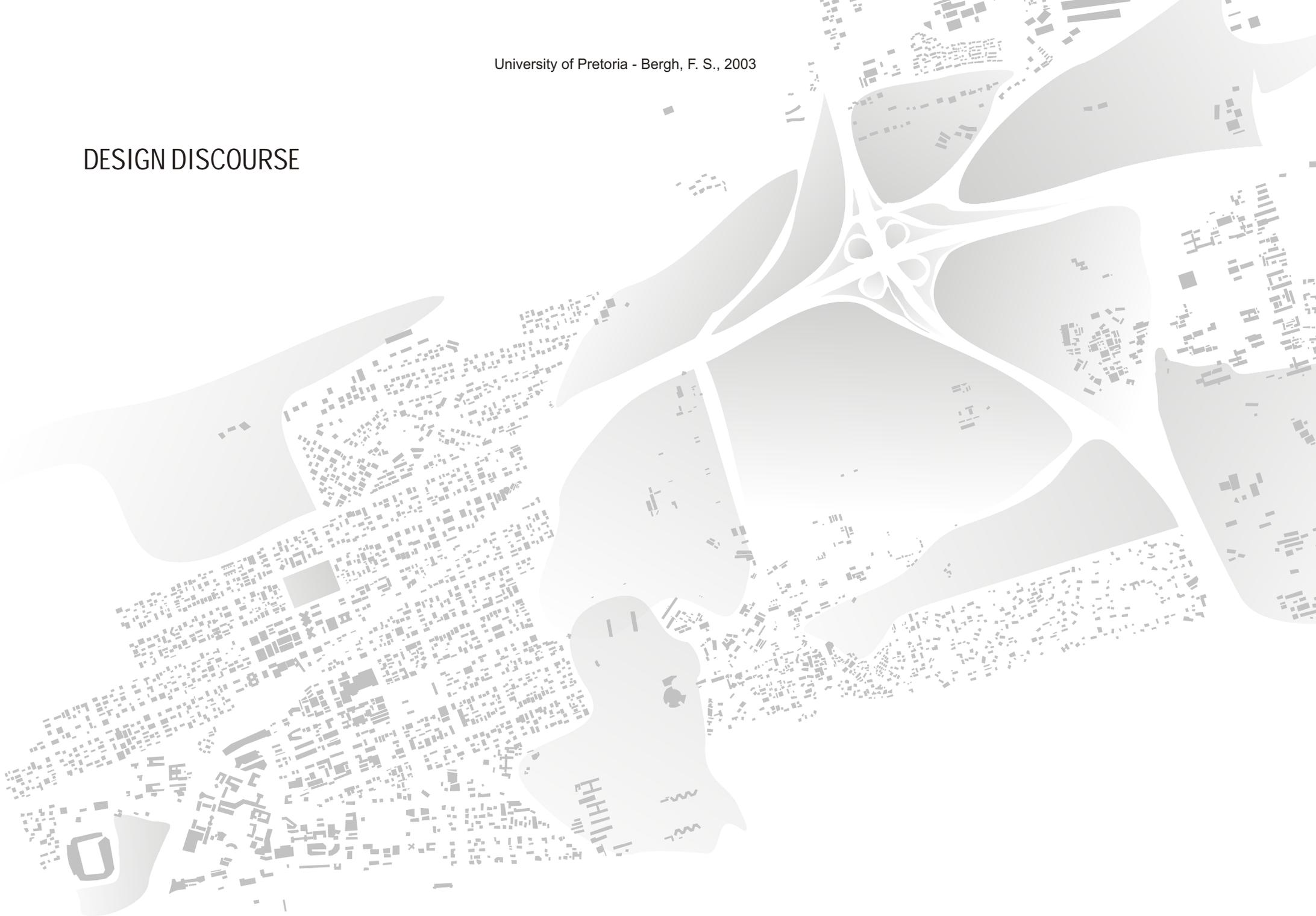


DESIGN DISCOURSE



Introduction

It is important to understand what computer culture is, and what it entails.

Ten Indications of an Emerging Computer Culture

Computer culture is understood in the broader and in the narrower sense of the word: in the broader sense asking the question of how far the computer changes our lives, our society, and our attitudes; and in the more narrow sense, how far the computer as a tool influences cultural and artistic processes and artistic creation and in how far a new creativity is emerging. The application of the computer in the sphere of art and in the media has become an integral part of overall development. Hannes Leopoldeder (1986) has developed the following concepts:

1. Computer culture is an emerging culture

Generally speaking, the computer is still in its initial stage. The pre-school children of today are growing up with home computers and video clips and will consider the computer as an ever-ready instrument and a vital tool. Industry has become increasingly dependant on the computer and will become even more so.

2. Computer culture calls for a new alphabet, language and a new way of thinking

The technology involved with the computer and the instrument itself has created a new language, a new alphabet, specifically the binary alphabet and binary thinking. Hardly any other technical key innovation has produced such a variety of new terms, expressions etc. The computer language will eventually be integrated into idiomatic language, and will eventually require a response in architectural language.

3. Computer culture demands the computer-literate learning society

Compared to other technical innovations, the computer is a machine with intelligent products. It is focused on information and knowledge. The change brought about by the computer requires an understanding of the computer, be it hardware or software, its language, its thinking, its alphabet.

At this point in time, we are living in upheaval: therefore computer culture leads to pros and cons in our society: on the one hand, its followers, the computer-literates, and on the other hand, its adversaries, the computer-illiterates. The computer thus requires constant learning.

Computer culture, much as in the time when the printing press was invented, causes the temporary emergence of elites, those people who have command over the alphabet. To be able to make use of the medium 'book', the written word, it is necessary to be literate, to be able to read. While the transmission of knowledge through the book required reading as prerequisite, Virtual reality (VR) allows, through its world of images, knowledge being accessible without any preconditions.

4. Computer culture requires restructuring of work, leisure time, and society

Computer culture is marked by a decisive change in the world of work, and therefore in our economy and in the effects on leisure time, basically our entire lives. Computer culture may have a drastic impact on the individual-loss of job, changes in the sphere of work and the necessity of on-the-job re-education.

5. Computer culture requires the screen as major tool in home and office

The significant universal tool of computer culture is the electronic screen. The screen is the pet of computer culture, at the office and at home. The television screen has developed into the universal communication medium of the information age; the screen is the paper of the Gutenberg age.

6. Computer culture permits a new type of artist

The computer programmer becomes the new type of artist, with his potential being creativity, and his art can be the programme.

7. Computer culture permits a new world of images and sound

Sounds and Images can collaborate on a whole different level because of the dawning of the computer age. New applications of images and sound are possible, which includes the concept of holography.

8. Computer culture permits new networks

The computer, being a universal machine, opens up new possibilities of communication and new networks. The computer networks create an entirely new level of communication by combining computers, circuits, and satellites. The global networks are still in their infancy, telecommunication, teleconferencing, e-mail etc. It creates a new virtual space determining life in the computer culture.

9. Computer culture permits new media

Similar to books, CD-Rom discs might become the new medium of information storage. A new, lightweight alternative to the written word.

10. Computer culture allows new experiences in art and culture

The computer as universal machine will become an effective tool in practically all spheres of art, music, literature, film, and architecture.

It now becomes important to understand the role the foregoing will play in society, and in architecture.

