

# Enhancing Participatory Development in Morocco: Analyzing the Sketch Mapping Behaviour of Men and Women and Integrating Paper and Digital Participatory Mapping Environments

Cora Stern<sup>a, \*</sup>, Matthew Rice<sup>a</sup>

<sup>a</sup> Department of Geography and Geoinformation Science, George Mason University, Fairfax, VA 22030, USA;  
coraelizabeth.stern@gmail.com, mrice4@gmu.edu

\* Corresponding author

**Abstract:** Twelve participatory paper maps by separate groups of men and women were facilitated by the High Atlas Foundation in six communities in Morocco between 2010-2020 as part of their process of participatory development. In this research, these sketch maps are analyzed for the first time. The twelve participatory paper maps underwent a gender-focused content frequency analysis. Seven communities were located using OpenStreetMap and Google Maps by a High Atlas Foundation expert. It was found that men contributed more overall geographic elements and written Arabic commentary than women, which could indicate a higher level of familiarity with their community and comfortability in communicating their opinions in writing. It was also found that there are many barriers to adding data from the sketch maps to OpenStreetMap due to language, loss of institutional memory, inconsistencies between the sketch maps of the same location, and inconsistencies between the sketch maps and satellite imagery.

**Keywords:** Participatory Mapping, Sustainable Development, Morocco

## 1. Introduction

Morocco is a developing country, ranking 121 out of 189 countries in 2018 according to UNDP. In the last two decades, there has been significant poverty reduction, but the urban-rural gap remains wide. Development in urban areas has outpaced rural areas, though 40% of Moroccans live in rural areas (World Bank, 2018). 75% of impoverished Moroccans live in rural areas, where the poverty rate is close to five times the national rate (Ben-Meir, 2019, p. 195).

The High Atlas Foundation (HAF) has worked in Morocco since 2000 to combat poverty and foster sustainable development. A cornerstone of HAF's philosophy is participatory methods for development. HAF utilizes participatory mapping (PM) exercises as part of this approach by asking participants to draw sketch maps of their communities that identify the most important places in their lives.

After paper mapping, facilitators use the maps as a catalyst to discuss what participants wish to change in their community, their future needs, and community knowledge. HAF uses the process of sketch mapping as a tool in a larger participatory development process but has never analyzed the data on the maps specifically. This research takes 12 of these maps and analyzes them for the first time.

## 1.1 Research Questions and Objectives

This study focuses on Morocco and addresses sketch map creation and analysis. Secondly, it considers paper and digital participatory mapping and the interoperability of participatory methods as it relates to open-source mapping and sustainable development. The sketch maps were done in rural, relatively unmapped communities in Morocco and capture many unique elements in these communities. The detailed data contained in these sketch maps contrast with the lack of information available in digital mapping platforms. Exploring the relationship between local knowledge production and digital mapping platforms addresses research gaps. The following questions were crafted to form the basis for this study: What do participatory paper maps indicate about the geographical knowledge of local communities in Morocco and how can this knowledge be used to enhance participatory development initiatives? Is there a difference in the sketch mapping behavior of men and women in terms of content and positional accuracy and if so, what factors may account for this? And finally, what are the enablers and inhibitions to data integration from paper to digital participatory mapping platforms and what implications does this have for open-source mapping in developing countries?

## 1.2 Significance of the Research

There is significant research about PM in developing countries. There is also significant research about sketch

map accuracy and content, mostly done in developed countries. However, these two bodies are fairly separate. This research seeks to investigate sketch map accuracy and content from maps that were developed not in an academic, research setting, but rather in the field with an operational development organization utilizing PM to work with poor, rural peoples in the developing country of Morocco. The results directly serve the High Atlas Foundation by providing them with further insight into the sketch mapping behavior of the men and women with whom they work.

