



Theory + Urbanism

The more complex the network is, the more complex its pattern of interconnections, the more resilient it will be (Capra, 1996:303).



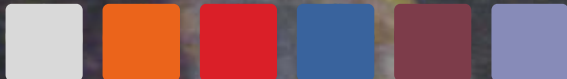
This chapter will focus on the formulation of a theory. The modern world has reached a point of crisis that can only be solved by making drastic changes. The world is faced with a food crisis, a freshwater shortage, fuel depletion and countless other problems. To curb these problems the attitudes and lifestyles of every member of society needs to change and cities and buildings need to be planned better by architects, town planners and the like. South African cities are unique to the world as political policies influenced the segregated and fragmented patterns of its planning. The structure of South African cities needs to change radically integrating the South African city is supported by the Development and Planning Commission (DPC) of Tshwane Land Affairs. There needs to be an 'outright rejection of the low density, sprawling, fragmented and largely mono-functional forms of development' that characterized the Apartheid city (Jencks, 1996:219).

The Compact City

compact city, n. (pl. -ies): 1 a high density, mixed-use compact urban form (Porter, 2004).

The idea of the Compact City was first promulgated by the New Urbanist and Smart Growth movements. It is based on the belief that the physical form of towns and cities can have a major effect on sustainability. The European Commission (CEC, 1990) was an early supporter of this concept. Theoretically, the Compact City aims to reduce urban sprawl, it leads to a more efficient use of existing urban land, and ensures that the functions of work, leisure and living are in close proximity to each other. The Compact City would also provide benefits in terms of environmental, social and economic sustainability. There will also be less need to travel and hence it would be much easier to walk and cycle to areas than using a motor vehicle. Marabastad presently relies on motor transport because of the previous planning of Pretoria, which was designed for people not living in the city; as a result the city has become fragmented. Promoting the Compact City would lead to densification.

The City of Tshwane directly and indirectly continues to suffer the consequences of funding low-density developments on the periphery of the city. This is forcing people (mostly poor) to live outside the city. They bear the burden of high transport costs since their income derives from jobs they hold in the city. The author discovered that it costs R9.00 (April, 2009) for a student to travel from the University of Pretoria to Marabastad and that works out to around R558.00 per month (62 trips which equates to 2 trips a day for a 31 month period).



Densification of the area can solve problems such as congestion and the number of commuters travelling to the city. The city of Tshwane needs to come up with a spatial development strategy that promotes densification and integration, and which counters urban *sprawl*. The principles of the Compact City need to apply to land, housing, transportation and economic development strategies; the Compact City has been studied worldwide and would benefit the greater community.

sprawl, v. & n.: 1 intr. (e.g. town, etc.) be of irregular or straggling form. (*Concise Oxford English Dictionary*, 1995).

The South African city, as well as countless cities around the world, is known for commuters who travel to it in search of work, and travel out of it to go home. In South Africa this is mainly because a large percentage of people live on the outskirts of the city due to historical factors such as the *Group Areas Act (1950)*. The city also faces the worldwide problem of growing larger and larger until it eventually encroaches on the surrounding rural areas. The city consumes and grows and by promoting a compact form this growth would be kept under control. The theoretical concept of the Compact City could serve as a method for understanding the city as a system.

The city needs to be increasingly accessible and this can be achieved by reducing the need to travel and developing more compact, integrated and diverse land use patterns which will support good public systems. Higher densities would mean that there are more people to support good transport systems such as a Bus Rapid Transit System (BRT) and pedestrian-friendly areas. If this were the case there would be no dependency on cars and taxis, and there would be a huge reduction in greenhouse gas emissions. Since most commuters in Marabastad either use rail or taxis and cannot afford their own vehicles, providing a more efficient transport system would be beneficial for the community. This thesis explores the possibility of a community that relies on efficient and eco-friendly transportation alternatives such as a BRT system, bicycle transportation and railway transportation. However, for practical reasons the vehicle is still included as a key design element.

Mixed uses and more people living and working in the same area would give rise to social and cultural liveliness. Facilities within easy reach of everybody also have economic benefits and higher densities would mean that local businesses can become more viable as there are larger populations to serve. The challenge lies in creating a sustainable and self-financing proposal that would serve the Compact City.



