How networks are shaping Tshwane Introduction and Context– Part I

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Structure of Presentations

Introduction: AFD – Urban Morphology Institute – Gauteng universities and Research Institutions program of cooperation

- Part I- Introduction and Context
 - Spatial Structure, Networks, Urban Morphology, and Resilience
 - South Africa and Gauteng Urban System
 - Urban Morphology of the City of Tshwane
- Part II- Tools for urban network analysis
 - Application of simple metrics and network analysis
- Part III- Tools for urban network analysis
 - Application of Space Syntax and Dual Approach
 - Future research and policy implications

Introduction AFD – Urban Morphology Institute – Gauteng universities and Research Institutions Program of cooperation

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District Hospital

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Spatial Structure, Networks, Urban Morphology, and Resilience

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Why Spatial Structures?

- An urban spatial structure is defined by:
 - The average density (consumption of land per person)
 - The spatial distribution of densities and population
 - The pattern of daily trips
- It is deficient when (Bertaud 2008):
 - Commuting distances for a significant part of the population are too long to be travelled within a reasonable travel time or/and at a reasonable cost
 - The spatial distribution of population and the pattern of trips are incompatible with the main mode of transport affordable to the poor

Defining spatial structure: the pattern of trips



"Order Whithout Design" Bertaud 2006 (unpublished)



Spatial Distribution of Gauteng' Population seen from the South West



Spatial distribution of population in Gauteng (2001 census) compared to Jakarta, London and Paris

Source: Bertaud 2008

Why Networks?

Gauteng urban networks trajectory from Euclidean space segregation to topological space segregation

- From open grids segregated by spatial distance To closed disconnected forms segregated by spatial logic
- Disconnected and fragmented metropolitan area reflecting the values and spatial behavior of a disconnected and fragmented society
- Evolution from open connected forms (grids) where segregation was created by spatial distance to closed disconnected forms where segregation is locked in the urban form.

Why Urban Morphology?

An urban morphology is defined by:

- The socio-spatial patterns of interaction between people and activities
- The network of streets that reflects the social patterns
- The plot subdivisions
- The land use patterns
- The topography
- The built environment

Alexandra: the very low standard housing filling the vacant space within the older formal housing is a typical example of demand driven informal housing.

Gauteng: Sebokeng

Sebokeng sample density

Design density	123	p/ha	Total real density	182	p/ha
Total population	2,155	people	people in backyard shacks	1,034	people
people per formal house	5	people	People per backyard shack	3	people
formal stands and houses	431	units	Total backyard shacks	345	units
Total area	17.51	ha	Back yard shacks	0.8	per stand

- Alexandra, Sebokeng, Turin and Prague represented at the same scale (400 meters side).
- Repetition of detached identical units versus composition of the urban fabric at different scales
- In South Africa, design densities are modified by backyard shacks that represent demand driven land use prevailing over designed land use but this bottom up process fails to create an emergent urban spatial order.

What is resilience ?

- Dynamic resilience: the system is able to recover from an endogenous or exogenous shock or stress
- Structural resilience: the system absorbs a shock (natural catastrophe, change of civilization) by an adaptive complexification process
- Adaptive resilience: The system evolves constantly far from the equilibrium and constructs new structures while keeping memory of its previous states

Key scales for urban sustainability

Lattice (tree) or semi-lattice

 Alexander (1965): Cities may reflect lattice (no overlaps) or semi-lattice (overlaps)

City should not be a tree

Need to allow for social & spatial overlaps

Resilience and arborescence

Resilience and loops (The leaf paradigm)

South Africa and Gauteng Urban System

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The two charts provide quantitative informations on the distribution of the global urban system. The above chart is the same as the bottom chart, but population and rank are plotted according to their logarithm and tend (u) to align.

35

30

City population (millions) 52 12 12

10

5

0 0

20

40

City Rank

Area (km²)

Country scale

Regional scale

The South African urban system is dual

Log Rank Log Size analysis of South African Cities in 2001

Log Rank Log Size analysis of South African Cities in 2011

Gauteng spatial structure

- Differs from most other major metropolis
- Main characteristics (Bertaud 2008):
 - Extremely large footprint
 - High density residential settlements far away from employment areas
 - Employment areas dispersed in clusters through the region

Gauteng density map (Census 2001)

Scaling down to Tshwane

Tswahne density map (census 2001)

Gauteng - Profile of population Density in the built-up areas 2001

Distance from Johhanesburg city center

Density distribution in the 1000 densest km² of Gauteng, out of 16,000 km² in total

Comparison of Seoul (South Korea) and Gauteng in the densest 600 km². The densest 600 km² in Seoul host more people (10 million people) than all Gauteng 16, 000 km2 (9 million people)

Jobs in Gauteng are concentrated in the center and north but spread over a wide area at low job densities. 50% of jobs are located in areas where the job density is lower than 10 jobs per hectare.