This research also aims to support the inclusion of non-traditional data sources that better address the needs of a local community, rather than relying on digital mapping and satellite imagery to build a complete map of the world. The research process investigates bridging the gap between paper and digital PM by taking data from the sketch maps and working with HAF to add them to OpenStreetMap (OSM). The result of the research is an improved understanding of geographical knowledge of local communities in Morocco and the benefits and limitations of integrating paper and digital mapping environments.

### 1.3 Research Motivation

The researcher worked with HAF to add the locations of the villages and all identifiable geographic elements from the sketch maps to OSM to support HAF's work and provide the resource to community members. Adding data to OSM improves the open-source community's map of Morocco and benefits all organizations that rely on the OSM base map. The process of adding data to OSM and recording the barriers contributes to the general understanding of data integration between paper and digital platforms as it relates to PM, spatial webs, and geographic data in developing countries, which supports the push to establish a more equitable, open-source map of the world. Finally, a better understanding of the limits of digital PM and OSM assist all in addressing the specific needs of rural, non-western, developing countries.

Ideally, local development organizations should map familiar areas in collaboration with local communities, rather than outsiders attempting to map using satellite imagery. Local development organizations are an indispensable resource of knowledge and should be included in the effort to map the world to make open-source maps more complete. A better understanding of integrating data from sketch maps to digital platforms could address this problem and improve the open-source map of Morocco while also supporting HAF's community development initiatives.

The research motivation for analyzing the content of male and female made sketch maps is to investigate how men and women relate to their community, represent their idea of where they live, and make meaning of their surroundings on a sketch map. If distinct gender trends are discovered, it helps HAF tailor their process to elicit the most useful and complete information from

community members at the onset of their relationship. It can also provide HAF with a deeper perspective about their past and current development initiatives and if these initiatives address the needs of both men and women. Finally, investigating gender distinctions can challenge HAF's procedures of dividing the community into gender groups, rather than other socioeconomic distinctions, and challenge assumptions about the lived experience of different genders in Morocco based on traditional gender roles.

### 1.4 Research Setting

This research focuses on seven villages in Morocco in which paper participatory maps were completed between 2010-2020 by HAF. The villages are Alhadyane, Taghrit, the El Mellah neighborhood in the city of Marrakesh, Lakliaa, Idganoudane, Boughrar, and Ighil. Two maps were done in each community: one each by a group of women and men. 12 maps compose the final set for the content frequency portion of the research. This is both a limitation and a strength. These 12 maps from six villages were chosen specifically by HAF because of their importance to HAF's work. As such, the results from these maps will be immediately applicable to HAF. However, the relatively small data set is a limitation, because unknown variants such as the makeup of the participant groups, time of day, time of year, process of map facilitation, and more are unknown.

### 1.5 Structure of this Paper

The remainder of this paper is structured as follows: Section 2.1 will outline the methods employed in this research. Results are presented in section 2.2. Finally, section 3 reflects on the findings and discusses. Section 3.1 proposes future research. Section 4 provides acknowledgements, and section 5 references.

## 2. Main Body

### 2.1 Research Methodology

HAF uses PM as a visual tool from Participatory Rural Appraisal methods (Thompson, 2010, p. 19). They split the overall community into groups of men and women and provide each with a white, blank, flip chart paper, and several blue, red, black, and green pens (exact number is unknown). Potentially, multiple people work on the map at once in coordination to piece together a sketch map of the community. The facilitators provide a rough guide for mapping: natural features in green and roads and buildings in black and blue. They give them an unlimited amount of time to complete their maps. The last step of the mapping process is the "dream" step, in which participants use a red pen to add items they wish to see in their community in the future (A. El Hajjami, personal communication, March 31, 2021). In this research, these dream items are coded in a separate category to keep the "real" map and the "dream" map separate.

HAF relies on local associations to gather participants for the meeting in which the mapping takes place. Time of

day, day of the week, time of year, number of participants, and makeup of participants is left to the association to organize, meaning there is little control between the maps as one would find in an academic, research study. HAF does not collect any additional information on participants other than gender when they split them into groups to do sketch mapping.