Introduction to Architecture and the Image

In the media society of today, technological advances in telecommunications and in methods of visual reproduction ensure that we are constantly being inundated with images. Televisions, faxes, photocopiers, and computers have become the virtual windows of the age of the information highway, and are the conduits of digitalized impulses that link the individual with a global network of communications. The modern office and home are deluged with reproduced images and information; news on the hour, every hour; movies previewed, premiered, released, cloned into videos, and drip-fed through cable TV. It is a culture of the copy, a society of saturation, the second flood. (Leach, 1999)

It has been generally assumed that an overkill of images leads to an 'information society' which, in turn, promotes a high level of communication. Yet some commentators suggest that this, 'ecstasy of communication' has precisely the opposite effect. The French cultural theorist Jean Baudrillard states: "*We live in a world, where there is more and more information, and less and less meaning.*" (Leach, 1999. p.) It is precisely in this infinite cloning of the image, in this infinite proliferation of signs, that the sign itself has become invisible.

Society is rapt in this decline into a culture of simulation where the function of the image shifts from reflecting reality, to masking and perverting that reality. Then, once reality itself has been removed, all we are left with is a world of images, of hyperreality. The detachment of these images from their original complex cultural situation decontextualizes them.

"The image is all there is. Everything is transported into an aesthetic realm and valued for its appearance. The world has become aestheticized" (Leach, 1999. p.5)

With aestheticization becoming more and more widespread, its effects will be all the more marked within a discipline that operates through the medium of the image namely architecture.

Architects are engaged in a process of aestheticization as an essential consequence of the profession. Convention dictates that architects should see the world in terms of visual representation-plans, sections, elevations, perspectives, etc. The world of the architect is the world of the image. (Leach, 1999) The consequences are profound. This privileging of the image has led to an impoverished understanding of the built environment, turning social space into fetishized abstraction. The space of lived experience has been reduced to a codified system of signification, and with the increasing emphasis on visual perception there has been a corresponding reduction in other forms of sensory perception. As Henry Lefebvre observes: "*The image kills, and cannot account for the richness of lived experience.*" (Leach, 1999. p.10)

According to Leach, this condition is further exacerbated by the techniques and systems employed in the architectural office related with the presentation of projects. In a professional culture of parallel motions, set squares, tracing paper and computers, and further trapped within the value-laden hierarchies of Capitalism; the separation between spatial practices and representations of space has become complete. The very processes of architectural representation have contributed to the aestheticization of design itself, a process serving to obscure many of the underlying constraints that govern architectural practice.

"As for the eye of the architect, it is no more innocent than the lot he is given to build on, or the blank sheet of paper on which he makes his first sketch. His "subjective" space is freighted with all-too-objective meanings. It is a visual space, a space reduced to blueprints, to mere images-to that ~world of the image which is the enemy of the imagination." (Lefebvre, 1999. P.10)

As a consequence, the architectural techniques and practices within the office, architects grow increasingly distanced from the world of lived experience. The very fetishizing of the image in architecture decontextualizes that image and traps the discourse of architecture within the whole logic of aestheticization, wherein everything is deprived of much of its original meaning. Architectural culture, therefore, encounters the same depoliticizing urge that affects all discourses, which work within the medium of the aesthetic. (Leach, 1999)

Furthermore the tendency to privilege the image potentially serves to distance architects from the users of their buildings, in that it encourages them to adopt a highly aestheticized outlook, remote from the concerns of the users. This concept might begin to explain the failure of the Modern movement whose 'socially aware' designs were never accepted by the public for whom they were intended. Utopian architectural visions came to be seen as abstract aesthetic experiments of an architectural elite out of touch with the practical needs of the populace.

Brutalism is a good example of the concept of aestheticization and the contrast between the views of a Profession and the views of the public. For when such a movement can be turned into an aesthetic landscape by the precious language of architectural commentators, the 'reality' of Brutalism, its harsh, uncompromising nature, is overlooked. What to the public appears, as a grossly insensitive living environment may be represented as a highly sensitive piece of architecture. (Leach, 1999)

Architects have a duty to create quality living spaces; it is the driving force behind the profession. To make use of the old cliché of beauty being in the eye of the beholder, who can really decide what is aesthetically good or bad? In my opinion, buildings and spaces, which are optimally designed for the users of buildings, for people, should have their own unique aesthetic. Buildings shouldn't rely on 'secondary' devices to make them aesthetically pleasing. The aesthetic should be a direct result of optimal design.

Architecture and Communication

The intrusion of media into today's urban environment is overwhelmingly apparent as a system of electronic space mapping. These abstract functions range from real surveillance mechanisms, to traffic movement analysis or how design functions in physical space. Society has grown accustomed to these systems, which are ongoing and always quietly at work. The next generation of communication technologies will require more advanced, conceptual ability to perceive abbreviated language, as bits of images from commercial and authoritative sources. The necessity to expand the creative expressions of environmental electronic architecture is a developing concern of designers. Unrestricted exploration of multi-media artists is of real value to architects and urban planners who are socially concerned with the numerous electronic augmentations and configurations of natural space. (Huffman, 1994)

The Importance of Virtual Reality

The possibilities of Virtual Reality (VR) has in recent times moved out of the sci-fi novels and into our everyday lives. 'Architectural walk-throughs' are obvious industrial applications of VR in the architectural practice, not only for the designers but also bridging the gap between engineers, consultants and clients. VR's potential for increased activity calls for an integrated vision even at the lowest level of simulation.

"The job of the space designer is to make [the] experience [of cyberspace] seem real. Thus, the job is as artistic as it is technical, for experience is something manufactured spontaneously in the mind and senses, not something that can be built, packaged, and sold like a refrigerator."-(de Kerckhove, 1990. p. 238)

Several aspects of VR concern the arts. One is that VR is defined by its sensory values more than by any other. VR brings to the fore the fundamental nature of art which is grounded in aesthetics, that is, the exploration and manipulation of the senses.

VR, the architect and the Image

Virtual Reality fits into exactly the same niche between people that is normally taken up by the physical world. No more, no less. Thus, the types of interactions that people have in the physical world are acceptable in virtual reality. What we have in VR is the ability to directly make up shared reality instead of just talking about it. This is actually a very simplistic concept, and most of the practical and commercial applications of VR rely on exactly this idea. For instance, when an architect uses a virtual reality to show client buildings, the client could suggest a new position for a window, and could move it there. That is post-symbolic communication. They are actually in the building, and no longer relying in models, specifications, and blueprints. (M. Russell and J. Lanier, 1990)

Virtual Reality could therefore impact the concerns Leach displays for aestheticization and its profound impact on the architectural profession. Virtual Reality could in fact become revolutionary in areas of design and client relations. Users are dealing with the direct experience not a representation of an experience. This way of communicating without representation, with actual experience itself, is the importance of Virtual Reality.



