Part 2: Design research

In this chapter, an analysis of the existing spatial, functional and experiential condition is conducted. The existing issues on site, in terms of performance enhancement, are addressed through the new intervention's response to the old. The new intervention is unpacked below, describing how evidence based design theory is translated spatially to create a more appropriate and beneficial architecture for the athlete.

Introduction

Architecture, shaped by its boundaries, impacts the user far beyond the mere physical presence of the building as an object in space (Sfinteş, 2012: 1). Instead, its scope goes further to satisfying various human desires and needs. Architecture carries potential to enhance athletic performance through the psychological and physiological impact that designed spaces have on athletes (Moses, 2012 and Deasy: 1990, 112). Through the lens of *evidence-based design* as a means of bridging the gap between architecture, environmental psychology and sports psychology (Malkin, 2008), the *context* and *user* play a vital role in the success of the design's intention to aid in athletic performance enhancement. The context is investigated through an analysis of the existing spatial characteristics, materiality, functionality and architecture that is found on the University of Pretoria Hillcrest Sports Campus; while the user is placed central to the design scheme through critical design responses based on theory and confluences found between sports psychology and environmental psychology as well as collaboration with the end user and other important stakeholders. This critical approach to design is where theoretical findings are translated into spatial and functional interventions that form the architecture - as opposed to a predetermined form into which functions are placed (as is the case in many sports architecture and stadium designs). The formalist approach seems to negate the *experience* of the user - the very experience that evidence-based design theory has proven can have positive psychological and physiological effects on the athlete and, in this project specifically, contribute to their athletic performance enhancement. Rather, form is derived through spatial translations of evidence-based design theory. The role of architecture shifts from a *passive* one to an *active* one; a permanent functional shell to a dynamic space that evokes unique experiences that allow for the creation of a *place* (Sfinteş, 2012: 2).

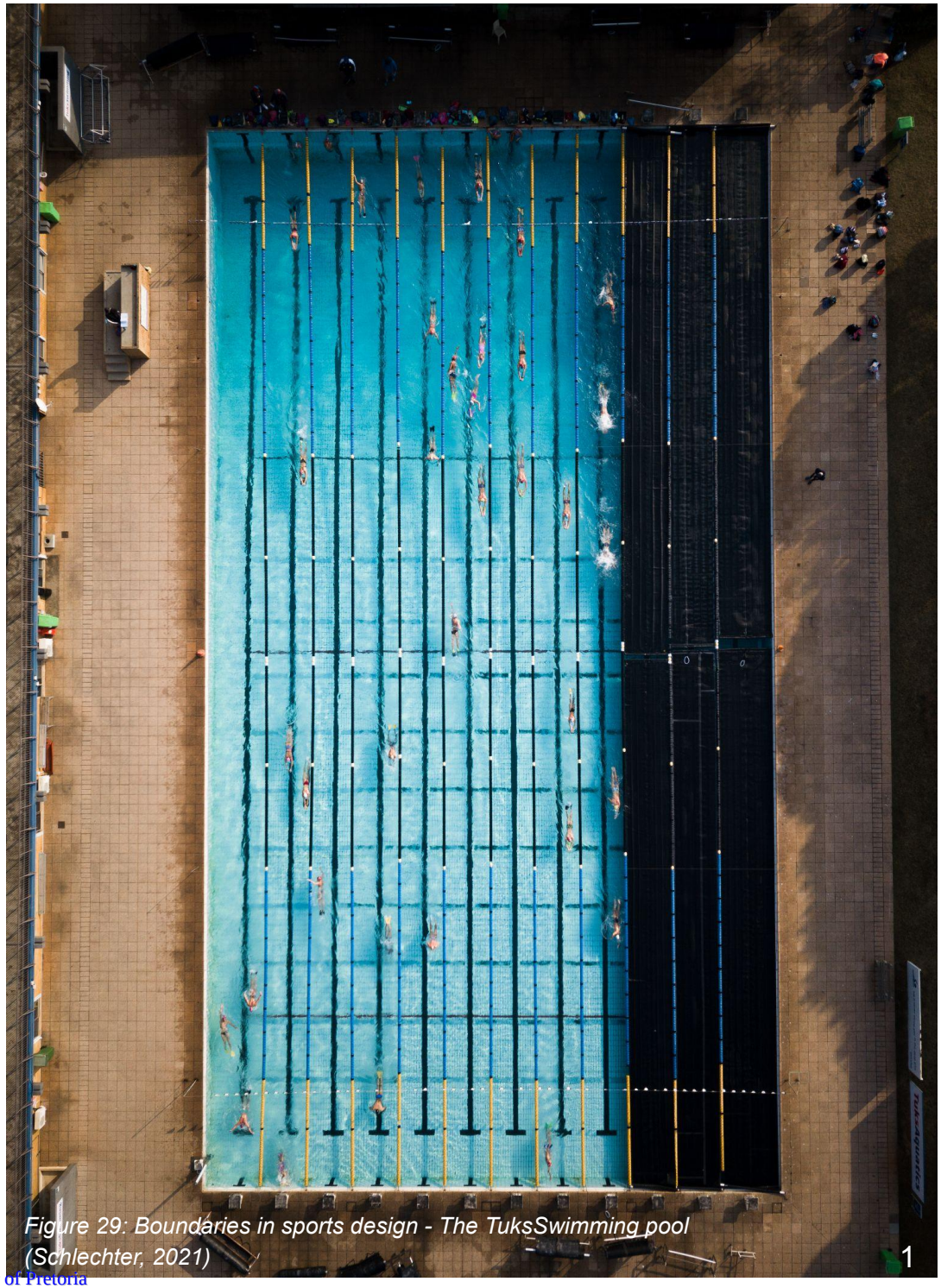


Figure 29: Boundaries in sports design - The TuksSwimming pool (Schlechter, 2021)

Unpacking the existing

The existing TuksAquatics and squash complex houses a variety of spatial problems that could possibly detract from athletic performance. In order to find solutions to ineffective sports architectural typologies, the faults and problem spaces on the site need to be identified. The complex exists as an isolated element in the larger landscape of the Hillcrest campus, almost entirely blocked off from surrounding facilities and urban spaces. The existing site is yet another example of sports architecture that is disintegrated from its urban (or campus) environment.

The complex is perceived to be highly inaccessible with only one small entry and exit point to the entire complex. The site is further rendered inaccessible due to the impenetrable edge conditions of the existing buildings. At the west, the existing squash courts create a solid mass, restricting both physical and visual access into the site. At the north, pump rooms and store rooms create a wall of monofunctional spaces that do not interact with the street edge. Furthermore, the impermeable boundary condition creates pockets of dead space throughout the perimeter of the site (figure 30 and 31).

Upon entry into the site, a narrow walkway leads users towards a dead-end with sharp turns to the pool complex at the east or the squash courts at the west. The supporting spaces to the field of play are organised along narrow hallways with no visual access to the internal spaces. Many of the existing internal spaces and rooms have been left unused and either lie empty or as unplanned, unorganized store rooms. Furthermore, the spectator spaces are accommodated only by small staircases at each end. Function and minimum spatial requirements seem to be catered for, but the experiential factor of space appears to be fully negated. Missed spatial opportunities on site include closed-off rooms at the perimeter of the central courtyard as well as disconnected green spaces stretching from west to east across the site. In summary, the major issues lie in the disconnected spaces within the site and, ultimately, the site's disconnection with surrounding facilities on campus (figure 30 and 31).

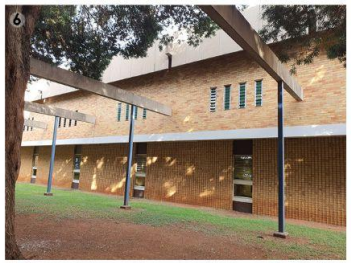
Western facade of the squash courts: Solid, inaccessible wall.

Northern facade of the pool complex: Monofunctional dead spaces (pool pumps and storage rooms).

Resultant dead spaces on the perimeter of the site.

Long, narrow hallways in the swimming pool complex with no visual access to internal spaces.

Long narrow hallways in the squash complex with limited views to the central courtyard.



No provision made for live-out spaces to the central courtyard (eastern facade of the squash court complex)

No provision made for live-out spaces to the central courtyard (western facade of the swimming pool complex). No views through to the field of play.

Figure 30: The existing condition of the TuksAquatics Centre (Author, 2021).

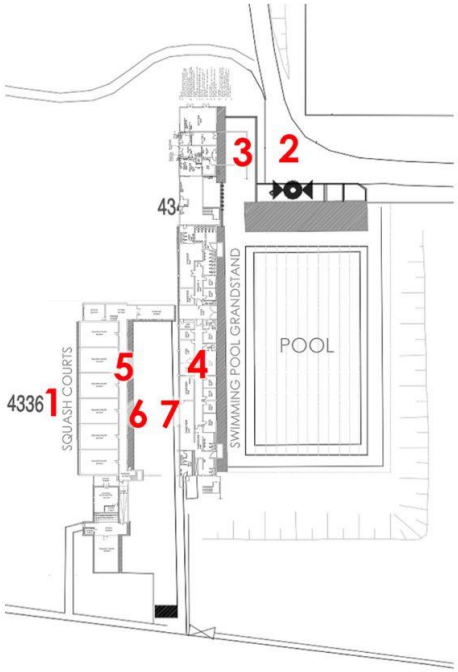


Figure 31: Plan of existing building as key for photographs (Adapted from Verbeek, 2020).

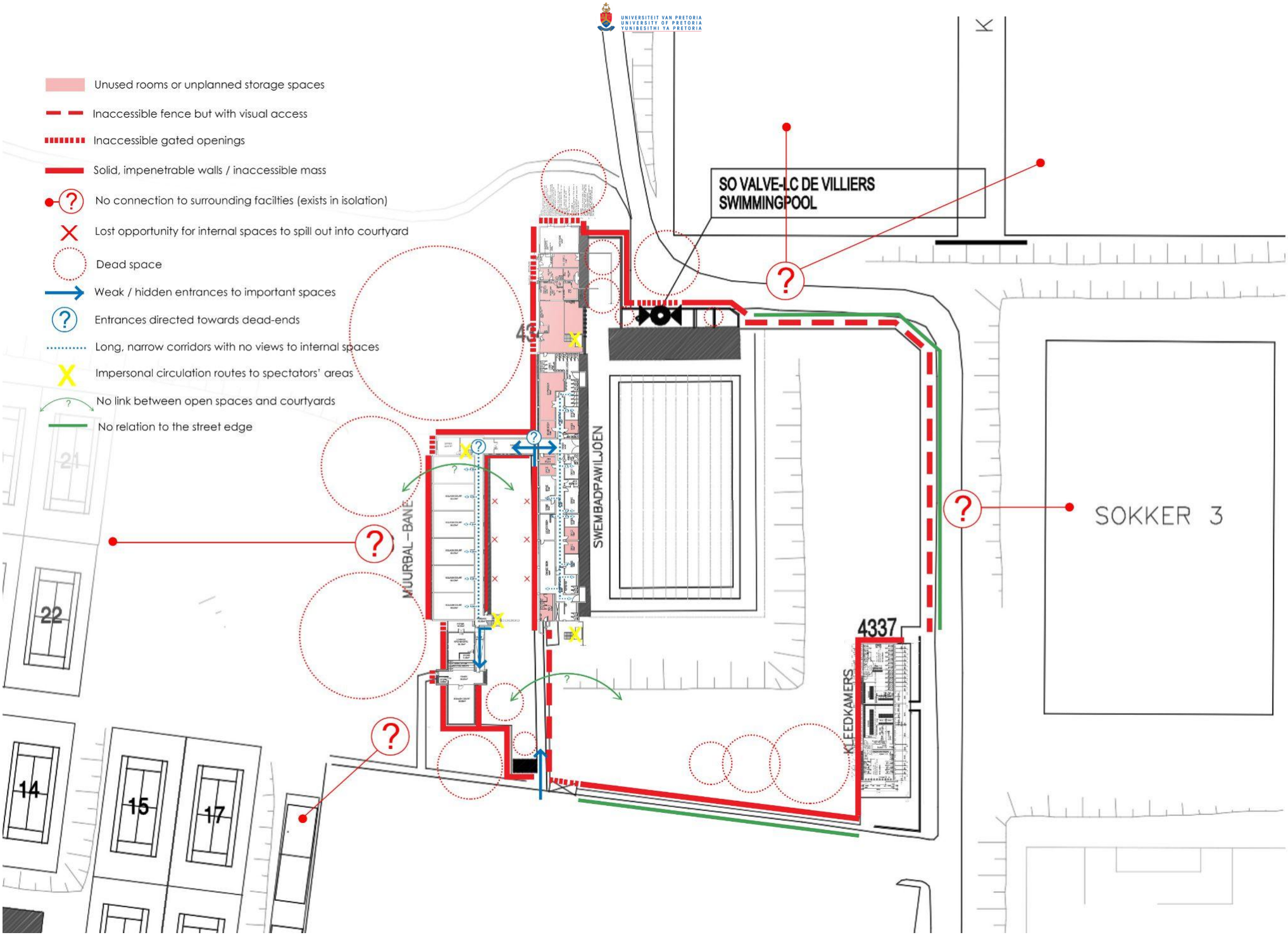


Figure 32: Critique of the existing condition of the TuksAquatics complex (Based on Verbeek, 2017; Dinolofatsi, 2009; Dinolofatsi, 2020, Dinolofatsi, n.d.).

Unpacking the existing:
Photos of existing spaces on site

Figure 33: View to the west - the spectator stands (Author, 2021).

Figure 34: View to the north (Author, 2021).

Figure 35: Green open space at the south (Author, 2021).

Figure 36: Unused gym at the north (Author, 2021).

Unpacking the existing:
Photos of existing spaces on site

Figure 37: Pool-deck access to shared ablutions (Author, 2021).


Figure 38: Forgotten victories hidden in the coach's office (Author, 2021).


Figure 39: Unwelcoming coach's office (Author, 2021).


Figure 40: Unused braai area due to bad locality (Author, 2021).

Unpacking the existing:
Photos of existing spaces on site

Figure 41: Old equipment stored and left unprotected (Author, 2021).

Figure 42: Informal kit-bag storage on pool-deck (Author, 2021).

Figure 43: Failed tuks-shop and cafe' due to bad locality (Author, 2021).

Figure 44: Waterpolo equipment left without dedicated storage (Author, 2021).

Unpacking the existing:
Photos of existing spaces on site

Figure 45: Staircase to the spectator stands (Author, 2021).

Figure 46: The spectator stands (Author, 2021).

Unpacking the existing:
Photos of existing spaces on site

Figure 47: View to the north-east from the spectator stands (Author, 2021).

Figure 48: View to the west from above the spectator stands (Author, 2021).

Figure 49: View to the south-east from the spectator stands (Author, 2021).

Figure 50: View to the west from above the spectator stands (Author, 2021).

Unpacking the existing:
Photos of existing spaces on site

Figure 51: Vehicle entrance to the pool (Author, 2021).

Figure 52: Concrete fences surrounding the entire facility (Author, 2021).

Figure 53: Main pedestrian entrance to the pool (Author, 2021).

Figure 54: Views to the pool from far-off through the fences (Author, 2021).

Unpacking the existing:
Photos of existing spaces on site

Figure 55: Competition squash court (Author, 2021).

Figure 56: Unused open land and impermeable walls at the west of the squash courts (Author, 2021).

Figure 57: Fences and gates within the facility (Author, 2021).

Figure 58: Closed-off edges of the squash complex (Author, 2021).

Figure 59: Endless fences at the north (Author, 2021).

Figure 60: Inaccessible spectator spaces (Author, 2021).