The theorist Nikos A. Salingaros describes the Compact City as a compact, geometrically integrated city that should replace *suburban* sprawl as the dominant development pattern in the future. He also proposes that the Compact City should replace the high-rise, ultra-high-density mega city model. He criticizes both conventional suburbia and the hyper-intensity of the urban core (Salingaros, 2006:100–115).

suburbia, n. often derog. : 1 the suburbs, their inhabitants, and their way of life (*Concise Oxford English Dictionary*, 1995).

A radical intervention is required on the part of concerned urbanists. We need to rethink the positioning of individual buildings to form a coherent urban fabric, as well as the role of thoroughfares, parking, and urban spaces. New zoning codes based on the rural-to-urban Transect and the form of the built environment are now available to assure predictable densities and mixed-use for the Compact City (Salingaros, 2006:100–115).

The city of tomorrow has a low-rise, compact human scale. Suburban sprawl is self-generating and is not conducive to natural human actions and needs. Sprawl exists because vehicles are in control, as is the case in Marabastad. Suburbia actually aids sprawl. Suburbia traps those without cars; it is therefore in the interest and to the betterment of the Marabastad community that this pattern does not continue and that good transport systems are provided for the community. Also, the design for the *Trader's Centre for Arts* utilizes pedestrian routes for guided tours of Marabastad.

Salingaros states that high-rise apartments and office towers are equally unsustainable. Ultra-high-density urbanism, like Marabastad's neighbouring high-rise residential developments of *Kruger Park* and *Schubart Park*, create more problems than solutions; they rely on the energy and resources of their surroundings. *Kruger Park* and *Schubart Park* have become slums and are used by illegal immigrants and the homeless and may pose a security threat. The author discovered that the Tshwane municipality cannot relocate the inhabitants because there is nowhere for them to go. Under the National Acts (*PIE- Prevention of illegal eviction Act*) it is illegal to forcefully remove them without providing an alternative place for them to stay.



Successful suburban growth (a low-density phenomenon) occurs due to genuine and powerful socio-economic forces. The Compact City can use these forces and become integrated with the region of Marabastad. There is nothing wrong with high-density or low-density, just as long as there is not too much of the same thing in the same neighbourhood. Single-use zoning is destructive for cities, as office skyscrapers, mass housing and massive plazas are the result. Zoning determines the patterns of urbanism. A housing zone on a master-plan will become mass housing only, whilst a mixed-use zone will display an integration of parts. Thus, the Compact City is sustainable, whilst sprawl and a high-rise mega city are not.

The Compact City is the exact opposite to what Marabastad is now. Not enough people are living in Marabastad to support the idea of the Compact City. For a mixed-use neighbourhood to exist, corner stores and restaurants need to be located within walking distance of residences. High-rise buildings and vast open parking lots also destroy the desired human scale of the area (Salingaros, 2006:100-115). Suburbia requires constant travel whilst a healthy mix of uses in an area ensures that the area is not dead after business hours; this is a common phenomenon which happens in Marabastad and parts of Tshwane's inner city.

Sprawl accommodates the vehicle as the highest common denominator (HCD) in cities and thus reduces people to the lowest common denominator (LCD). Treelike dendritic patterns of roads exist throughout the city and are excellent for the vehicle but their large scale are a major problem for people. None of the patterns of sprawl encourage walking. Marabastad can benefit from a pedestrian-orientated neighbourhood and designers therefore need to promote a pedestrian urban fabric which would also reinforce the tourism market of the area.

Theorists such as Christopher Alexander and Nikos Salingaros have stated many times in their work that people need to be given preference over cars. Urban and suburban morphologies of the city will become unsustainable when cheap resources become too expensive (as is happening with the price of food and oil in February 2009); thus living in the city would be the more sustainable choice as it would mean less travel.

Salingaros states that a complex urban fabric means: *condensation, connectivity and mixing; the opposite of homogeneity* (Salingaros, 2006:100-115).



Most of today's planning is actually *homogeneous* and replaces the healthy existing urban fabric in compact cities. High-rise building does not belong in the Compact City. Buildings should be three, four, or a maximum of six storeys high (Alexander, 1977).

homogenous, adj. Biol. archaic = homogenetic. : 1 consisting of parts all of the same kind. 2 uniform (*Concise Oxford English Dictionary*, 1995).

The Compact City should have a "low-speed" geometry and hence there should be narrow streets accompanied by pedestrian lanes. There should however be enough space for a fire truck to make a U-turn. A city for people consists of buildings displaying local character. Parking should be the last priority and materials such as gravel or brick can be used to slow cars down. Also, car lanes should be designed around major pedestrian routes. Pedestrian paths are very important as they connect urban nodes and reinforce a connected complex of urban space (Salingaros, 2006:100-115).