Fig. 129:NASA Ames Virtual Interactive Environment Workstation, Image no. AC89-0437-25



Fig. 130:Evans & Sutherland: Nite-view head mounted display offering fully immersed virtual reality with stereo opticals and audio



Fig. 131:The Atari DataGlove

FORM FOLLOWS WORLD VIEW

University of Pretoria - Bergh, F. S., 2003

Charles Jencks (1995) developed the "Trap and the Butterfly" theory. Jencks explains that the trap is the referral to that mechanical device used for capturing anything living, and a butterfly is that particularly fragile and beautiful insect which seemingly moves freely and unrestricted. Combining these two concepts allow for an array of metaphors, determinism versus free will, dead versus living, and Modern architecture versus the organic tradition of design. In short, the oppositions normal in the West since the Romantic Period. If these were the only oppositions, the title would not be very relevant or new. Furthermore, it would send the wrong message, for the trap will be the clear winner in any battle between them because it has the main force on its side: the world economy.

Modern civilization has become locked into a system of global economic efficiency, which further exploits the ecosphere. A machine civilization has won, at least for the moment, and especially as long as the Second and Third Worlds are trying to catch up and industrialize. The trap, if we think of it in one of its many guises as the world economic system, will grow wider and stronger for the next 100 years, and those who control it will continue to enjoy a marginally better standard of living. Others, who do not, will probably be worse off. The butterfly cannot escape this logic. (Jencks, 1995)

Jencks' metaphor has a deeper meaning, one that is connected to the Romantic concern for nature and the problems caused by the modern economy, but still separate from both. It concerns the trap of Modern thought laid down in the seventeenth century that proved to most scientists and thinking people that nature was a machine which ruled over the other animals, and that everything in the world was as determined, mechanistic, and rational as a machine. That mental trap ambushed us because it was so successful—we mistook it for a total explanation. (Jencks, 1995)

The world was ensnared in an efficient, wealth-producing worldview.

The Machine Aesthetic in the architecture of the 1920's was the perfect example of this world view; similarly High-Tech today. According to Jencks, the universe can be made to perform as if it were a beautifully efficient machine, if one sees life in this way, and organizes life accordingly.

We now know, however, the counter-lesson of the butterfly: mechanistic behaviour is only one mode, the simplest, reduced and least characteristic one. As the new sciences of complexity are revealing, most of the universe is self-organizing, unpredictable, creative, and self-transforming like a butterfly.

Jencks theorizes that every living thing has the property of self-repair, a small version of its great power of self-organization, but that a machine does not have this characteristic. Furthermore, the butterfly is a supercharged shape-shifter. It jumps from stage to stage in growth, changing identity and shape. The transformations of the butterfly are perfect symbols of thought jumping from idea to idea, and the universe as it leaps from stage to stage toward higher organization. The butterfly can trap edible matter in three or four different ways, but can a trap turn its jaws into wings and fly away? All in all, the trap is a reduced, impoverished butterfly, just as machines are simplified caricatures of organisms.

(Jencks, 1995)

"As buildings reveal a way of life, this new world view will be most visible be expressed in architecture. Architects express the ideals of an age (or, when these are absent, their own egos). Architecture is 'built' meaning. We may speak or write our thoughts, a blush may betray an inner feeling, clothes may 'maketh the man', but architecture reveals what we believe, how we want to live. It fatefully expresses who we are." - (Jencks, 1995. P.12-13)

Le Corbusier demanded that buildings should look as 'neat, clean and healthy' as ships, they should work like airplanes and resemble cars. "A house is a machine for living in", as he prophesized, and soon mass-housing looked like factories. It is not whether buildings should be machines, but a more basic point that architecture always expresses a way of life, a belief system and building metaphor. Architecture is that impressionable, that reflective of our beliefs and customs. By contrast, if we look at nature and value the creativity of the cosmos, it looks dynamic, surprising, and has amore subtle order that grows out of chaos. Form follows worldview. (Jencks, 1995)

Our worldview and way of life are represented in architecture, and today both are becoming more adjusted to what contemporary science is revealing about nature. Surprisingly, it shows that machines are evolving along with everything else; they are becoming more flexible as they begin to take on primitive animal characteristics, such things as information processing and learning. The trap in effect, is evolving slowly towards the butterfly, though there may be limits as to how far it can become an adaptive system.

In the new view of unprecedented technological advances in industry, design and society, what has the criteria for architecture become? In an age of computer technology, it seems that people have been isolated in their working environments; staff is confined to small cubicles and only interact (if at all) in their short tearoom breaks or lunch appointments. This has an incredible impact on the working dynamic of companies and its workers. The emphasis, at the Innovation Hub, is on interaction. It demands the design of comfortable open spaces, encouraging a work ethic in a more relaxed and comfortable environment. Structured workspaces are also present, but the structure and construction of the building allows for flexibility in this regard. Buildings will essentially be for people, but also for machines.

Daniels (1998) describes the different types of offices associated with new technological advances:

Nomadic Office:

Working at any location worldwide with the help of a portable telephone linked to a database (via the Internet). Project leaders and team members communicate exclusively via computer. This type of office will make up a large portion of the operations associated with the Naledi Factory.

Market Office:

A working environment, which has flexible interiors in order to create adequate working spaces. This office also relies on a centrally located administrative sector, which is shared by several people or parties. Interior spaces are created for the exchange of ideas and concepts, and the formation of teams to generate new projects.

Virtual Office:

Information processing takes place online by telephone, fax and data-processing systems.

Festival Office:

Strategy meetings and workshops with specific goals take place over the course of several days at festival sites to underlie the importance of the event. Work is supported by all available information and communication technologies. The festival office is characterized by user friendliness, reliability and facilities for relaxation. Because of the evolving market and associated technologies, many opposing forces will influence the urban and regional development in a complex and differentiated manner. It will also influence site patterns for industry, trade and living. Cyberspace communities will play a key role in the new economic order emerging together with the new infrastructure.

(Daniels, 1998)

Urban Design Rationale

The Innovation Hub is essentially an urban development. Therefore, it will be necessary to make use of urban design theory and thinking.

Dewar and Uytendogaardt (1991) stresses that the description of place is made in terms of its performance, and not its form. An important dimension of creating a sense of place, is seeking to promote uniqueness as opposed to standardisation.

Through the interaction of surface, relief, water and vegetation, climate and the sky, characteristic totalities are formed which constitute the basic elements of landscape. When settlement making is informed by, and is sensitive and appropriate to these, the entire outcome is enriched: the intellectually derived diagram of structural relationships, which is the essence of the plan, is warped and moulded by landscape, and is thus given life.

Dewar and Uytendogaardt (1991) refer to a number of characteristics, which underpin high-performance environments, and would help to bridge the gap between intention and design.

Balance:

Two types of balance are identified. The first is the balance between settlement and nature and ensuring that all people have easy access to nature and ensuring that actions on the ground are compatible with the natural conditions on the site. The second type of balance is the one between urban opportunities, ensuring that all people have easy access to the full range of activities associated with urban life.

The proposed development at the Innovation Hub has the potential to be such a place. The site allows free interaction with green, open space, and buildings and layouts should be designed accordingly. By creating an urban environment, shared facilities and the clustering of activities, the Hub will provide easy access to these activities.

Intensity:

Intensity is necessary to achieve convenience. The Hub development is essentially an office park Development, but the goal is to create a sustainable environment for employees in the development.

Intensity is essential to achieve this.

Freedom and Complexity:

High performance environments are complex. The complexity results from the interplay of structured public actions and freedom of individual actions. In this regard, the urban design framework proposed for the Innovation Hub development is disappointing, to say the least. The proposal of buildings with similar roof pitches, textures and colours is totally inappropriate in a high profile development such as the Hub. Complexity will never be achieved with Country Club design guidelines. Each building should reflect the company it is associated with, be it solar technology or virtual reality.

