

# **Redeveloping a selected node in Mamelodi: A focus on the creation of stimulating environments**

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## **Introduction**

This paper is written within the framework of the course Housing at the Department of Architecture, UP. The course was divided into two parts: The first being a group assignment to analyse and assess the area of the township Mamelodi and to design an urban framework for one particular identified node; Eerste Fabrieke railway station. In the second part, of which this paper is the result, a study is done with the focus on the people-environment interface in the earlier defined node. It focuses on the characteristics of the environment, the way people perceive that environment and how the environment consequently influences human behaviour. Studying an area from the viewpoint of environmental psychology and analysing the environment-behaviour relationship helps to understand the influence of the environment on behaviour and to design an appropriate urban framework for the specific location and population. The aim of this study is to justify our urban design framework from an environmental psychology viewpoint. Theoretical frameworks like cognitive maps and the understimulation approach, and methods like cognitive mapping, interviews and measuring physical traces are used to provide an integrated approach to our framework.

This report is divided into three sections. The first section describes in short the history of the development of townships of South Africa, the development and current situation of Mamelodi and of the Eerste Fabrieke area. The second section deals with the way people perceive the environment of Eerste Fabrieke and the way it influences their behaviour. The last section defines design solutions and the way they are expected to change perception and behaviour.

## **Section I Environmental conditions**

This section gives a short history of the housing situation in South African townships, and a description of Mamelodi in general and Eerste Fabrieke in particular.

### 1. The housing problem in South Africa

From 1948 till 1994 South Africa suffered under the regime of Apartheid. Only since the first democratic elections in 1994, the country is to be considered a democratic one. Till that time it has had a policy of oppressing people by race and colour. The country still struggles with the consequences of its past as the policies of Apartheid have influenced the lives of all the people living in South Africa and still continue to do so. During the Apartheid, everything was aimed at a creating divisions according to race and colour. All public life was separated: the jobs people were allowed to take, the shops to shop, parks to recreate, buses to take, benches to sit on and places to live in. The Group Areas Act issued in 1950 stated that people were only allowed to live in places designated for their race. It forced Black, Coloured and Asian people to move from the 'wrong' places they previously lived in to places called townships. These townships were designed at some distance from the cities, but close enough to be able to commute to work every day – thus keeping cheap black labour close to, but never integrated with, the white city. Often these places had inadequate infrastructure, services and facilities. Though Apartheid ended 12 years ago its history has greatly influenced the spatial layout of cities and townships. The largest problems today occur in the townships, which were once deliberately designed as mono-functional and isolated residential areas were people now still find their living environments without opportunities and choices.

Unfortunately, it seems that the current development of townships unintentionally is a continuation of former apartheid policies, where still the matchbox type of houses is provided (Osman et al., 2005). Areas with houses built within the framework of the Reconstruction and Development Programme (RDP) look not very different from old Apartheid planned neighbourhoods. Too often, the only problem targeted is the shortage of houses, not the actual housing problem, which deals with the design of a whole living environment (Osman et al., 2005). Existing mono-functional and bland living environments in the townships need to be developed to offer residents a stimulating environment with opportunities and choices. Recently, programmes like Breaking New Ground offer a more integrated approach to the development of housing is gradually replacing the RDP approach which dominated thinking in the first few years after democracy (Brouwer, 2006).

### 2. Mamelodi

The township Mamelodi is situated in the South African province Gauteng, east of the city Pretoria and about 20 kilometres of the city centre. It is separated from the city by the Waltloo industrial area consisting of most automotive industries, and by a strip of vacant land between the residential area Silver Lakes and Mamelodi.

Its history starts in 1953 when the former farm 'Vlakfontein' was established as a township. The first residents worked in the bottle and brick making factories which became later known as Eerste Fabrieke. In 1962, the name Vlakfontein was changed into Mamelodi. Now the township spreads over an area of approximately 25 km<sup>2</sup> and is bordered by the Magaliesberg in the north and north-west and the railway line in the south. These geographical boundaries have prevented urban sprawl. Parallel to the railway line runs the main road (Denneboom avenue/Tsamaya road) in east-west direction. The Pienaarsriver divides Mamelodi into Mamelodi East and Mamelodi West.