Salingaros points out that parking lots should actually become "parking ribbons" located on the sides of the road. Pedestrians still need to be given preference over these "ribbons" and thus there needs to be a raised footpath, possibly with a covered canopy in a vibrant colour to distinguish it from its environment.

Make parking lots small, serving no more than five or seven cars, each lot surrounded by garden walls, hedges, fences, slopes, and trees, so that from the outside the cars are almost invisible... (Alexander, 1977).

The proposed new *Trader's Centre for Arts* utilizes both Salingaros's "parking ribbons" as well as Christopher Alexander's "small parking lots".

The urban environment of Marabastad is degraded, fragmented and anti-human. In his book *A Pattern Language*, Christopher Alexander states that living cities can only come about through an *adaptive process*. Therefore any future proposal for Marabastad must be able to adapt to the conditions of the area over time. This gradual evolution of cities is similar to that of dissipative structures and the Bernard cells discussed on *page 59*.



To create a lively neighbourhood people need to move into the area and so there needs to be adequate land for housing. Zoning should encourage integration and mixed uses. The proposal should focus on integration and the pedestrian as the highest common denominator (HCD) within the area.

Chaos theory and complexity

chaos theory, n.: 1 the mathematical study of complex systems whose behaviour is highly sensitive to slight changes in conditions, so that small alterations can give rise to strikingly great consequences (*Concise Oxford English Dictionary*, 1995).

complexity, n. (pl. -ies): 1 consisting of related parts. 2 complicated (a complex problem) (*Concise Oxford English Dictionary*, 1995).

As the new sciences of complexity are revealing, most of the Universe is self-organising, unpredictable, creative, and self-transforming like a butterfly (Jencks, 1996:11).



(Figure 072) *The Fractal Nature of Things*
(Author, 2009).

20th century artists have used the new science of chaos theory and complexity to inform their paintings and craftwork. Science has always impacted architecture and has helped create technologies – such as concrete – which is used in most modern and contemporary buildings. Art and Science form part of Architecture and in order to understand this “new world view” and “new science” the author explored the concept and pattern-making of *fractals* (see *Figure 072*).

Scientists relate complexity to “dynamic systems theory”, “network dynamics”, “self-organization” and autopoietic networks. *Autopoesis* is the organizational pattern of living systems. To determine whether a system is alive it is important to locate its pattern of organization and make sure it is part of an autopoietic network.

Note: Autopoesis means self-making.



Autopoietic networks must continually regenerate themselves to maintain an optimal level of organization. This is where the whole idea of self-organization comes in. The “new sciences of complexity” – complexity theory, chaos science, self-organizing systems and non-linear dynamics – have broadened our understanding of the Universe. All these theories support the idea that the Universe is a *single, unfolding, creative event that is always reaching new levels of self-organization* (Jencks, 1996:9).

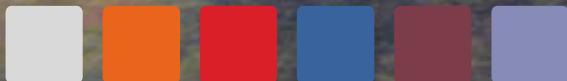
The computer scientist Benoit Mandelbrot developed the concept of *fractals* (Mandelbrot, B.1977) and added to the list of complexity sciences. Fractals entail the study of fractional dimensions and fractures. Around the mid 1970s, all the abovementioned scientific concepts brought about a new view of nature. The universe is now understood to be fundamentally dynamic and self-organizing on every level. Again, this perception and understanding influences artists and their understanding of the world.

A fractal ... [is] something considered simple and orderly that is actually composed of repeated patterns no matter how magnified. A fractal is almost infinitely complex. I love fractals, so I put them everywhere (Young, 2008:129).

Self-organizational systems emerge at the important interface between chance and necessity, just at the “edge of chaos”. *Julia sets* or *Mandelbrot sets* (developed by Benoit Mandelbrot) are fascinating because what produces such a magnificent and natural pattern is just a simple equation. All questions concerning pattern, order and complexity are essentially mathematical, as the Mandelbrot and Julia sets depict by their organic nature. Different systems have their own patterns for creating order and equilibrium.

The author envisions that artistic impressions of fractals can be applied in painting and mosaics onto the walls and columns of the *Trader's Centre for Arts*. The educational nature of the arts facility means that its exterior can be utilised to express new views and new ways of understanding.