The sketch maps were translated by Kawthar Mansouri and Hassan Mansouri in Google Slides. The translators inserted text boxes with English translations from Moroccan Arabic, Modern Standard Arabic, and French into English. The researcher then worked with Amina El Hajjami, Director of Projects at HAF, to identify village locations using Google Maps. Amina shared her screen over Zoom to show the strategy of finding each community as the researcher took notes. The researcher then attempted to match patterns of identifiable features from the sketch maps to OSM and Google Maps data. She focused on the topology of mapped elements and the relative positioning of adjacent or neighbouring features. She also looked at the shadows of minarets to identify mosques and any formal names written on the sketch maps.

The researcher investigated trends in orientation in the style of drawing map elements. She also investigated indications of scale, specifically the relative sizes and distortions of size between map elements and distortions of elements drawn in the center of the maps versus the edges. Finally, she analyzed the use of symbols and colors to represent map elements.

Finally, the researcher did a content frequency analysis using the program Dedoose. She employed the descriptive codes of natural landmarks, manmade landmarks, dream elements, road segments, agricultural parcels, written labels, Arabic commentary, and map legends. Developing these codes was an iterative process developed over time through the analysis of map symbols, conversations with HAF about their observations of mapping behavior of men and women, the inclusion of dream elements in red, and receiving the sketch map translations. The goal of this analysis was to establish gender trends in a theoretical frequency count framework based on the availability of data.

## 2.2 Results

### 2.2.1 Spelling Variations

Many different spelling variations exist for village names. These variations derived from the sketch maps, translations, from HAF's documentation, Google Maps, and OSM. The variations made it challenging to identify village locations. For example, the village of Boudghrar, in the commune Ait Oussif in the Tinghir province of Morocco, had other spelling variations of بوتغرار, Boutaghrar, Boudeghrar, Bouteghrar, and Bou Tharar.

### 2.2.2 Location Identification

To locate the village of Boughrar, Amina remembered she stayed at a hotel in Boughrar and identified [Hotel Boutaghrar valley of roses - Kelaat Mgouna – Morocco](#)

in Google Maps. The town name in Google Maps is spelled Bou Tharar. For El Mellah, Amina found the neighbourhood in the city of Marrakesh relatively quickly based on her knowledge. In Google Maps, the city is named [Mellah الملاح](#).

For Lakliaa, Amina searched Google Maps but found an incorrect village with the same name. She knew the village was located outside the city of Agadir, so she scrolled south along R105 from the city until she found Lakliaa, spelled [Lqliâa](#) in Google Maps. Lakliaa is a relatively large city, and it is evident the sketch maps were done in a specific neighborhood. The researcher, Dr. Rice, and Amina were unable to identify the correct neighborhood within Lakliaa. On the sketch maps for Idganoudane, the commune of Toubkal and province of Taroudant is written. Amina searched near Toubkal Mountain on the edge of the Taroudant province. Although spelled Idganoudane, Idougnane, and Idganoudine in the sketch maps, the village is spelled [Iguanoudine](#) and أيكانودين in Google Maps. Amina found this village by searching within the general region until she saw the village name.

To find Ighil, Amina found a nearby commune based on her knowledge of traveling to the village. She searched along the river from there until she found Ighil. In Google Maps, the village is named [Centre Commune Ighil Morocco](#) and مركز جماعة إغيل. Simply searching Ighil in Google maps reveals at least five different possible locations. On the women's sketch map, a nearby village of *Boulaabaq* is written, and on Google Maps, there is a nearby location of [Boulahebak](#), which supports that Amina identified the correct Ighil. To find Taghrit, Amina knew that Taghrit is in the [Al Haouz Province](#). She looked to the western edge based on her memory of traveling there but could not find the village location.