The township has now a population of almost 1 million people<sup>1</sup>. Most residents of Mamelodi East were, under Apartheid, relocated from Lady Selbourne, Bantule or Eastwood to the township. The spatial development of the area was planned from 1947 onwards and historically, the access to the township was restricted. Even now, Mamelodi has only three entrances, Stormvoël road from the west at Denneboom station, Waltloo road and Simon Vermooten road from the south, and the Hans Strijdom drive at the eastern side of Mamelodi. Before the area was officially developed as a township there were already building activities. The first houses were built in 1947 according to the *lapa* plan and their remains can still be seen today. These rondavels were criticized by black as well as white, and the program was not continued. Instead, new houses built were matchbox type, low cost brick houses known as four-roomed houses. They are now referred to as Apartheid houses or NE51/9 houses.

Different tribes were housed in different areas of the township, so Sotho, Zulu and Tswana lived separated from each other. From 1968 to 1974 a freeze was put on housing development in the township which led to shacks being erected in backyards. Squatter camps came into existence as a result of the shortage of accommodation. Today, the housing situation ranges from self-built shacks in squatter camps with communal taps to bond houses provided with all services.

### 3. Eerste Fabrieke node

As said in the introduction, this study concentrates on one particular area. Mamelodi stretches over a large area in south-west direction and in the first part of the course we identified the major route Denneboom Avenue/Tsamaya Road as an important energy flow. Places with activity along this road were identified as nodes. A node has a functional and a visual significance and nodes with different functions will create tension and movement along the road. We defined (successful) existing nodes as well as potential but underdeveloped nodes to develop in coordination with existing energies and thus enhance these existing tensions. We chose to work with and to design an urban framework for one of those existing but underdeveloped nodes: Eerste Fabrieke railway station.

Eerste Fabrieke railway station is located at the southern edge of Mamelodi, near the former Vlakfontein farm which now is a heritage site. At the southern side of the railway lies Nellmapius, an emerging RDP site where now 12.000 houses have been built. These

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<sup>1</sup>unofficial, source: [www.saweb.co.za](http://www.saweb.co.za) , retrieved 06/11/06

houses mainly house former squatters from Mamelodi. The north-south connection between Mamelodi and Nellmapius is still underdeveloped as a result of apartheid politics to keep people separated. The road from Mamelodi to Nellmapius crosses the railway line at Eerste Fabrieke but is underutilized and serves no public transport. There is one formal road that connects the railway station to Tsamaya road. Informal footpaths spread into the surrounding residential areas.

The train station is served daily by trains running to and from Pretoria every 30 minutes from 03:30 till 21:00 hours. Commuter peak hours are in the morning from 04:00 to 08:00 and in the afternoon from 15:00 to 19:00. During these peak hours approximately 7 to 10 thousand people use the station, but during the rest of the day and night there is hardly any activity. At the Nellmapius side, and only during peak hours, there are some informal food stalls. There is no taxi or bus stand; commuters from Nellmapius reach the station by foot. At the Mamelodi side there is a bit more activity, some informal food stalls, and in the morning a newspaper vendor and a taxi stand. A small part of the area near the station is a light industry area with businesses such as auto dumps. Where the road to the station meets Tsamaya road is a large gas station, and a small 2 storey complex with a bar, liquor store, restaurant, and a driving school. At the northern side of Tsamaya road are some informal shops like a tyre and spare parts service and a public phone service.

The Pienaarsriver runs at the western side of the station in north-south direction. The river side is not developed because of flooding risks and unreliable soil conditions so there is a large part of vacant land between the station and the river. A footbridge connects the residential area in the north to Tsamaya road and is heavily used as the informal footpaths show. Houses in the surroundings are one storey bond houses, one per plot. At some distance to the east is the hospital, to the west is a park situated. The nearest schools are in the north across the river.

