The thesis discourse sets out to challenge what has become an important issue - the relationship and connectedness between Homo sapiens and "nature".

The thesis focuses on different habitable spaces which have been designed to promote the existence of a number of South African butterfly species. The architecture responds to the context as well as to one of the largest insect groups, the order Lepidoptera.

Following a sustainable approach, more ecological knowledge is at the core of the design. Instead of human functional needs driving the design, site components respond to the indigenous spatial character, climate, topography, soils, and vegetation as well as compatibility with the existing cultural context.
Although there has been little time for play during the past 5 years I have made some fantastic friends. I would like to thank all the collaborators in the class of 2004 with whom I shared some awesome times. (Boertjie) GERHARD, MADER, JEAN, HAROLD [remember the fine times we had sitting outside the student centre admiring the wonderful designs that adorn the university grounds]; ROGER for your support and trusted advise; FRANK and MORGANA SEEWALD for providing me with documentation and allowing me free reign on their property; JOHAN, the pilot, good friend and my sisters boyfriend - we’ve been high; MOM and DAD for allowing me to realise my dreams and aspirations, THANKS hundreds; ANNEKE [my girlfriend] for those extra special pleasures of life, thanks 4 everything I can’t start to mention all that you do for me; KIRST you little brat, you’re a wonderful sister.

In memory of my Grandfather [TED] who is still an inspiration to me. THANK YOU

© 2004 Ryan P Pettey and the University of Pretoria

First edition, first impression

Senior Designer: Ryan P Pettey
Mentor: Roger C Fisher

Printed by Epson Stylus Photo 2100
Steger Street, Groenkloof, Gauteng

Published by Ryan P Pettey

© All rights reserved. No part of this publication may be reproduced in any form or by any means - mechanical or electronic, including recordings or tape recordings and photocopying - without the prior permission of the publishers, excluding fair quotations for purpose of research or review.

Printed and bound in the Republic of South Africa
Table of Contents

List of Figures                                      V
Preface                                             IX

one Briefing Document
Introduction                                         002
Project Rationale                                    002
Client Profile                                       002
Site Selection                                       002
Funding/ Interested and Affected Parties             003
Key Users                                            003
Activity Requirements                                003
Precedent Studies                                    004
Context                                              004
Legal and Regulatory Requirements                    004

two Baseline - Design and Development Guidelines
Design and Development Guidelines                    006
  sustainable site design
  general site design considerations
  specific site design considerations
Social Issues                                        007
  occupant comfort
  climate
  inclusive environments
  access to facilities
  participation and control
  education, health and safety
Economic Issues                                      010
  local economy
  efficiency of use
  adaptability and flexibility
  capital and ongoing costs
Environmental Issues                                 010
  site-adaptive design considerations
  natural characteristics
  water
  energy
  recycling and reuse
  site
  construction limits and landscape
  indigenous landscape preservation/restoration
# Table of Contents

## three  Context Study
- Location 014
- Historical overview of the Magaliesberg 014
- Macro Site 016
- Climate 017
- Sun Angles 018
- Micro Site 019
- Natural Environments 019
- Man Made Environments 019
- Topography 020
- Views 021
- Focal Site 021

## four  Precedent Studies
- Butterflies for Africa _ Africa’s top Butterfly House 024
- Kirstenbosch _ National Botanical Gardens 025
- Institute for Forestry and Nature Research _ IBN-DLO Institute 026
- Tent Structures _ Influence -Frei Otto 027
- Constitutional Court _ Constitutional Hill 028
- Apartheid Museum _ Johannesburg 029
- Vulcania _ European Volcano Park 030

## five  Technical Inquiry and Design Discourse
- Sun, Site, Self 032
- Hartbeespoort Butterfly Conservancy Review 034
- Emerging Architecture 035
- Site Design 036
- The Conservancy 036
- Design Interpretation - step by step 038
- Environmental Studies 046
- Creating an Environment 047
- Implementation and Management 050
- Materials 051
- A Final Word 054

## six  Appendices
- Appendix A  Project Management 056
- Appendix B  Accommodation Schedule 060
- Appendix C  A Paradise Lost 061
- Appendix D  Biomes and Species 062
- Appendix E  Cladding 067