In the men's sketch map of Alhadyane, the communes of *Sidi Mansour*, *Sidi Ghanem*, *Sidi Abdellah*, *Rahamna*, and *Sokhour* are written on the peripheries of the map. Also, there is a prominent road crossing: a highway connecting Casablanca and Marrakesh intersects with a road connecting *Soukhour Rehamna* and *Sidi Ghanem*. Amina stated she had never herself been to Alhadyane. She looked at the highway connecting *Casablanca* and *Marrakesh* and found other communes mentioned on the map to get to the correct section of highway. She focused on road junctions in Google Maps, and found the general region, but was not positive about the location of Alhadyane village. She decided upon a village named [Oulad Bou Henda](#) as being a village likely in the general area of Alhadyane.

There were many challenges in identifying village locations. The process would not have been possible without Amina, a local expert who speaks the native language and has been to many of the communities. She used different strategies, including multiple languages, spelling variations, and her knowledge of HAF's activities in Morocco. To do a similar process, an outside researcher should rely on local experts to provide the necessary expertise for location identification.

### 2.2.3 Topology of Mapped Features

To analyze relative positioning, the researcher looked at the general arrangement and patterns of mapped features that were nearby, connected, or adjacent. The researcher took the identifiable features within the sketch maps and attempted to find them in Google Maps and OSM.

In the women's map of Lakliaa, there is a cemetery and mosque with a road nearby, as seen in Figure 1:



Figure 1. Lakliaa Women: Cemetery, road, and mosque.

Dr. Rice and the researcher tried to find these elements in a similar geometric pattern in Google Maps. They found four possible occurrences of a cemetery, road, and mosque in Lakliaa, but were unable to narrow down the overall city into the correct neighborhood.

For El Mellah, the men's map identified a formal name of "Bab El Mellah" for a ceremonial door. However, this formal name did not appear in OSM or Google Maps data. There were 10 instances of "bab," meaning "door", in Google Maps, none of which are "Bab El Mellah." The researcher assumes this name is an informal name used in the community.

For Ighil, the researcher identified and labeled in OSM the likely location of a mosque due to the shadow of the minaret, as seen in Figure 2:

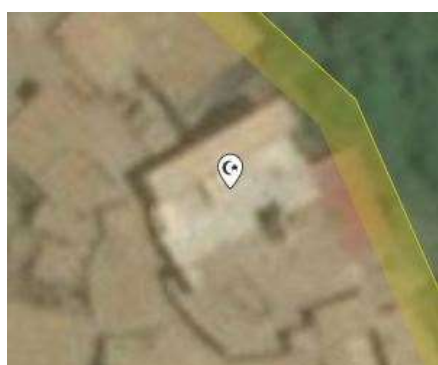


Figure 2. Ighil Mosque (Bing Aerial Imagery)

In the women's sketch map of Ighil, *Boulaabaq* village is drawn down the main road from Ighil, between the road and the river; this also appears in Google Maps with the village spelling *Boulahebak*. The researcher added the village of *Boulaabaq* to OSM using the sketch map spelling variation. The two villages allowed the

researcher to reorient the sketch maps to generally match the satellite imagery, as seen in Figure 3:



Figure 3. Women's map Ighil, reoriented.

In the women's sketch map, the villages of Izrane and Azerdine are labeled on the peripheries of the map across the river and nearby a zigzag road, as seen in Figure 4:



Figure 4. Ighil women, Izrane and Azerdine.

The researcher identified a zigzag road segment in Google Maps also across the river, as seen in Figure 5:



Figure 5. Ighil zigzag road segment, Google Maps.



The researcher added Azerdine and Izrane as village point features in OSM based on the locations from the sketch map.