## **Section II Perception of the environment and effects on behaviour**

### 4. Perceived environmental quality

The environment people move around in influences their behaviour and feelings. There is an interrelationship between environment and behaviour: the environment influences and constrains behaviour, but behaviour also leads to changes in the environment. An environment can be deliberately designed to achieve desired behaviour. This process is shown in the following model:

*Environmental conditions (section I)*

*Perception of the environment (section II)*

*Effects of environment on behaviour (section II)*

*Design to achieve desired perception and behaviour (section III)*

This report is organized following the model. In the previous section the physical features and functions of the Eerste Fabrieke area were described and analysed. This section will deal with the human perceptions of the Eerste Fabrieke node and the surrounding area. The perceived environmental quality is assessed on the basis of two theories. Also, the behaviour that people show in this environment is mapped. In the last section, design solutions to change perception and behaviour based on the preceding analyses are given.

### 5. The perceived distance to Eerste Fabrieke: cognitive mapping

To study how people perceive Eerste Fabrieke in the context of Mamelodi we use the concept of *cognitive maps*: the mental representation of the layout of an area. Five categories of features are used to describe and analyze cognitive maps: paths, edges, districts, nodes and landmarks (Lynch, 1960, in Fisher et al., 1984).

**Paths** are lines along which movement takes place, such as roads, footpaths or rivers.

**Edges** are limiting linear objects, such as rivers or railway lines.

**Districts** are larger spaces that have a common character such as neighbourhoods or the CBD.

**Nodes** are places with a heightened activity, a function and are often located at the intersections of major paths.

**Landmarks** are visually important structures that usually function as reference points.

Though previous studies have shown that socio-economic status influences the accuracy and expansiveness of cognitive maps (Appleyard, 1970, 1976; Goodchild, 1974 in Fisher et al., 1984), cognitive maps reflect what is most important to people. That most residents of Mamelodi have a low socio-economic status may influence the accuracy of their maps,

but that does not affect the aim of this study. Every person's perception is valid and thus adds value to the study.

To study how the area around Eerste Fabrieke is mentally represented in the minds of the people who live in the surroundings a small study was carried out. The study area was delimited to the area we expect people to use the Eerste Fabrieke station, namely the area in between the two neighbouring railway stations; Denneboom station and Mamelodi Gardens station. Next, three sub-areas were defined as follows:

**Area A** is situated in between Eerste Fabrieke station and Mamelodi Gardens station. It is at the border of the area supposed to serve Eerste Fabrieke so it is expected that some people use Eerste Fabrieke and some people use Mamelodi Gardens.

**Area B** is situated in between Eerste Fabrieke station and Denneboom station. It is at the border of the area supposed to serve Eerste Fabrieke so it is expected that some people use Eerste Fabrieke and some people use Denneboom.

**Area C** is situated near Eerste Fabrieke station, with Mamelodi Gardens station and Denneboom station at larger distances in respectively the east and west direction. Because Eerste Fabrieke is the nearest station, it is expected that all people use this railway station.

In each of the sub-areas three people were asked a few questions about the distances and the routes to Eerste Fabrieke station and Nellmapius with emphasis on the mentally represented paths and edges. These questions can be found in appendix A. The aim of this study was to get an indication of the perceived distance compared to real distance. In total, nine people were questioned, 5 male and 4 female, aged approximately between 20 and 60 years. The small sample was necessary due to time constraints but is expected to give an indication of general perception in each sub-area.

The results show that people in area A generally perceive Eerste Fabrieke station as the nearest station despite the fact that Mamelodi Gardens station was nearer. Accordingly, if they go by train they use Eerste Fabrieke station. In area B people generally perceive Denneboom station closer than Eerste Fabrieke station, despite being located in the middle of the two stations. The people who go by train use Denneboom station. In area C people perceive both railway stations as too far, Eerste Fabrieke Station being even further than Denneboom Station. Despite the fact in this area they live closest to a railway station, they perceive the distance to the station as too far and prefer a taxi instead. If they would go by train, they would use Denneboom station. Interestingly, none of the participants perceived the distance accurately according to the actual distance.