Equity:

Equity refers to the issue of ensuring that no individuals or groups are unfairly advantaged or disadvantaged over others and that all people have access to the full range of opportunities generated within the settlement. The development will mostly rely on shared facilities and mixed-use buildings, which will produce 'fair' environments.

Continuity:

The continuity of urban fabric (as opposed to fragmentation) is essential to capture the systemic nature of urban settlements. The proposal of developing the whole of the Hub on the Agricultural Research farm is in conflict with this statement. The proposed site, being a Greenfield site and rather isolated because of the highways surrounding it, is an integral part of the urban fabric of Pretoria. The aim of creating an activity spine from the University of Pretoria, the new Hub development, Persequor Technopark and the CSIR, is contradicted by not integrating the Hub with the existing Persequor park.

The first phase of the development should start on the north east of the NI highway, which will allow for the densification of the rather bland, Persequor Technopark, and not on the research farm as proposed. Activities should be positioned where the research will be most effective i.e. Biotechnology on the edge towards the open space allowing for cultivation etc., Wetland research on the northern apex of the site.

Integration:

Positive urban environments are integrated and interdependent, in the sense that there is a mix and overlap of activities and a locational synergy different but complimentary activities and facilities located in close proximity benefit from each other. (Dewar and Uytendogaardt, 1996) By integrating the Hub development with the Persequor Park, the above will be achieved. Sharing knowledge, facilities, and expertise will become the main driving force, the original vision of the Innovation Hub.

Clarity:

Positive urban environments exhibit qualities of structural clarity, in the sense that they are easily legible to users and that the structure sends clear and unambiguous signals to decision-makers. Another facet of clarity is the interface between public and private domain. The clarity of the definition of the definition determines the degree to which public activities impose on private space and it affects patterns of responsibility for the maintenance of space. (Dewar and Uytendogaardt, 1996)

The concept of clarity becomes an extension of my critique on the Urban Design Framework for the Innovation Hub and its country club design rationale. Is it possible to resolve clarity in an environment where buildings have similar colours, textures, roof pitch and cover materials?

Bentley also refers to few important concepts relating to urban design. Some of these overlap with the ideas of Dewar and Uytendogaardt, which puts emphasis on their relevance. These are:

Permeability:

Permeability refers to the freedom of movement and access. Harsh urban environments do not exhibit the concept of permeability. The Hub development will revolve around pedestrian movement and pedestrian scale. The proposed off-ramp from Meiring Naude drive into the Research farm, will not only destroy the character of the Proefplaas, but also fragment the surrounding areas even more. With the integration of the Hub with Persequor, the introduction of a pedestrian bridge will be the sensible approach and the widening of the 'tunnel' to provide vehicular access to the hub. Service entry and access will be obtained through South Street.

Legibility and Visual Appropriateness:

As argued previously, each building should maintain its own unique character and exhibit qualities unique to the activities within each building.

Variety:

This concept refers to the provision of a range of choices and the introduction of mixed-use facilities.

Robustness and Flexibility:

The concept of robustness and flexibility is an important concern, not only from a feasibility or economical point of view, but also sustainability wise. The integration of a flexibility plan should be employed at the planning stages of the project and not only on a micro scale, but also at urban design development level. The integration of the Hub (on the north east of the NI) and Persequor allows for the most flexibility in terms of growth and feasibility.

Richness:

The provision of, not only a range of activities, but also a range of sensory experiences is important. Visual richness is an obvious concept, but it should be enriched with touch (using texture), smell (choice of vegetation), sound (introduction of bird feeders, choice of materials for pathways etc.)

Urban Design Objectives:

Fig. 132: Balance between natural and hard open spaces.

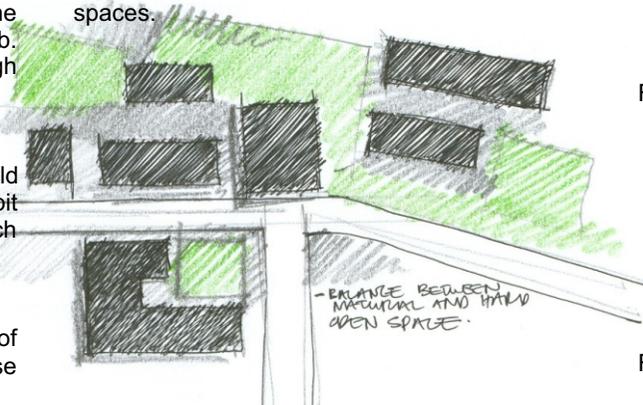


Fig. 133: Sense of identity, different parcels



Fig. 134: Hierarchy of spaces and connections.

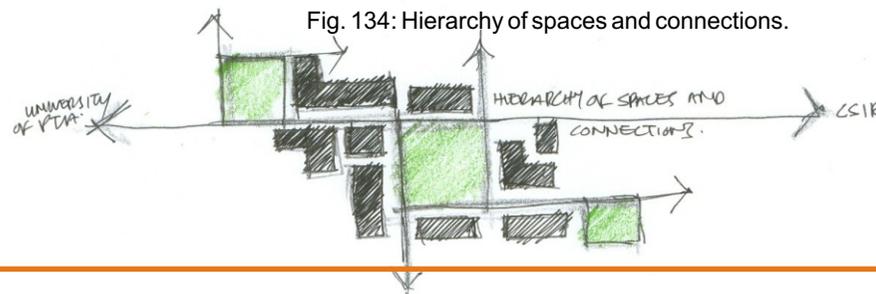


Fig. 135: High legibility (connectivity)