#### 2.2.4 Element Orientation- Overhead vs. Oblique

The researcher analyzed the orientation of sketch map elements for whether elements were drawn with an oblique or overhead view. Mosques appear with an oblique view with a minaret, except in two cases: the women's map of Ighil and a dream element in the men's map of El Mellah. Mountains and trees are always mapped using an oblique view. Roads, cemeteries, wells, soccer fields, and rivers are mapped with an overhead view. Houses and schools appear to be mapped both overhead and obliquely, sometimes within the same sketch map.

#### 2.2.5 Map Element Scale and Distortion

There are various indications of scale in the sketch maps. The relative size of map elements is distorted. In many cases, map scale is also distorted from the center of the maps to the peripherals. Manmade elements, like schools, houses, and mosques, appear generally smaller relative to certain natural features. Natural features, such as trees, are significantly larger than houses in many cases, as is the case in the sketch map from Alhadyane women, as seen in Figure 6:

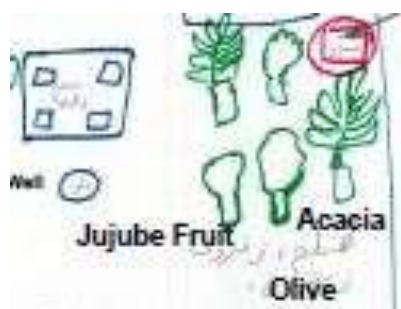


Figure 6. Relative sizing of trees and houses, Alhadyane women.

In Figure 6, the rectangle on the top left contains four smaller rectangles, each of which represents one house.

Mountains, if included, are on the peripheries of the sketch maps, and are drawn smaller than would be possible, as seen in the men's map of Ighil in Figure 7:



Figure 7. Relative sizing house and mountain, Ighil men.

In many of the maps, nearby villages, communes, and mountains are drawn on the peripheries. The villages are

not placed in terms of metric distance but are included to provide meaning by placing the village's location relative to nearby villages important to the sketch mappers. In Figure 8, the nearby village of *Ben Mbarek* is noted in the men's map of Lakliaa:

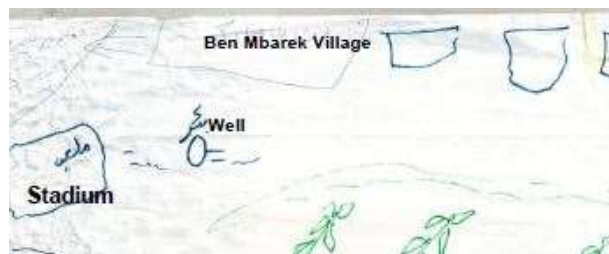


Figure 8. Border village, Lakliaa men.

In the same map document, scale changes in various parts of the paper, presumably to allow the sketch mapper to add more meaning to their representation of their space. This indicates that the sketch map contents, including the relative direction of nearby landmarks, is more important to the mappers than scale and positional accuracy.

#### 2.2.6 Symbols

There are trends in the ways participants mapped certain elements in terms of the symbols and colors used. Mosques had a very consistent symbolic representation, with an evident minaret shown with an oblique view. Houses were drawn with squares and rectangles. In most cases, to show an oblique view of houses, windows and a door were drawn on the shape. Interestingly, in the women's map of Lakliaa, the houses were represented with pointed roofs and a square base. This style of house is very uncommon in Morocco, where houses usually have flat roofs. The mappers could have copied symbols of houses as they are shown in western maps. Wells were drawn with a blue circle in most cases. Rivers were always drawn with two parallel lines. In all cases except one, rivers were drawn in blue. Roads were commonly represented with two parallel lines in blue or black ink. Mountains were symbolized obliquely with a triangular shape, showing a broader base and a peak at the top in all colors: blue, green, black, and red. The colors mappers used were generally determined by HAF, who gave broad guidelines to participants to map natural features in green, infrastructure in blue and black, and dream elements in red ink.

#### 2.2.7 Formal Map Elements

Formal map elements were included in a few instances in the sketch maps. Four maps (Idganoudane and Alhadyane men and women) include a map legend, an example of which is seen in Figure 9:



Figure 9. Map legend, Alhadyane women.