References 069
List of Figures

0.01 Parides iphidamas - PETTEY, R.P. 2004

one
1.01 Hartbeespoort Dam - 1:50 000 TOPOGRAPHIC MAP
1.02 The site at the Damdoryn node - PETTEY, R.P. 2004
1.03 North West Parks - THE HEART OF AFRICA
1.04 Department of Environmental Affairs and Tourism - THE HEART OF AFRICA
1.05 North West Province Coat of Arms - PROVINCES OF THE REPUBLIC OF SOUTH AFRICA

two
2.01 Daylight Requirements - VAN RENSBURG, R.J. 2001.
2.02 Noise thresholds - VAN ZYL, B G. s.a

three
3.01 Physical Position - South Africa, North West Province and Madibeng Municipality - PETTEY, R.P. 2004
3.02 Hartbeespoort Dam - PETTEY, R.P. 2004
3.03 The site at the Damdoryn Node - PETTEY, R.P. 2004
3.04 Chamaeleon village as viewed form site - PETTEY, R.P. 2004
3.05 Northern aerial section of the site - PETTEY, R.P. 2004
3.06 Northern aerial section of the site - PETTEY, R.P. 2004
3.07 Northern aerial section of the site - PETTEY, R.P. 2004
3.08 Northern aerial section of the site and Chameleon Village - PETTEY, R.P. 2004
3.09 Aerial view of the regional site - PETTEY, R.P. 2004
3.10 Hawkers at the Damdoryn Node - PETTEY, R.P. 2004
3.11 Municipal Guidelines - Buitestedelijke Gebiede Dorpsbeplanningskema, 1975 - table C
3.12 Minimum parking requirements - Kosmos Town- Planning Scheme Part 3
3.13 Chameleon Village and site - PETTEY, R.P. 2004
3.14 Regional site and supporting functions - PETTEY, R.P. 2004
3.15 Temperature - CARRUTHERS, V. 1990
3.16 Precipitation - CARRUTHERS, V. 1990
3.17 Wind Velocities and Prevailing wind directions - CARRUTHERS, V. 1990
3.18 Sunrise over Hartbeespoort dam - PETTEY, R.P. 2004
3.19 Sunrise over the Magaliesberg - PETTEY, R.P. 2004
3.20 Stalls at Damdoryn node along the R27 - PETTEY, R.P. 2004
3.21 Steyl, J pilot - PETTEY, R.P. 2004
3.22 Cessna 172 - PETTEY, R.P. 2004
3.23 Aerial view of the Magaliesberg - PETTEY, R.P. 2004
3.24 Sunset over the Magaliesberg - PETTEY, R.P. 2004
3.25 Sun Angles - PETTEY, R.P. 2004
3.27 Heuer’s Wholesale Nursery - PETTEY, R.P. 2004
3.28 Heuer’s Wholesale Nursery - PETTEY, R.P. 2004
3.29 Heuer’s Wholesale Nursery - PETTEY, R.P. 2004
3.30 Heuer’s Wholesale Nursery - PETTEY, R.P. 2004
3.31 Heuer’s Wholesale Nursery - PETTEY, R.P. 2004
3.32 Heuer’s Wholesale Nursery - PETTEY, R.P. 2004
3.33 Heuer’s Wholesale Nursery - PETTEY, R.P. 2004
3.34 Heuer’s Wholesale Nursery: Natural Environment - PETTEY, R.P. 2004
3.35 Heuer’s Wholesale Nursery: Man Made Environment - PETTEY, R.P. 2004
3.36 Movement and Services - PETTEY, R.P. 2004
3.37 Infrastructure - PETTEY, R.P. 2004
3.38 Natural Site Characteristics - PETTEY, R.P. 2004
3.39 Site Context - PETTEY, R.P. 2004
3.40 Site Context - PETTEY, R.P. 2004
3.41: Chameleon Village from site - PETTEY, R.P. 2004
3.42: Chameleon Village from site - PETTEY, R.P. 2004
3.43 Site Development Plan - PETTEY, R.P. 2004
3.44 Heuer’s Wholesale Nursery - PETTEY, R.P. 2004