These misperceptions can be explained if the area is analysed with special attention to the features used to describe and analyse cognitive maps.

In area B people generally perceive Denneboom station closer than Eerste Fabrieke station, despite being located in the middle of the two stations. This is probably caused by

the fact that the paths people can take, like routes and roads, to Denneboom are more significant and utilized. There is public transport to and from Denneboom but not to and from Eerste Fabrieke. Furthermore, people travelling to Eerste Fabrieke will have to cross the river, which will be perceived as an edge. That there is no footbridge available only contributes to the perceived distance. Apart from that, Denneboom is a hub of activity, and is more likely to be perceived as a node which will make it much more significant on the cognitive map and more salient in people minds.

The reason that the people in area C perceive both railway stations as far away is difficult to explain. It is possible that these people have higher incomes and their threshold to take a taxi is lower as is their tolerance to walk distances. The reasons for them to perceive Eerste Fabrieke as further away than Denneboom are the unsafe route through vacant land to Eerste Fabrieke station and the absent bridge over the river. Both create edges that are difficult to cross. Besides that, there is public transport to Denneboom, while public transport to Eerste Fabrieke is absent. This will shorten the perceived distance to Denneboom. And, as mentioned above, the clear representation of Denneboom as a node will also influence the perceived distance on the cognitive map.

That the people in area A generally perceive Eerste Fabrieke station as the nearest station despite being Mamelodi Gardens station as near is difficult to explain from the framework of cognitive mapping. It is possible that people rather use Eerste Fabrieke station because the distance to travel to Pretoria by train is then shorter and therefore cheaper. It is also possible that there is some difficulty in accessing Mamelodi Gardens station that the researcher is not aware of.

In general, it can be concluded that the availability and significance of the paths, edges to be crossed, and salient nodes influence the perceived distance. The river and the strip of vacant land along the river are perceived as a major edge that is difficult to cross because there are almost no bridges provided and the area is unsafe to cross at night. Their means of transport also influences people's perception of distance and their cognitive map. Most people don't own a car and reach their destination on foot or by taxi. Perceived paths are not only determined by the physical existing roads but also by the intensity they are used and the routes public transportation uses.

#### 6. Perceiving and evaluating Eerste Fabrieke: the understimulation approach

To study how people perceive and evaluate the area of Eerste Fabrieke, the *understimulation* approach is used. Townships were in general designed with only one function: providing temporary accommodation to a work force. Today, these areas provide a bland, featureless environment with no sensory stimulation – people could be labeled as being disabled, disadvantaged or deprived in terms of sensory experience. This is also the case for Mamelodi which spreads out without a real centre and without any distinguishing landmarks that help people orientate or give sense of direction. For example, there exists no easy visual or commonly known place to meet when you say

‘see you in Mamelodi!’). Typical of other townships, Mamelodi has no “heart” or central location that gives it identity as would be found in other successful urban settings.

The Understimulation approach suggests that the environment-behaviour interaction is determined by levels of stimulation. If an environment offers too little stimulation, environment-behaviour problems are called into existence (Fisher et al., 1984:67; Gifford, 1987:38). The level of stimulation an environment offers can be measured by the three dimensions of stimulation: intensity, diversity and patterning. (Berlyne, 1960a, 1972, 1974, in Fisher et al., 1984; Wohlwill, 1966, 1976, in Fisher et al., 1984). As the Yerkes-Dodson Law shows for arousal, a mediating variable in many types of behaviour, performance is maximal at medium levels of arousal (Fisher et al., 1984). The same is the case for levels of stimulation, as humans seek an intermediate level of stimulation. (Berlyne, 1960a, 1974, in Fisher et al., 1984). We usually prefer an optimum level of stimulation, which is a combination of sensory stimulation, social stimulation and movement. In contrast to the overload approach the understimulation approach emphasizes the problems resulting from too little stimulation. Though cities are often perceived as social overstimulating, the physical environment is often understimulating because of repetitive patterns. The experience of understimulation has an effect on satisfaction and performance.