Including formal map elements, such as legends, implies mappers are familiar with formal cartographic map products. It is unclear what previous cartographic products the mappers have been exposed to and is an area for potential future research. The map from Taghrit men also included distance, areal, and depth measurements. This could indicate that Taghrit men had done or participated in measuring these distances or depths previously, perhaps with HAF or on their own for unknown purposes. The men's desired development project could relate to these measurements, prompting them to include them in the sketch maps for the subsequent process of resource identification.

### 2.2.8 Qualitative Content Frequency Analysis

Content frequency analysis on 12 sketch maps was done to analyze trends in the mapping behavior of men and women. The results of the code count by gender are presented in Figure 10:

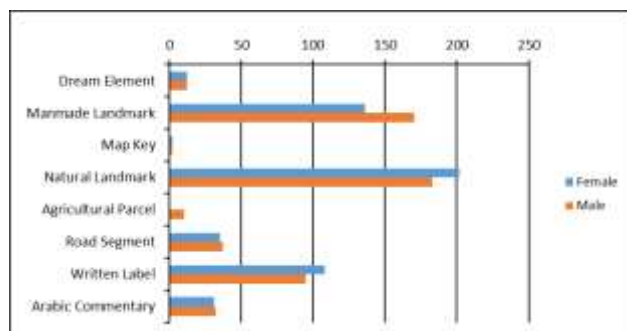


Figure 10. Code count x gender.

Overall, men and women added relatively similar amounts of data to the sketch maps, with men adding slightly more elements than women. Natural landmarks saw the most data added, followed by manmade landmarks. The researcher hypothesized men would add more natural landmarks than women, which was not supported by the data. Additional research is needed to discover the patterns of behavior of men and women engaging in agriculture in these villages. The researcher also hypothesized that women would add more manmade

landmarks than men, which was not supported by the data. Women added more written labels to the sketch maps than men. Men added slightly more Arabic commentary to the sketch maps than women, which could indicate a higher level of comfortability sharing suggestions and opinions in writing.

Combining the written labels with Arabic commentary provides the overall amount of writing on the sketch maps. The researcher hypothesized that women would write less than men on the maps due to women's higher rates of illiteracy and lower schooling. However, the data does not support the hypothesis, as seen in Figure 11:

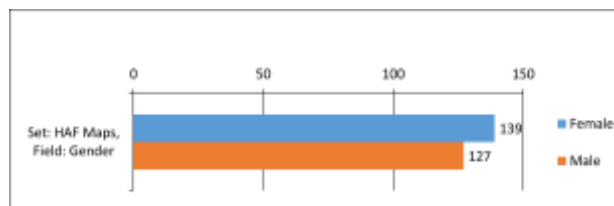


Figure 11. Total writing on sketch maps.

Women might have been able to overcome literacy problems by channelling their opinions and ideas through one literate woman who held the pen. Future research into the literacy and educational levels of participants is needed to better understand these results. The content frequency results reveal the importance of challenging assumptions about a place, as the results conflicted with beliefs based on assumed gender roles.

Finally, dream elements were drawn by participants in seven of the maps, and results are presented in Figure 12:

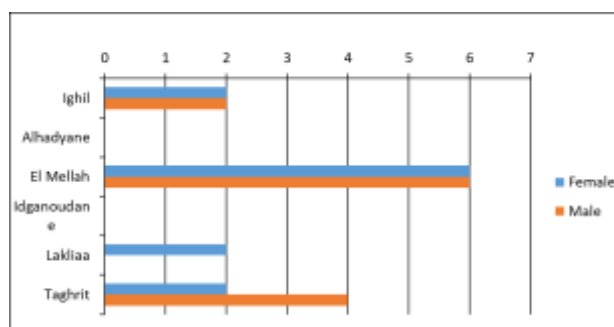


Figure 12. Dream elements.