four
4.01 Words - PETTEY, R.P. 2004
4.02 Butterfly House; Pietermaritzburg - PETTEY, R.P. 2004
4.03 Caterpillar - PETTEY, R.P. 2004
4.04 Exterior of the Butterfly House; Pietermaritzburg - PETTEY, R.P. 2004
4.05 Interior with humidifying sprayers - PETTEY, R.P. 2004
4.06 Flower, Honey and Banana supplements - PETTEY, R.P. 2004
4.07 Parides iphidamas - PETTEY, R.P. 2004
4.08 Flower and Bee - PETTEY, R.P. 2004
4.09 Background picture Parides iphidamas - PETTEY, R.P. 2004
4.10 Kirstebosch Conservancy - National Botanical Institute
4.11 Kirstebosch Conservancy interior - National Botanical Institute
4.12 Kirstebosch Conservancy interior - National Botanical Institute
4.16 Membrane and Cable and Net Structure - HARRIS, B J. 1996
4.17 Food Market and Transport Terminal site plan - HARRIS, B J. 1996
4.18 Food Market and Transport Terminal - HARRIS, B J. 1996
4.19 Entrance to Constitutional Court - PETTEY, R.P. 2004
4.20 Inside Entrance Court - PETTEY, R.P. 2004
4.21 Inside Entrance Court - PETTEY, R.P. 2004
4.22 Inside Entrance Court - PETTEY, R.P. 2004
4.23 Inside Entrance Court - PETTEY, R.P. 2004
4.24 Inside Entrance Court - PETTEY, R.P. 2004
4.25 Old stairs from the Awaiting Trial Block - PETTEY, R.P. 2004
4.26 Inside Entrance Court - PETTEY, R.P. 2004
4.27 Inside Constitutional Court - PETTEY, R.P. 2004
4.28 Gabion wall; Apartheid Museum - PETTEY, R.P. 2004
4.29 Gabion wall; Apartheid Museum - PETTEY, R.P. 2004
4.30 Apartheid Museum - Digest of South African Architecture. 2003
4.31 Apartheid Museum - Digest of South African Architecture. 2003
4.32 Background photo section through Apartheid Museum - Digest of South African Architecture. 2003
4.33 Vulcania - HOLLEIN, H. 2002
4.34 Vulcania - HOLLEIN, H. 2002

five
5.01 Sun, Site and Self - DIKE, R. 1983
5.02 Climate, Situation, Society - DIKE, R. 1983
5.03 Butterfly Conservancy, Hartbeespoort - PETTEY, R.P. 2004
5.04 Site Plan: Cycles - PETTEY, R.P. 2004
5.05 Section F - F - PETTEY, R.P. 2004
5.06 Site Plan - PETTEY, R.P. 2004
5.07 North Elevation - PETTEY, R.P. 2004
5.08 Ground Floor Plan - PETTEY, R.P. 2004
5.09 Roots and Soil - Dike, R. 1983
5.10 Site Model - PETTEY, R.P. 2004
5.11 Model Interior - PETTEY, R.P. 2004
5.12 Model Top: North West View - PETTEY, R.P. 2004
5.13 Model: North Elevation - PETTEY, R.P. 2004
5.14 Model: North Elevation - PETTEY, R.P. 2004
5.15 Model: East Elevation - PETTEY, R.P. 2004
5.16 Model: North Elevation - PETTEY, R.P. 2004
5.17 Model: North Elevation - PETTEY, R.P. 2004
5.18 Model: South Elevation - PETTEY, R.P. 2004
5.19 Isometric View of Conservancy - PETTEY, R.P. 2004
5.20 Perspective of Curtain Wall - PETTEY, R.P. 2004
5.21 Window Support Connection Detail - PETTEY, R.P. 2004
5.22 Vertical Section Through Window Profile and Support Structure - PETTEY, R.P. 2004
5.23 Horizontal Section Through Window Profile and Support Structure - PETTEY, R.P. 2004
5.24 Growth Screen Fixing Detail - PETTEY, R.P. 2004
5.25 Perspective of Growth Screen - PETTEY, R.P. 2004
5.26 Growth Screen to Slab Detail - PETTEY, R.P. 2004
5.27 Section C - C - PETTEY, R.P. 2004
5.28 Key Plan - PETTEY, R.P. 2004
5.29 Section G - G - PETTEY, R.P. 2004
5.30 Flexibility - Wellmann, B.G 2004
5.31 Adaptation (Durbania amakosa natalensis) - MIGDOLL, I. 1987
5.32 Key Plan - PETTEY, R.P. 2004
5.33 Section D - D - PETTEY, R.P. 2004
5.34 Key Plan - PETTEY, R.P. 2004
5.35 West Elevation - PETTEY, R.P. 2004
5.36 Rock Curtain Detail - PETTEY, R.P. 2004
5.37 Key Plan - PETTEY, R.P. 2004
5.38 Section B - B - PETTEY, R.P. 2004
5.39 Biodiversity values for provinces in South Africa
5.40 Key Plan - PETTEY, R.P. 2004
5.41 Rainwater Tank and Filter - PETTEY, R.P. 2004
5.42 Rainwater Tank and Filter - PETTEY, R.P. 2004
5.43 Cable Clamp and Steel Belt Connection - PETTEY, R.P. 2004
5.44 Heat Consumption Coefficient - VON ZABELTITZ. 1999
5.45 Air - Water nozzle - VON ZABELTITZ. 1999
5.46 Climate Control and Ventilation Louvre - PETTEY, R.P. 2004
5.47 Plan ETFE/ Wall Connection - PETTEY, R.P. 2004
5.48 Elevation ETFE/ Wall Connection - PETTEY, R.P. 2004
5.49 Section ETFE/ Wall Connection - PETTEY, R.P. 2004
6.50 Cartitopa erinnys (larva wrapped in food plant leaf - MIGDOLL, I. 1987
6.51 Charaxes britis natalensis (pupu) - MIGOLL, I. 1987
6.52 Bagworms (thorns) - HOLM, E 1988
5.53 Hakahana - Growth Screen - PETTEY, R.P. 2004
3.54 Plastic Film - CAPE SHADE
5.55 Concrete at Hi-Performance Sports Centre: University of Pretoria - PETTEY, R.P. 2004
5.56 Plascon - A COMPLETE GUIDE TO CARING FOR WOOD
5.57 Brick work - Nelson Mandela Museum
5.58 Stonework - CAP STONE 21
5.59 Steel at Hi-Performance Sports Centre - University of Pretoria - PETTEY, R.P. 2004

