Participatory mapping as a tool for community empowerment – a case study of community engagement in Koffiekraal, South Africa.

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Abstract. Community engagement has become a core responsibility of higher education in South Africa, alongside teaching and research. The academic-based community engagement focus of the Department of Geography at the University of South Africa (UNISA) is the project "Roots Driven Rural Development" which is conducted in collaboration with a non-governmental organisation, the Greater Rustenburg Community Foundation (GRCF) and communities in the Bojanala Region of the North West Province, South Africa. Apart from striving to facilitate development in the Bojanala region, the project also aims to further develop and fine-tune a methodology of Community Asset Mapping Program (CAMP) developed by the GRCF to conduct and steer roots driven change for the global south.

The paper will outline the methodologies followed and sources used in the process of participatory community mapping which culminated in Koffiekraal being mapped collaboratively via OpenStreetMap. Secondly, the paper will share best practices of physical mapping experienced during the CAMP process and will suggest possible improvements in methodology as applied currently. Thirdly, it will demonstrate how academically-based community engagement not only serves the communities but provides a laboratory for research, a source of authentic learning material and contexts for formal and non-formal program offerings.

Keywords: Community mapping, Koffiekraal, South Africa, CAMP, Open-StreetMap

1. Introduction

The White Paper on Higher Education (Department of Education, 1997) paved the way for the transformation of Higher Education in South Africa from the segregated, inequitable and highly inefficient apartheid institutions towards a single national system that serves both individual and collective needs. Stemming from the White Paper, one of the priorities identified in the National Plan for Higher Education (Ministry of Education, 2001) is the enhancing of "responsiveness to regional and national needs, for academic programmes, research, and community service". Community engagement thus became one of the pillars of the South African higher education system.

The above is in line with global trends. "Higher education should reinforce its role of service to society, especially its activities aimed at eliminating poverty, intolerance, violence, illiteracy, hunger, environmental degradation and disease, mainly through an interdisciplinary and transdisciplinary approach in the analysis of problems and issues." (UNESCO, 1998). During the World Bank's Human Development Week in 2000, Mamphela Ramphele, stated that "There is no way we can succeed in the eradication of poverty if the developing world is not a part of knowledge creation, its dissemination and utilisation to promote innovation. Higher education is a critical factor in making this possible and must be part of any development strategy." (World Bank, 2000)

The vision, "Towards the African University in the service of humanity" of the University of South Africa (UNISA), a mega Open Distance Learning Institution, encapsulates the desire of the institution to connect with society through community engagement. In its 2015 Strategic Plan sound community development is defined as "leveraging our knowledge and skills to the benefit of communities and improving our research, teaching and learning for staff and students as a result" (UNISA, 2005). In the Community Engagement and Outreach Policy document (UNISA, 2008) of the institution, community engagement is further formalised as "The focus here is clearly on academically-based community engagement: the use of the University's teaching and research competence to build mutually beneficial relationships with various communities in areas of discipline strength and community needs. The Department of Geography at UNISA responded to the call to engage by registering the project "Roots Driven Rural Development" which is conducted in collaboration with a non-governmental organization, the GRCF and communities in the Bojanala Region. Apart from striving to facilitate development in the Bojanala region, the project also aims at further developing and fine-tuning the CAMP, a methodology developed by the GRCF to conduct and steer roots driven change for the Global South.

2. Community Mapping

In the Local Agenda 21 Planning Guide (developed out of the United Nations Rio Conference on the Environment in 1992), community-based mapping is identified as a best practice for locally-based sustainability planning (IDRC, 1996).

Participatory mapping originates from Participatory Rural Appraisal — an approach of mapping that is widely used for a number of reasons (Chambers, 2006). (1) It is versatile. (2) It can be facilitated with relative ease. (3) People often derive fun, fulfilment and pride from their participation. (4) It empowers people.

An aspect of mapping that should not be forgotten is the role of technology today in the way we deal with and present maps. Goodchild (2007) has described the Google Earth phenomenon as the "democratisation of GIS" because it has opened some of the more straightforward capabilities of GIS to the general public. Along the same line Butler (2006) has commented "Just as the PC democratised computing, so systems like Google Earth will democratise GIS."

