

Sofia Naranjo Mata
ARCH 771
Dr. Ganapathy Mahalingam

North Dakota State University



designing a

holistic environment for athletic performance

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“The whole idea is to get an edge. Sometimes it takes just a little extra something to get that edge, but you have to have it.”

- Don Shula, NFL Hall of Fame Coach



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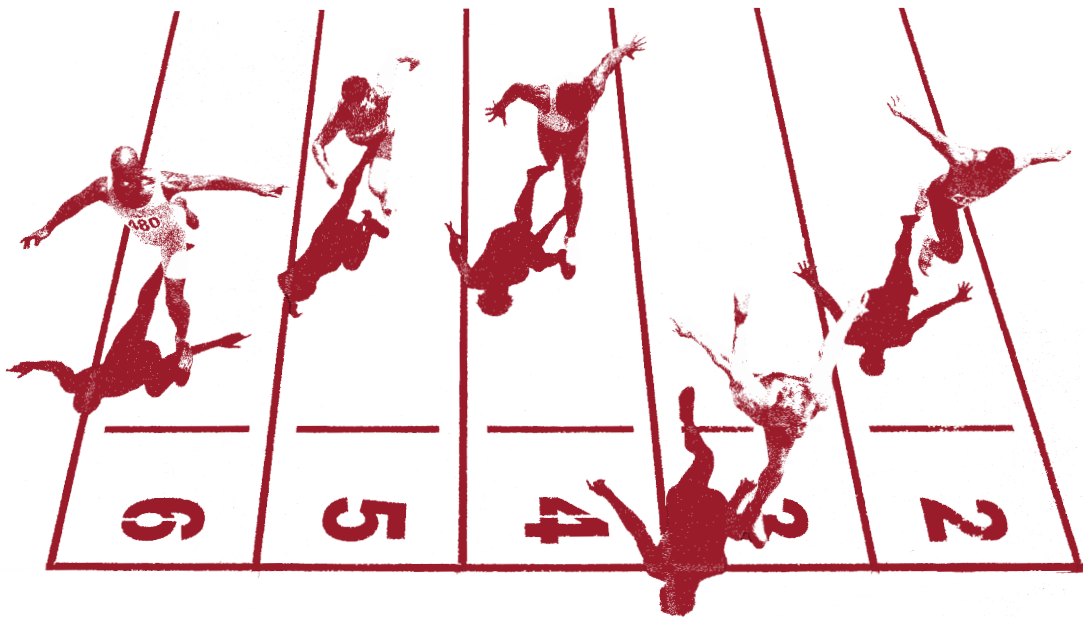
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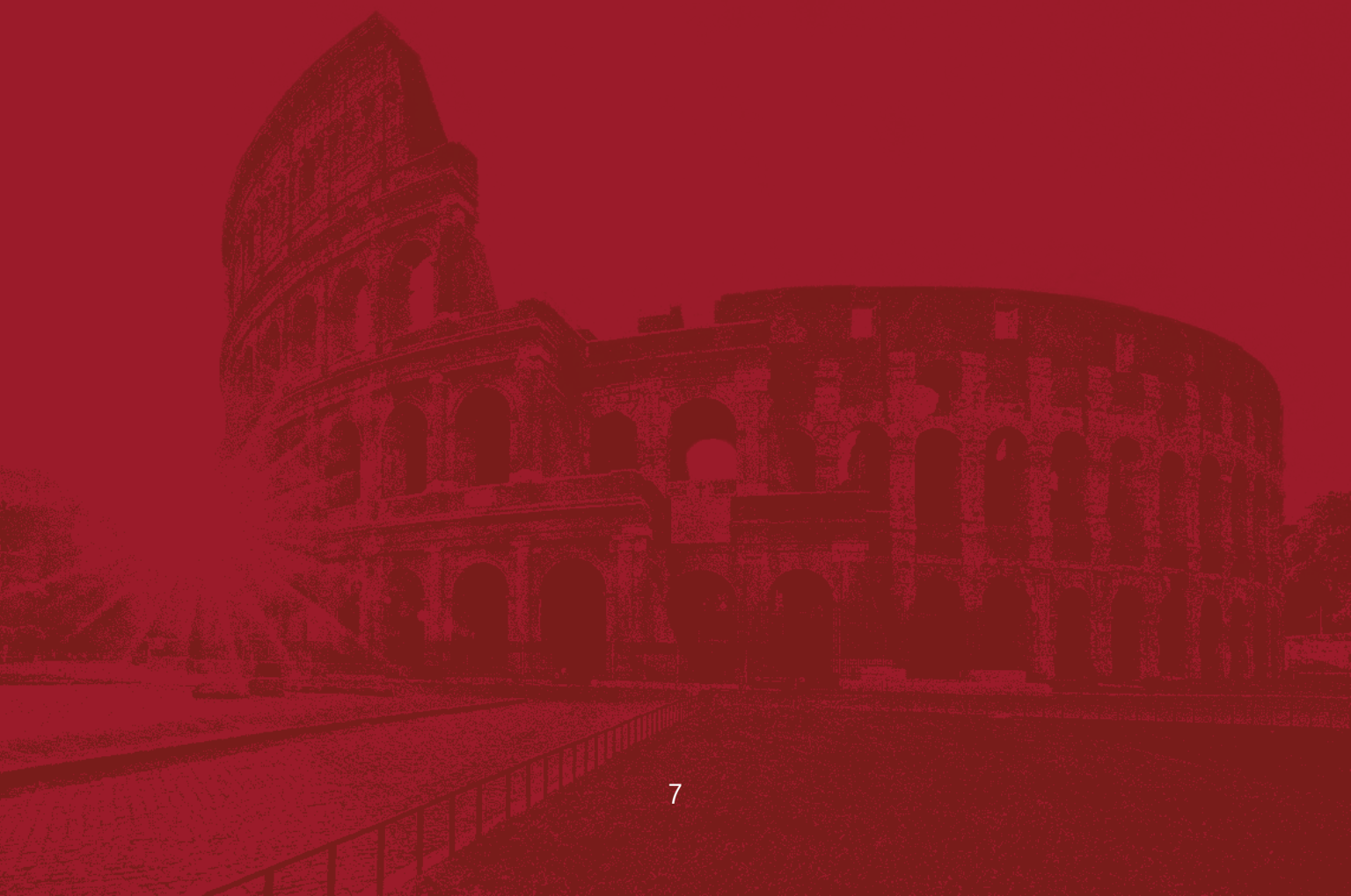
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This research is dedicated to all the amazing people and athletes that I have met through sports. The lessons and memories I have made from track will stay with me for my lifetime. Despite all the pain and frustration that athletics brought me, I wouldn't trade my experiences for the world.