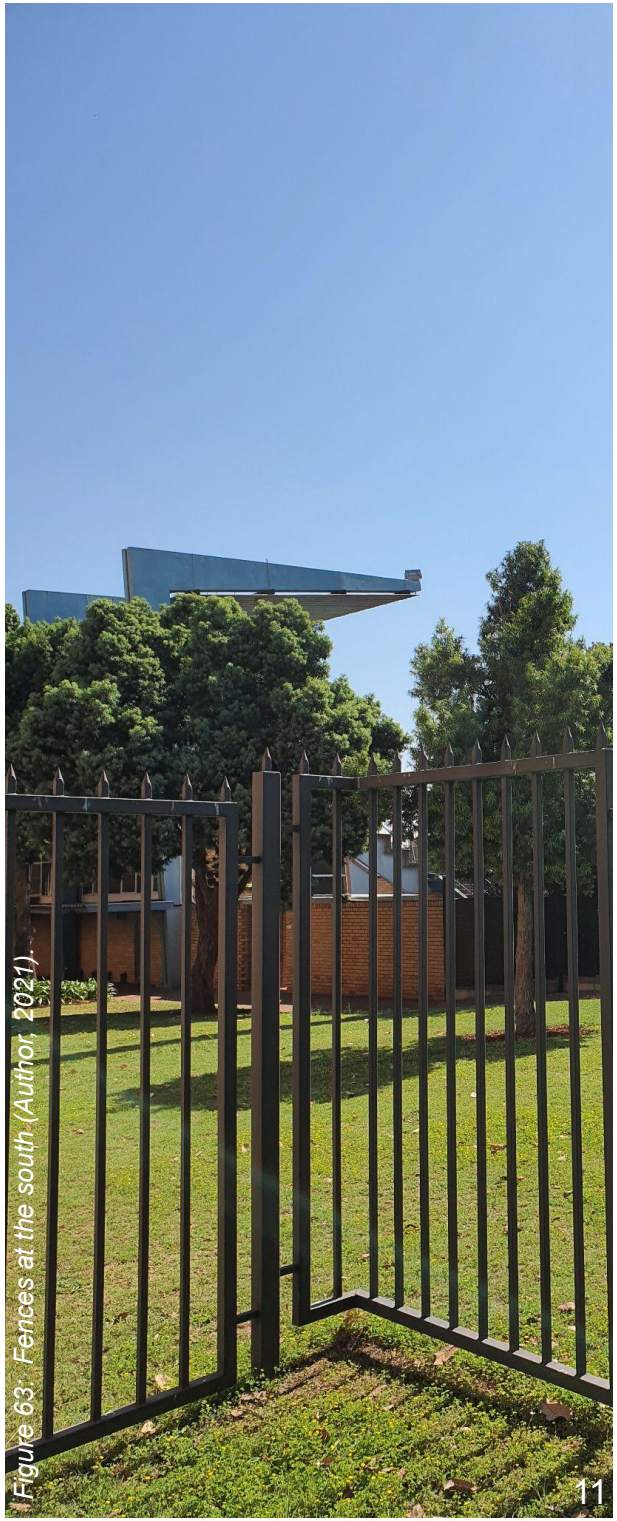


Figure 63: Fences at the south (Author, 2021).

Figure 61: Endless fences at the east (Author, 2021).

Figure 62: Endless fences at the south (Author, 2021).

Figure 64: Main pedestrian route to the pool-deck (Author, 2021).

Figure 65: Closed-off views to the field of play (Author, 2021).

Figure 66: Central courtyard between the squash courts (left) and the pool complex (right) (Author, 2021).

Figure 67: Restricted visibility to the field of play from within the facility (Author, 2021).

Figure 68: Dead spaces surrounding the northern site boundary (Author, 2021).

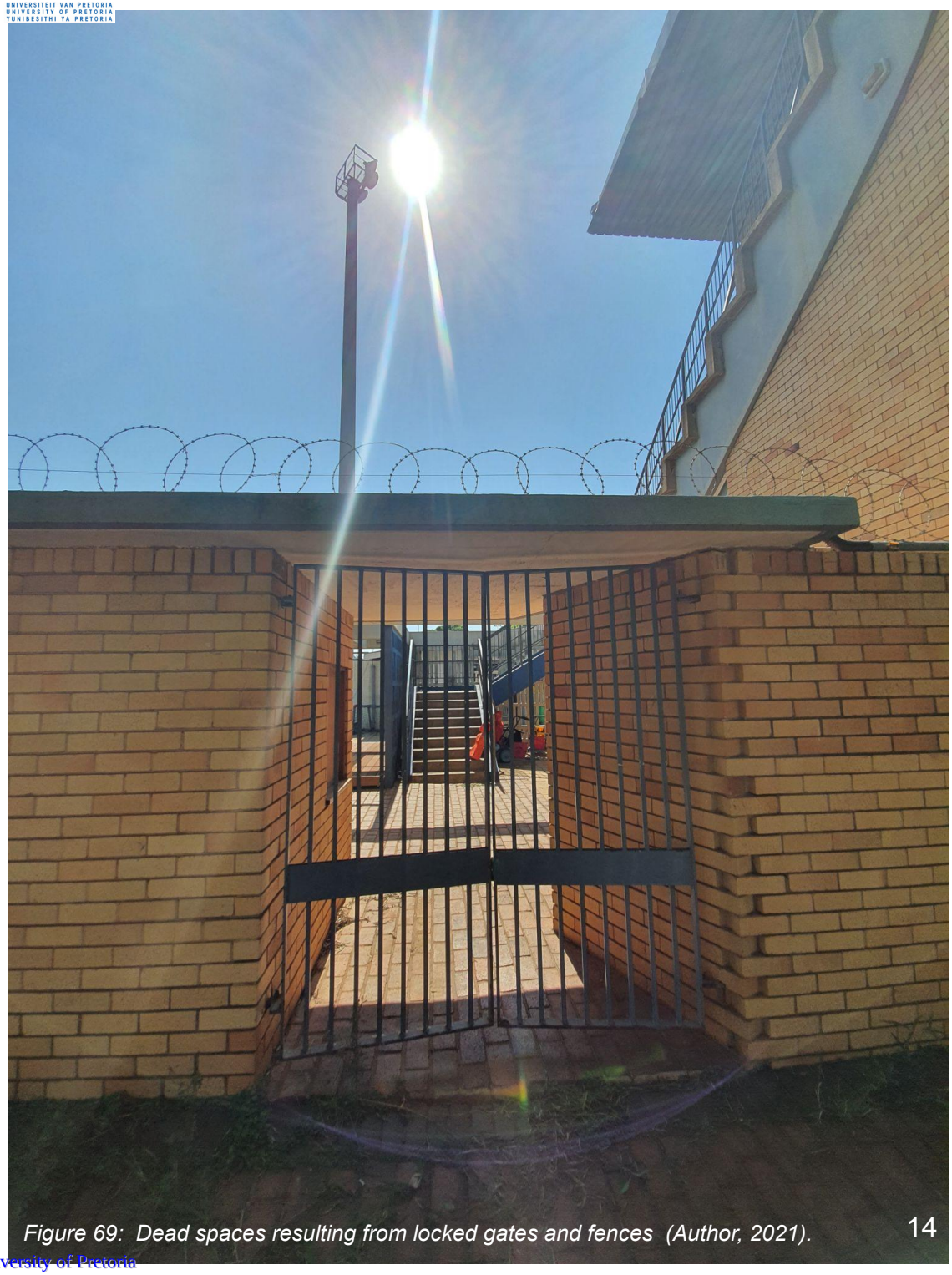


Figure 69: Dead spaces resulting from locked gates and fences (Author, 2021).

Initial design responses

In terms of the larger site, I considered the proposed campus vision of connecting the TuksAquatics Complex to Arcadia Street and intersecting it with the Uitspan public node. This is done as a means to enhance the site's interaction with its campus and urban surroundings.

Figure 70: Proposed connection between Arcadia Street, the campus and the site (Google, 2021 and Author, 2021)

Design themes are derived through the existing topography that stretches from the proposed pedestrian entrance at Arcadia Street to the site itself: The fall of the landscape exposes certain functions at the west and encloses other functions at the east. Hence, the public functions of the new proposal are situated at the west - exposed, open and accessible - while the more private functions are located at the east - enclosed, controlled and protected (figure 71).

The treatment of proposed water bodies across the site occurs in a similar manner (figure 72): The existing Uitspan dam with its social swimming facilities is fully accessible, natural and public in comparison to the 50m training and competition pool for the professional athletes, which exists in a more private and controlled setting. The connection between the two nodes is achieved through a public running route and a 250m long open water channel.

This channel acts as a hybrid space, merging the organic public function at the west with the rigid private function at the east. It serves both private functions (as a training ground for professional open water swimmers) as well as public functions surrounding the open water channel.

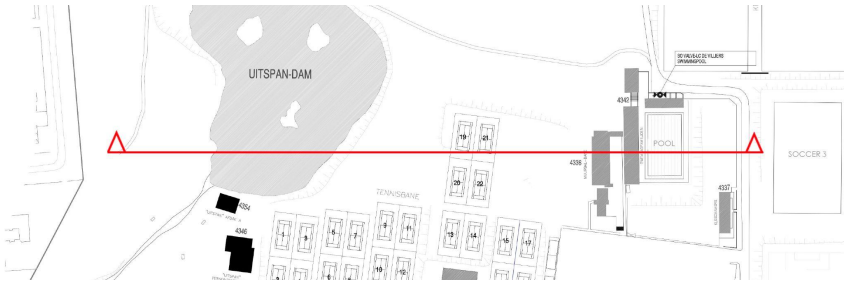


Figure 74: Site plan showing where sectional sketches are drawn (Author, 2021)

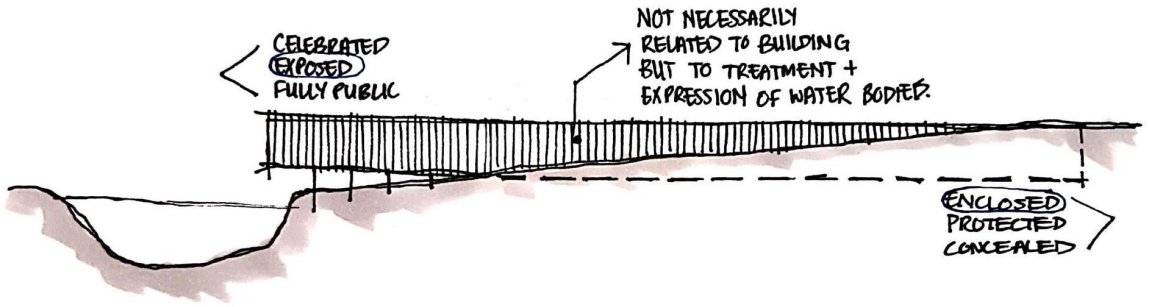


Figure 71: Expose vs enclose concept (Author, 2021)

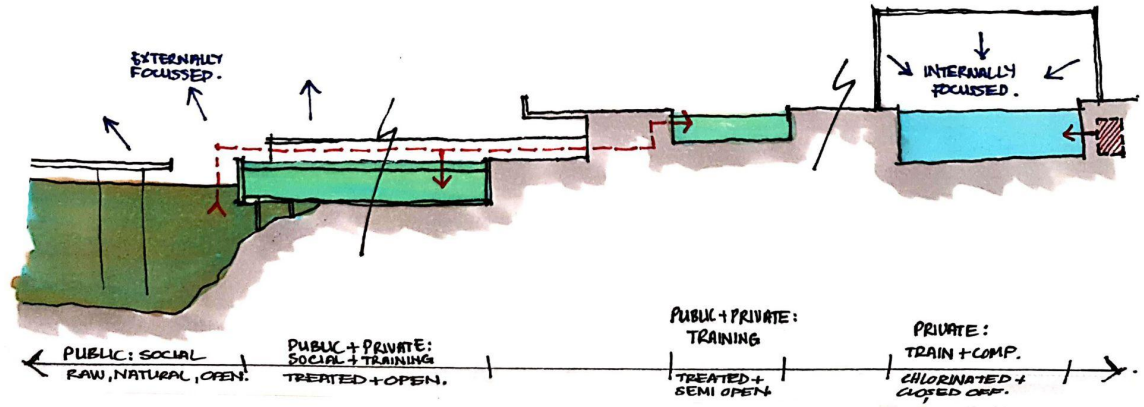


Figure 72: Treatment of water across the site (Author, 2021)

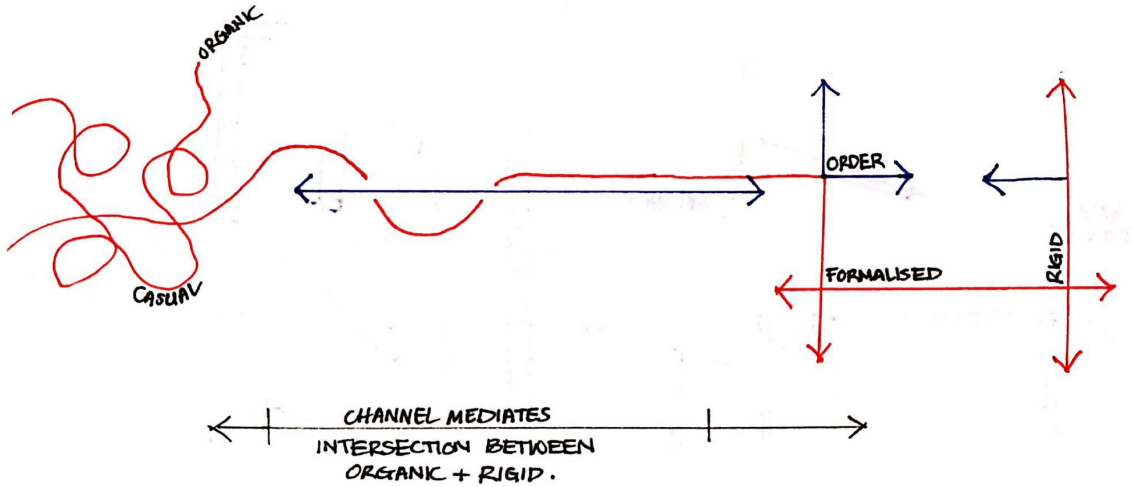


Figure 73: Conceptual progression from organic to structured spatial organisation

Furthermore, the new architectural language should respond to the low-structural intensity and high natural value evident on the Hillcrest campus through highly tectonic structures that appear minimally invasive and that sensitively engage with the existing landscape, but do not try to dominate it.

Zooming in further, in terms of the aquatics complex itself, the new architecture that is to be introduced needs to sensitively respond to the existing structures. This is necessary in order to respectfully add and make changes to the near 50 year old buildings. To place the existing sport facility within the continuum of sports architecture, the 'evolution of the stadium' can be revisited: ranging from the monofunctional, to the multifunctional, to the commercial, to the flexible stadium. Although most buildings on campus borrow from notions of the multifunctional or commercial stadium typologies, the TuksAquatics complex appears even more outdated. It exists as a merely monofunctional sports venue.

The new proposal can make this evolution and advancement of sports architecture evident through the new interventions' dialogue with the 'old'. This dialogue can be accommodated by layering facades, from new to old. The new architecture, thus, wraps around the existing structure, not hiding nor demolishing it, but rather enhancing its functionality and effectiveness for the user (figure 75). Existing functional elements of the building are altered, broken up and pierced through to induce new *experiences* in the users. This approach attempts to enhance the existing structure, site and user, both architecturally as well as in terms of athletic performance enhancement.