Note: The basis of the Julia sets is the simple mapping of $z \rightarrow z^2 + c$
 Mandelbrot sets is the collection of all points of the constant c in the complex plane for which the corresponding Julia sets single connected pieces.



Living systems work in different ways because they interact with their environments by continually modifying their structures; therefore the physical structure of living systems contains a record of previous structural changes. The study of patterns is crucial to the understanding of living systems because systemic properties arise from a configuration of ordered relationships. Systemic properties are properties of a pattern. When a cell is damaged, what is actually damaged is part of its pattern. The components are still there but the pattern is destroyed and so the cell dies.



(Figure 073) The artistic impression of Bernard cells shows the relationship that cells have with each other. Each is connected and cannot exist without the other, just as a community is joined together (Author, 2009).

(Figure 074) Close-up of artistic impression of Bernard cells shows that a seemingly complex pattern is actually orderly on closer inspection (Author, 2009).

Patterns in life are linked to networks. The human brain, the spine and the nervous system are interlinked networks, much like the internet is a network of information. The pattern of life is a network pattern capable of self-organisation. Patterns of self-organisation can be seen in Bernard cells (see Figure 073 & 074). Bernard cells are *dissipative structures* and not living systems. Under a microscope a snowflake has a pattern; even microprocessors have patterns on them and so do buildings.

There is a pattern to everything; it is just a matter of understanding what pattern is suited. The real problem lies in complexity and when there is a problem that the designer cannot resolve, he/she ends up resorting to a common formal order. Therefore the designer is not solving the problem but just using a working pattern that does not relate to the starting equation. The true problem thus remains unresolved. Design problems are leading to levels of complexity that cannot be solved quickly or at all. Theorists such as Fritjof Capra and Christopher Alexander both understand the importance of pattern (Capra, 1996 and Alexander, 1977).

Note: Dissipative structures maintain themselves in a stable state far from equilibrium and may even evolve.



Patterns cannot be measured or weighed; they must be mapped. To understand a pattern one must map a configuration of relationships. In other words, structure involves quantities, while pattern involves qualities (Capra, 1996:81).

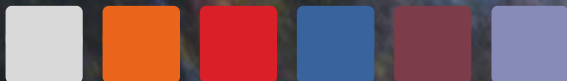
There are infinite patterns in nature and not one is exactly the same as the other. Every pattern goes through its own unique changes and imbalances; hence every pattern has its own story to tell. As in the case of Bernard cells whereby no two cells are the same, they all have their own set of irregularities and thus maintain their differences. In a certain part of Bernard cells there is an irregularity and unique pattern (see Figure 074).