01

introduction



01 *introduction*

1.1 Problem Statement

For a great part of documented history, sports have played an integral role in society. The spectacle and display of peak athletic performance has created entertainment, brought communities together, and provided incentive to push the limits of what humanity can achieve. From young kids playing little league soccer to athletes that have dedicated so much of their time for a chance at success, sports find a way into everyone's lives. By standard human nature, people have discovered how to create massive amounts of profit from athletic competitions and they now hold incredible significance to the economy. The sports industry as a whole recorded a revenue of almost \$487 billion in the year 2022. This number is expected to increase and surpass \$600 billion in 2027 (Gough, 2023). Much of this profit comes from extrapolating as much money as possible from the athletes and the fan bases, which makes the dollar sign the main consideration when major organizations are making decisions. Though profit is important in the world of sports, it holds more precedence in the industry than the athlete, who is arguably the most necessary component for this industry to stay afloat. This precedence can be seen in the design of competition and training facilities. This creates an environment that is not tailored towards the athlete and does nothing to help improve their performance.

As time goes on, more and more is required for athletes to perform better than their competitors. With technology and civilization becoming more advanced, athletic talent has reached heights unheard of. New research allows for more effective training, elite resources are being offered at younger ages, and the bar keeps being raised for what is required to be great. Because the average athletic standard will continue to get better with each generation, athletes will begin looking to new areas that can help enhance their athletic performance.

In *The mind gym: an athlete's guide to inner excellence*, Don Shula, an NFL Hall of Fame coach, states that "the whole idea is to get an edge. Sometimes it takes just a little extra something to get that edge, but you have to have it" (Mack, 2002, p. 13). Nutrition, sleep, high level recovery, and mental training is just a small list of acts that athletes have learned to control to get an edge on their competition. When it comes to improving athletic performance, few have questioned the environment that athletes spend all their time training and competing in. Within the design of athletic complexes lies an untouched group of controllables that can become another factor in

the equation of athletic greatness. By shifting the focus of these facilities back onto the athlete, they can be designed to harbor an environment that improves the overall wellness and health of athletes, helping them reach their optimal conditions for being successful.

1.1.1 Research Questions

To enrich the relationship between sports and architecture, it must be asked “how can design decisions impact the mindset and wellness of athletes and in turn, impact their training and performance?” This research can be broken down into two different categories: the examination of athletes’ incentives and mental states within sports psychology, and how architecture can influence the experience of users within a building. Other questions that will arise involve what emotions are desired during training and competing, what intrinsic motivations an athlete may have, and what components they believe are essential to successful training. These questions are to help make up for the lack of information there currently is regarding how the built environment directly affects the athlete’s experience. Discovering these answers will lead to higher quality training and competition centers that are athlete focused.

1.1.2 Proposed Outcomes

By doing this research, an analysis of emotional and psychological factors for athletes can take place with the incentive of better understanding how the built environment affects them. With the gained knowledge from this research, it can be reintegrated into existing literature regarding design’s impact on the users and new design solutions can be created. An example of this is an athlete stating that having autonomy over their training helps them feel more motivated and reduces the possibility of them feeling burnt out. A design solution to this would be to provide them with multiple places where their training can occur, such as distance runners being able to complete their training on trails outside the facility, or within the facility in an altitude training room. A set of these design schematics created by analyzing the data regarding an athlete’s mindset will influence new concepts for training facilities that place the athlete at the forefront of major decisions.

1.2 Objective

1.2.1 Aim

The goal of this research is to recenter the needs of the athlete when it comes to the design of training facilities and question how this form of architecture can be optimized. To continue to increase the effectiveness and value of architecture, new approaches must be taken in how spaces are designed. By looking into other spheres of knowledge such as mental wellness and sports psychology, more information is gained that can influence a new design protocol that be

implemented into this building type. These solutions will provide incentives for these massive teams and organizations to seek an architect that is well versed in this area of design. Athletes will have a higher likelihood of staying where their needs are prioritized and feeling valued can help with overall wellness and performance. This can demonstrate how something seemingly insignificant such as a building's design in relation to athletic performance can cause a chain reaction that provides people with their desired outcome of success.

1.2.1 Significance

As sports continue to grow, so will the stresses and pressure of being an athlete. When the foundational part of something so culturally significant begins to falter, the rest of it can come crashing down. Many of the beloved star athletes today fell in love with their sports at a young age, but when the sport becomes their job and livelihood, the incentive for continuing begins to go to outside sources. This coupled with collegiate, high school, and even youth athletes feeling the demands of athletics more harshly and at a younger age means shows that the base premise of sports being an enjoyable game is wavering. Elite athletes are beginning to recognize this and there are more conversations now regarding the mental health of athletes than ever before. There are many byproducts of sport, such as economic value, profit and cultural significance, and many decisions in the sports world are made with these byproducts taking the most precedence. This research signifies another area of athletics and training that is centered on the athlete, for without the athletes, sports would cease to exist. Taking care of a pivotal part of athletics will help the joy of the game be invigorated and rediscovered. By keeping the passion alive and the athletes well, sports can continue to play its role in society and be something that so many people love.

02

background



02 *background*

2.1 Background

The prevalence of sports architecture is undoubted as Rod Sheard states that “there is no other building type so powerfully able to touch the hearts and minds of the ‘common man’” (Sheard, 2001, pg. xiv). This building archetype can be seen as far back as 80 CE with the Colosseum built in Rome, Italy. The Colosseum was one of the first buildings designed to host large gatherings of people and marks the beginning of the evolution of these structures as the prevalence of sports also evolved (Augustyn et al., n.d.). These structures continue to get bigger and better as sports become more popular and have great influence on the growth of their surrounding urban fabric because of their economic and social impacts. Many economists have challenged whether the costs of the massive facilities and stadiums are worthwhile, but these places connect people, provide reasons for communities to be proud, and allocate space for the competitiveness and drive of the human spirit to be displayed (Pushparaj, 2021).