Although conceptualised independently, the CAMP methodology shows many similarities with the well-known methodology of ABCD (Asset Based Community Development) developed in 1990's by Kretzmann and McKnight (1993) in the USA. As the name suggests, mapping is part and parcel of the CAMP methodology to effect change in communities. These mapping activities include power mapping, association mapping, economic mapping, cognitive mapping and creative mapping — collectively aimed at the communities being able to visualise their community assets, capacities, abilities and community structures.

3. Objectives

The main objective of "Roots Driven Rural Development" through the CAMP in the Bojanala Region of the North West Province is to unlock assets in communities and to identify opportunities that could lead to the generation of sustainable social and economic projects. A four day CAMP workshop was conducted from 13 to 16 August 2012 in Koffiekraal, a traditional village situated in the North-West province of South Africa. According to Mr Peter Phefo, a representative of the tribal office, Koffiekraal has a population of approximately 10 000 people. There are approximately 3 000 households in the village. Mr Phefo pointed out that the unemployment rate is very high and that the influx from neighbouring villages is problematic.

During this particular workshop, employees of the GRCF were responsible for non-mapping related parts and members of the Department of Geography at UNISA assisted with facilitation of the various mapping related elements of the CAMP process. Three elements are of particular importance namely:

- Physical creation of a community map of Koffiekraal

- Conducting a transect walk in order to observe opportunities and elements which should be added to the community map.

- Finalising the community map

Since the engagement of the Department of Geography with communities is required to be academically-based, this paper reflects on two further objectives of the Koffiekraal CAMP namely:

- Testing and evaluation of new strategies implemented for the first time during the Koffiekraal CAMP workshop to further develop and fine-tune the process of physically creating a community map;
- Acquiring authentic learning material and contexts from the workshop for formal and non-formal program offerings of the Department of Geography.

The informal discussions during tea breaks paved the way for an unexpected and unplanned additional objective. In this regard Mr Phefo played a leading role. The CAMP was followed by a workshop aimed at empowering Geography teachers to teach GIS concepts as specified in the Grades 10 to 12 syllabi of the National Curriculum. Upon conclusion of this workshop ideas were exchanged about the way forward. Mr Phefo and Mr TM Molefe (a Geography teacher at the local Secondary School) were prominent voices in these discussions.

From the discussions it became clear that there was a need for more detailed, sophisticated and permanent mapping to be conducted. The members of the Department of Geography established a work plan to create an online community map, based on OpenStreetMap (OSM). OSM thus serves as a starting point to be augmented with local spatial knowledge representing points, lines and polygons to increase not only the richness and the diversity of the information available but also more closely parallel the manner in which communities know or conceive of their space. (Weiner, Warner, Harris & Levin, 1995) The OSM platform has been selected despite the fact that as stated in Haklay (2010) there are "areas where nobody wants to

map". On the other hand according to Panek (2012) there are advantages of using OSM for community-driven mapping projects.

4. Methodology

4.1. Application of mental mapping in Koffiekraal

Kevin Lynch (1960) stirred wide interest in community mapping, and ignited a vigorous movement for "mental mapping (of) the world". During these years colour pencils and paper were used to create mental maps. During the 1990s paper maps were being converted into computer graphics accurately georeferenced to a specific physical location on the Earth's surface. Considering the rural context of the Koffiekraal village, the team decided to revert to conventional pen and paper in order to make the process of community mapping as easy, natural and uncomplicated as possible.

The elements of the process related to physical community mapping of the village were scheduled for day three. The workshop presenter described the purpose of the mapping activity as "You are living in this community, right? You walk every day, you walk to the shop, you go to church, you go visit your friends, so you walk around. I want you now either to build or to draw, doesn't matter, Koffiekraal as you think it is." Great care was taken not to interfere with the creativity of the individuals and groups. Each group received a similar set of stationary which included different colours of A4 paper, one sheet of A2 paper, pens, colour pencils, scissors, glue, and other items.

Once the first phase — creating a draft community map — was finished each of the four groups were sub-divided into two smaller groups. As per the standardised CAMP process, one group (sub-group A) was tasked to conduct a transect walk through a section of the village. Sub-group B was formed to evaluate the effectiveness of and desirability for incorporation of aerial photography into the community mapping process.