To study how the area of Eerste Fabriek station is perceived in the theoretical framework of understimulation the area is assessed by the researcher on the basis of the three dimensions of stimulation; intensity, diversity and patterning. In addition to this more or less objective assessment, people are asked after their perceived environmental quality of the area, with reference to the understimulation approach. The results of the assessment of the researcher show the following on the three dimensions:

**Intensity:** Eerste Fabriek station is heavily used during peak hours between 04:00-08:00 in the morning and between 15:00 en 19:00 in the evening. During the rest of the day the area looks desolate with only a few commuters and hawkers active. When a train arrives there is a massive flow of 200 to 300 people walking into Mamelodi or Nellmapius with only a few who take a taxi. Within 5 minutes after a train has left the area looks abandoned, till another train delivers again a flow of people rushing home.

**Diversity:** At the station area, there is almost no differentiation in colour or shape. There is a sharp contrast between the relatively new and formal station building and the informal stalls made of wood, rags, carton boxes and corrugated iron sheets. The station is situated in an underutilised area of dust and grassland and is not connected to the rest of the area by shape, colour or presence. The informal stalls are used throughout certain hours of the day after which they are left, all looking the same without any personal signs. The area is not perceived as a coherent whole. There is a bit of activity on the crossing with Tsamaya road, and activity directly at the station, but these activities are not connected. Furthermore, the railway track divides the station area.

**Patterning:** In Mamelodi, whole blocks consist of the same housing typology (e.g. Reconstruction and Development Programme or Apartheid houses) with similar building

height, similar colour, and similar layout. Whole neighbourhoods have the same patterns repeated in every street. The residential areas surrounding Eerste Fabrieke show only little diversity in allocation and utilization of spaces, like for public or communal use.

The way the environment is perceived leads to favourable or unfavourable evaluations of the environment. How people perceive an environment is influenced by their background, their previous experience and by their learning experience. To study how people perceive the quality of the environment, usually participants are asked to rate along a scale. However, a pilot study revealed that the people in Mamelodi were not able to think about and judge their environment in abstract terms usually used in such scales, such as stimulating vs. boring, unlively vs. lively or attractive vs. unattractive (Fisher et al., 1978). In an environment like Mamelodi, a different method has to be used to find out how people judge and perceive their environment.

A structured interview with open-ended questions gave the participants the opportunity to express their views. When necessary, the interviewer encouraged or asked the participant to explain more. The necessary use of an interpreter will undoubtedly have influenced the procedure because of translation inaccuracy. To minimize this effect, the interpreter was informed about the aims of this research. Questions asked involved the like/dislike of the environment, an overall judgement of aesthetics, safety and cleanliness, the opportunities for social contact, and suggestions for improvement of the area. These questions can be found in Appendix B. Commuters as well as informal stallholders participated in the interview, a total of three people being interviewed.

It was found that people were perfectly capable of assessing the functional aspect of the environment but had difficulties with expressing more abstract views. In general, their comments were concerned with the functions of the place. The results of the interviews are summarized below.

**Safety:** The safety of the area was perceived as a problem, especially during the night because of the lack of lighting and security. The fact that there are not many people present and that criminals have hiding places contributes to the feelings of vulnerability.

**Cleanliness:** The area was perceived as unclean, which was attributed to the lack of garbage bins and opportunity for stallholders to dump their waste.

**Social interaction:** Interviewees indicated that they only use the station area to do what they have to do. The area is not utilized as a meeting or socializing area at all, people rush home. Remarkably, the area looks abandoned, even during the evening rush hours, except the 5 minutes after a train has arrived.

**Wishes:** If asked about their ideas to develop the area, people react according to the functions they use the environment for. They are barely able to generalize to a wider view. Informal stallholders demand better circumstances for their businesses. Commuters do recommendations about the functional and physical circumstances, like pavement,

more shops and better transportation. Only one participant mentions prettifying the environment and adding new functions like a park.