2.2 Literature Review

2.2.1 Sports Architecture Research

When beginning to research the topic of sports architecture, one can discover how much of this design sector is not solely focused on sports. As sports have become more profitable in recent years, demands for these buildings have shifted from a place to simply host events, to massive mixed use facilities that are sewn into the urban fabric and have significant impact on the cities they reside in (Kennedy et al., 2022). To ensure that these facilities are successful, many books have been compiled containing all the specific technicalities that must be considered when endeavoring in this architecture type. These technicalities include certain design aspects needed for each sport, programming and adjacencies within the programming, how this building type impacts the community around it, and what different users need from the building. To gain an understanding of the typical programming in these buildings, one must understand the three user groups that need to be satisfied with the design: the spectator, the owner, and the athlete. The spectator is the largest percentage of users within this design sector. Spectators provide the profit, the crowds, and the fan bases that so passionately fuel the sport. Spectators need to have a positive experience while viewing the sport to justify the money spent attending the competition. Owners are the user group that demand a return-on-investment for these structures and push

for the commercialization of the spaces adjacent to where the main building purpose is happening. With buildings of this size, the owners must also ensure that the impacts on the surrounding environment are positive so that project has greater likelihood of being well received by the community and the taxpayers that are oftentimes funding it. Lastly, it is necessary that the design allows the athlete to compete to their best ability and provide the entertainment that pushes for this building to exist in the first place (Sheard, 2001). By understanding what the users need and their reason for using the spaces, design within sports architecture can be better understood.

The basic programming created by understanding the user groups will begin to influence the forms of these structures. The function of these buildings are to view a sporting event and allow spectators to witness the competition. Because of this, most sport facilities follow an ellipses shape to best perform their desired function (Pawlikowska-Piechotka, 2021). Besides this basic concept, sports facilities range from small arenas for local communities to massive and iconic stadiums used for mega sporting events such as the Olympics. There is a great variety in the construction methods and visual designs of these structures where the cultural and historical context is depended on to influence these items (Pawlikowska-Piechotka, 2021). When questioning the basis of design within sports architecture, one source argues that there is limited literature that examines the rich relationship between sports and architecture beyond what is on a surface level. Of the professionals in sports history that have searched for the connection, their focus often falls onto the social and financial impacts that significant architecture projects have had. With little history paying attention to the visual, artistic, and cultural impacts of athletic buildings, the meaning of the form is lost (Flowers, 2017). With this lost meaning in the form, one begins to question how design norms within this building typology came to fruition.

During the postmodern architectural movement, people began to question the functionality of typical sports facilities from that era. All designs had straight lines, right angles, and a standardization occurred across facilities within the same sport. It was believed that these forms followed the essential function of sports, but there is utmost certainty that during this time, there had not been any experimental studies to compare sports performances within differing environments. The typical rules for the design of sport facilities came not from the direct effects of sport, but instead a socially adopted standard that no one dared to step foot outside of (Eichberg, 1993). This standard can be altered to adapt to the needs of the athlete as all forms within sports architecture have been catered to the owners, the spectators and the surrounding community. By including athletes in the basis of designs, greater meaning can be found in the outcome.

2.2.2 Gap Identification

When reviewing sources regarding sports architecture, a deep knowledge of the programming, technicalities, business cycles, and tendencies is displayed in a great manner. To design an environment that is tailored to optimizing the performance of the athlete, information regarding how the built environment affects athletes is needed. This information is difficult to find in the current literature. One source included in this review had 227 pages of helpful information regarding the topic, but only four pages were dedicated to the needs of the athlete and none regarding their wellbeing was included. To design spaces that improve the wellness of the athlete, the research must venture outside the world of sports architecture and into areas of sports psychology, sports performance, and how the user's experience is affected by architecture. By examining sports psychology and sports performance, it can be understood what is needed for an athlete to perform their best. After knowing these requirements, review in the literature of how design impacts people within the buildings can be utilized to find design aspects that are conducive to the athlete's performance. By synthesizing information from three groups of sources, a design protocol can be implemented that offsets the lack of knowledge in how design impacts athletes who experience their buildings.

2.2.3 Sports Performance Research

The performance of the athlete and the team in the world of sports is vital to its successes as a whole. Sports performance is defined as "a multifactorial trait resulting from the interplay of individual, environmental, and task characteristics" which eventually results in what an athlete is able to accomplish (Gomes et al., 2020). Understanding the numerous aspects of varying levels of performance is intricate and constantly in motion, therefore an "adoption of a holistic perspective" is required to be fully knowledgeable (Gomes et al., 2020). When people think of what is required to be successful in athletics, many think of the physical and athletic traits that all the best athletes in the world have. Though these physical aspects are vital in the sports excellence equation as a whole, there is a large variety of specific physical traits athletes desire as one goes from sport to sport. To create a design protocol that helps athletes in all situations, a factor that is present within every athlete must be the center of focus with this sports performance research- that factor is sports psychology.

Sports psychology must be researched because the mental state of the athlete is a necessary component to consider when analyzing performance during competing and training (Schinke et al., 2018). Similar to how athletes train their bodies to withstand the stresses of competition, their minds are trained to create the proper mental space needed to succeed. Athletes are much more

susceptible to mental distress compared to their non-athlete counterparts (Schinke et al., 2018). It was hypothesized that when a body was under copious amounts of stress, it would lead to a higher likelihood of negative health effects, such as physical injury. This led researchers to closely examine how injuries in sport and stress factored into each other (Appaneal et al., 2014). It was discovered that stress was highly correlated with athletic burnout, which is defined as consistent exhaustion physically and emotionally, lesser feelings of accomplishment, and seeing a lost value in one’s sport (Li et al., 2013). How an athlete responds to stress can determine whether they have greater chances of injury (Appaneal et al., 2014). This is explained in the model of stress and injury shown in Figure 6.