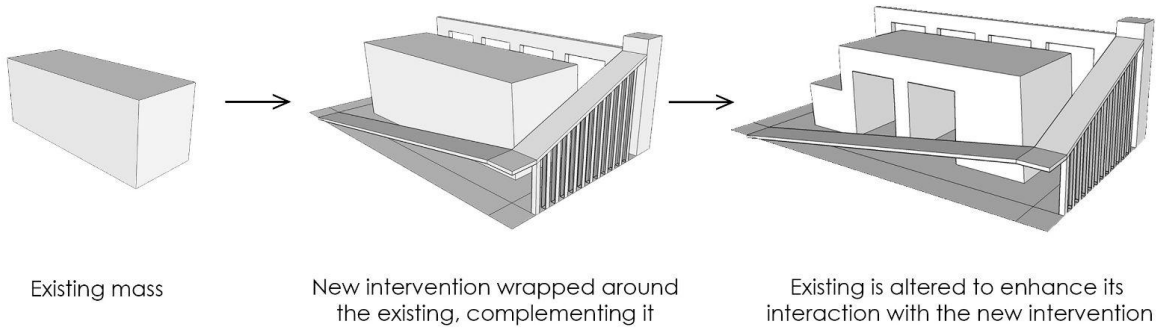


Figure 75: Approach to the existing (Author, 2021)

Critical design: Translating theory into architecture

Architecture no longer exists as a mere shell to house a variety of functions - rather evoking responses from the user through a variety of experiences (Sfinteş, 2012: 4). This evolution of architecture and, in this case specifically: sports design, transforms the architect's perception of the user from a neutral body that undergoes functional activities, to a central element of the designer's intentions (Sfinteş, 2012: 4). To allow this level of user-centrality in design, a deeper understanding of the user is required, which is why theory of sports psychology has been integrated into existing studies of environmental psychology and evidence based design in order to better understand the athlete and their needs.

The following critical design responses are based on evidence-based design theory as well as confluences found between environmental psychology and sports psychology principles. The overarching objective remains to determine the athletic performance enhancing potential of architecture. Confluences found between sports psychology (Cohn, 2008 and Gullu, 2020) and environmental psychology (Malkin: 2008) are summarised in the table alongside. Spatial aspects which can benefit from evidence-based design principles are also highlighted in the table (figure 76):

	Evidence-Based Design	Additional Spatial Responses
Focus and Concentration	Focus To prevent "result-oriented" mindsets	Restrict visual access From external distractions
Doubt vs. Confidence		Break-away spaces Protecion from doubt inducing external factors
Coping skills	Positive thoughts Combat emotional toll of minor setbacks	Improved accessibility Between athlete and support figures
Regulating adrenaline	Calmness / Energy-inducing	
Motive to perform		Athlete residence facilities Complimentary facilities
Mental impact of injuries		Visual access to rehab spaces Transparent design to familiarise athletes with the recovery process
Game plan		Accessible design of coach's office Visible, centrally located game plan
Being in the zone	Improve concentration and remove distractions	Break-away spaces Avoid external distractions
Athletes with disabilities		Universally accessibly spaces for mobility impaired athletes Visual access for visually impaired athletes
Spirituality in sport		Social spaces for interaction between athletes Spirituality-related design drivers for resillience
		Social spaces to encourage healthy habits Removal of dead spaces
		Improved accessibility to training facilities Performance spaces
Coach-athlete relationship		Locality of coach's office in relation to other stakeholders Accessible design of coach's office and support facilities
	Promote creativity in coaching environments	Adaptable design of training venues to suit varied coaching methods
		Transparent design of coach's office and physio rooms
		Private space in athlete's living environments Zoning between coach, athlete and secondary stakeholders

Figure 76: Summary table of design opportunities based on theory (Author, 2021)

Accessibility

Many athletes who experience minor setbacks during competition or training tend to over-inflate these setbacks, fixating on them and draining their own energy. This often results in underperformance (Cohn, 2008). Athletes need to stay composed by regulating their emotions. This can often be achieved through an *accessible support system*. The design must respond to this by creating spaces where athletes are able to gain access to the various components of their support system when needed, for example: their parents, coaches, teammates and sports psychologists. This may be done by, for example, not fully restricting access between the athletes' and spectators' areas, so that athletes are able to freely and easily move between the various spaces in order to reach out to their support system (figure 77). Inaccessible designs may result in the athlete feeling isolated and hopeless.

Hence, social spaces that encourage positive interaction and support between teammates (Kiecolt-Glaser: 1998 in Malkin: 2008, 8) becomes vital to the scheme. One of the ways of incorporating social spaces is through the introduction of accessible public spaces into the site (figure 77 and 78). Public use and access benefits the professional training and competition facility by adding to its sustainability. This is because youth and recreation-level swimming programs are widely used to fund and maintain professional sporting institutions. The public programs become vital to the facility's survival and maintenance - hence, public accessibility plays a major role in the success of the architecture.

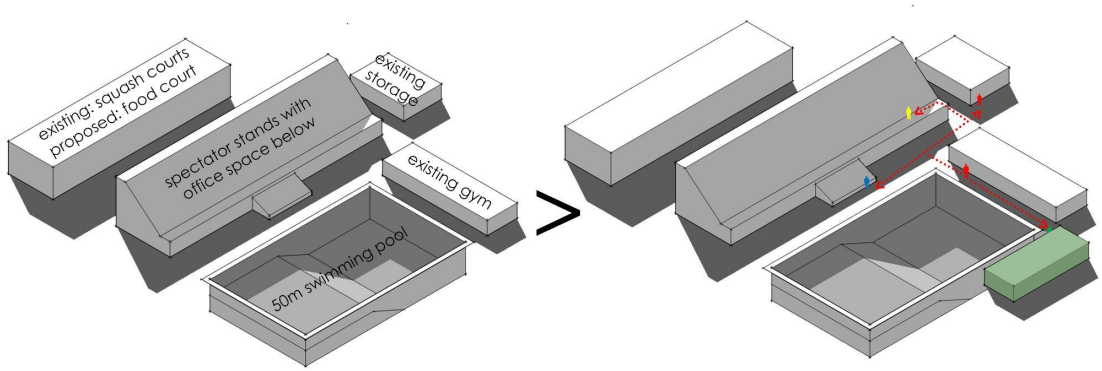


Figure 77: Free movement between athletes and supporting figures (Author, 2021)

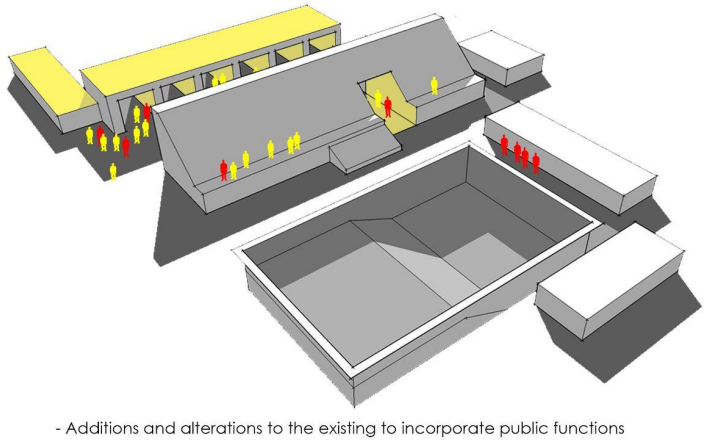
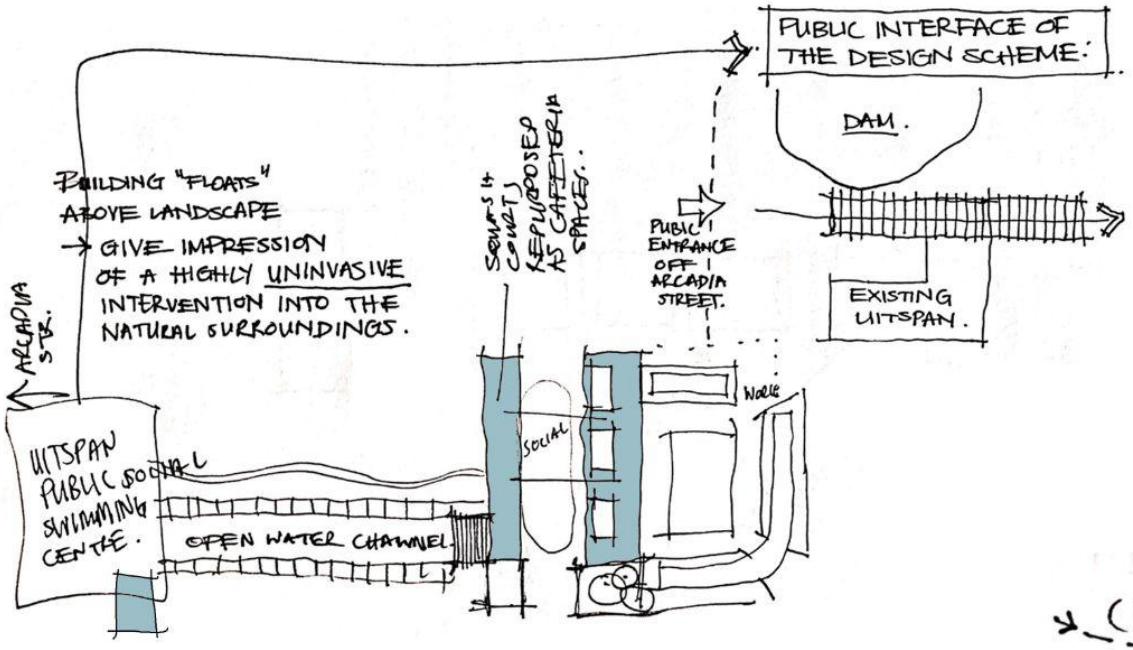
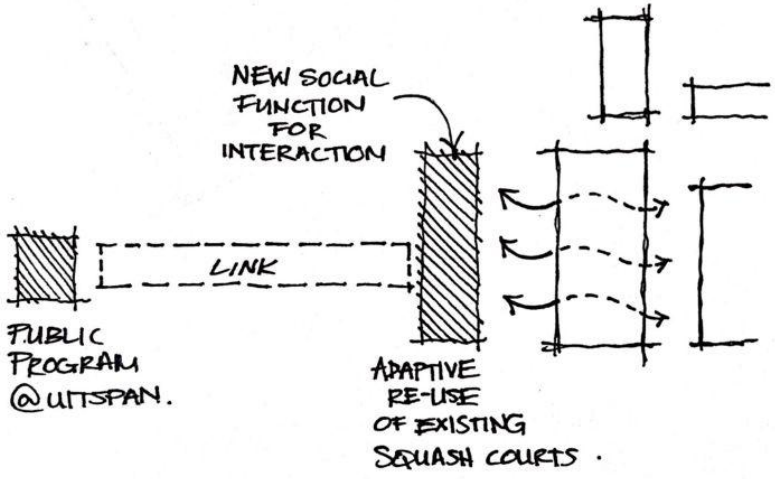


Figure 78: Positive social interaction through public integration (Author, 2021)

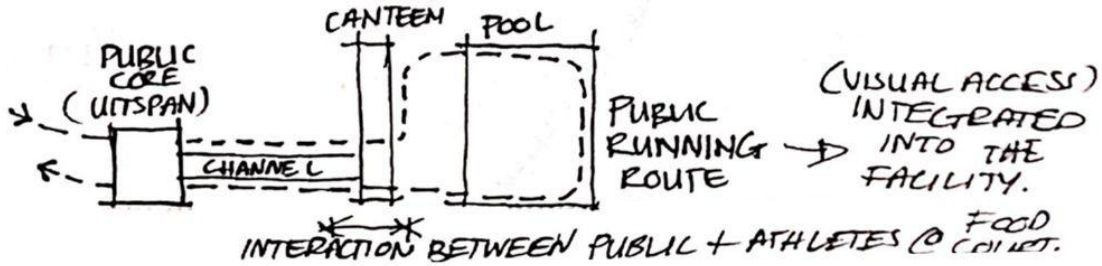
Calmness
(Ulrich: 1984 in Malkin: 2008, 8)
(Kiecolt-Glaser: 1998 in Malkin: 2008, 8)
(Malkin: 2008, 7)



Social core forms buffer between public and private space:
Interaction between athletes and the public



Linking proposed public node to the site:
Enhances social interaction



Proposed public running track merges with existing pedestrian route:
Integrates public into the facility - sometimes only through visual access

Figure 79: Positive social interaction through public integration (Author, 2021)

Accessibility (continued)

Accessibility to sports facilities becomes of even greater importance when one considers athletes with disabilities. Mobility impaired athletes, for example, experience major physical barriers within the built environment of sports architecture. A study indicated that the two largest barriers include the lack of or poorly designed wheelchair ramps and the lack of parking spaces for wheelchair users. Of the total interviewees, 72,1% and 69,2% respectively experienced these issues (Kljajić et. al, 2018: 16-24). Inaccessible spaces pose additional stressors on disabled athletes which could negatively impact their performance. These athletes may develop feelings of struggle and inadequacy which could limit their confidence and motivation. Sports facilities need to be designed inclusively to accommodate athletes of varying degrees of physical ability (figure 80). This includes physical access to spaces through ramps and elevators as well as visual access for visually impaired users to information through legible signage, large enough results-screens as well as the minimisation of glare over water bodies.

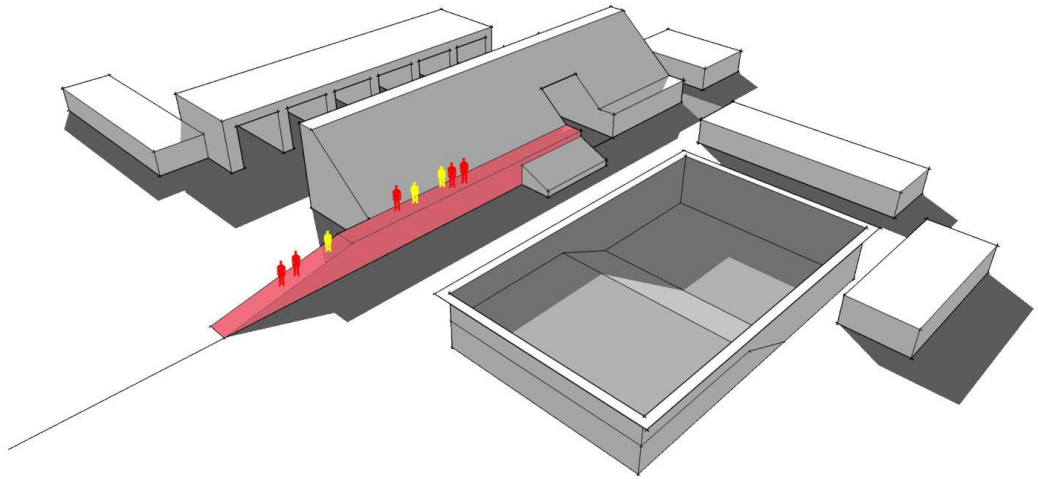
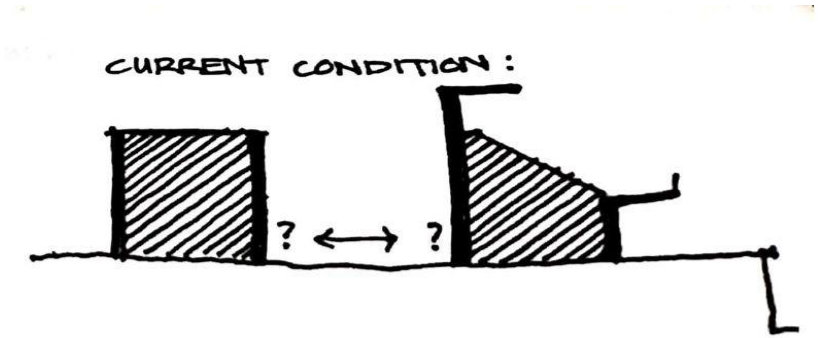


Figure 80: Inclusive design through the addition of ramps (Author, 2021)