### 7. Effects of the environment on behaviour: physical traces

The way people perceive their environment influence how they behave in it. This can be explained by the coping mechanisms adaptation vs. adjustment. Adaptation is ‘a quantitative shift in judgement and affective responses because of continuous exposure to the stimulus’ (Wohlwill, 1974, in Fisher et al., 1984). Simply said, it involves a change in the response to the stimulus. Adjustment means changing the stimulus itself (Sonnefeld, 1966, in Fisher et al., 1984). Usually, people will take the course that causes the least discomfort. In modern times, with all technical knowledge, we are used to be able to adjust the environment to our wishes and less willing to adapt to the circumstances.

By carefully looking at the physical traces in the environment, the relation between environment and behaviour can be assessed (Webb et al. 1966, 1981, in Fisher et al., 1984). Signs of erosion, like wear patterns in lawns as well as accretion, the deposit of materials like littering can indicate how people perceive their environment and if it fulfils their needs. In this study, traces that show four different activities have been analysed: the lines of movement, the places where people dump their garbage, the places where informal trade happens, and the places where people gather for social interaction. Results are shown on the aerial photograph and described below.

**Movement:** The routes people take can clearly be seen on the aerial photograph, indicated by the informal footpaths. The environment doesn’t fulfil the needs of the commuters travelling to and from the station so they adjust it by making their own routes.

**Dumping:** The whole area is not very clean, but there are a few places where garbage has accumulated. Two of those places have an informal sign which says: ‘no dumping please’ which indicates that somebody cares about and has a sense of ownership of that part of the environment. These dumping places are at the back of the trading stalls, in corners, and near but not on heavily used route and indicate that in general the sense of ownership of the area is low. There is not a single garbage bin in the area.

**Informal trade:** Informal trade happens just in front of the station, at the places where most people pass by.

**Social interaction:** Most interesting was that there are almost no places where people gather. The area is not perceived as an area to stay, people rush home. After a train has arrived, people are disappeared within 5 minutes, swarmed out over formal and informal roads, on their way home.

### **Section III Urban design framework: design to achieve desired behaviour**

#### 8. Design solutions derived from cognitive mapping

People act according to their cognitive maps, they use the station they perceive as closest, or use none if they perceive them all as too far away. In designing an (urban) area, designers have the opportunity to use the features to control cognitive maps to a certain extent. The extent to which the real environment is accurately represented in a cognitive map can be explained by the concept of legibility (Lynch, 1960, in Fisher et al., 1984). Legibility refers to the ease with which parts of an environment can be recognized and organised in a coherent pattern. It can be improved if distinguishing landmarks are easily visible and if districts are clearly bounded. Good legibility can enhance mobility, give a heightened sense of security, and enables people to navigate efficiently through their environment.

The lack and underdevelopment of the routes and public transport to Eerste Fabrieke causes people to perceive the station area as difficult to access. If paths are developed, as well in physical forms like roads and bridges, as in more public transport, people will find it easier to access the area. The now informal route from the residential area in the north to Eerste Fabrieke will be formally developed into a main road that connects Nellmapius to Moretele Park. This will connect the area to Nellmapius as well to the Northern part of Mamelodi, and offers a new public transport route. At both sides of the station a taxi stand provides the possibility for transport interchange.

Minor roads and paths will spread into the surrounding residential areas so the major route is easily accessible for pedestrians from all directions. The river and the railway are perceived as edges, and are difficult to cross. To lower these actual and perceived barriers, places to cross these edges have to be developed. The earlier mentioned main road that crosses the river and several footbridges will improve this. Instead of an edge, a river can also be perceived as a path. Informal footpaths show that people already walk along the river, and this can be encouraged by providing footpaths shaded by trees along the river, with footbridges at regular distances. Green spaces at both sides of the edges, connected by a footbridge will enhance the perception that spaces cross the river. Special attention has to be paid to the vacant land in between the railway station and the river. This area is below the flood plain which inhibits any building activities. To make this area safer and easier to cross a footbridge, adequate lighting and development as a park, sport fields and play ground, and residential buildings that look onto the place contribute to the development of this area.