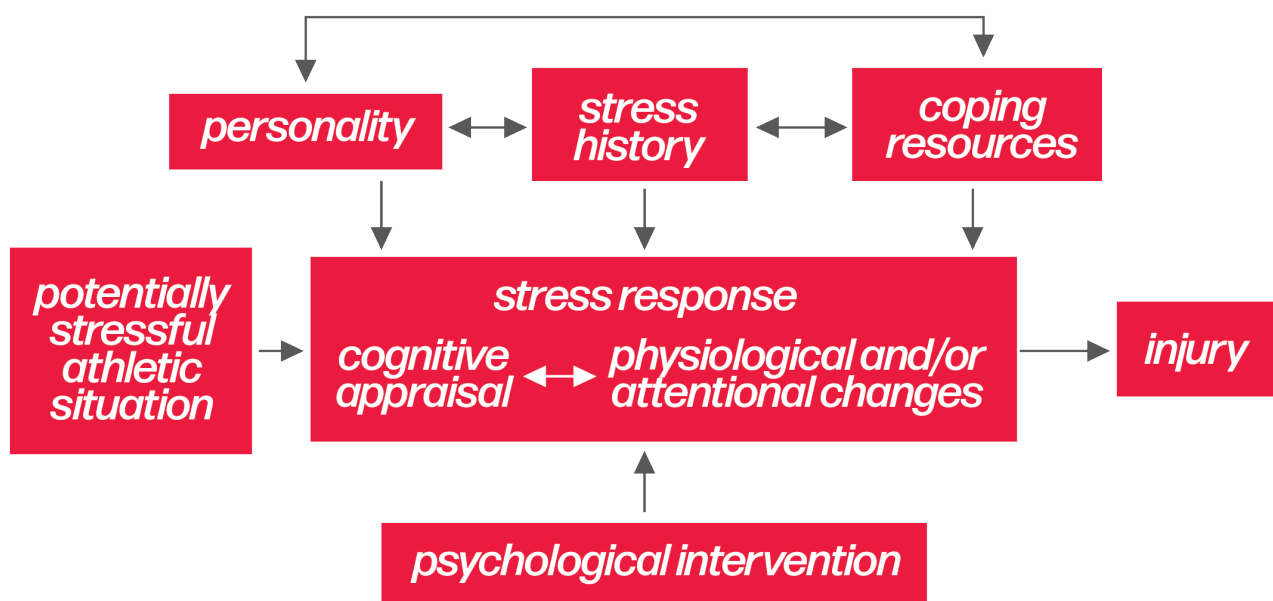


Figure 6. “Stress and injury model.”
 Source: This model was produced by Appaneal, R. N., Perna, F. M., and Madrigal, L in Psychological susceptibility to injury, 2014, Figure 1. Modified by author.

The stress injury model demonstrates that “three categories of psychological risk factors (i.e., personality, history of stress, and coping resources)” alter how an athlete reacts to stressors within their sports and sequentially effects their chances of sustaining injury as described by Appaneal et al. (2014). This model also offers guidance for interferences and mental adaptations that can deter negative effects of stress and hopefully avert injuries in athletes. An important aspect of the stress and injury model is a person’s cognitive appraisal. This concept can be broken down into two reactions, the first being an assessment of the potential damage that stress can induce in a situation and second, an assessment of the coping mechanisms one can use to alleviate said stress. If the coping mechanisms are sufficient to offset the demands of said stress, there is little reaction to the stressors. Detrimental reactions to stress occur when the

coping mechanisms are insufficient for stressor (Appaneal et al., 2014) which reduces the overall wellness of the athlete. By providing alternative and sufficient coping mechanisms, it reduces the negative impacts of the stressor and the athlete is less likely to feel the negative biophysiological responses to stress.

Stress, when contributing to overtraining, can also deter peak performance as it is a factor in burnout, which can cause injury and occurs when training is overtly intense. Symptoms that an athlete can experience due to overtraining displays closely to clinical depression and includes disruptive sleep, lower levels of hunger and sex drive, and an increase in anxiety and touchiness. Despite all the negative physical effects, a biopsychological approach should be taken to also counteract the mental detriments that occur concurrently to the physical detriments (Schinke et al., 2018). By minimizing stress, there is less of a risk for burnout and an athlete has greater chances of performing to their highest capability. With understanding the stress injury model and stress's role in athletic burnout, reducing it in athletic situations is beneficial for increasing the overall wellness of the athlete and helping their performance.

Another important factor within sports performance is the motivation of the athlete. All athletic endeavors require some form of dedication and this desire to succeed is driven by multiple factors. There are two main forms of motivation to be considered: extrinsic motivation and intrinsic motivation. Intrinsic motivation is defined as completing a task for the rewarding feeling that one gains from participating. Extrinsic motivation refers to when separate outcomes and outside influences are the reason for finishing a task (Oudeyer & Kaplan, 2007). There is an overall desire for athletes to have a greater percentage of inner motivations because they are more likely to stay consistent even when outside incentives waver, feel less nerves when it comes time to compete, and display a higher level of talent than those that are extrinsically motivated. One method that can increase whether someone participates in an activity based on inner motivations is described in the self-determination theory. This theory explains that "competence, autonomy, and relatedness" are essential human desires (Hollembek & Amorose, 2005, p. 21). Competence is important because it distinguishes one's actions as necessary and effective, therefore it is worthwhile completing them. Autonomy represents how one has freewill to their thoughts and actions. Feeling one's actions as their own fulfills the desire for autonomy. Lastly, relatedness describes the camaraderie people experience with those who complete similar tasks as them. When a task fulfills these three categories, a person is more likely to willingly participate because there will be more satisfaction felt (Hollembek & Amorose, 2005). By creating a training environment that satisfies these three needs, the athlete is likely to have greater inner motivation

and not have to rely on inconsistent sources to successfully complete their training. These motivations are key factors in the mindset of an athlete and must be considered when optimizing performance.

With knowing how mental components such as stress and motivation can impact an athlete's training and competition, there is no doubt that the mental state of the athlete must be cared for. But with the added stressors and cultural norms seen within the world of sports, this task isn't as easy as it seems to be. Athletes are praised for not letting pain interfere with reaching their goals. This appraisal places that behavior on a pedestal and it carries over to how they handle their mental health. This standard of showing no weakness pushes athletes to wait until the last possible moment to seek help when mental health concerns are present. (Schinke et al., 2018). To counteract the historical precedent of placing physical health over mental health, a priority must be placed on reducing current stigmas and supporting the mental wellness of athletes. Allowing space for conversations to occur regarding an athlete's mental health can help prevent negative emotions and successfully treat dysfunctional symptoms that dampen elite performance. This mental awareness helps take a step back from the 'no pain no gain' model that many athletes grew up with and creates space for new mental techniques that can assist in the desired outcome. R.J. Schinke et al. states that "mindfulness and resilience [are] two key components associated with well-being" that can contribute to a successful environment for performance (2018, p. 630). Mindfulness is an encompassing term that covers a variety of practices that help the user notice details around them intentionally and in the present moment. Mindfulness differs from other mental health practices as it tries to alter the relations that the user feels between themselves and their thoughts and encourages the user to fully feel their emotions. An example of mindfulness at work are its practices helping athletes enter their flow state, which is defined in *Mindfulness in athletes* "as complete absorption in the task at hand, and the quality of present-moment and non-self-conscious concentration" (Anderson et al., 2021). Those who are more mindful have greater chances of experiencing said flow states, which are significant factors in obtaining optimal performance in sport (Anderson et al., 2021). Mindfulness not only harbors a good mindset for an elite athlete, it also deters psychological issues, which in turn can lessen the likelihood of suffering physical injuries (Nippert & Smith, 2008). Mindfulness is a dependable and easy practice to increase mental skills and overall wellbeing that is readily available to all (Anderson et al., 2021) and factor into an environment made in mind of the athlete's wellness. With a brief journey reviewing literature regarding sports performance and the psychology of athletes, one can begin to understand the basic necessities needed for peak athletic performance.