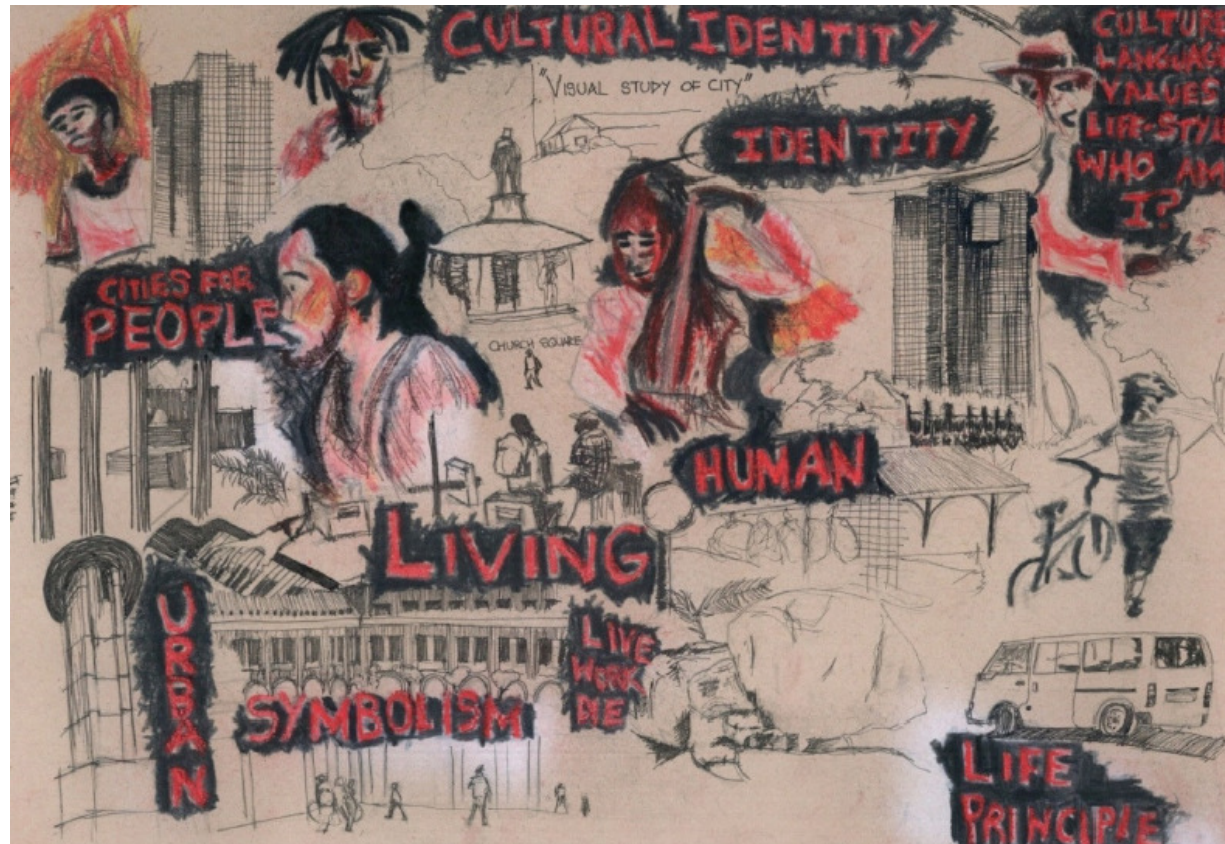
Once again, all these concepts and theories relate to Art and the influence this new way of thinking has on the canvas of a painting. The relevance of chaos and complexity rests in the mindset of the modern way of thinking and new ways of thinking have always influenced the perception of Art (as in the case of Picasso) and continue to inspire artists and architects.

Memory

Rather than using words or photographs, it was felt that a visual study of Pretoria would best express the memory and atmosphere of the city (figure 075). The author travelled through the city with fellow students on bicycles and sketched various parts of the city that evoked memories of historical significance (e.g. Church Square), as well as memories generated by experiencing city life (e.g. the rushing and yet efficient taxis transportation).

After sketching and detailing the drawings (see figure 075) some key words emerged that were relevant to the subject matter of the visual study and important for generating the memory and feeling of the city. These were: *cultural identity, life principle (live, work and die), urban symbolism, cities for people* (William, 1990), and *human living* (e.g. *culture, values, lifestyles and identity*).