At Eerste Fabrieke station, the railway will be lowered which removes the actual, visual and perceived barrier in that place, and the main road will cross at ground level. The station, commercial buildings and a market place will be built over the railway track to connect both sides of Eerste Fabrieke. The Eerste Fabrieke area exists now of two disconnected small nodes: a commercial function at the crossing at Tsamaya road and a transport function at the railway. We connect both small nodes into one multifunctional

node, by developing the area in between with commercial, residential, social and transport activities. The area is rich of history, and with the heritage site it can develop its own identity. The heritage site will act as a landmark that will contribute to the ease people can navigate in the area and will make the node more salient on their cognitive maps.

#### 9. Design solution derived from the understimulation approach

The area of Eerste Fabrieke shows a barren landscape with in general low intensity, low diversity and repetitive patterns. To restore excitement the environment should be made more complex and be designed with a level of intensity, diversity and patterning that provide moderate stimulation.

To heighten the level of intensity throughout the day, as much functions as possible are incorporated in the urban design. Activities that take places on different moments on the day are combined. Proposed are commercial functions like shops, bars, restaurants and informal markets, light industry like carpenters, small scale manufacturing and training facilities, public amenities like a police station, a library, court rooms, a day care centre and a school, leisure spaces like parks, sport fields and playgrounds and high density housing. Formal and informal trade will be integrated by providing shelters in the market area. Streets will be wide enough to allow hawkers and will not only serve as a travel route but also as a living space.

To heighten the level of diversity, there will be a differentiation in building heights related to the local context, with the highest buildings at the railway station and Tsamaya road. Moderate height buildings will connect those two places along the main road, with lower building heights fading out into the surrounding area. There will be a variation in shapes, colours, proportions, position, and orientation of buildings. (Open) spaces will vary in level of enclosure and allocation, ranging from public to communal and private areas. Despite all those variation, the design of building blocks will be harmonized with each other so the area will be perceived as a coherent whole.

#### 10. Design solutions derived from physical traces analysis

To change Eerste Fabrieke from an area where people rush through to an area where they can shop, travel, reside and socialize a stimulating living environment has to be created with clearly utilized spaces. The previously defined urban framework provides in such an environment. The fine scaled pedestrian network connecting to the main road improves accessibility and permeability into the neighbouring residential areas. Wide streets and a market place allow informal trade, and public and communal spaces provide a place to meet and socialize. Their connection to buildings or functions will enhance a sense of ownership and reduce littering.

## **Conclusion and recommendations**

The aim of this study was to explain our urban design framework from an environmental psychology viewpoint. Theoretical frameworks like cognitive maps and the understimulation approach, and methods like cognitive mapping, interviews and measuring physical traces were used to provide an integrated approach to our framework.

This study has shown how with the understanding of the environment-behaviour relationship can guide the design of an urban framework that offers a stimulating environment to its users. The concept of cognitive maps gave evidence that attention should be paid to the design of paths such as roads and public transport, the possible crossings of edges like rivers and railways with for instance bridges, the development of nodes with their own identity and landmarks, that will facilitate recognition, navigation and salience. All these features influence the perceived distance and with that the behaviour of people. The understimulation approach advocates the design of a stimulating environment with moderate levels of intensity, diversity and patterning. Different functions that cause activity throughout the day, differentiation in building heights, shapes and colours and allocation of spaces are the most important ingredients of an environment that visual and functional related to the context of the surrounding environment.

While the concept of cognitive maps is supporting legibility, an environment can also be too legible and become uninteresting and boring, which can cause understimulation. A balance has to be found in which the environment offers a moderate level of stimulation in a surrounding that allows for an accurate cognitive map. With carefully designing the environment, the perception and behaviour can be influenced, leading to the desired behaviour. The area will become a living environment in which people feel at home and will have the opportunities, choices and changes to develop themselves socio-economically.

This study underwent exploration and description of an existing setting and is a first attempt to understand the area, the perception and the behaviour of the people in the Eerste Fabrieke station. It is only the view and interpretation of the researcher, and doesn't mean to provide an absolute truth as perceptions and interpretations will no doubt differ. But it offers more insight into the situation at this particular node which has many shared characteristics with other township settings. This is one interpretation of many possible interpretations. Furthermore, this study has some limitations. The samples were very small due to time constraints, though it is assumed that they provide a general view.