4.2. Transect walks

Sub-groups A were required to conduct a transect walk during which they had to focus on spotting opportunities (social, economic and environmental) and additional general features which they deemed necessary to be added to their draft community map. This activity is a current component of the CAMP process. Groups were accompanied by a CAMP facilitator and a member of the Department of Geography. A new element introduced for the first time was the recording of the route using a GPS device. These

routes were later converted to shape file format and visualised using GIS software.

4.3. Introduction of aerial photographs

Sub-groups B stayed in the venue and had to conduct similar tasks as sub-group A by using a 1:50 000 topographical map and a 1:10 000 aerial photograph (overlaid with tracing paper) depicting Koffiekraal. The fact that only two photographs were available was problematic because one photograph had to be shared by two groups.

Aerial photographs were newly introduced to the CAMP methodology and proved to be a valuable source of information for the whole process. It allowed participants to visualise landmarks more easily. Later in the process the aerial photographs were used for plotting the houses of the CAMP attendees and through this process the attendees strengthened their sense of belonging to the community.

4.4. Finalising the community maps

Upon the return from the transect walk, the sub-groups merged and continued with mapping their community. This entailed adding the opportunities and features identified and listed during the transect walk and the interpretation of the aerial photograph. Upon completion of this stage individual group members were required to complete a questionnaire. Part of the questionnaire required individuals to plot their homes (and the questionnaire ID number) on any one of the two available photographs. This data was used to establish the spatial distribution of the homes of the attendees and whether the distribution covered the entire village or only certain sectors of the village. Once the community maps were finalised each group had the opportunity to present their final product (See Fig. 1).
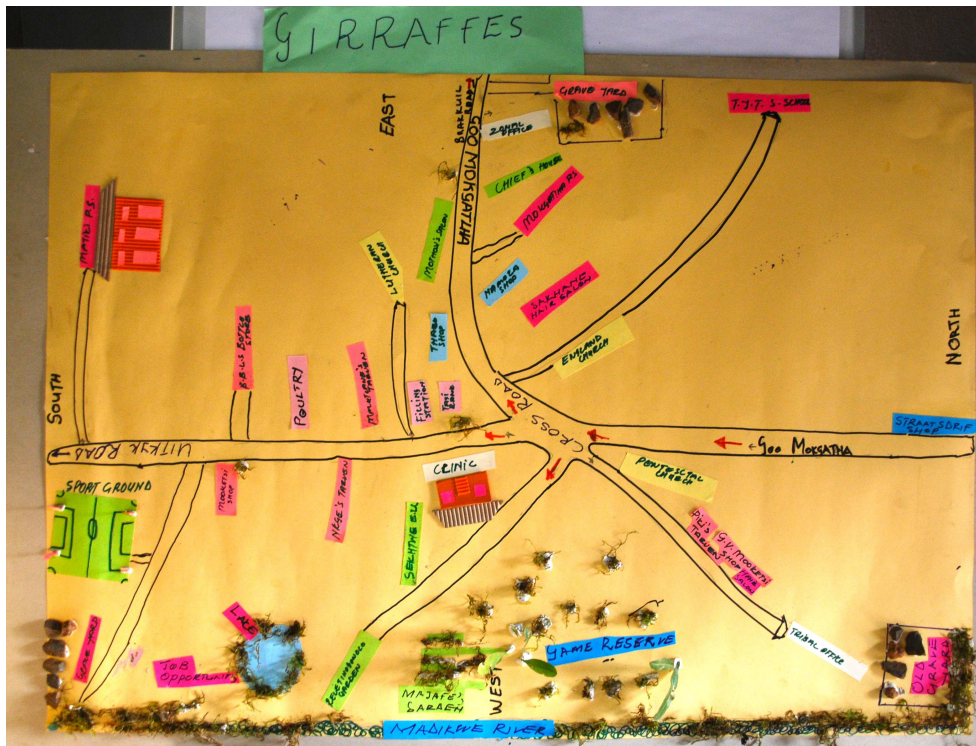
Figure 1. Community map done by one of the Koffiekraal CAMP groups.