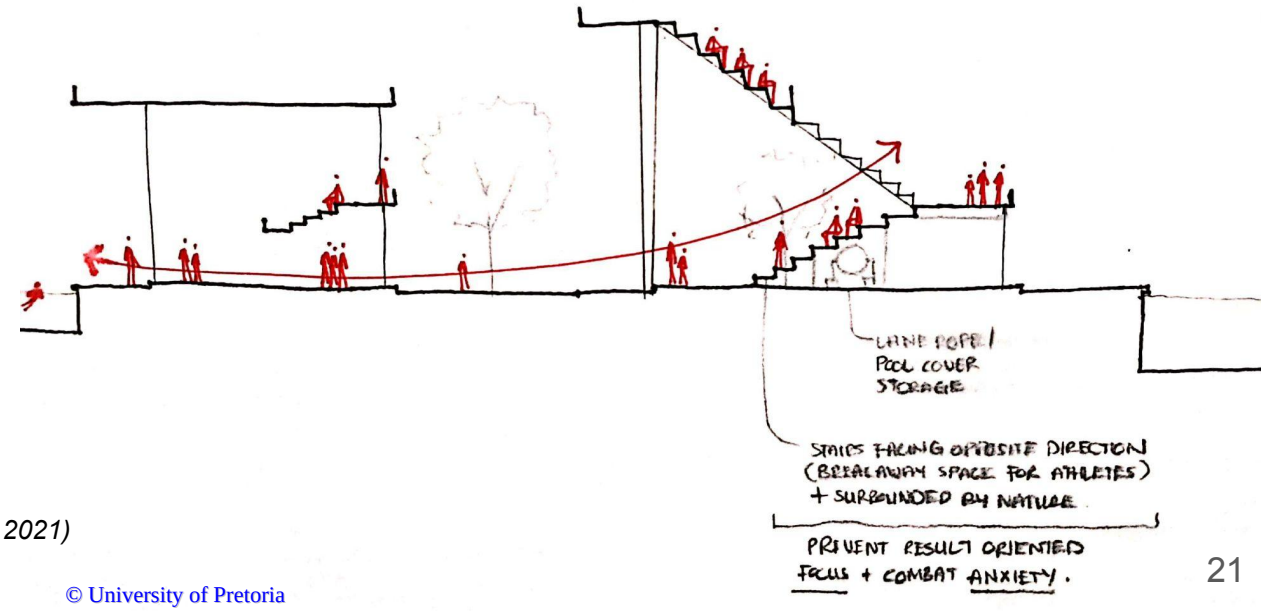


Figure 81: Altering the current condition to enhance accessibility (Author, 2021)

Pre-race spatial implications: marshalling and breakaway spaces

In order to enhance an athlete's focus pre-race, various evidence-based design techniques can be used (figure 82). However, the majority of professional-level athletes have highly-developed concentration and focus abilities. However, many athletes tend to focus on the wrong activity at the wrong time (Cohn, 2008). Cohn differentiates between "result-oriented focus" and "process-oriented focus". For example, a swimmer's mind is fixed on the time he or she wants to swim (result) while in the race, instead of focussing on the motions and intensity needed to swim that time (process). Result oriented focus distracts the athlete from what needs to be done or what process needs to be followed to achieve their goal.

Multisensory design acts as positive distractions for athletes, helping them to avoid pre-race anxiety (Taylor, 1997 in Malkin, 2008). These take the form of 'breakaway spaces' (figure 83 and 84). The spaces where athlete's experience the highest levels of doubt need to be identified and designed accordingly. For example, during warmup, some athletes may experience feelings of doubt after interaction with overly-confident competitors or teammates. Break-away spaces may be needed where athletes can temporarily prepare for their race in isolation from doubt-inducing external factors. The proposed breakaway spaces take the form of a highly social setting at the proposed social and public core of the scheme (acting as positive distractions to anxious athletes); as well as more private, quiet and natural spaces, fully removed from the venue where athletes can temporarily escape the pressures of the competition environment in the interior of the venue.

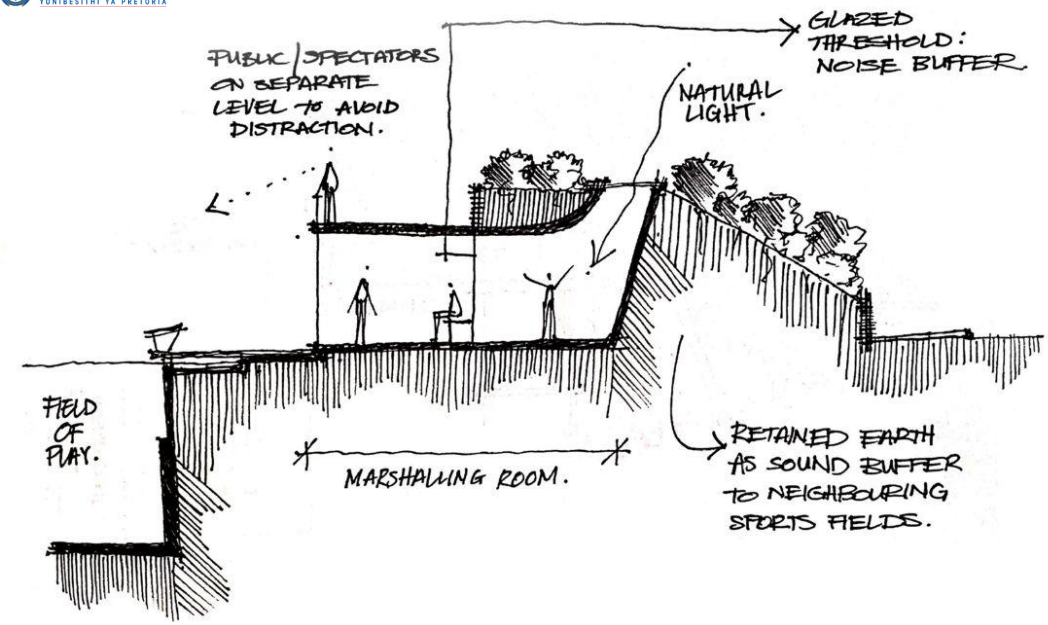


Figure 82: Design to enhance focus pre-race (Author, 2021)

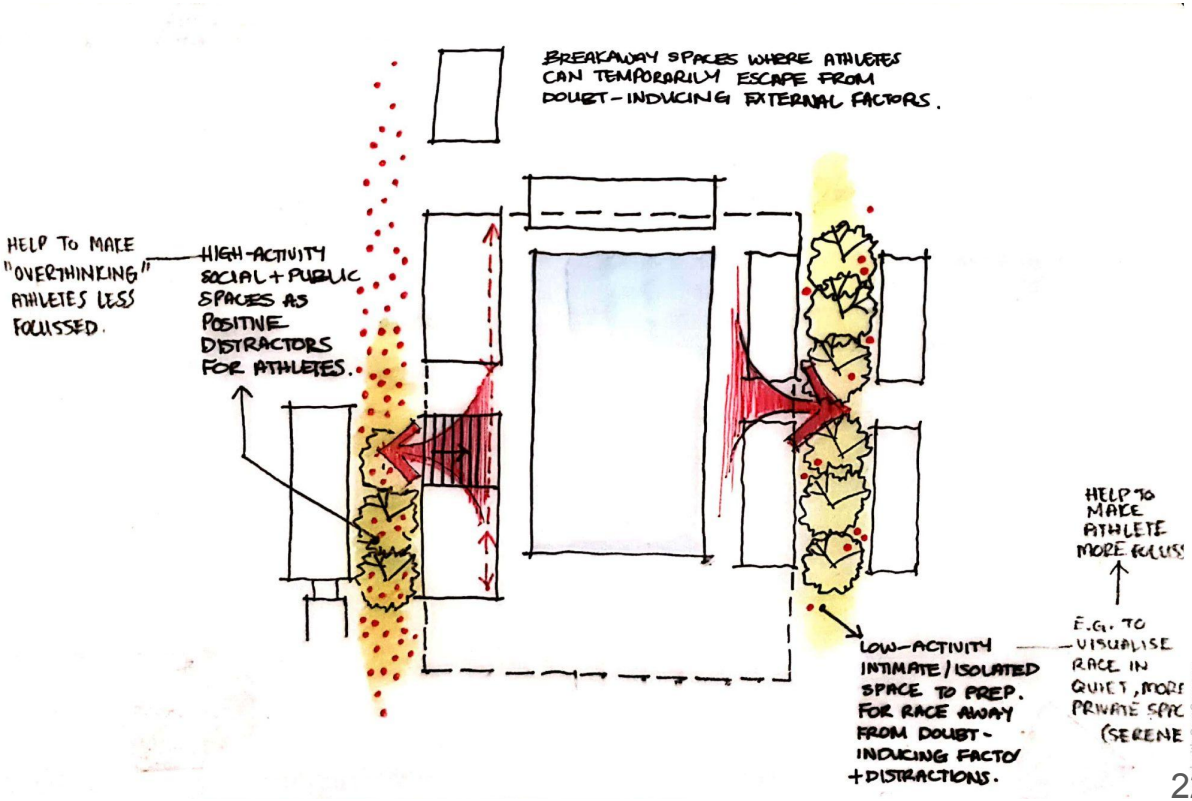
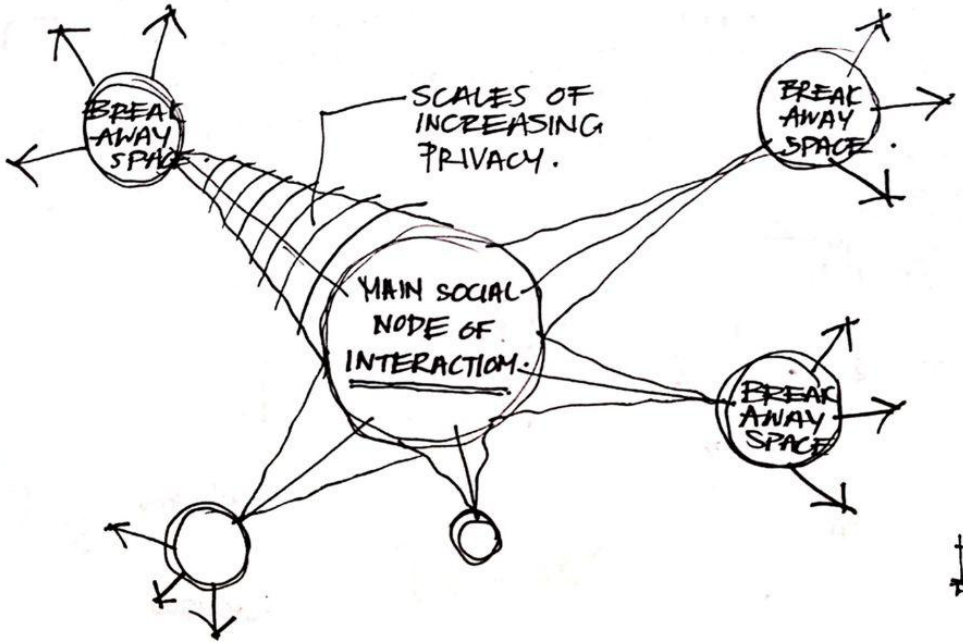


Figure 83: High-activity versus low-activity breakaway spaces (Author, 2021)

Break-away spaces
Protecion from doubt inducing external factors
((Winkel and Holahan 1986 in Malkin: 2008, 8))



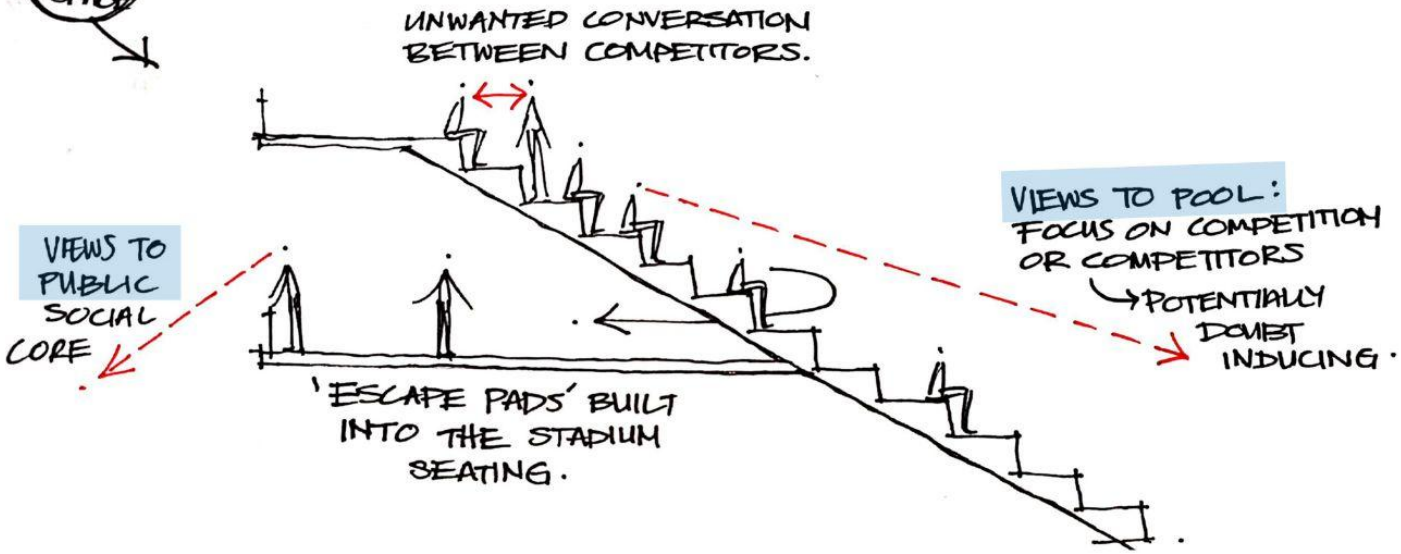


Figure 84: Incorporating break-away spaces to escape negative distractions (Author, 2021)

Furthermore, visual access to distractors can be restricted in certain spaces, for example, restricting visual access to the spectators' stands from the marshalling area to prevent athletes from focussing on the expectations of coaches or parents which could place unwanted pressure on the athlete prior to their race (figure 85 and 86).

Where focus on the race is required and athletes need to get in "the zone", evidence based design techniques to enhance concentration can be implemented. Being "in the zone" can be described as the optimum mindset that athletes reach for the best performance outcome. Sports psychologists help athletes to identify what conditions they need to get themselves "in the zone" (Cohn, 2008). Techniques, like imagery, concentration exercises, relaxation and self-talk are used by sports psychologists not only to aid performance enhancement, but also athletes' general wellbeing and improved experience of the sport (Anderson et. al, 2002 in Hagan et. al, 2019: 191). The designer can accommodate this by creating isolated, private seating or lying-down spaces where athletes can confidently undergo these pre-race mental exercises without distraction or interruption (figure 87). Noise reduction and improved quality of light in these spaces can help to boost focus (Malkin, 2008: 8).