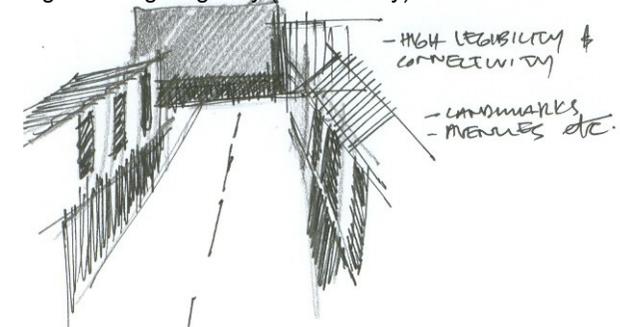


Fig. 136: Sense of Place

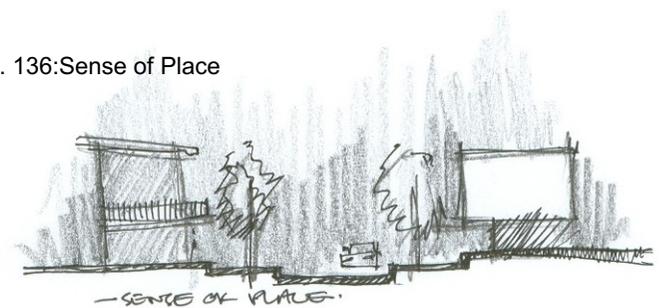


Fig. 137: Sense of arrival

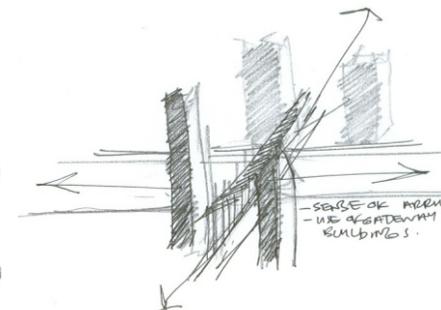


Fig. 138: Cluster as oppose to dispersal

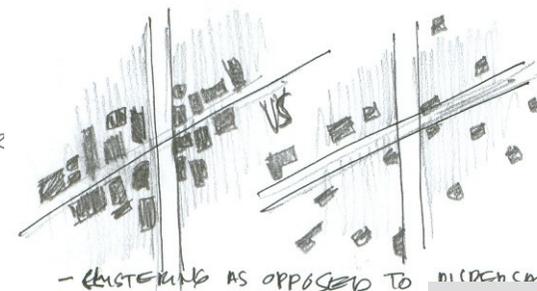
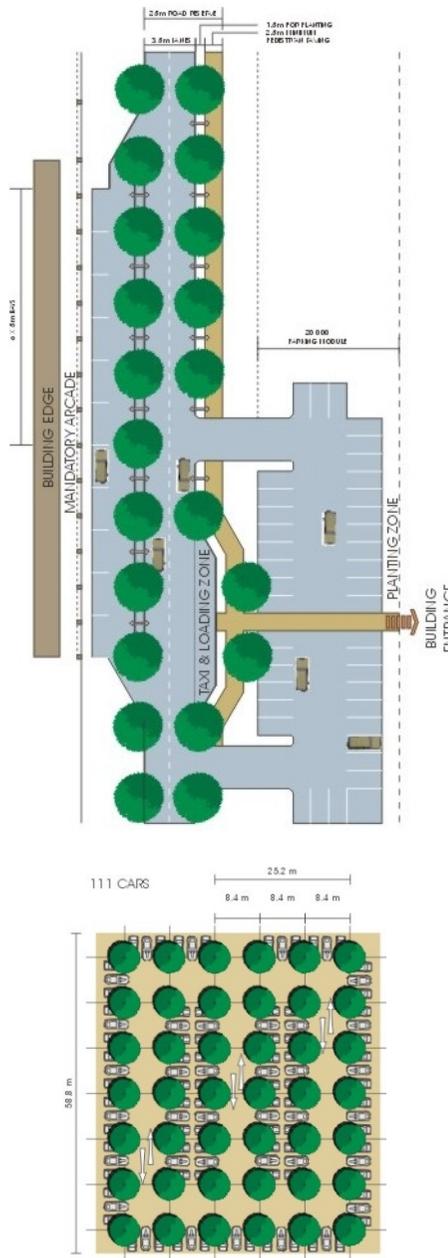


Fig. 139: Roads and parking integrated as part of the open space system.



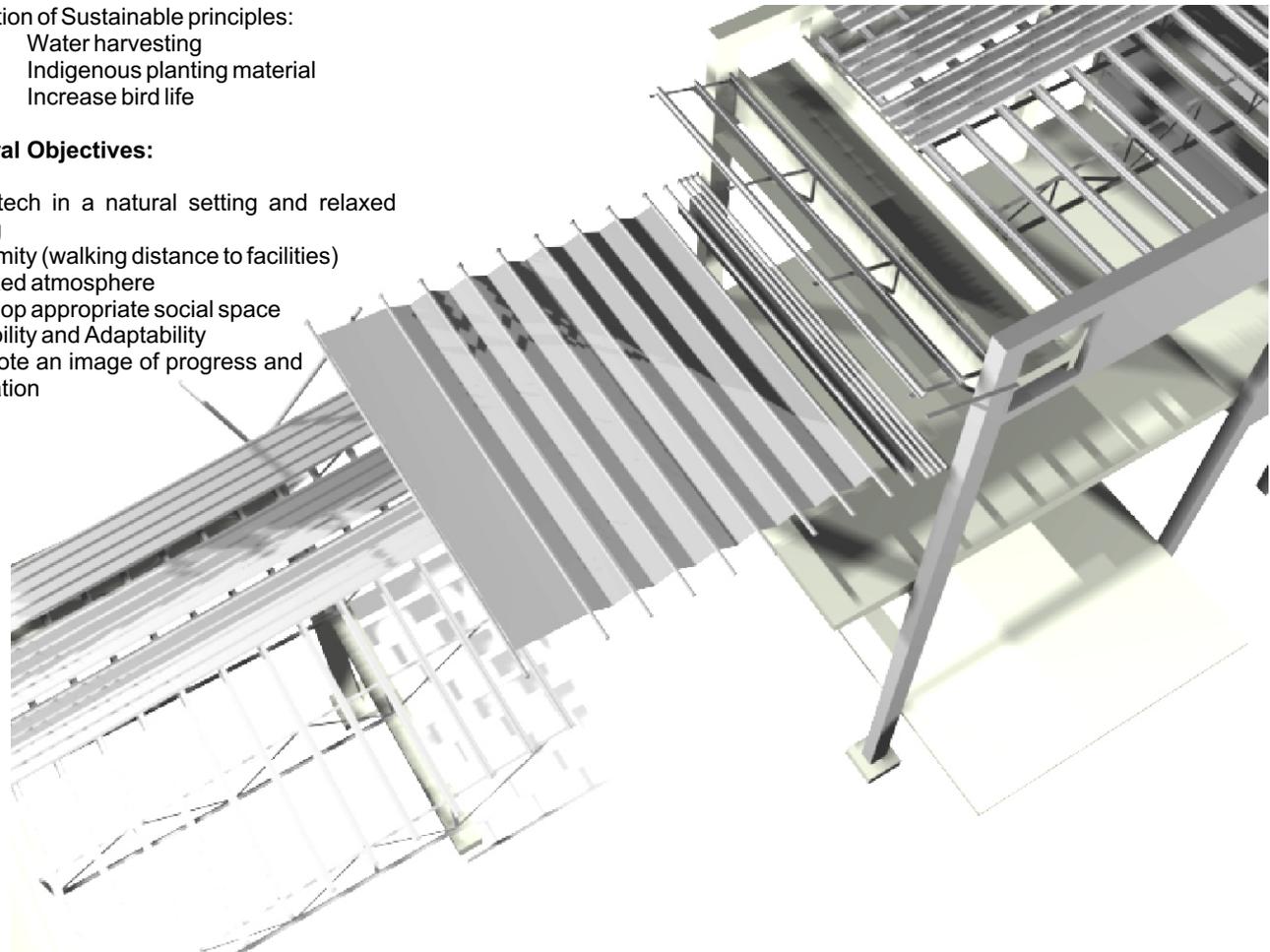
- Enhance site features and opportunities
- Reduce negative impact
- Concentration of social activities
- Articulation of building mass in relation to the natural context
- Continuous fabric of buildings
- Diversity and consistency of character/image

Environmental Objectives:

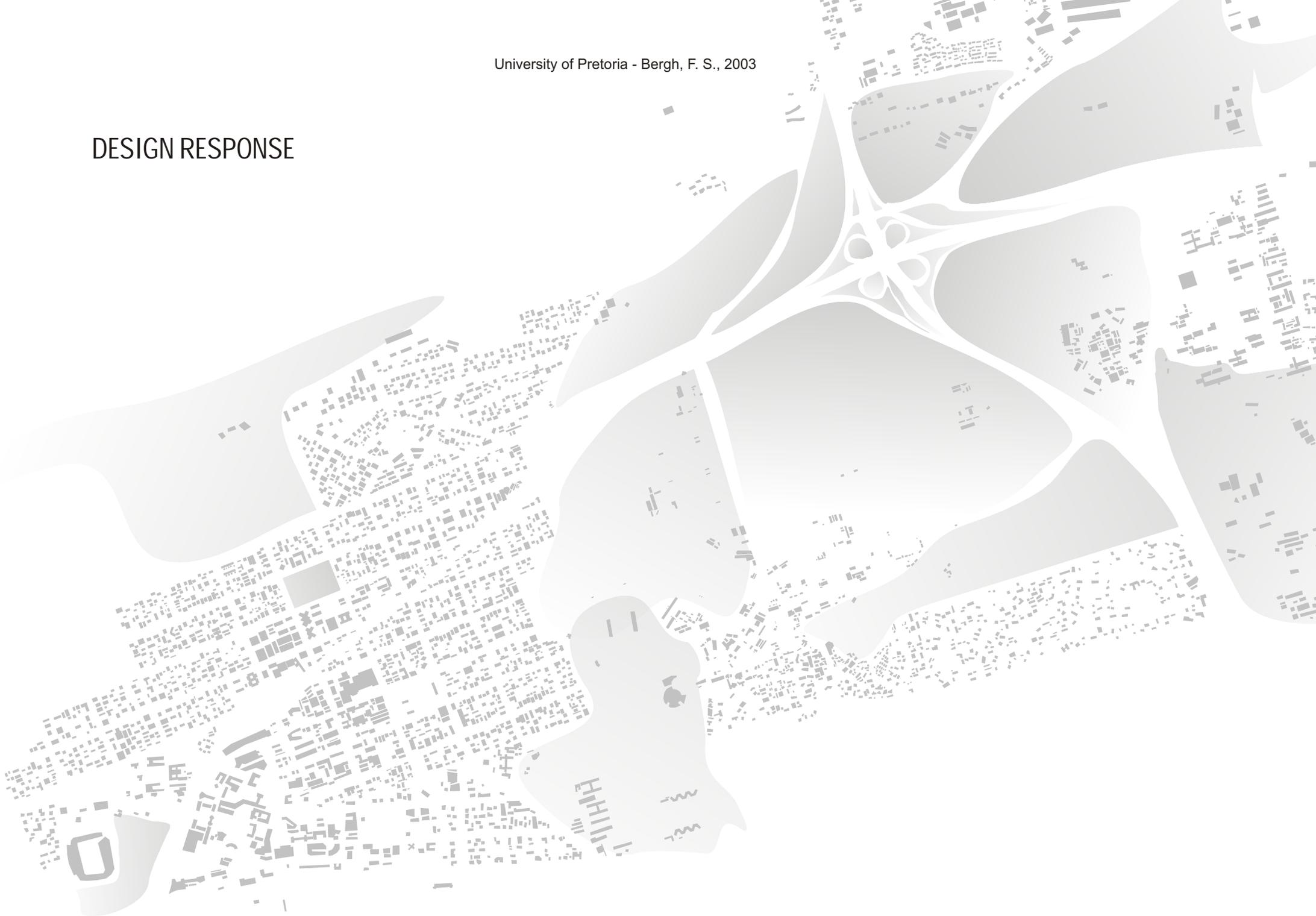
- Plan for minimum impact
- Retain existing vegetation
- Enhance fauna and flora
- Adoption of Sustainable principles:
 - Water harvesting
 - Indigenous planting material
 - Increase bird life

General Objectives:

- High-tech in a natural setting and relaxed setting
- Proximity (walking distance to facilities)
- Relaxed atmosphere
- Develop appropriate social space
- Flexibility and Adaptability
- Promote an image of progress and innovation