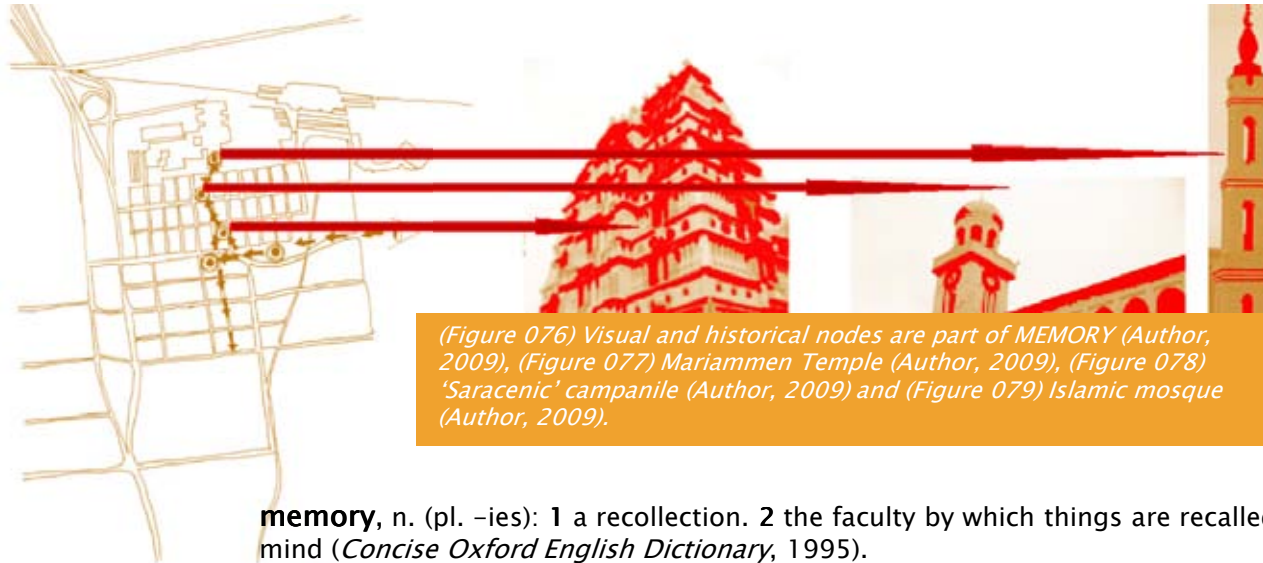




(Figure 075) Original visual study of Tshwane inner city showing that the experience of the city is strongly linked to memory. The people, the mode of transportation (taxi), the sounds and music of the city, the historical monuments and buildings are all part of the city's experience and memory (Author, 2009).



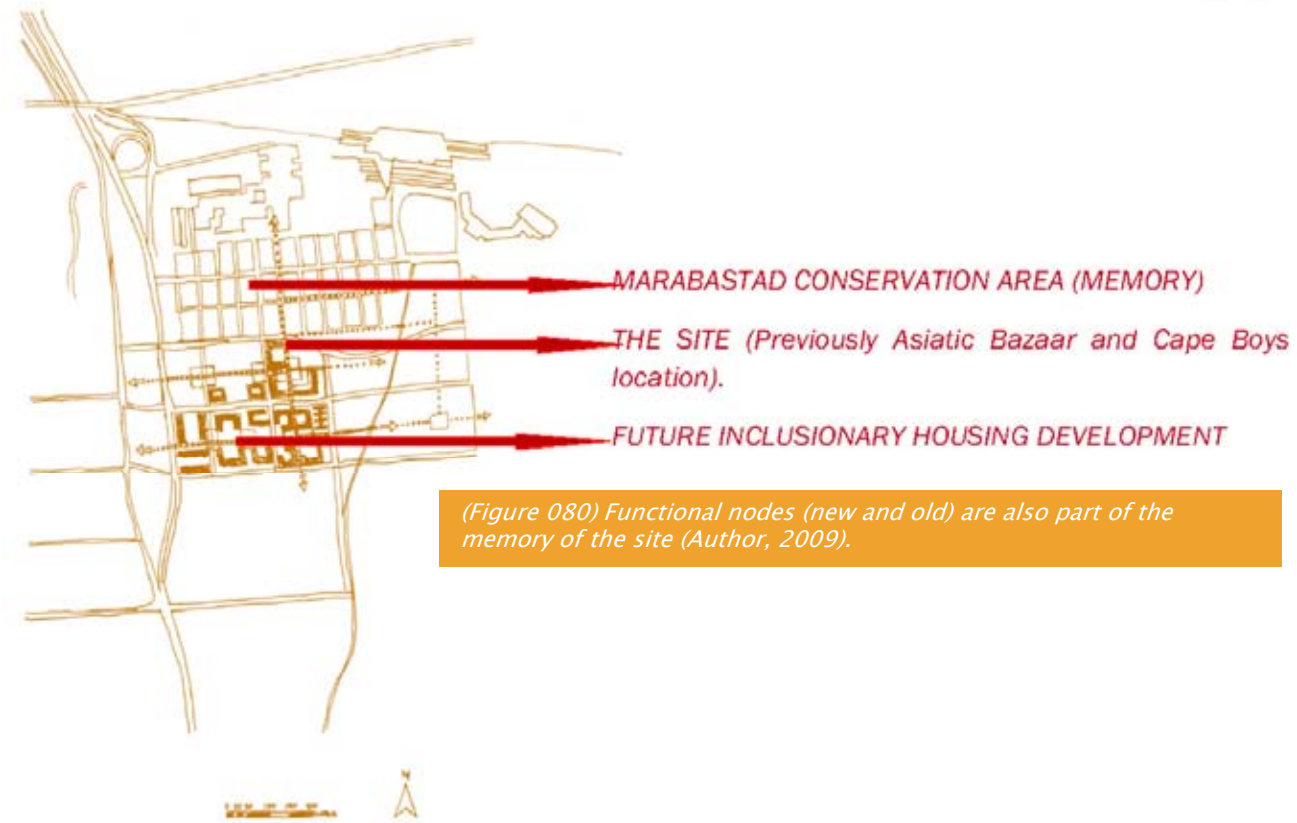
To aid the process of Marabastad changing into a “compact neighbourhood”, the memory of the site should be incorporated. Memory is deeply rooted in the process of building.



memory, n. (pl. -ies): 1 a recollection. 2 the faculty by which things are recalled to or kept in the mind (*Concise Oxford English Dictionary*, 1995).