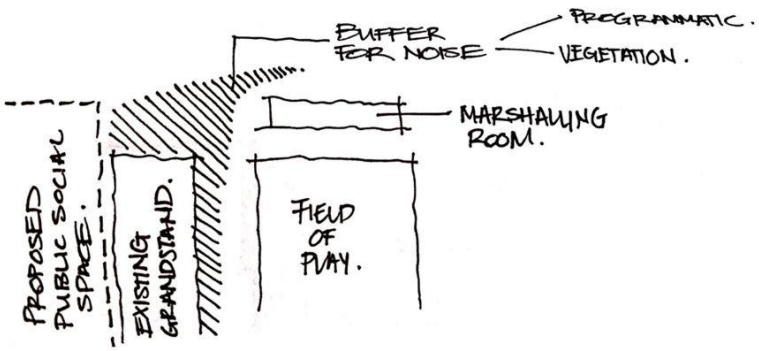
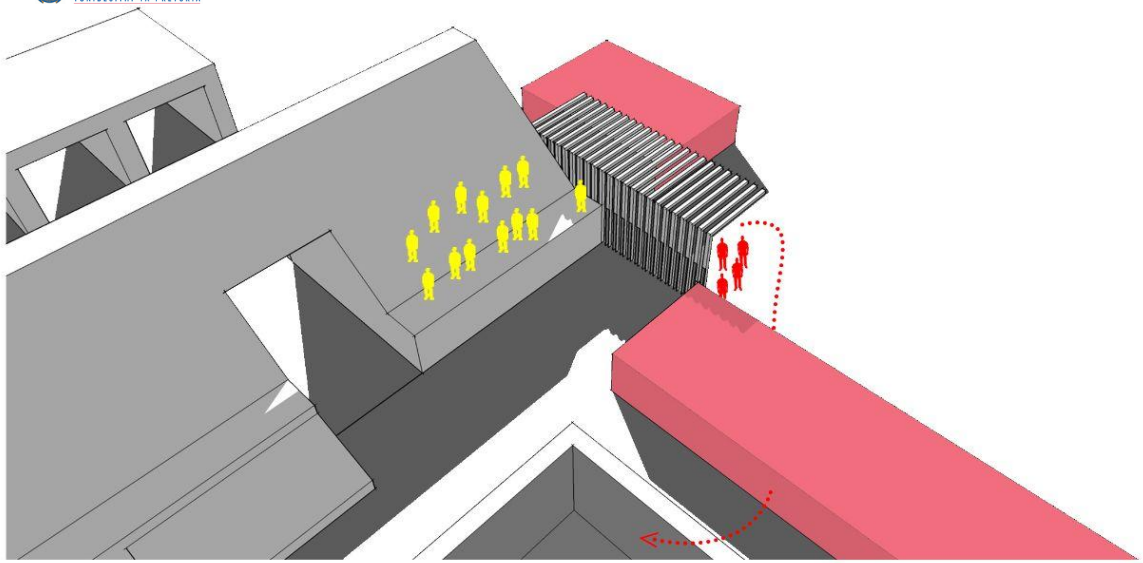
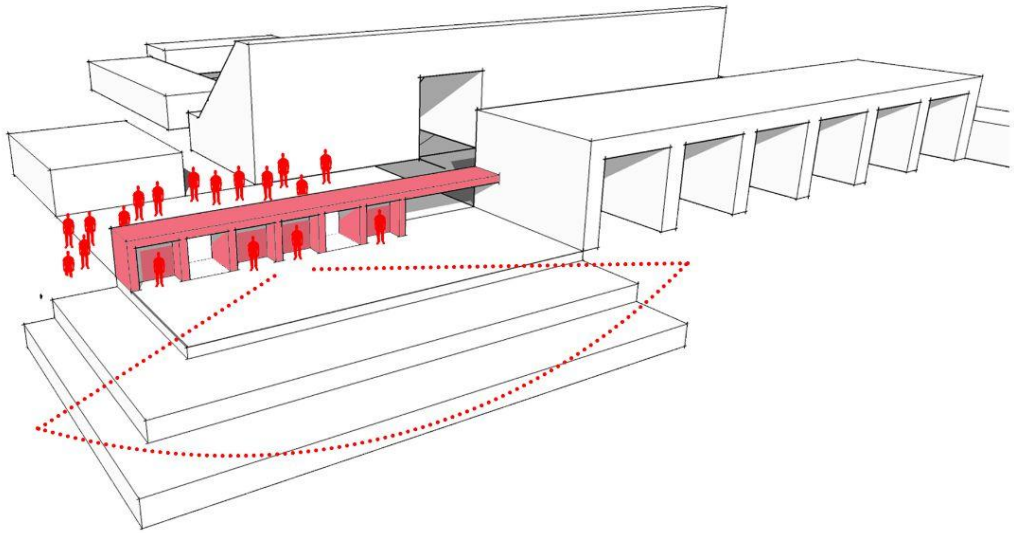


Figure 86: Buffer zones to prevent distractions (Author, 2021)



- Restricting views to the pool and to spectator stands to reduce anxiety (self-applied or through parents or coaches)

Figure 85: Restricted visibility to avoid negative distractions (Author, 2021)



- Intimate private spaces where athletes can mentally prepare for their races away from distractions and interruptions,
- Views overloooking nature and the Uitspan dam to reduce anxiety.

Figure 87: Private spaces overlooking nature to enhance internal focus (Author, 2021)

Lastly, it is important to note that athletes need to determine which emotional state best prepares them for optimal performance. Athletes must confidently look forward to, but not be *overly-excited* for a race. When athletes become too "pumped" prior to competing, large amounts of adrenaline move through the body. The result is that very little adrenaline or energy remains when the time for the actual race arrives, leaving athletes feeling drained and even weak (Cohn, 2008). Spatial design principles, such as exposure to nature, that induce feelings of *calm* can be incorporated into the design of spaces which athletes interact with in the lead up to their race; for example, ablutions, stretching areas and marshalling rooms. In addition, the athletes' movement through the marshalling rooms and views to the field of play can be controlled to prevent premature excitement before a race (figure 39).

However, the spatial experience should transform to more dramatic and energy inducing only once athletes walk out onto the field of play (figure 88 and 89). Enhanced sensory experiences can be used to induce energy or excitement (Malkin, 2008: 9) through drastic changes in spatial characteristics. Here, architecture can act as an experiential threshold, immersing the user (spectator or athlete) in an ephemeral condition for a limited period of time, after which they escape back into the 'real world' (Sfinteş, 2012). This is where heightened spatial characteristics are used to enhance this ephemeral condition right before and during a race, after which athletes exit the arena and a new temporary condition is created with the line up of the next group of competitors.

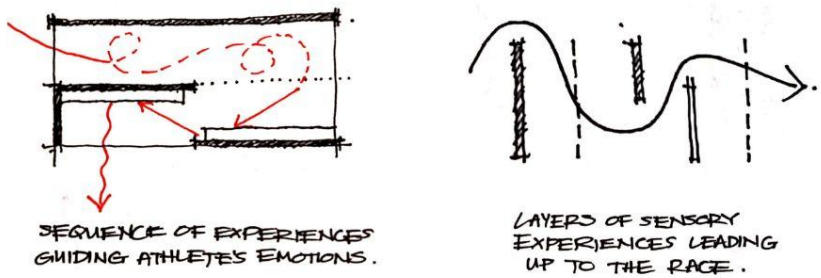


Figure 88: Controlling athletes" movement and views (Author, 2021)

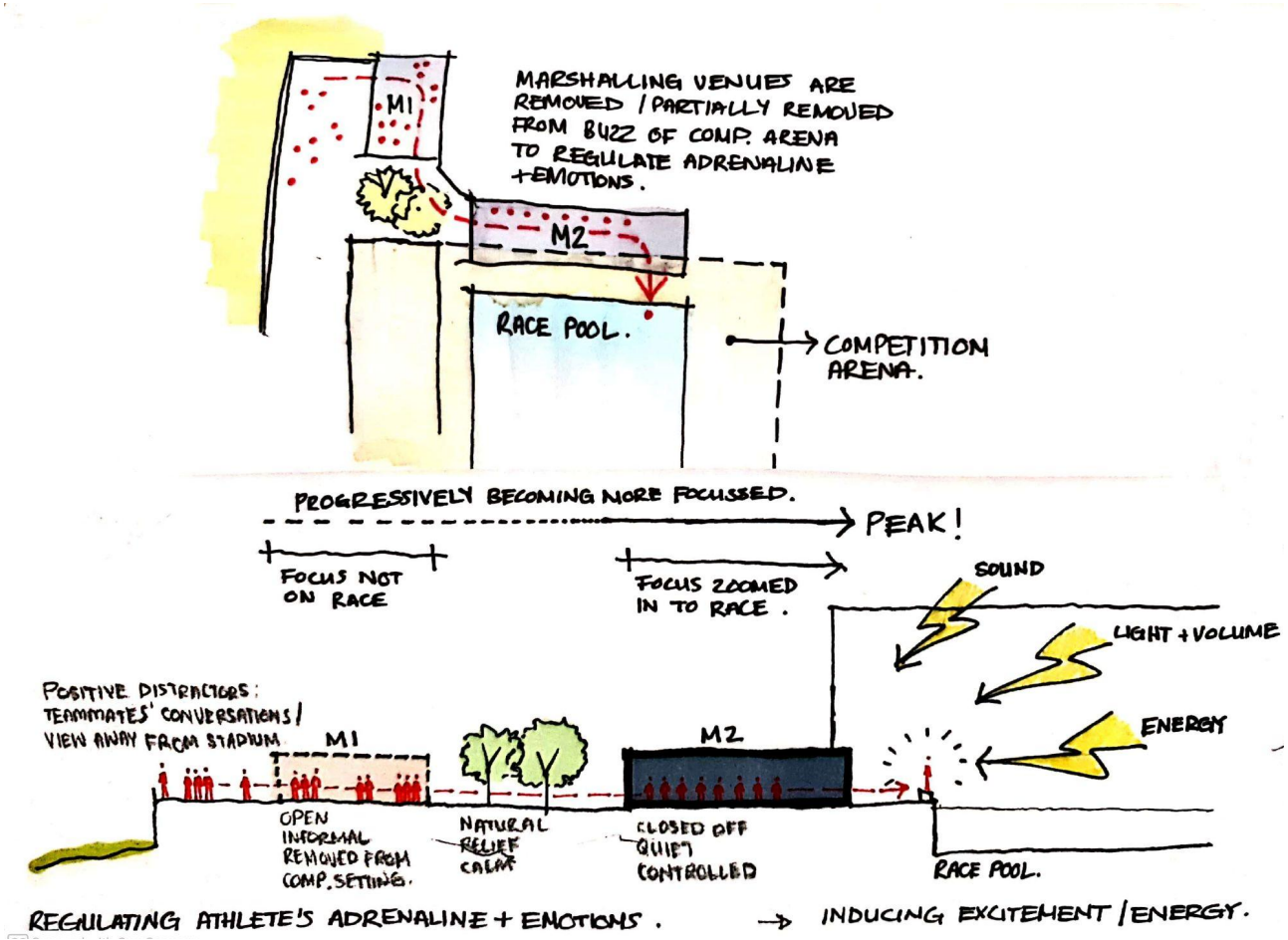
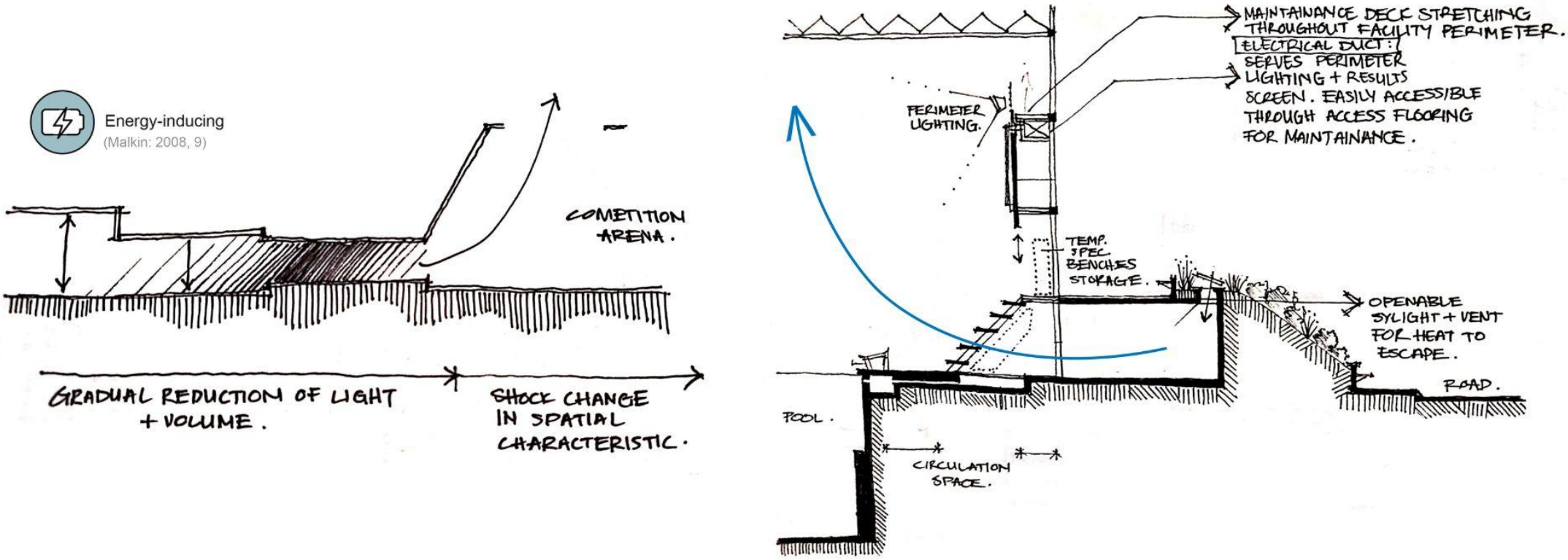


Figure 89: Drastic spatial changes to induce adrenaline in athletes (Author, 2021)



Multisensory design to induce energy and emotions:
Scales of light intensity and volume (spatial characteristics) regulate the adrenaline levels of the athlete as they approach the pooldeck for their race.

Figure 90: Drastic spatial changes to induce adrenaline in athletes (Author, 2021)

Post-race spatial implications

The post-race effects of space are based on two typical race outcomes: a good performance and a bad performance. Different users may experience different outcomes that need to be accommodated spatially and functionally. Athletes who experienced a positive race outcome may desire social, vibrant and loud spaces where peers, family and teammates can be received and the race celebrated. On the other hand, athletes who experienced less-than-satisfactory results may desire more intimate or even isolated settings where they are able to gather their thoughts and compose themselves away from the crowd before their next race (figure 91 and 92).

Race simulating spaces

Although the training and competition environments for 'pool swimming' seem relatively similar and standardised, professional open-water swimmers have greater trouble preparing for competition conditions. The proposed open water channel is designed to mimic these conditions: Firstly, unchlorinated water, that is rather naturally treated through natural filtration ponds, immerses the athlete in an atypical training environment. Furthermore, the channel is surrounded by a public running route constructed as a jetty system that floats within the channel. The jogging public creates movement over the jetty resulting in waves within the channel. These waves simulate the conditions of dam or sea swimming environments during competitions.

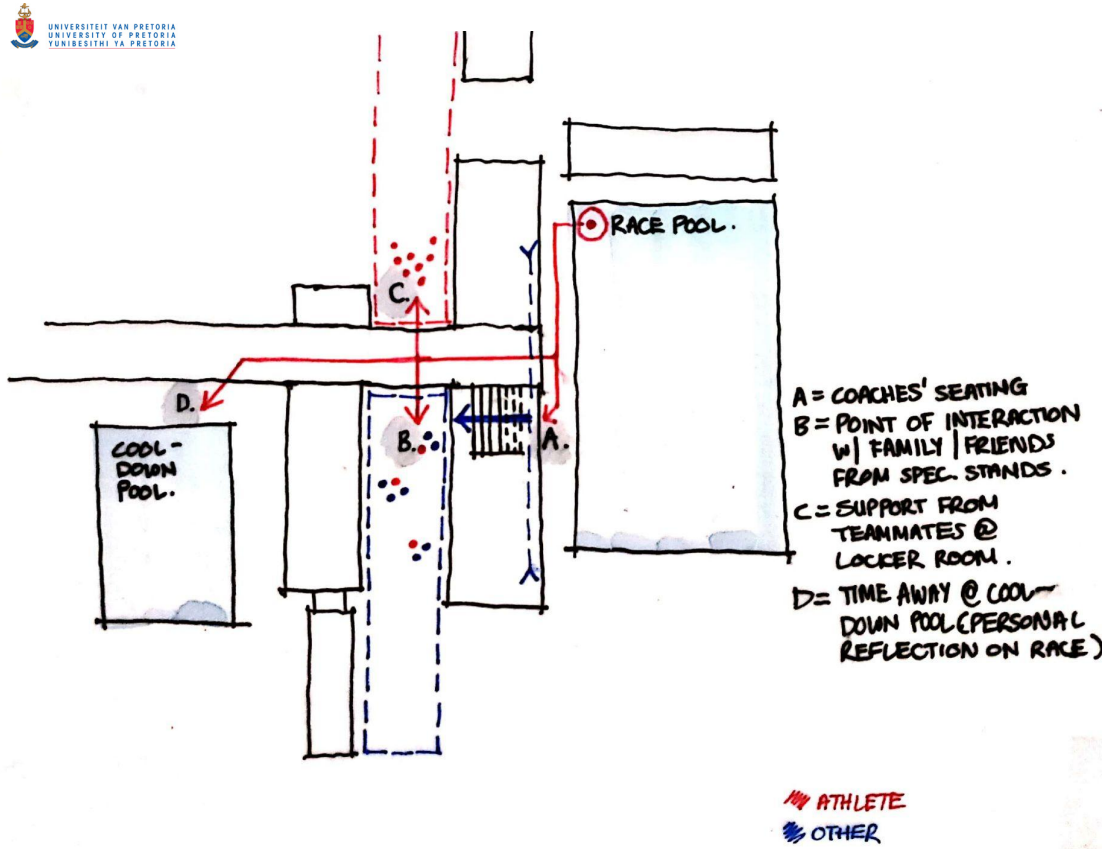
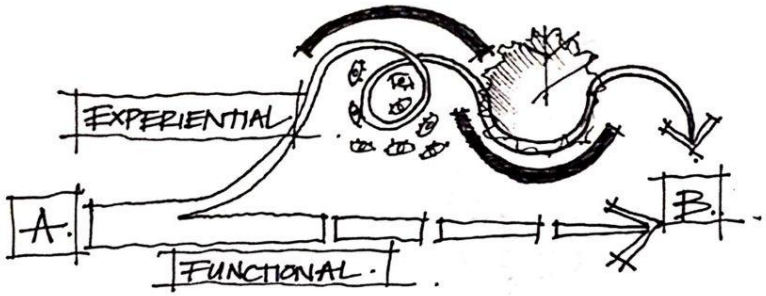
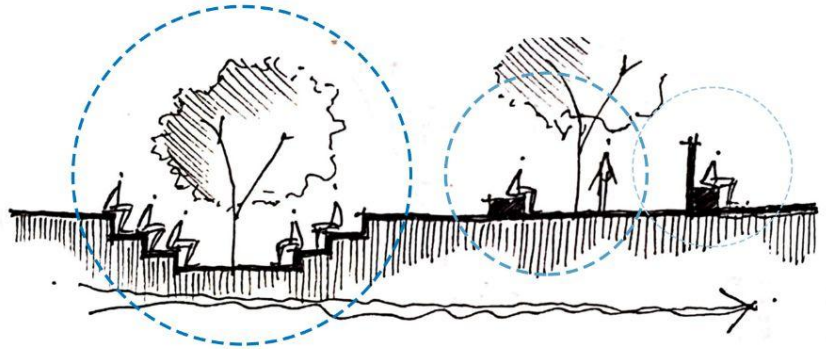