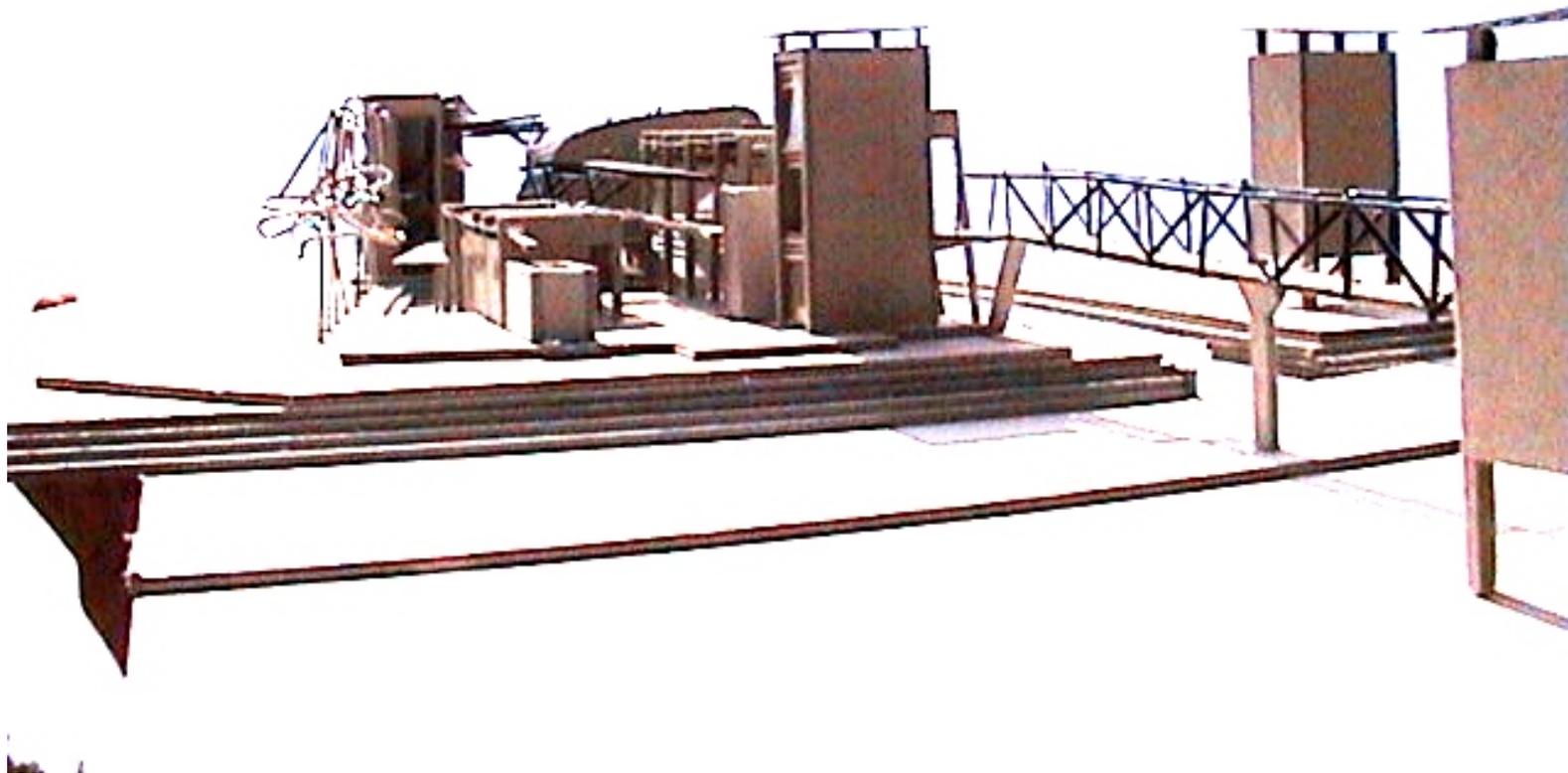


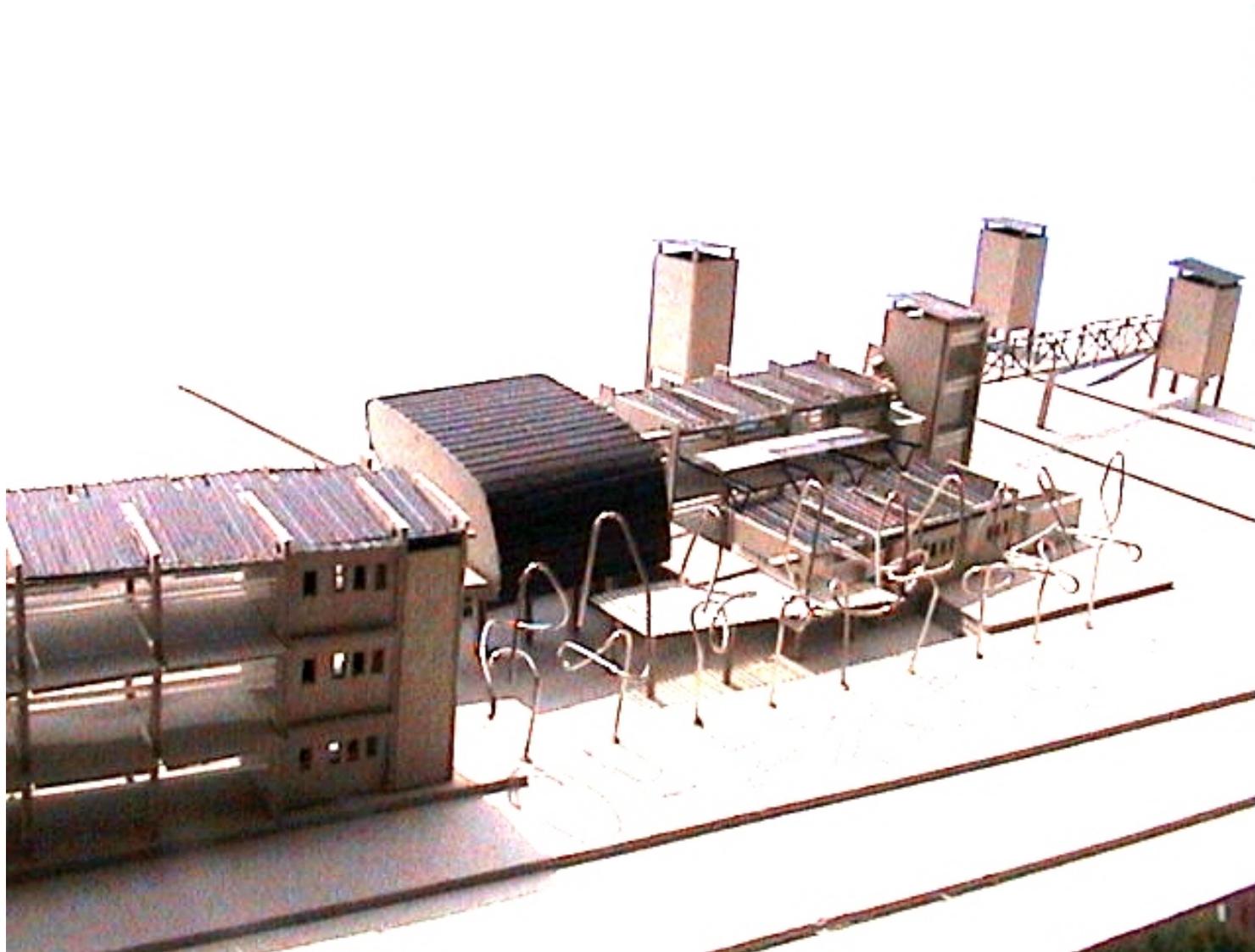
DESIGN RESPONSE

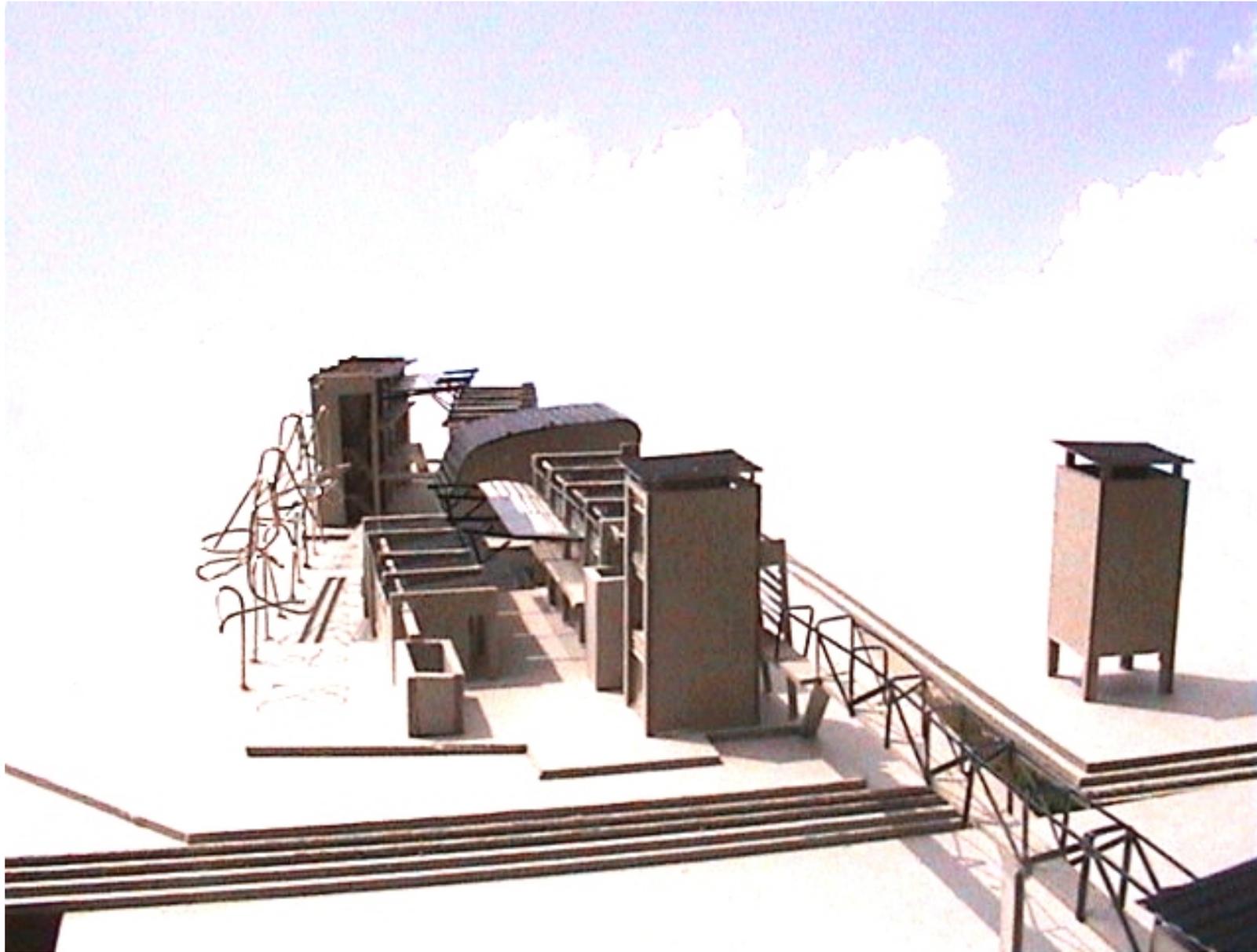












- AD DESTINATUM.** 1960. *Gedenkboek van die Universiteit van Pretoria, 1910-1960.* Johannesburg: Voortrekkerpers Beperk.
- AD DESTINATUM II.** 1987. *'n Geskiedenis van die Universiteit van Pretoria, 1960-1982.* Kaapstad: CTP Boekdrukkers.
- AD DESTINATUM III.** 1996. *'n Geskiedenis van die Universiteit van Pretoria, 1983-1992.* Pretoria: Die Universiteit van Pretoria Drukkery.
- BENTLEY, ALCOCK, MURRAIN, McGLYNN and SMITH.** 1998. *Responsive Environments.*
- DANIELS, K.** 1998. *Low-Tech Light-Tech High-Tech.* Birkhauser Publishers. Switzerland.
- DAVIES, C.** 1988. *High Tech Architecture.* Thames and Hudson: London.
- DE BEER, P.** 2000. *Out of Africa: New work in Zimbabwe.* S.A. Architect. P. 22-29.
- DE KERCKHOVE, D.** 1990. *Virtual Reality for Collective Cognitive Processing.* Ars Electronica. The MIT Press, Cambridge, Massachusetts, and London, England.
- DEWAR, D and UYTENBOGAARDT, R.S.** 1991. *Creating Vibrant Urban Spaces to live: a primer.* Cape Town: Urban Research Unit, University of Cape Town. Cape Town.
- DRUCKEY, T.** 1999. *Ars Electronica: Facing the Future. A survey of Two Decades.* The MIT press, Cambridge, Massachusetts, and London, England.
- DU PREEZ, A.** 2001. *Virtual Culture.* VKK 356. Department of Visual Arts. University of Pretoria
- GIBBERD, J.** 2002. *Sustainable Building Assessment.* Lecture Series. Pretoria: CSIR.
- GREEF, GP.** 2001. *Urban Design Framework.* The Environmental Scoping Report. SEF. The InnovationHub.com
- HUFFMAN, K.R.** 1994. *Video and Architecture: Beyond the Screen.* Ars Electronica. The MIT Press, Cambridge, Massachusetts, and London, England.
- JENCKS, C.** 1995. *The architecture of the jumping universe.* Academy Editions.
- JH CONSULTING.** 2001. *Environmental Noise Report.* Scoping Report. TheInnovationHub.com
- LEACH, N.** 1999. *The Anaesthetics of Architecture.* The MIT Press, London.
- LEOPOLDSEDER, H.** 1986. *Ten Indications of an emerging computer culture.* Ars Electronica. The MIT Press, Cambridge, Massachusetts, and London, England.
- MALAN, P.** 2003. *Hersonering by Tuks in Visier.* Rapport 12 Januarie, p. 4
- MALAN, P.** 2003. *Tuks kry 'ja' vir sy plan met Proefplaas.* Rapport 28 Januarie, p. 3
- McINSTRY, M.** 1999. *Bring Me Sunshine.* Architectural Review. P. 64-67.
- MICROSOFT ENCARTA ENCYCLOPEDIA.** 1999. Microsoft Corporation.
- MITCHELL, W.J.** 1996. *City of Bits.* Basel : Birkhauser Publishers.