2.2.4 Architecture's Effect on the User Research

For an environment to be optimized for athletic performance, there needs to be in depth knowledge regarding how a building's design can influence the user. With an understanding of what deters and optimizes athletic performance, it can guide research into what emotions and outcomes are desired for creating a design protocol for athletic facilities. Stress is a great deterrent for performance and a significant amount of research has been done in regard to how stress can be alleviated through design. In *Quantifying human experience in architectural spaces with integrated virtual reality and body sensor networks*, researchers used a group of body sensing machines on users to obtain quantifiable results of the body's reaction to differing design decisions within a virtual environment. Previous literature was used to determine the design parameters that would be used to create positive and negative environments. The four design features used were levels of luminance, amount of natural light, colors used within a space, and visibility of landmarks and entrances. The conclusion from the literature was that lower levels of luminance and darker colors on surfaces increased stress whereas natural daylight and being able to see entrances and landmarks outside reduce stress. To measure participants reactions to these design decisions, their heart rates, types and levels of brain activity, and skin conduction were recorded and analyzed. With analyzing the reactions of participants in both environments, it was found that they were greater emotional reactions in the negative environment and concluded that the positive environment did not induce stress. Besides the bodily reactions that were recorded, there was a survey that the participants completed. Approximately 84% of participants said they would rather spend time in the positive environment and noted that it was more focused, relaxing, and pleasant in that environment. With these findings, it can be concluded that design not only impacts one's perceived feelings in a space, but that the body also experiences effects from how spaces are designed. To reduce negative psychological and bodily reactions in spaces, there should be lots of daylight, high levels of luminosity, lighter colors, and visibility of outdoor landmarks and entrances (Ergan et al., 2019). Findings through studies like this can begin to influence which design features will help in obtaining the desired outcomes.

Stressed spaces: mental health and architecture is another source that displays how design can impact users, specifically in regard to mental health and healthcare architecture. Light was once again a design feature touched upon in this literature review. It was shown that light had beneficial effects on patient's emotional states, outlooks and overall health. Patients that stayed in areas of the hospital that were exposed to more natural light reported lower levels of stress, pain and significantly cheaper pain medication costs, with the highest useful outcomes in the morning

hours of the day. Additionally, light helped improve accuracy in visual functions and balanced the body's natural circadian rhythm (Connellan et al., 2013). Though these outcomes were seen in healthcare settings, they can be applicable to athletic facilities because they share the goal of optimizing the health of their building's users. Providing views of nature was a new design feature found in this review. Nature offers patients a helpful diversion from painful sensations, therefore reducing the severity of pain. Views of nature also influenced and reduced anxious and stressful emotions (Ulrich et al., 2008) as well as introducing nature to the inside of the building with indoor plants (Connellan et al., 2013). A view of nature was described in a separate review as a space with prominent greenery, water, or landscape, lack or concealment of manmade aspects, and a greater number of curved lines than straight (Ramadan & Kamel Ahmed, 2019). This separate review by Ramadan & Kamel Ahmed named *Spatial design through stimuli to promote wellness through buildings' design* seconded the information found in previous studies and introduced new features to this research.

When designing for wellness, colors are a tool that can help in achieving optimal results. There are numerous beneficial responses that the body can experience through color, making it useful in designing holistic spaces that help people. Ramadan and Kamel Ahmed list specific physiological reactions to color, "for example, the red color activates the circulation system and benefits the five senses; blue raises metabolism, stabilizes the heart, muscles and bloodstream; green strengthen bones and muscles, disinfects bacteria and virus, and relieves tension" (2019, p. 13). Color is typically the most notable aspect of a material, so altering colors in spaces will greatly change its ambience (Ramadan & Kamel Ahmed, 2019). Materiality is another aspect of interior design that will affect the user's experience. Natural materials can be used to emulate a sensation of the natural environment (Ramadan & Kamel Ahmed, 2019) which is proven to lessen negative physiological and psychological responses (Ulrich et al., 2008). Natural materials are greatly desired over their synthetic counterparts, but the use of material and color should be heavily coordinated with the function of each space to ensure the proper outcome of these choices (Ramadan & Kamel Ahmed, 2019). By understanding the differing effects of colors and materials, they can be altered so that the environment of a space matches its purpose.

Mindfulness was another important component in sports performance and understanding which design features promote it is helpful. A study by Thampanichwat et al. examined Instagram posts to see what kinds of architectural environments were most associated with mindfulness. Three design concepts were chosen for the study: "traditional Japanese, Biophilic design, and Buddhist contemplative space" (Thampanichwat et al., 2023).