4.5. GPS data collection

Acquiring authentic learning material and contexts from the workshop for formal and non-formal program offerings of the Department of Geography is one of the objectives of the engagement with communities. To realise this objective it was decided to capture the geographical coordinates of all the mapped features using a GPS. It should be noted that the community maps were, of course, not planimetrically correct. The coordinates captured using a GPS were also not 100 % correct since the coordinate reading was done from a vehicle parked on the road alongside the feature. Once the coordinates were overlaid on top of the georeferenced aerial photograph, they were later adjusted for use in OSM. A secondary objective was to form an idea of the completeness of the community maps. The coordinates of features not depicted on the community maps where therefore also captured. As a result of this process more than 20 point and area features were captured and later added to the OSM of Koffiekraal (See Fig. 2).

4.6. From community mapping to participatory GIS

As mentioned earlier, an objective which surfaced after the conclusion of the CAMP workshop was to engage the community and Geography learners with collecting data for an online community map based on OSM. Letters requesting cooperation and permission to engage in collaborative mapping of Koffiekraal were handed to the principal of the local Secondary School and the Kgosi (the tribal leader of the community).

Six categories were identified to be mapped; Infrastructure (water only); Infrastructure (other); Services or facilities; Services or facilities of a busi-

ness nature; Other points and areas of interest; Agriculture. Both the secondary school and the larger community were provided with an aerial photograph, tracing paper, colour pencils, instructions on what had to be mapped and the symbology to be used. Registration marks were added to the photograph and tracing paper prior to it being handed over.

Overcoming the distance barrier (Koffiekraal is situated approximately 230 km from the Florida campus of UNISA) was rather challenging. This was confirmed when we eventually received the aerial photograph six weeks after the mapping has commenced as it was clear that the overlays were not accurately registered to the aerial photograph. The implication was that the point data (e.g. the location of features such as communal water points and boreholes) that were captured were basically of no value except being authentic examples to be used in study material on how not to conduct registration when mapping from aerial photographs. Since the position of line and area features could be seen on the photograph, the overlays could still be used to start digitising these types of features.
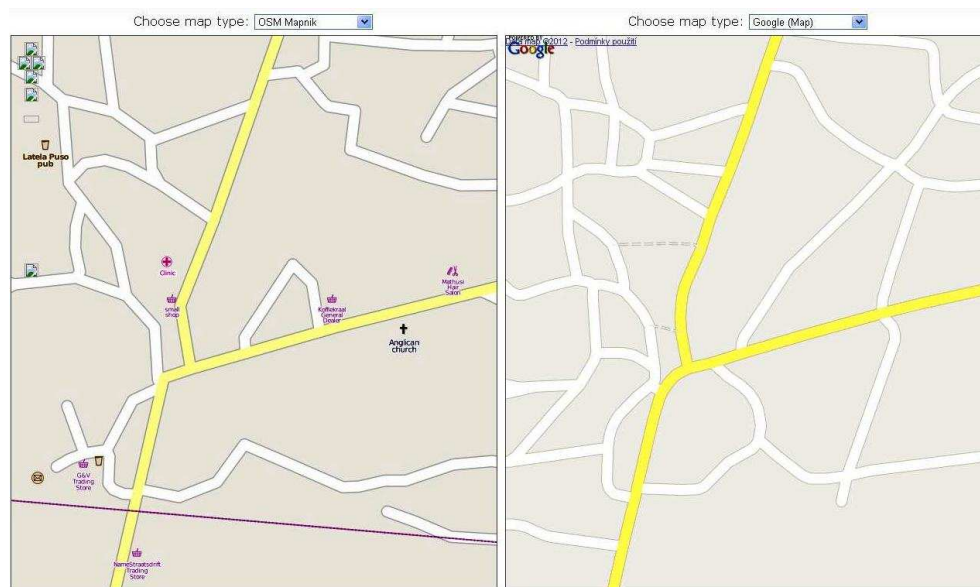
Figure 2. Difference of Koffiekraal map on OpenStreetMap and Google Maps on 13th November 2012

4.7.   Salvaging the participatory GIS project

The delay in the delivery of the overlays and aerial photograph and especially the inaccurate registration of the overlays had implications. We were committed to present a live GIS based on OSM to the community on 8 Oc-

tober 2012. Since the aerial photograph was only received on 5 October the entire project could not be completed in time.