Also, the interviews were not totally satisfactory as the interviewer had the feeling that the people didn't quite understand the questions, or were not able to express their views. For future research, it is recommended that an assessment approach better suited for the people of Mamelodi be used that may relate more to their language and culture and current terminology they may use in describing places and experiences within those places.

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## Appendix A: Questionnaire cognitive maps

Do you live in this area?

This question has to be answered positively before proceeding

I Do you travel by train?

Area A

Participant#

1. Yes.
2. No, too far too walk, prefer taxi.
3. Yes.

Area B

1. No, too far too walk, prefer taxi.
2. Yes.
3. No, too far too walk, prefer taxi.

Area C

1. No, too far to walk, prefer taxi.
2. No, too far to walk, prefer taxi.
3. No, too far to walk, prefer taxi, route to EF unsafe through vacant area, no bridge to cross the river.

II Which railway station do you use, why?

Area A

1. Eerste Fabrieke, is nearest.
2. -
3. Eerste Fabrieke, is nearest.

Area B

1. -
2. Denneboom, Eerste Fabrieke is too far and unsafe route through vacant land.
3. -

Area C

1. -
2. -
3. -

III How far is it walk?

Area A

1. Eerste Fabrieke 15 min.
2. -
3. Eerste Fabrieke 25 min.

Area B

1. -
2. Denneboom 30 minutes.
3. -

Area C

1. -

2. -
3. -

#### IV Do you visit Nellmapius?

##### Area A

1. -
2. -
3. -

##### Area B

1. Yes
2. Yes
3. -

##### Area C

1. Yes.
2. -
1. Yes.

#### V Which route do you take?

##### Area A

1. -
2. -
3. -

##### Area B

1. By taxi to Denneboom, interchange to Nellmapius, or 45 min walk through Eerste Fabrieke bridge.
2. By taxi to Denneboom, interchange to Nellmapius, no direct taxi service available.
3. -

##### Area C

1. By taxi to Denneboom, interchange to Nellmapius, no direct taxi service available.
2. -
3. By taxi to Denneboom, interchange to Nellmapius, no direct taxi service available.

## Appendix B: Interview perceived environmental quality

I do you like the environment? Why (not)?

Participant#

1. Yes, has a stall from 2000 onwards and provides an opportunity to make money
2. No, not enough facilities, not enough shops, no toilets, no transport, no shelter.
3. Yes, because of the heritage site, history and development potential.

II Do you feel safe in this area during day and night?

1. Yes, but is there only during daytime. There is the fear of theft but stallholders protect each others possessions.
2. No, there is no security.
3. No, not during the night because the shelters provide hiding places to criminals and there is no lighting or security.

III Do you think the area is clean?

1. Yes, there are cleaners.
2. No, it is not clean, people dump their garbage because there are no garbage bins.
3. No, it is not clean.

IV Do you meet people you know?

1. Yes, socialize with colleagues and customers, people from the neighbourhood.
2. No, but travels with colleagues and friends.
3. No.

V Do people linger, are there any other activities?

1. No, the only people here are commuters or customers.
2. No.
3. No.

VI Do you like how the environment looks and feels?

1. -
2. -
3. There is nothing to see, nothing to value, it is boring, and kids don't play around because there is nothing for them here.

VII What would you like to change or to develop?

1. A shelter or a cubicle instead of an informal shack with a lock.
2. More and different shops, toilets, a park along the river where people can wait for the train and children can play, garbage bins where people can dump their litter so the area gets cleaner, lightning and police patrol outside the station that enhances safety during the night.
3. Formalize the businesses, a recycling area for waste, more residential buildings, maybe short stay for businesspeople and students. Sign the site history.

VIII What would you like to change about how the environment looks and feels?

1. -
2. Prettify the environment, pavement so the ground won't get muddy when it rains and people will stay clean.
3. -