mindful architectural atmosphere

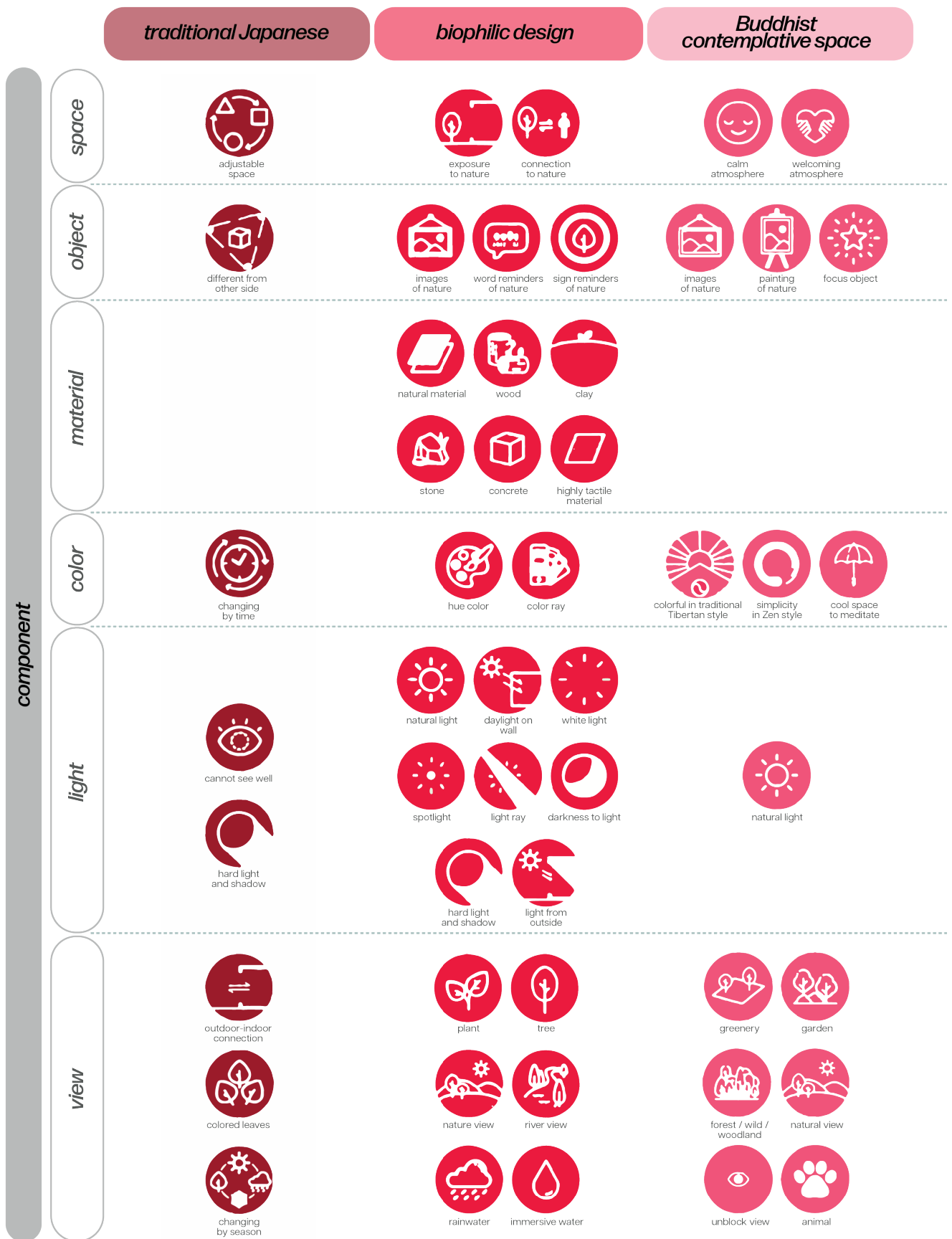


Figure 7. “The architectural atmosphere influencing mindfulness”

Source: This figure was produced by Thampanichwat, C., Bunyarittikit, S., Moorapun, C., and Phaibulputhpong, P. in A Content Analysis of Architectural Atmosphere Influencing Mindfulness through the Lens of Instagram, 2023, Figure 1. Modified by author.

Figure 7 describes the different components of each design concept. Their research discovered that people connect mindfulness to Japanese architecture the most, with biophilic design closely following (Thampanichwat et al., 2023). While it is noted that this data is for which design methods are associated with mindfulness, not which have proven to support it, it does repeat many of the previous design features which have been proven to improve the user's experience within a building.

For a design protocol to be created, it must be understood what features influence the effects of the environment that is being designed. Discovering what features alter the user's perception of stress, pain and wellness, while promoting their practices of mindfulness can determine whether or not a design aspect will be included in the final result.

03

data collection



03 *data collection*

3.1 Data Collection Protocol

This research will be approached with a focus on the athlete and a holistic view of how their performance can be increased. This holistic view can be separated into two categories: the performance of athletes and the promotion of wellness through qualities of the environment. Following the collection of data regarding the athlete's mindset and their wellness through a survey and an interview, there will be connections made between those results and literature of sports performance and wellness within architecture to create a general design protocol that can

Data to answer the research questions will be gathered in two manners: a survey and a one-on-one interview. The survey titled *Examining emotions and motivations as factors in training and competition* will ask qualitative questions regarding athlete's mindsets and what they believe are the most important components in being successful. The only identifying factors that will be collected are what sport the athlete does, whether it is an individual or team sport, and the level of collegiate athletics they participate in. Other questions that will be asked include features they believe are most important in a training facility, what causes them to burn out, and what they do to remain motivated. Collegiate athletes will be the base requirement for this survey because to have made it thus far in an athletic career, the athlete has had to have been successful. By knowing that the subjects are talented in their respective sport, it ensures that the data is being collected from people who have the desired outcomes for this research.

Apart from this survey, an interview will be conducted with a professional athlete to ask more open ended questions to gain more insight on the topic. Similarly to why collegiate athletes are the base requirement for the survey, professional athletes have greater defined success because only a small percentage of athletes reach that level. This athlete has competed in high stake events all across the globe. By analyzing their experiences competing in some of the highest quality competition venues, it can be discovered how they felt the environment affected their performance. With a one-on-one interview, more specific questions will be asked to cover the gaps that the survey is not able to address. These inquiries will help discover the relationship between sports and architecture.

3.2 Survey Results and Analysis

The first part of the data collection was the survey mentioned before. This survey was shared with athletes at North Dakota State University and athletes apart of a mental health support page on Facebook. There was a total of 104 participants in the survey. Figure 9 shows the range of sports that were covered by the participants in the survey. Figure 10 further breaks down the demographics of the survey participants. There was a relatively even distribution of athletes who competed in team sports and individual sports. Sports that were noted as ‘individual’ also included sports that had team aspects to them, such as gymnastics and wrestling, but are noted as ‘individual’ because the athlete competes solo and without their teammates.



Figure 9. Sports represented in survey. World cloud diagram showing which sports were represented in the survey. Larger words had a greater number of survey respondents.

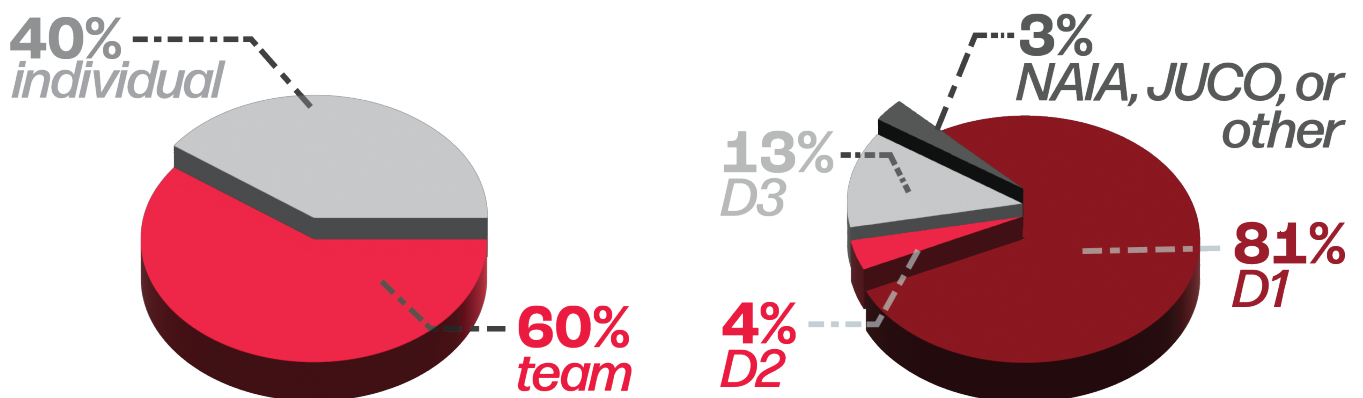


Figure 10. Survey demographics. The left pie chart shows the percentage of participants that were in team or individual sports. The right pie chart shows the percentage of participants that competed in each level of collegiate athletics.