A presentation was made on 8 October in Koffiekraal during which the status quo of the project was demonstrated using QGIS software. The need for recapturing the point data due to the inaccurate registration of overlays was also explained. On the evening of 8 October three members of the community, Mr TM Molefe, and a German volunteer community worker who has been placed at the secondary school, attended a session during which we demonstrated how to get started using QGIS. Under the leadership of Mr Phefo the community members accepted the challenge to apply heads-up digitising to capture the water points and boreholes. The photograph was projected onto a portable white screen. Mr Phefo did the digitising of water points while his two colleagues used a laser pen to point out the exact location of points to be digitised. It was indeed an eye-opener to experience how quickly they mastered the technology and used the laser pen to point out where point elements are.

On our departure the secondary school and Mr Phefo received CDs containing the QGIS, the layers already captured and a manual specially developed for getting started with using QGIS for community mapping in Koffiekraal.

5. Outcomes

The introduction of aerial photographs as part of the CAMP methodology was well received by the GRCF facilitators as well as the attendees. Evidence gathered indicates that, despite a lack of previous exposure to aerial photographs, the attendees were able to read an aerial photograph. The GRCF facilitators expressed the desire to incorporate aerial photography in future CAMP workshops.

The introduction of aerial photographs during the Koffiekraal CAMP workshop was experimental. Valuable experience was gained on how and at what stages it should be embedded in the CAMP methodology as applied by the GRCF. It was also observed that the word "mapping" was used in a very loose manner during the workshop. A need for standardisation of terminology related to different formats of mapping has thus been identified.

The Koffiekraal experience provided a blueprint on how the community maps created during a CAMP workshop can be used as the foundation for more detailed, sophisticated and permanent mapping through a participatory approach.

It was proved that members of a rural community such as Koffiekraal have deep and intimidate spatial knowledge of their community. Enthusiastic

community members can be empowered with relative ease to take control and ownership of the mapping of their community through a participatory GIS approach.

6. Suggestions

Based on the experience gained during the pilot integration of aerial photographs into the CAMP methodology and the positive feedback received from the workshop facilitators and participants we recommend the following to boost the mapping experience and community empowerment:

·	When entities the size of individual households is to be mapped the scale of the photographs should be a minimum of approximately 1:5 000 as opposed to the 1:10 000 we experimented with.

·	The tracing paper that was used should be replaced by transparent film which is firmly taped to the aerial photograph.

·	The aerial photographs should be introduced much earlier in the process. During tea and lunch breaks the community members can start plotting (using very fine-tipped marker pens) their houses on the film registered to the photographs.

·	The attendees can be alerted to what will be required later in terms of making a community map and conducting a transect walk. Their walking to and from the venue in the mornings and afternoons can then be utilised as information gathering opportunities.

·	The routes of transect walks can be planned by taking cognisance of the spatial distribution of the houses of attendees.

·	A glossary of terms related to different expressions of mapping should be made available.

·	More thought should go into exactly how the briefing of the mapping task should be phrased and what material should be provided in order not to steer into desired end product.

With regards to the community mapping conducted after the workshop by Geography learners of the local secondary school and a core group from the community, the success and sustainability of the initiative is dependent on the enthusiasm and leadership of one or two role-players. The use of larger scale aerial photographs and film as overlay material is again recommended. We are convinced that Geography teachers can be empowered in a short time to oversee such digitising.

Due to poor network coverage in the region, the community could not be challenged with uploading information onto OSM. This technical limitation might be addressed in the near future. Just the fact that villagers know that the outside world can see that Koffiekraal is no longer merely a name on a map, has tremendous empowering value which should be treasured.

7. Conclusion

Our conclusion is that Koffiekraal village residents:
- have deep local spatial knowledge;
- can read an aerial photograph;
- can draw a basic community map but that the end product can be improved by better contextualising the task of community mapping and transect walking;

We believe that creating their own maps of their community has an empowering effect, because members of the community have the opportunity to think spatially about their environment and literally put their community on the map. The process of creating data and eventually a map triggers feelings of belonging to the community and a sense of ownership of the process. With ownership the empowerment starts and leads to sustainable development — driven and run by the community itself. Based on our experience we strongly suggest adaptations to the current CAMP methodology and especially the integration of aerial photography as a core element of the community mapping process. The Koffiekraal experience provided an example of how a community can pool its efforts to do more extensive mapping and thus literally and figuratively put themselves on the map.

The Department of Geography at UNISA is in the process of migrating to the use of open-source in GIS-related modules. The Koffiekraal experience provided authentic data that will be used in revamping course offerings.

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