Source: Bertaud 2008

The fragmented urban spatial structure of Gauteng and labor markets

- A labor market is efficient when it is integrated, when it is fragmented it looses its efficiency (Bertaud 2008).
- Gauteng fragmented spatial structure fragments labor markets, and contributes to a high unemployment rate for the poor.
- Integration of labor markets requires that all jobs be potentially
 physically accessible to all adults within a reasonable commuting time
 (Zahavi's rule states 1 hour two ways, which is realized in the world
 competitive cities) and at a reasonable cost (below 8% of income). The
 poor cannot fully participate in the labor market when
 - They are spatially dispersed beyond 1 hour commuting time from employment areas or
 - when transport costs represent more than about 8% of income;
- Spatial dispersion decreases economic opportunity for the poor and reduces the economic efficiency of the entire city.
Only when we understand the underlying factors influencing urban morphology/fragmentation can we put our city back together not just physically but also socially



The fragmented map of wealth in Tshwane (gated communities)



The fragmented map of poverty in Gauteng

The spatial distribution of households living below the poverty level in Gauteng

Map iv: Distribution of economic growth and poverty in the Gauteng province



Urban Morphology of the City of Tshwane

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Introduction

 Comparative typology analysis between various areas in the City of Tshwane and International Examples

Scale of analysis:

- City/ Metropolitan Scale
- Neighbourhood Scale
- 1600m X 1600m (1 square mile)
- 800m X 800m
- Block and Building interface

Morphological Typology in the City of Tshwane

Case study areas

•Suburban (Irene, Brooklyn, Newlands,

- Grid Model
- Enclosed and Gated Communities
- •Township (Mamelodi)
 - Informal Township area
 - "RDP" / Formal Township area
- •Rural (Hammanskraal)
- •Inner city of Pretoria Tshwane
 - Grid model (Central Pretoria)
 - Fine grain grid (Marabastad)



Tshwane a City of Broken Glass?

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Gated communities: concentrated



Selected area of concentration



Concentration of different types



Concentration of different types



Selected study areas



Brooklyn



Brooklyn: unit of analysis (800 x 800 m blocks)



Does not lend itself to large enclosures



Irene



Irene: unit of analysis (800 x 800 m blocks)



Newlands



Case 2: Newlands (enclosed area)



Newlands: Unit of analysis (800 x 800m block)



Most of Pretoria east: suburban layout





Salat (2012)

Silver Lakes



Silver Lakes: unit of analysis (800 x 800 m block)





Zambezi Country Estate



Walnut Creek: 107 intersections

Woodhill estate

Indicator	What is being calculated	Brooklyn	Irene	Silver Lakes	Newlands
Intensity	Surface occupied by road network (%)	9.1	15.4	24.8	37.5
Connectivity	Nodes per km ²	31.6	28.1	12.5	28.1
	Cyclomatic complexity of the car grid (per 0.64 km ²)	25	26	11	14
	Average distance between intersections car grid (m)	150	152	224	147
	External Connectivity (How easy is it to get outside of the area)	34	2	2	3
Proximity	The mean distance between two destinations (nearest major shopping centre – straight line distance)	> 1 km	> 1 km	1 - 2 km	> 1 km
Diversity	The number of different uses	< 6	< 6	2	1
	Number of road hierarchies	2	1	1	2



Salat (2012)



Should it be considered as a new type of urban morphology or just the ultimate manifestation of suburbia?

Adapted from Salat (2012)



Evolution of modernistic planning In Tshwane





Should gated communities it be considered as a new type of urban morphology or just the ultimate manifestation of suburbia?

"Township" and Rural Areas



•Apartheid separation

- •Economic and Social separation
- •Informal vs Formal
- •Formalisation Processes



Ahmedabad: 2700 intersections

Hammanskraal
Ahmedabad



















Ahmedabad: 2700 intersections

Mamelodi



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Google earth

Google earth





Grid Resilience & Subdivisions





Change from open grid to closed loops



2013

Marabastad



Pretoria Central





New York



Barcelona: 168 intersections



Brooklyn



Marabastad





The Contrast between interface and use

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LEGEND

Informal Trader

Convenience Store

Individual Shop

Wholesale

Speciality Retail

Mobile Street Trader



Chain Store/National Retailer Arcade/Shopping centre route

87

Google eart

Small Blocks with subdivisions and mixed uses









Thank you for your attention !