The survey began with questions regarding athlete's motivations, emotions, and factors that contribute to burnout. Figure 11 shows whether athletes felt they were more intrinsically or extrinsically motivated. Intrinsic motivation is defined as completing a task for the rewarding feeling that one gains from participating. Extrinsic motivation refers to when separate outcomes and outside influences are the reason for finishing a task (Oudeyer & Kaplan, 2007).

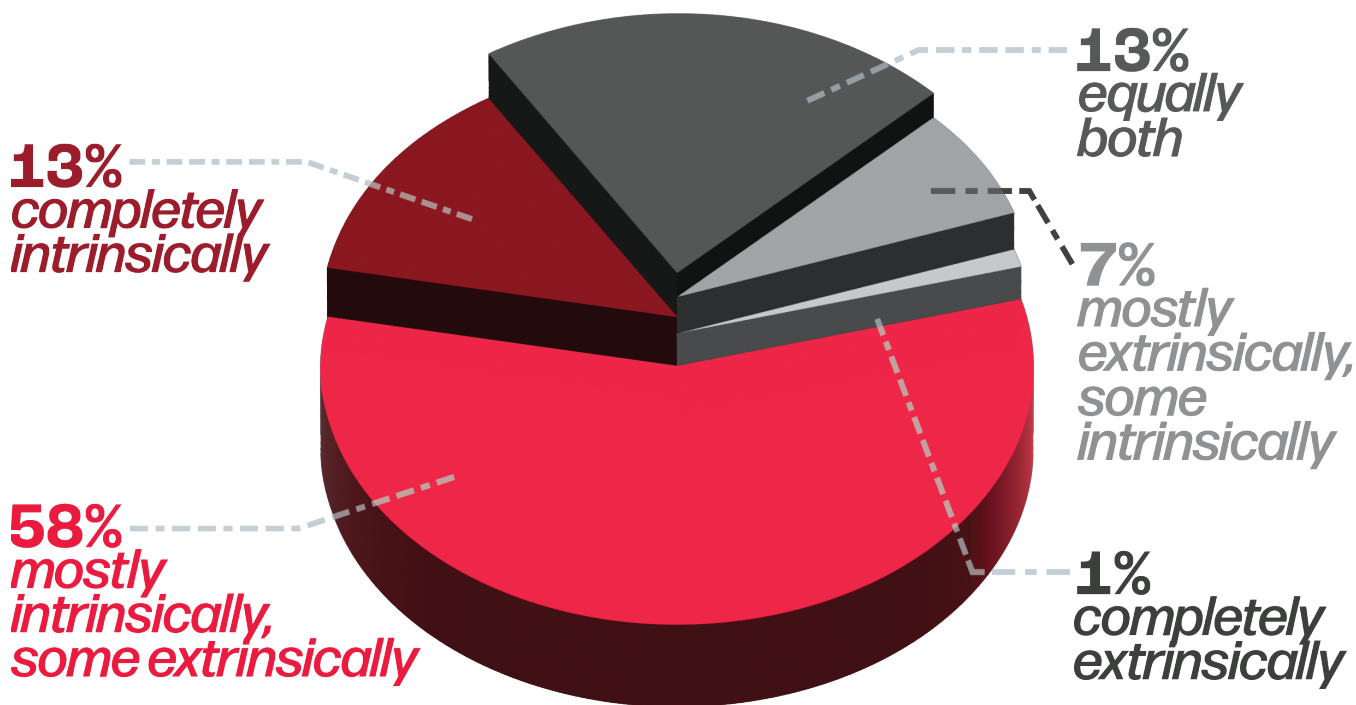


Figure 11. Would you describe yourself as more intrinsically or extrinsically motivated? Intrinsic motivation comes from within us whereas extrinsic motivation arise from external factors. An example of intrinsic motivation is participating in sport because of your love for the game. An example of extrinsic motivation is attending additional training sessions because your coach requires it.

A combined total of 71% of respondents said they had a greater portion of intrinsic motivations when it came to their training. This demonstrates that outside factors are not the main contributors for why an athlete trains in a large number of athletes. To help these athletes, a positive training environment should be created so that participants have a good experience and have greater chances of feeling fulfilled by their training. This will stimulate a higher level of intrinsic motivation, which in turn is affected less by outside influences and stays more consistent, offering a higher quality of training. To understand athlete's intrinsic motivation on a deeper level, respondents were asked to list one or more intrinsic motivations that they had. Though the question was open response, 48% of respondents listed something that had to do with personal achievement. Examples included the desire to be the best, being better than the day before and achieving goals set by themselves. Because so many athletes display this drive on their own,

supporting their wellness, helping their mental state and minimizing the chances of burnout helps this motivation continue and optimizes their outlook. Other notable responses included respondent's love of competition, the enjoyment of the sport they participated in and other statements shared in Figure 12.



Figure 12. List one or more intrinsic motivation you have. Respondents were asked to list one or more intrinsic motivation that they had. The question was an open response and participants were able to enter whatever they wanted. The responses were then analyzed and categorized into the keywords shown above.