Figure 91: Guiding athlete's interactions post-race (Author, 2021)



Control over circulation routes:
Scales of experiential vs. functional routes



Control over social environment:
Scales of social to private space

Figure 92: Giving athletes control over their environment post-race (Author, 2021)

Zoning

Sports psychology principles are used to determine the zoning of certain spaces in the sports venue, for example: the coach's office. The coach is located centrally within the facility, accessible to all stakeholders as the primary point of communication for all athlete-related matters (figure 93).

Spirituality related design drivers

For years, nature, light and water have been acknowledged for their calming abilities on the human psyche (Ulrich, 1984 in Malkin, 2008: 8). Spaces are identified within the facility where athletes may experience the highest levels of anxiety, for example: the marshalling room, physiotherapy rooms where athletes may be struggling with injury, or sports psychology consultation rooms (figure 94). These spaces are sensitively designed with these evidence-based design principles in mind.

Spiritual practices and performances, like dance or psyching verses are often performed during sporting events (de Witte: 2008 in Hagan et. al: 2019, 189) . Players are also often observed to be praying before a race for divine assistance during the competition, for example: drawing the cross with their finger and pointing their finger towards the sky (Hagan et. al, 2019: 191). Similar performances can be seen by the All-Blacks rugby team when they perform the *haka* before every match. Including spirituality into athlete-centred models - in this case design models - has the potential to benefit not only athlete performance, but also personal enhancement and development. Competitive sport can be understood through a more holistic approach that includes the moral, psychological, intellectual, emotional and social aspects of an athlete's life Miller et. al: 2002 in Hagan et. al: 2019, 191). The design should cater for space where athletes can express themselves through performance, for example, a social performance space for team war-cries before a competition as an excitement-inducing activity.

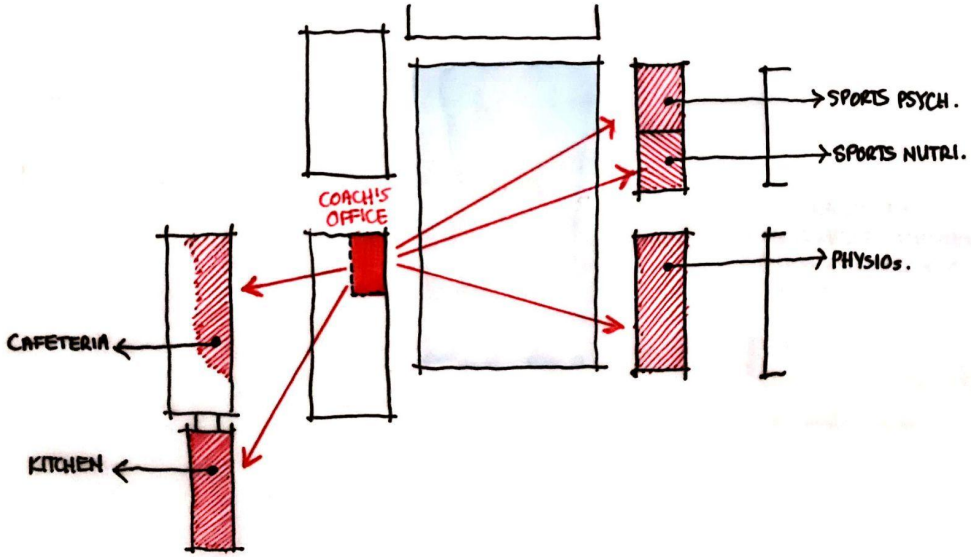


Figure 93: Zoning of the coach's office in relation to other stakeholders (Author, 2021)

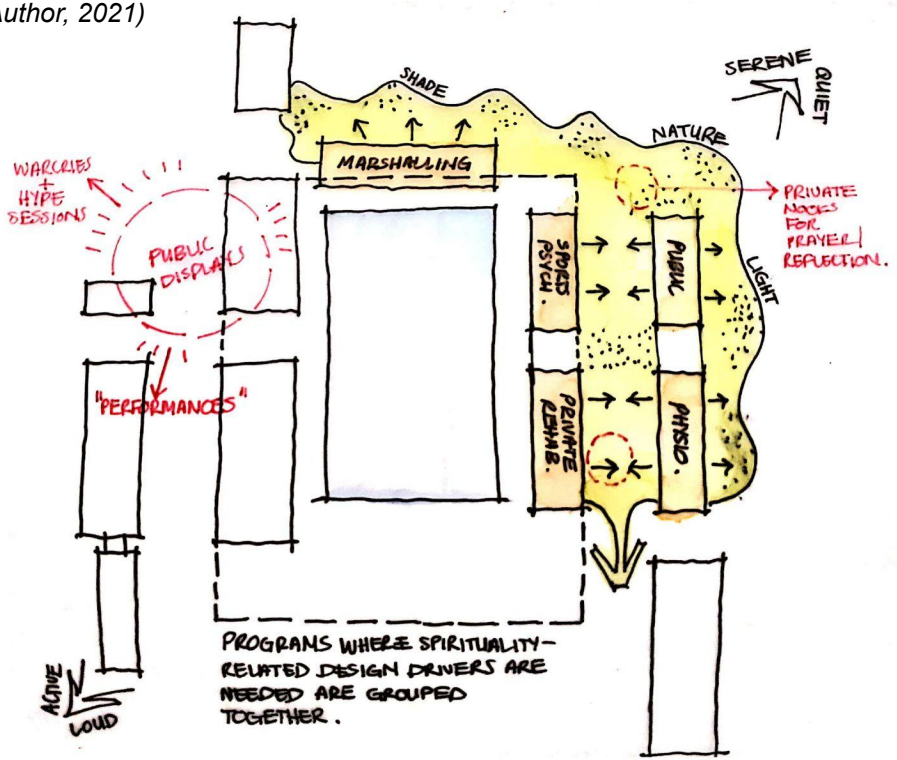


Figure 94: Incorporation of spirituality-related drivers in key-areas (Author, 2021)

Reducing the impact of external and internal stressors

A common external stressor experienced by athletes is that of changing weather conditions. Design flexibility in the sports venue is used to aid athletes in altering their environmental conditions through a retractable roofing system to protect the interior from rain and cold or to expose the interior to welcomed sunlight and fresh air (figure 95).

Common internal stressors are the mental impacts of injuries (Cohn, 2008). The design can address this by creating transparency in physio and rehabilitation spaces where athletes can witness, first hand, how their teammates are recovering, improving and getting stronger during and post-injury. Giving athletes visual access to this process of recovery can help them to believe in the process's success for themselves, should they become injured.

Additions to the program

Athletes whose motivation for performance is due to external factors, like pressure from parents, often tend to have fluctuating levels of motivation (Cohn, 2008). External motivators need to be identified, for example: athletes who compete in elite-level sports due to pressure from their parents. Extracting these athletes from their straining home environments and placing them in more positive living environments such as an athlete-residence can help them to let go of their parent's expectations and compete at a healthier, more personal level.

Furthermore, many professional athletes train with the assistance of bursaries as student athletes. These student athletes fight the daily struggle of attempting to juggle both professional sports and full-time studies. This oftentimes overwhelms athletes when they need their mental energy and focus the most. The issue can be addressed by including study and work facilities integrated into the design of training facilities, where student-athletes can study before and after training in an attempt to optimally manage their time with the resources and facilities they are given. Therefore, the sports venue, as a *holistic* spatial solution to athletic performance enhancement, can include multiple functions, including an athlete residence and study spaces.

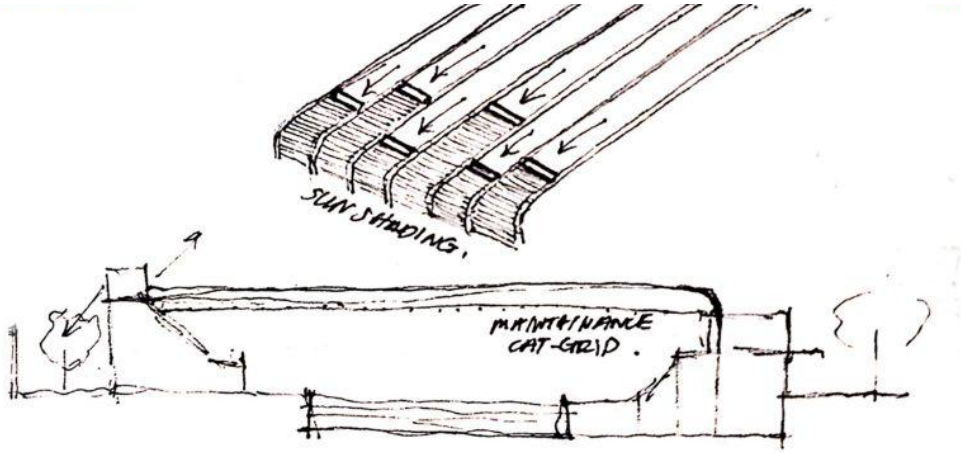


Figure 95: Retractable roof to mitigate the impact of unfavourable weather (Author, 2021)

Precedent studies and design informants

Ancient Greek Sporting Facilities

The first evidence of sport originated around 2500 B.C. in Crete. Although not much is known about the sporting history of these Aegean civilisations, more in-depth evidence lies in the competitive sport of **ancient Greece**, circa 776 B.C. - the year of the first Olympic Games (Deimary et. al: 2019, 2180). Through investigation into the functioning of the ancient Olympics, one is able to identify inherent characteristics of ancient sports as well as potential **design drivers** which could root from these characteristics.

A variety of **typologies** emerge when researching sports and athletics in ancient Greece. Some of these typologies are directly linked to the functioning of sport while others hold looser connections to physical activity in the ancient Hellenic society. These typologies include: **Agoras**, **stadiums**, **gymnasia** and **palaestrae**. A thorough understanding of the evolution of these typologies has allowed me to create a summarised timeline of the advancement of sports design and architecture in the ancient times (figure 98). Design drivers that further aid in design decisions are taken from these informants.

Figure 96: Acrobats play with a large cow, potentially a symbol of Zeus in Knossos, Crete (Deimary et. al: 2019, 2180).

Figure 97: Two Acroterion boxers wearing gloves (Deimary et. al: 2019, 2180). (Deimary et. al: 2019, 2180).

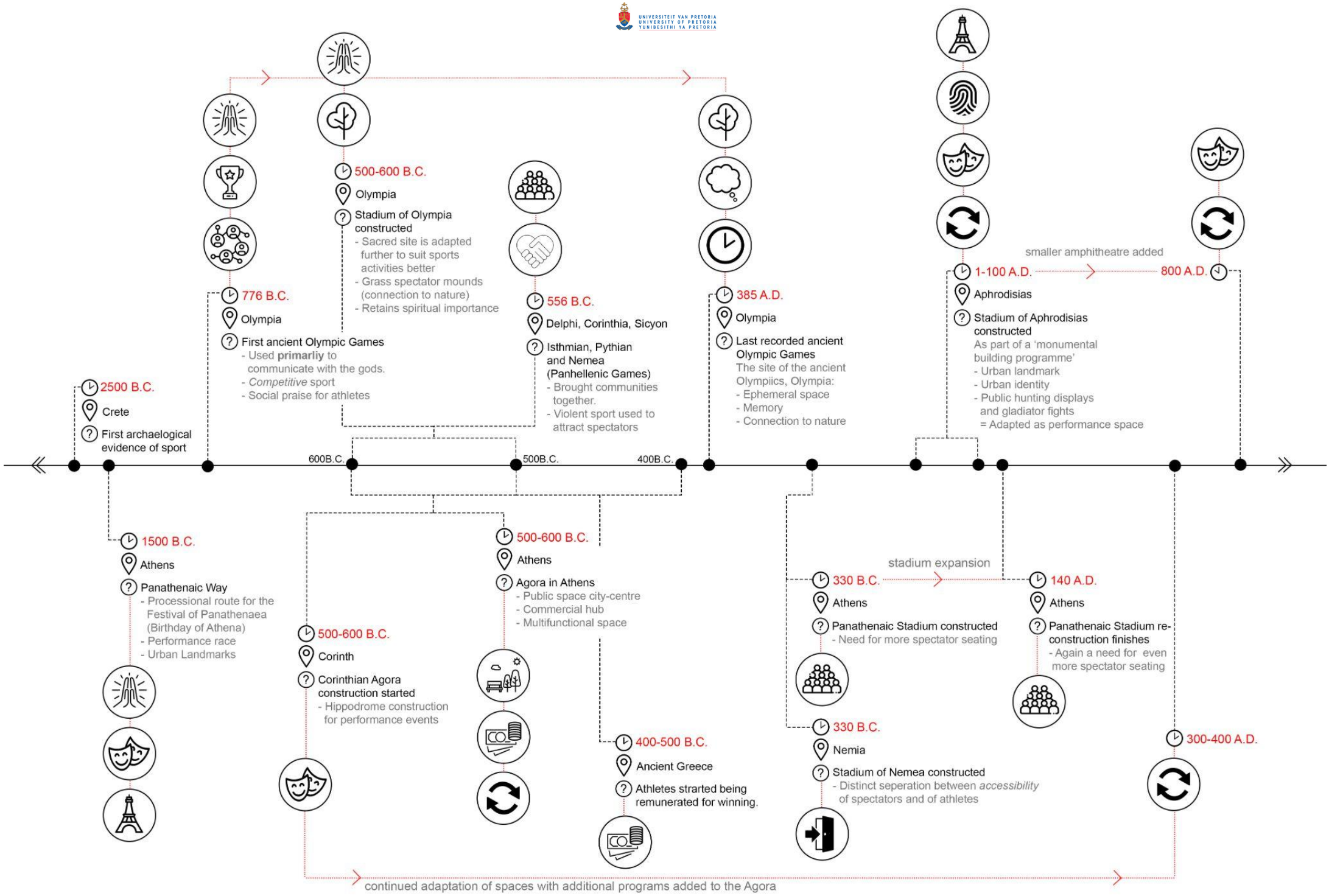


Figure 98: Timeline showing the evolution of sports architecture in ancient Greece (Based on Deimary et. al: 2019).

