mall. This is quite a relevant data about Omani society and the actual use of public spaces. Moreover, as previously observed, the majority of city users, using Shatti Beach and love road, are actually local ones. The Mosque is the place with the smallest number of contributions and it attracts mainly tourists. Again, in our interpretation we have to remember we mainly target young people, who are using social media. Probably the grand mosque still plays a relevant social meeting function for different age generations that simply do not appear in this mapping. The data is revealing a trend of the younger generation in considering these two locations as spaces of meeting and leisure: outdoor places in the first place, followed by the shopping mall. The analysis shows that at the scale of the neighbourhoods the social media feeds tend to be aggregated in some discrete hotspots rather than distributed in the built environment: the urban design of Muscat is responsible for this pattern, considering that leisure and free time activities are rather concentrated in some areas (shopping malls, mosque) rather than spread, for example along a road. We have already analysed some exception (the Wave) but also Love Road and that surprisingly this latter represents one significant meeting point for the young Omani population. The second observation refers to the usual hotspot spaces connected also to the locations from where the Omani society tends to use social media. As opposed to other contexts, the majority of feeds do not come from residential units but rather from what we called leisure buildings or outside spaces: beaches, shopping malls, shopping areas, souks and markets, hotels and also mosques. The Omani apparently use social media in the places where they socialise, creating a contemporary double layer of social interactions. Finally, we noticed different patterns between the Arab speaking feeds and the English ones, interpreted at times as foreign expats living in Muscat, at times as tourists. Although we observed locations with a similar number of contributions the usual trend is to have a distinct majority of the one or the other language, showing almost two different cities that only at some point collapse.

Conclusions

The current paper presents a mapping process in order to define activity patterns of city users in the city of Muscat, Oman, using social media data. The paper has two aims: to present a methodology to map activity patterns, in the context of Arabic cities, using social media data, but also to start an initial interpretation of the social media data aggregated in
the selected focus of analysis. The initial interpretation has the limit of a reduced amount of data currently collected, thus, we intend in the future to expand the research by adding real-time data, starting from the current results in terms of methodology and initial patterns. The data released by the API of the two software platforms is public, meaning the users decided not to limit the accessibility to the data. There are some ethical concerns about the use of personal data for the purpose of analysis, but the privacy is, in all cases, maintained, considering that the final visualisation shows the data already aggregated, representing each user only with their location. Further studies will include the crossing of the current data sets with other data sources (for example rent, land prices or demographic data) and the creation of a more automatic and quantitative-based system of interpretation of the data.

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Bibliography


Arab Gulf Cities in Transition: Towards New Spatialities


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