six
6.01 Feasibility Analysis - PETTEY, R.P. 2004
6.02 Project Planning - PETTEY, R.P. 2004
6.04 Accommodation Schedule - PETTEY, R.P. 2004
6.05 A Paradise Lost - PINCUS, D. 2004
6.06 Savana Biome - DEAT
6.07 Fynbos Biome - DEAT
6.08 A pilansii: tree - VAN WYK, 1997
6.09 Mixed Bushveld Biome - DEAT
6.10 Charaxes jasius saturnus ♀ - MIGDOLL, I. 1987
6.11 Colotis regina ♂ (Migdoll, I. 1987)
6.12 A. tortilis: tree (van Wyk, 1997)
6.13 A. quanzensis: flowers larva host plant (van Wyk, 1997)
6.14 A. quanzensis: fruit & seeds (van Wyk, 1997)
6.15 B albitrunca: tree (van Wyk, 1997)
6.16 B albitrunca: fruit (van Wyk, 1997)
6.17 B albitrunca: fruit (van Wyk, 1997)
6.18 Costal Bushveld - Grassland Biome - Deat, Pretoria
6.19 Iolalus sidus ♀ (Migdoll, I. 1987)
6.20 Charaxes cithaeron cithaeron ♂ (Migdoll, I. 1987)
6.21 A. adianthifolia: tree - VAN WYK, 1997
6.22 A. adianthifolia: fruit - VAN WYK, 1997
6.23 A. adianthifolia: flowers - VAN WYK, 1997
6.24 G. senegalensis: fruit - VAN WYK, 1997
6.26 Mountain Fynbos Biome - DEAT
6.27 Tarucus thespis ♂ - MIGDOLL, I. 1987
6.28 Stygionympha vigilans ♂ - MIGDOLL, I. 1987
6.29 P. paniculata: fruit - VAN WYK, 1997
6.30 P. buxifolia: fruit - VAN WYK, 1997
6.31 P. paniculata: flower - VAN WYK, 1997
6.32 Common Ehrharta - E. B. VAN WYK, 1994
6.33 Common Ehrharta - E. B. VAN WYK, 1994
6.34 Common Ehrharta - E. B. VAN WYK, 1994
6.35 A. ferox: flower - VAN WYK, 1997
6.36 P. mundii: flowerheads - VAN WYK, 1997
6.38 Amphitheatre - Sant - GOBAIN PERFORMANCE PLASTICS
6.39 Sports stadium - Sant - GOBAIN PERFORMANCE PLASTICS
6.40 Denver International Airport - SANT - GOBAIN PERFORMANCE PLASTICS
6.41 Phoenix Cardinals Pro-Football stadium - SANT - GOBAIN PERFORMANCE PLASTICS
Preface

A world for Butterflies

Eighteen years ago when I was five years old I met and made friends with the boy who lived across the road from my home. He is now studying industrial design in Cape Town. With guidance from my mom we would catch and set butterflies. In December 2002 he once again started catching and setting these magnificent creatures. During the four holidays proceeding this time he managed to catch forty different species in and around his mother’s garden at Hartbeespoort dam.

Butterflies never seemed a likely thesis topic until I realised the research and environmental opportunities that this field embraces. One of the most important concerns when choosing a thesis topic was to ensure that it enriched my future career. This topic is of great interest to me and encompasses a huge environmental component. Areas of interest which form part of the focus are; sustainability- the autonomous design, environmental conservation, community upliftment and social stimulation.

Overseas, these developments thrive and form part of educational networks. Cape Town and Pietermaritzburg have their own butterfly worlds, although on a much smaller scale than their overseas counterparts.

The proposed site is in the Hartbeespoort dam area. This dynamic area is accessible and is already an important tourist destination. I imagine that a development of this nature could become world-renowned.

-an elegant contextual structure housing the most elegant of species-

Ryan Patrick Pettet
South Africa
2004