Men and women provided the same amount of dream elements overall. The groups from Idganoudane and Alhadyane did not include dream elements, possibly because the HAF facilitator did not include the step with these groups. El Mellah provided the most dream elements, which could be explained by a higher feeling of relative deprivation. Because El Mellah is in the large, prosperous city of Marrakesh, participants could feel that they are generally more "worse off" than those around them. There is more opportunity for comparison, higher access to the internet, and more evident income inequality from wealthier city dwellers and visiting tourists. This could be something rural participants do not experience.

### 3. Conclusions

Paper participatory maps contain useful geographical knowledge of communities that is used as a basis for HAF's conversation about community needs, resources, and priorities. The maps are qualitative vessels of information for how participants think about their community and relate to it. This is especially true of dream elements, written labels, and Arabic commentary.

Most dream elements were physical elements that participants wanted built or improved, such as hospitals, schools, doctors' offices, police stations, widows' support centers, bridges, and road improvements. In the El Mellah men's map, participants noted societal commentary such as needing more job opportunities, the problem of unemployment, the lack of medication and doctors, needing doctors and medication, the problem of selling drugs in the neighborhood, needing increased security, the problem of not getting aid for widows, divorced women, and poor families, and the need to repair unstructured houses. This is important information based on geographical knowledge of the community that is unique to a process like paper participatory mapping. These opinions, dream elements, community problems, and improvement ideas would not have been included if HAF had only done community mapping with OSM. Sketch maps indicate important geographical knowledge, but the problems of positional accuracy and location identification are an obstacle to integrating the data into OSM. There are evident barriers in using sketch maps to enhance the digital mapping aspect of participatory development.

There are many inhibitions to data integration from paper to digital PM platforms and this has implications for open-source mapping in developing countries. There were many different spelling variations of village names, from the Arabic and English on the sketch maps, the translations, HAF, OSM, and Google Maps. This is partially caused by the distributed name sharing community, with the researcher in Virginia, HAF in Marrakesh and the U.S., sketch mapping contributors in the Moroccan communities, OSM data contributed from all over the world, and Google Maps data from various governments and the business community. Contributors also speak a variety of languages, including English, Moroccan Arabic, French, Tamazight, Tashlehit, and more from various OSM contributors. The researcher relied on the expertise of Amina to identify communities. However, if HAF facilitators had recorded a single set of GPS coordinates at the time of mapping or had taken a picture on their phone with location services enabled, the location identification process would have been simple and authoritative.

Considering the problems associated with location identification, there is an evident need for an official gazetteer for Morocco. However, there is also a potential danger in imposing an official gazetteer and place naming process in a country such as Morocco. It would benefit academics, government officials, development organizations, and the business community. But it could

hurt local Moroccans if the process erases their language and meanings of place by elevating one language over others. This would be a form of colonialism resulting in a loss of meaning and dignity. Gazetteers and data structures in developing countries that have unwritten languages should include flexibility to integrate local meaning, perhaps by including multiple languages, including audio capabilities, and in coordination with locals to capture internal naming variants.

It is striking that OSM contains the Tifinagh alphabet, which is specific to North African indigenous languages. Google Maps also has a high level of sophistication at accepting search terms in both Modern Standard Arabic and Moroccan Arabic. For example, they include a letter of the alphabet specific to Moroccan Arabic that is not found in other Arabic dialects. Western-made tools are adapting to include many languages and possible spellings, which increases place name support that both people inside and outside the region can use. If place naming conventions are standardized by the Moroccan government, there would be better interoperability between OSM and Google Maps.