- NAPIER, A.** 2000. *Enviro-friendly Building Methods in small Building Design for South Africa.* Published by the Author.
- RADEMEYER, A.** 2003. *Spil sal Proefplaas nie Vernietig, sê UP.* Beeld 7 Januarie, p. 8
- RADEMEYER, A.** 2003. *Tegnologiepark Goedgekeur.* Pretoria-Beeld, 21 Januarie, p. 6
- RUSSEL, M.** 1990. *Riding the giant worm to Saturn: Post-symbolic communication in Virtual Reality. Excerpt from an interview with Jaron Lanier.* Ars Electronica. The MIT Press, Cambridge, Massachusetts, and London, England.
- STRAUSS, H.** 2003. *Inwoners "Mislei".* Rekord Oos, 3 Januarie p. 3
- STRAUSS, H.** 2003. *Ontwikkeling Raak Paaie.* Rekord Oos, 10 Januarie p. 2
- STRATEGIC ENVIRONMENTAL FOCUS.** 2001. *The Construction of the Innovation Hub and Associated Infrastructure on the remainder of the farm Koedoespoort 456 JR, Pretoria. Scoping Report.* SEF
- STRATEGIC ENVIRONMENTAL FOCUS.** 2001. *A Vegetation Assessment for the proposed Innovation Hub Development on the remainder of the farm Koedoespoort 456 JR, Pretoria. Gauteng.* SEF
- SABS 0400.** 1990. *Die Toepassing van die Nasionale Bouregulasies.* Die Raad van die Suid Afrikaanse Buro vir Standaarde.
- THE INNOVATION HUB MANAGEMENT COMPANY.** 2001. *Facts and Guideline Document.* TheInnovationHub.com
- THE INNOVATION HUB MANAGEMENT COMPANY.** 2000. *Information Release.* TheInnovationHub.com
- THOMAS, R.** 1996. *Environmental Design.* Oxford: The Alden Press.
- TSHWANE TOURISM ASSOCIATION.** 2002-2003. *Tshwane/Pretoria Visitor's Guide.* Tshwane Visitors.
- TUTT, P and ADLER, D.** 1998. *New Metric Handbook: Planning and Design Data.* Architectural Press.
- URBAN SOLUTIONS.** 2000. *Melrose Arch Design Guidelines.* Privately Published.
- WINTERBOTTOM, D.** 2000. *Rainwater Harvesting.* Landscape Architecture. P. 40-46.

Websites:

[www. GreatBuildings.com](http://www.GreatBuildings.com)
www. Naledi3d.co.za
www.theinnovationhub.com

Vir my ouers, dankie vir julle liefde en ondersteuning, sonder die geleenthede wat julle vir my geskep het was hierdie afgelope 6 jaar nie moontlik nie. Ek is lief vir julle.
H Bergh, thanks boet! Sou niemand anders as 'n broer wou hê nie, jy bliksem!
Janine, jy het my deur alles gedra, jou geduld, jou inspirasie. Dankie vir alles. Ek is lief vir jou.
Natuurlik al die bra's in die studio: Louis, Shawn, Bernhard, Andre, Sonia, Trevor, Cornus, Andrew, Drikus en Morne. Thanks for adding a bit of spice.
Thanks Nick, for all the plotting headaches you sorted for me. Shot.

Dankie vir Ons Hemelse Vader, wat altyd sy belofes nagekom het, ten spyte van my tekortkominge.