Relevant sporting authorities

In terms of the focus sport of this research study; competitive swimming (pool and open-water), 4 main sporting authorities presently govern the sport: **FINA**, **SSA**, **IOC** and **SASCOC**.Their histories and organisational objectives are analysed to identify other key drivers that could aid as design informants. These are summarised in the diagram (FINA: 2018; SSA: 2015; IOC: 2021; SASCOC: 2020) (figure 99):

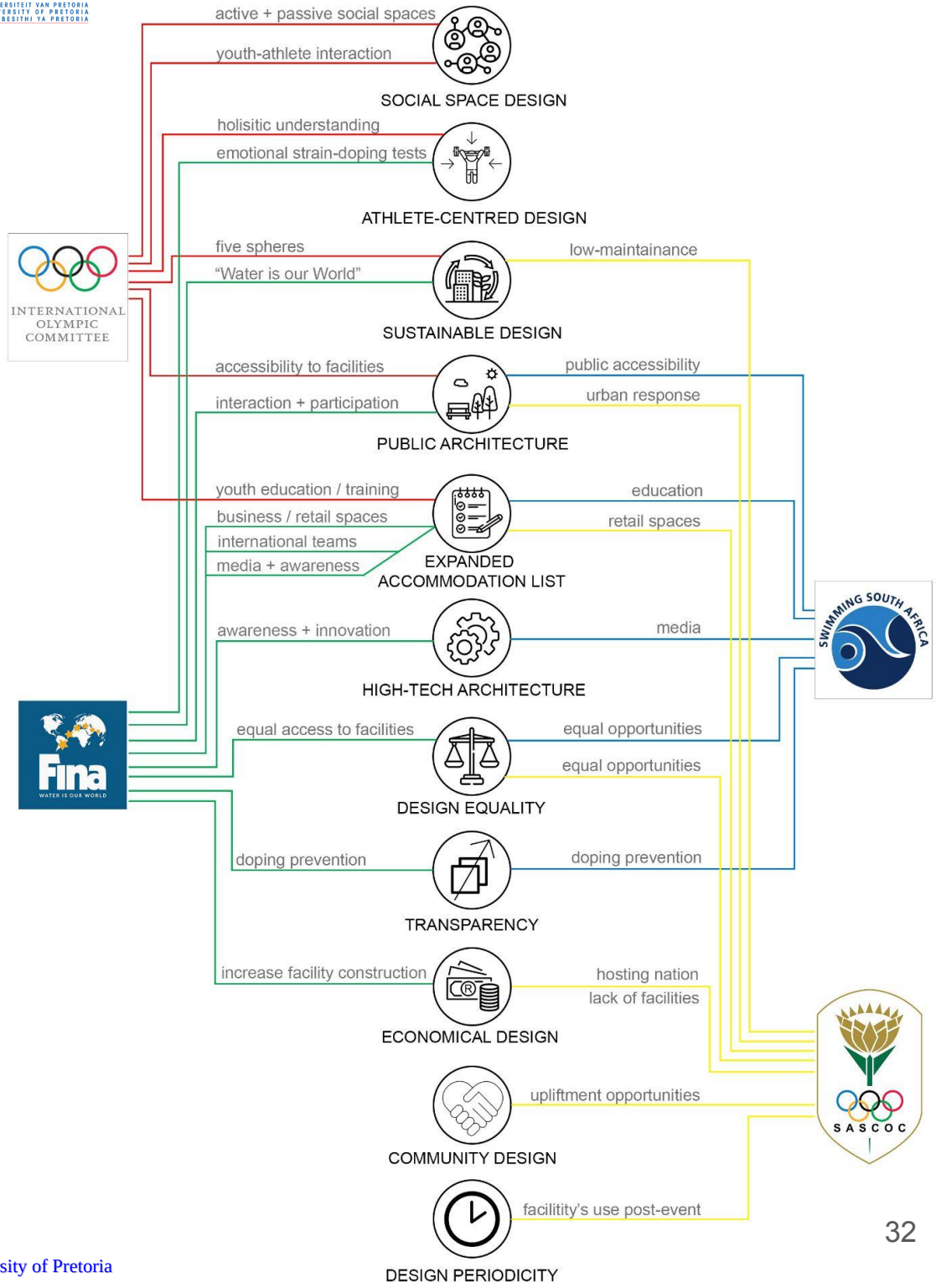
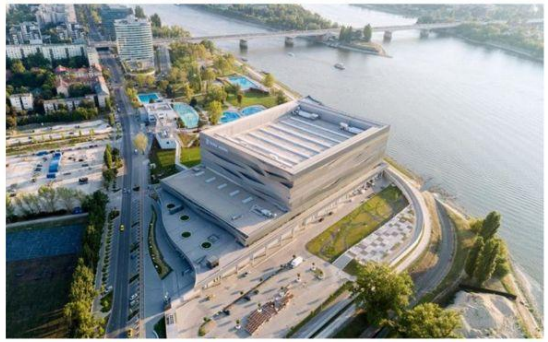


Figure 99: Shared objectives of sporting authorities and their relation to design (Author, 2021)

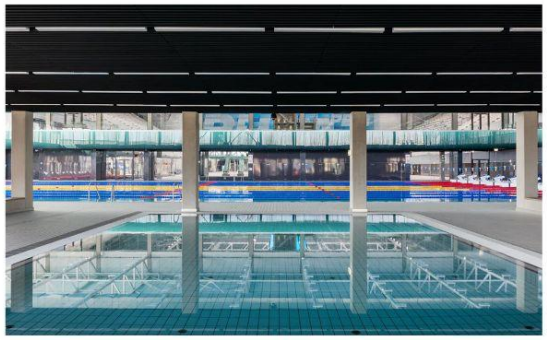
Duna Arena by NAPUR Architects

The steel structure attempts to reflect the movement and undulating light quality of the adjacent river.

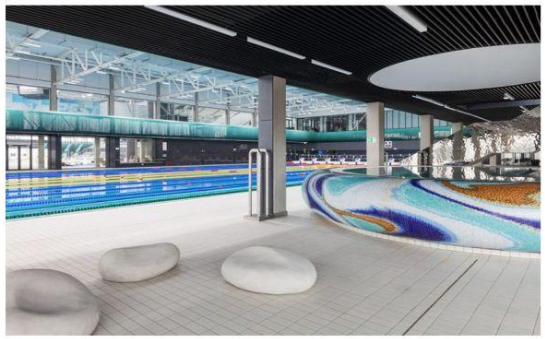


Layered facades step down towards the street edge, bringing the large mass to a more human scale.

The facade facing the river edge, however, stands tall and proud - acting as a landmark for boats passing by.



Continuity of internal spaces is created linking water elements to one another.



Social spaces for user interaction edges the perimeter of the field of play.

Transparency at ground level attempts to reduce the structural density of the arena and allows visual access to the internal activities.

Figure 100: Images and relevant characteristics of the Duna Arena (Lomholt, 2019)

Duna Arena by NAPUR Architects (continued…)

[The adjacent figures explain how lessons learnt from this precedent have been translated into my design]

The Duna Arena, completed in 2017 in Budapest for the FINA World Championships, is an example of an international competition venue that caters for public functions and continuity of use (figure 100). Designed with all FINA and IOC professional sporting standards in mind, the arena catered for more than merely professional athletes, opening its doors to the wider public and youth for recreational and social training opportunities. Flexibility became a vital principle in the design to allow the building to alter itself as needed, depending on the function it was serving - be it competition or public use. The roof height was raised to accommodate spectator stands for over 15000 spectators which would be dismantled after the event had ended. Furthermore, the three pools are designed with adaptability in mind, allowing them to be covered to create floor space for land-sport events or concerts. Upon entry, the scale of the large structure is mitigated through the layering of facades that bring the large mass down to human-scale as the building approaches the street edge (figure 102). However, the facade facing the river edge stands tall and proud, acting as a landmark in the city (figure 103). Furthermore, due to the highly multifunctional nature of the facility, transparent surfaces are used to prevent overly-densified internal spaces. Continuity of internal spaces is created, linking the water elements with one another (figure 104).

The arena is conveniently located near the northern gateway to the city and along the Danube River. This makes the facility easily accessible to most bus, tram, metro and boat routes (figure 105), connecting the facility to its wider context. Also relating the building to its context, a large terrace on the western facade visually connects the venue with urban landmarks such as the Hungarian Parliament Building and the Visegrad Mountains. Lastly, through the alternating sheet profiles of the facade, the building attempts to mirror the adjacent river. The steel sheeting alters the perception of the building depending on the weather: during sunny days, the facade sparkles and reflects the vibrant river edge, while during overcast weather, it blends into the surrounding fog and grey tones of the Danube (Lomholt, 2019).

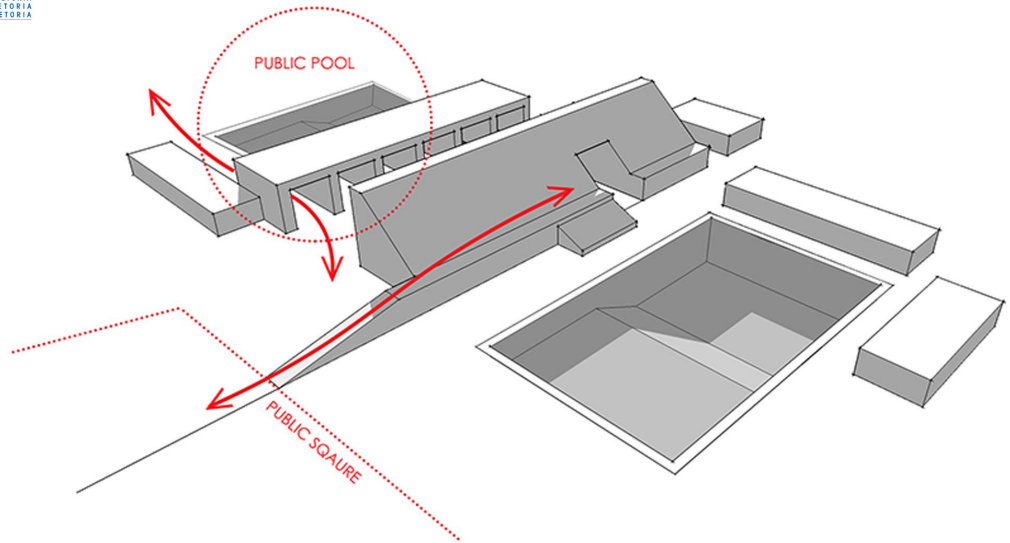


Figure 101: Continued use through public integration (Author, 2021)

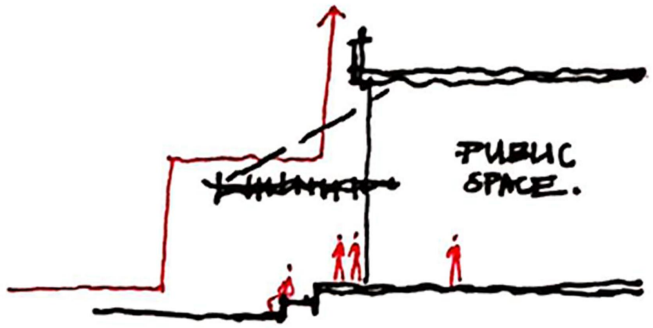


Figure 102: Stepped facades mitigate the building's scale (Author, 2021)

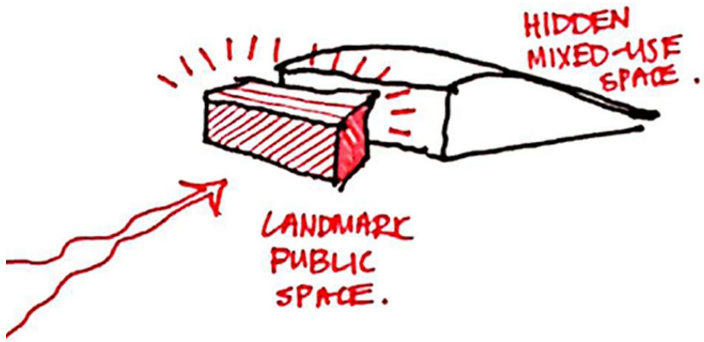


Figure 103: A landmark on the campus vs. a hidden facility (Author, 2021)

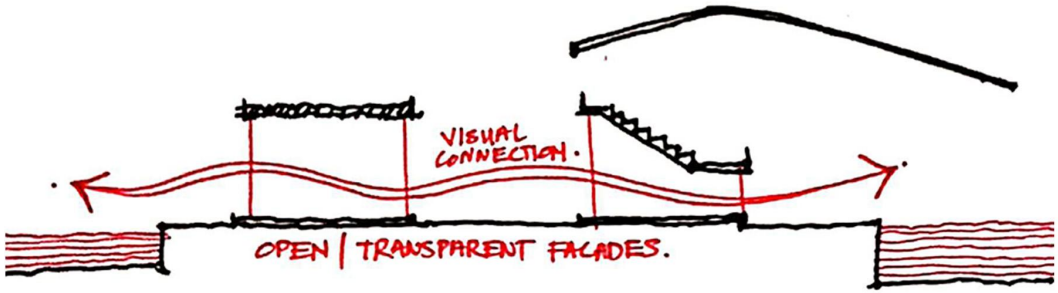


Figure 104: Water bodies are linked to one another (Author, 2021)

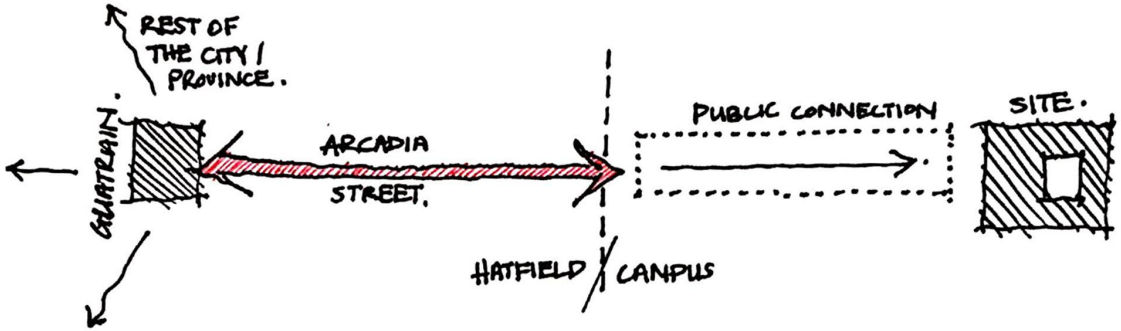


Figure 105: Linking the Gautrain, Arcadia Street and the site to enhance access to the facility and encourage continued use (Author, 2021)

The Duna Arena, along with personal experiences of both local and international sporting and swimming arenas has allowed me to draw up a detailed program list:

Category	Room name
Swimming training	50m swimming pool
	Open water channel
	Ablutions (wet and dry)
	Changing rooms
	Locker rooms
	Wetbag storage
	Pre-session stretching
	Team talks
	Coach's office 1
	Shared coach's office 2 + 3
	Aministrator's office
	Gym receptionist's office
	First-aid room
	Security house
	Parking lot
	Emergency pickup point
	Recovery quarters
	Physiotherapy consultation
	Nutritionist consultation
	Sports psych. consultation
	Support facility's reception
	Support facility's waiting area
	Gym
	Athletes' social space
	Athletes' living quarters
	Athletes' cafeteria + kitchen
	Maintainance + equip. storage
	Electical control room
	On-deck showers
	Staff breakroom
	Auditorium
	Pool covers storage

Category	Room name
Swimming competition	Spectator seating
	Temporary food stands
	Permanent cafe' / snack shop
	Temporary product stands
	Tickets booth
	Additional / separate ablutions
	25m cool-down pool
	Podium / performance platform
	Doping control room
	Dryland warmup space
	Media room
	Post-race interview space
	Race-suits changing rooms
	Marshalling venue 1
	Marshalling venue 2
	Officials meeting room
	Coaches' seating
	Starter's platform
	Timekeeper's seating
	Technical officials clear route
	Commentator's room
	Administrator's office
	Storage for comp. equipment
	Results wall

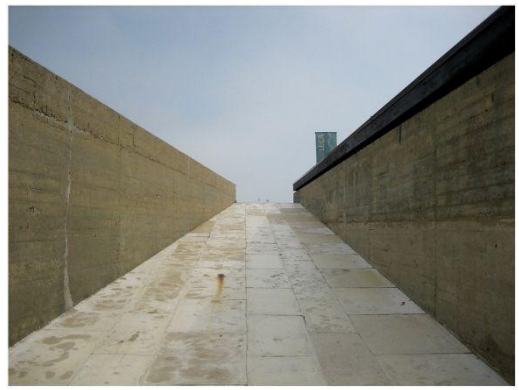
Category	Room name
Public spaces	Food court
	Kitchen
	Service and delivery
	Outdoor braai area
	Indoor braai area
	Events space
	Temporary market space
	Informal play space
	Recreational training pool
	Recreational social pool
	Changing + locker rooms
	Ablutions (wet and dry)
	Lifesaver's bench
	Public jogging / cycling route

Figure 106: Accommodation list for the new TuksAquatics Complex (Author, 2021)

Leça Swimming Pools by Álvaro Siza Vieira

The man-made structure of the pools lie sensitively between and against the natural rock formations, merging the building with its context.