A strong digital base map is important for NGOs, tourism, business, natural hazard response, and governing. Integrating paper and digital mapping platforms is a way to include locals in anything that relies on digital geospatial infrastructure technology. However, few elements were able to be identified from the sketch maps in OSM satellite imagery and Google Maps. The reality of working with the sketch maps revealed there was not an adequate amount of data that could be identified in satellite imagery to do a high-level positional accuracy analysis or add many map features to OSM. This difficulty arose from uncertainty from difference of map feature positioning between the male and female maps of the same location. There were also issues of tree cover in the satellite imagery, and issues identifying specific community locations within a broader geographic area.

There were also issues of scale in the sketch maps. In all maps, peripheral villages and mountains were drawn at a larger scale than the scale at the center of the sketch maps. This provides meaning by placing the village location relative to nearby village locations, which gives a more regional view of the area, and made it possible to identify peripheral village locations in OSM. Map scale and dimension are important aspects of humanitarian work, and especially natural hazard response. Morocco is at a high risk for earthquakes, tsunamis, droughts, and floods. In a natural hazard scenario, responders could not use the sketch maps to provide accurate directions, for example, from Ighil to Izrane due to the differences in scale throughout the sketch map. This is an aspect of mapping that is improved upon in OSM. However, a sketch map better addresses the development needs of HAF for the town of Ighil for them to get to know the community. If the communities in which HAF works are at risk for natural hazards, HAF might include OSM mapping into their processes in the future. To address

multiple needs of a community, multiple types of maps are needed.

Another limit of OSM is that it is a wholly visual platform. Contributors need to have a certain level of digital competency, literacy, and access to technology to engage. If OSM could expand to include georeferenced oral commentary, the platform could better accommodate illiterate people, those with low digital literacy, and some disabled individuals who cannot currently use the platform. These millions of people could participate in the collection and explanation of geospatial data in their spaces.

For HAF, collecting audio memos from mapping participants would add additional meaning about the relative positioning of map elements, add nuance to the aggregated group map, and provide necessary context to identify map elements in satellite imagery. It would serve as a record of oral history connected to important places and allow participants to describe their space in a local language that has meaning for them. These questions would add additional layers of meaning to the sketch maps. Participatory mapping done in developing countries should adapt to include an audio aspect.

Finding concurrence between the sketch maps and satellite imagery in OSM might have been especially difficult due to the original mapping intent of HAF and the participants. The intent was not to capture positional accuracy, but rather to understand elements in a community and how participants relate to their space. Positional accuracy was not stressed as important by HAF, and as a result, the mappers might not have spent effort on positional accuracy. Overall, people may not inherently care about positional accuracy as much as map content.

Sketch maps that are incomplete and relatively positionally inaccurate are still more useful to HAF than a map that shows GPS coordinates of landmarks. However, HAF and locals would benefit from integrating some aspects of digital mapping into their process. They could have improved records of locations in which they worked, monitor projects over time, decrease the potential loss of data if an employee leaves, and benefit locals who want to use digital maps to advocate their needs to the government or improve business and tourism, which could bring jobs and income.

### 3.1 Future Work

An important area for future research is into the overlap between the two main paradigms discussed in section 1.2: participatory development mapping, and cognitive mapping and sketch map creation. Much of the research into cognitive mapping and sketch map creation has been done in developed countries in academic settings, while much of the research into participatory mapping stems from Participatory Rural Appraisal done in developing countries. Doing more research into the overlap between these two paradigms would benefit the fields by including a wider variety of people with different cultures, religions, languages, and worldviews. It would make the

research more applicable to the lived experience of the developing world and could provide a roadmap for development practitioners using sketch mapping as a form of data collection.

Future work could also include exploring what aspects of sketch mapping behavior are exacerbated or diminished in a group setting as compared to individual mapping. Finally, in a future study, the researcher would recommend adapting the descriptive coding categories. She would split the manmade landmarks category into additional categories to investigate what types of manmade landmarks people interact with. She would also code within the dream category to analyze what things men and women want in the community. The results could be compared to the history of projects and plans for future projects undertaken by HAF and reveal trends into whose concerns HAF addresses within the community.

## 4. Acknowledgements

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