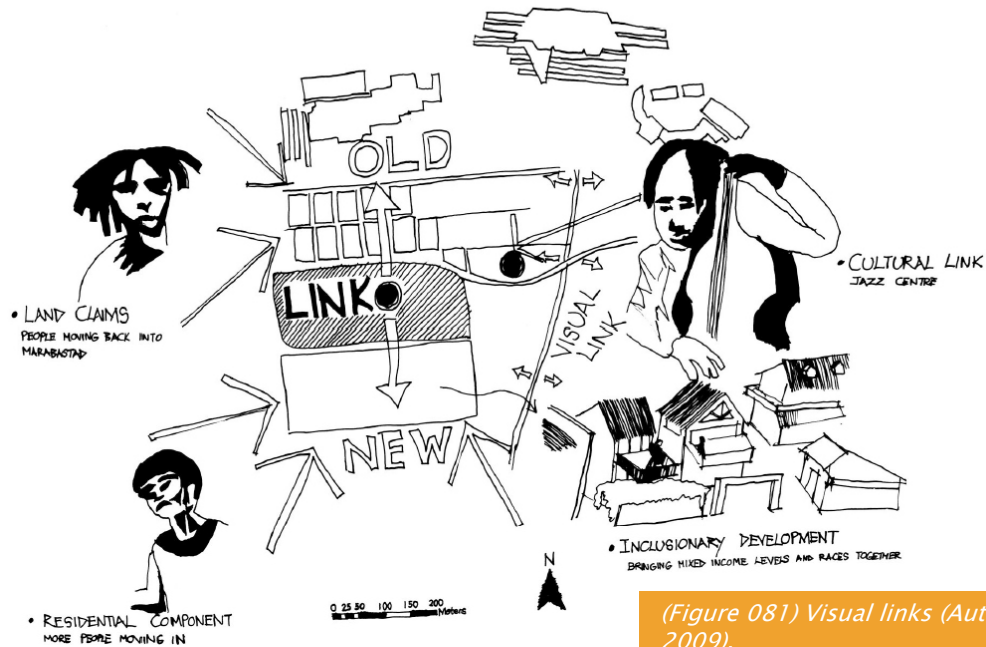
The author looked to architectural masters such as Alvar Aalto in order to best encapsulate memory in an architectural form (*see precedent studies page 67*).





link, n. & v. **1 a** connecting part, esp. a thing or person that unites or provides continuity; one in a series. **b** a state or means of connection (*Concise Oxford English Dictionary*, 1995).





(Figure 081) Visual links (Author, 2009).

In order to preserve the memory of the area, links with the past as well as with future developments should be established. Reinforcing this memory can be done by facilitating the transformation of the old Marabastad into the new by providing a *Trader's Centre for Arts* which will help to develop skills in the area.

This centre also represents a link between the proposed new inclusionary housing development to the south as well as to the rest of Marabastad to the north. It also establishes a link to the memories of the past through guided tours of Marabastad, and through the theme of culture and arts housed in the facility. The vacant land that PUTCO is currently utilizing will form an important *link* between the two areas and will help join them together. It is also important to study possible *functional nodes* (figure 080) and *visual links* (figure 081) such as historic buildings in the area and future landmark sites.



THEORY + URBANISM

65



(Figure 082) Context showing the proposed site, proposed new buildings to be built, the Jazz Centre location, road barriers and the proposed future mixed use zone (Author, 2009).

- new building
- Jazz Centre
- Road Barriers
- Mixed use
- The Site

(Figure 083) Conceptual model showing Mariammen temple located between fifth and sixth streets (Author, 2009).



(Figure 084) Conceptual model showing the context (Author, 2009).

(Figure 085) Conceptual model showing the context (Author, 2009).



(Figure 086) Conceptual model showing the context (Author, 2009).

Physically modelling the site and context helps apply theories into practice. The author built a conceptual model of the context and added proposals made by the Marabastad Group work framework. Decisions made in the group framework helped shape the surrounding context and urban planning of the future Marabastad.



THEORY + URBANISM