The view from the street edge is retained as passers by look over the new building.



The ramp immerses users into a space with no views, heightening their auditory experience of the ocean.

Function is not forgotten amidst all the sensory experiences: seen in the practically designed wet-to-dry transition of the changing rooms.

Sharp changes in direction create climax moments where views to the ocean are exposed.

The building, experienced in full height upon exiting the change rooms.

Figure 107: Images and relevant characteristics of the Leca Swimming Pools (Balters, 2011)

[The adjacent figures explain how lessons learnt from this precedent have been translated into my design]

The construction of the swimming pool makes constant reference to the existing rocky coast of Matosinhos, Portugal. The raw concrete with its exposed formwork markings mimic the rough rocky outcrop on the surrounding beaches. Immediately, the facility is blended into its natural surroundings (figure 108). Situated between the ocean and the street edge, the building is almost fully hidden by sinking it below the street level (figure 109). Furthermore, the views to the ocean from the street are retained. A hybrid setting exists where the natural rock pools of the Portuguese coast merge with the rigid man-made pools (figure 110).

Siza plays on the senses of the user by sinking the entrance ramp below street level and behind the changing rooms. The view of the street and the ocean are lost here, where one instinctively picks up on the audible sounds of ocean waves crashing against the rocks. He uses this sensory experience to mediate between road and beach (like the call-room transition). As one exits the changing rooms (one level below the street) the building is finally seen in full-height, creating a welcomed boundary to the street edge. Lastly, a sharp turn in the walkway to the beach finally exposes panoramic ocean views. Siza carefully directs the views and sensory experiences of the user, creating calm and climax moments throughout the building (Balters, 2011) (figure 111).

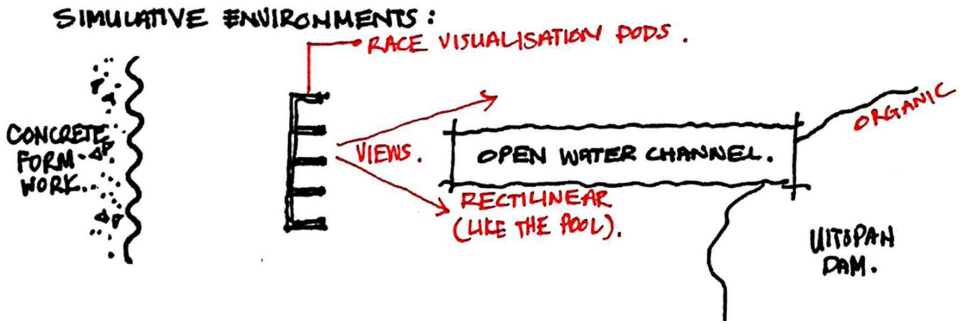


Figure 108: The building elements mimic those of nature (Author, 2021)

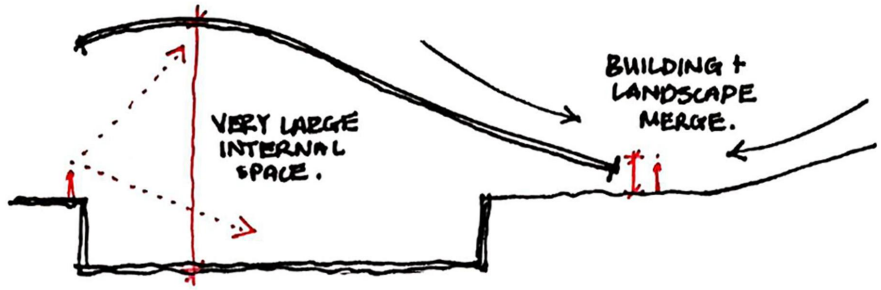


Figure 109: The change in level distinguishes the swimming pool complex from the surrounding urban infrastructure, acting as a more natural element in the landscape as opposed to built structure (Author, 2021)

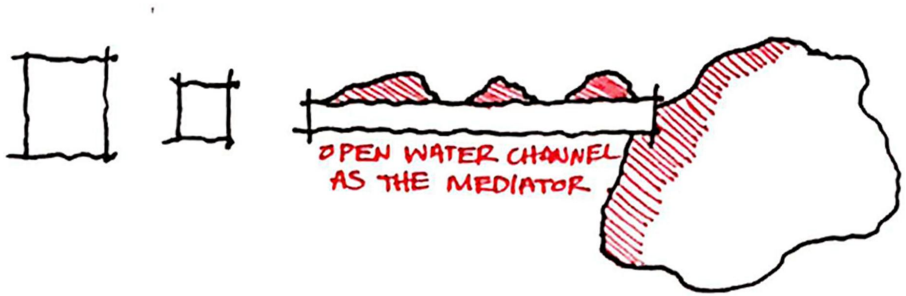


Figure 110: Linking the man-made and the natural water bodies across the site (Author, 2021)

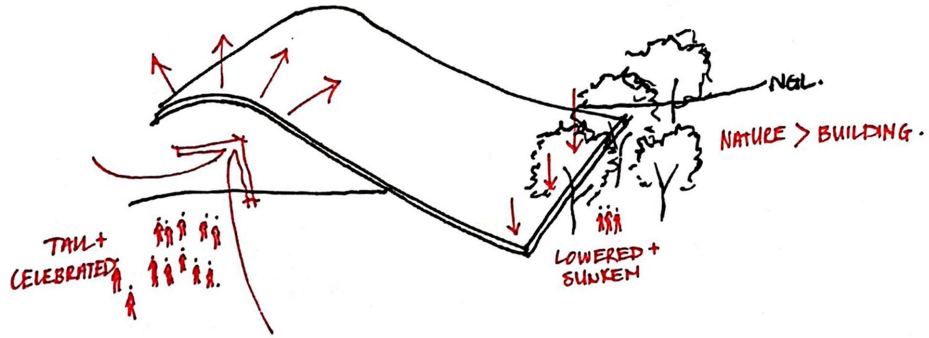


Figure 111: Calm private moments where nature dominates structure and climax public spaces where structure stands tall and celebrated (Author, 2021)

Conclusion

The typical stadium typology is inverted from an inward focussed *destination* typology to an outward focussed segment of a larger urban scheme. Sports architecture as a private monument becomes public architecture that houses both public and private sporting functions operating in harmony with one another. Not only do the new public functions add to the sustainability of the design by responding to the need for continuity in sports design, but the public also play vital roles in supporting the athletes by enhancing their psychological resilience, and as a result, their physiological well-being. The architecture responds to the athlete's psyche through evidence-based design interventions at various scales, attempting to contribute to the athletic performance enhancement of the diverse range of athletes, their mindsets and their approaches to their sport.

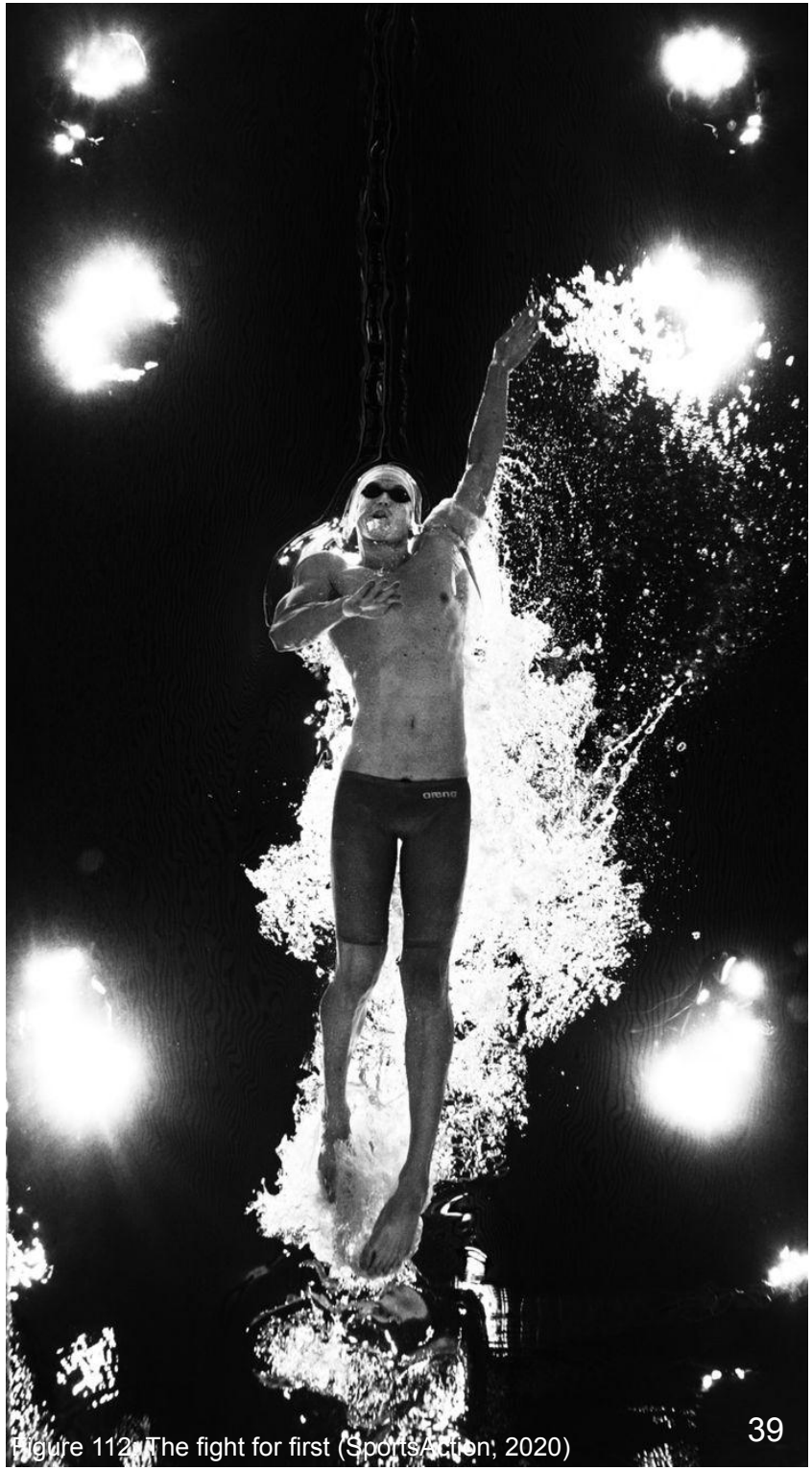


Figure 112: The fight for first (SportsAction, 2020)

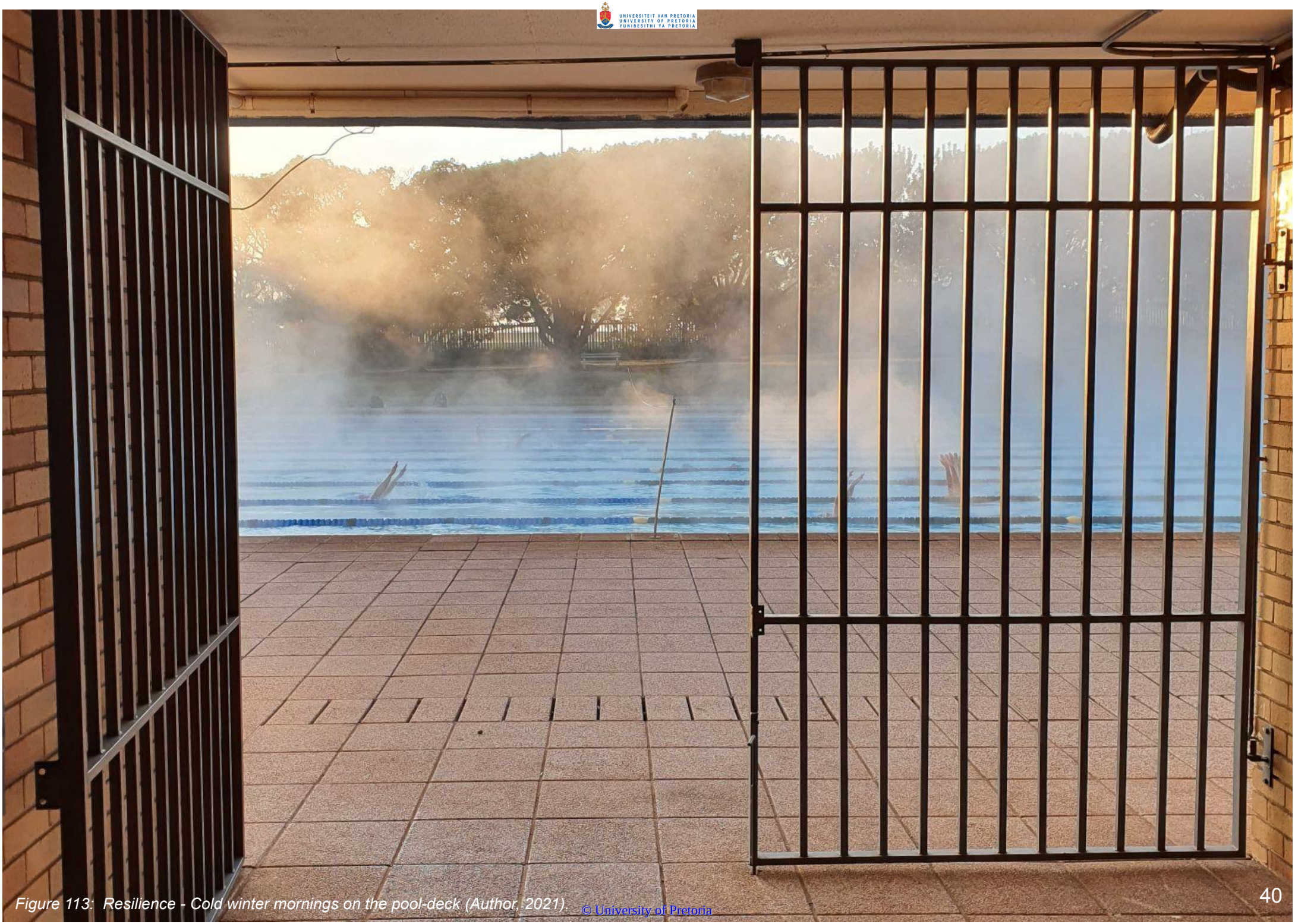


Figure 113: Resilience - Cold winter mornings on the pool-deck (Author, 2021).