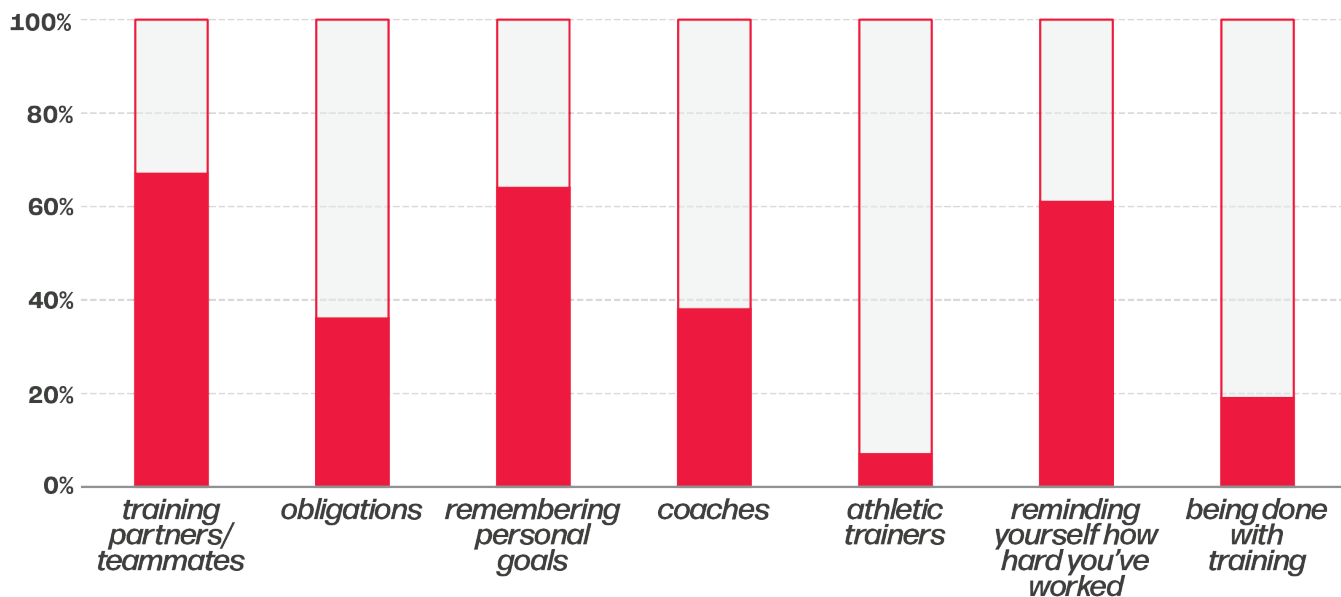


Figure 13. When you are not motivated, what do you depend on to complete your training? Respondents were able to select all that applied. Red color represents the percentage of respondents that selected each response.

The next question asked respondents what they depended on to complete their training when they weren't feeling as motivated. Responses to this question are shown in Figure 13. The most selected responses included remembering personal goals and reminding themselves how hard they had worked, with the most respondents saying that they depended on teammates.

With understanding what helps keep the athlete motivated, the next question discovered what contributed most to athletic burnout. The survey responses are displayed in Figures 14 and 15 and respondents were able to select multiple responses. The greatest response was physical injury, with mental health issues and loss of motivation closely behind. Other responses that had over or close 50% of respondents that selected them were “personal issues outside of sport, lack of recovery and no variety and training” (Naranjo Mata, 2023).

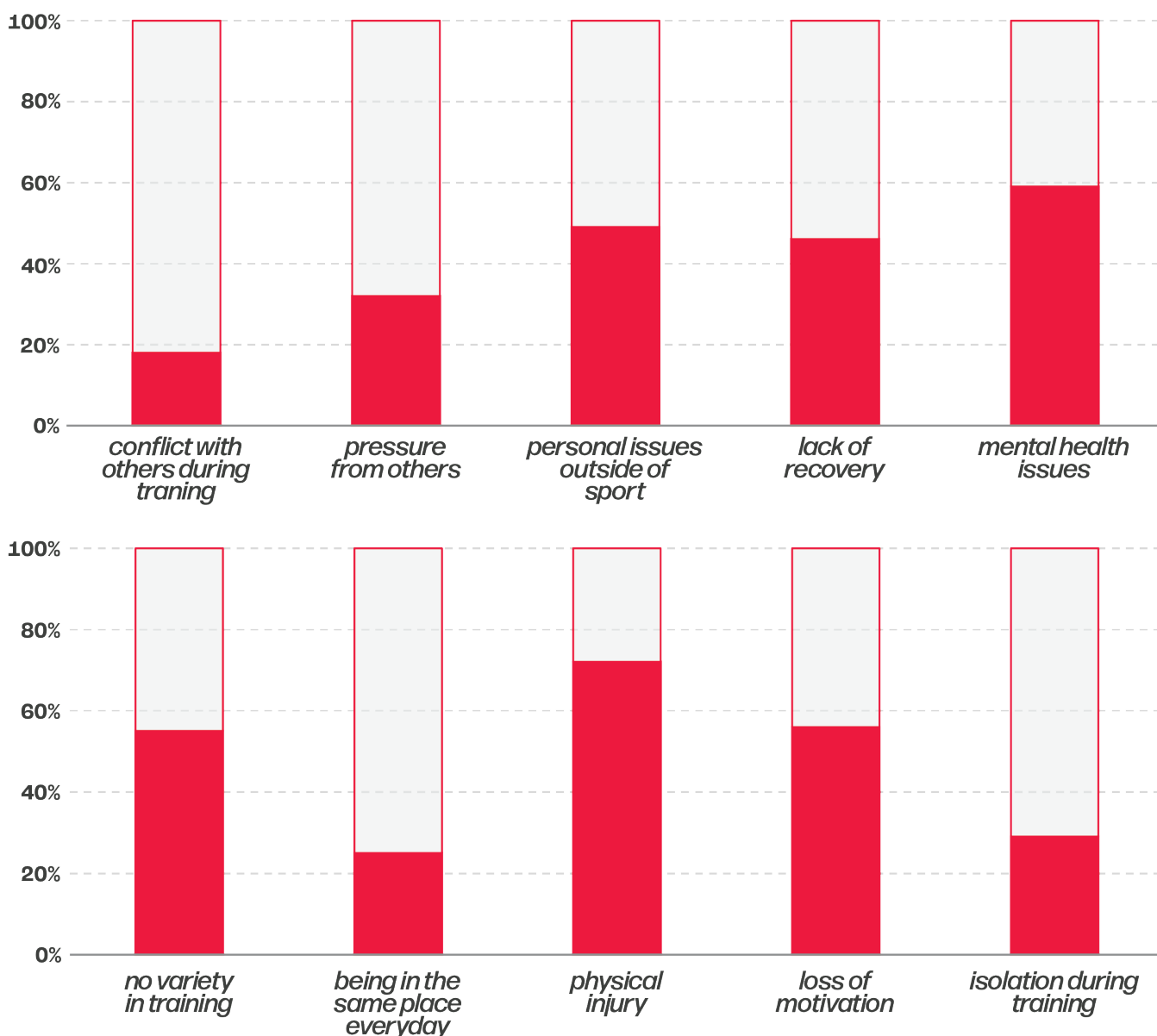


Figure 14 and 15. What causes you to burn out from training? Respondents were able to select all that applied. Red color represents the percentage of respondents that selected each response.

The next question was laid out similar to the previous one, but required respondents to select one answer as the greatest cause to their burnout instead of all that they felt were applicable. The results were alike to the previous question, with staying mentally and physically being the top two answers. Having no success in competition was also a highly selected response.

Based on the previous review of sports performance, it is indicated that stress increases the risk of physical injury and deters the mental state of the athlete (Schinke et al., 2018). With mental health issues and physical injuries facing many athletes, designing an environment to assist in alleviating stress can help athletes reduce the chances of experiencing these performance dampeners.

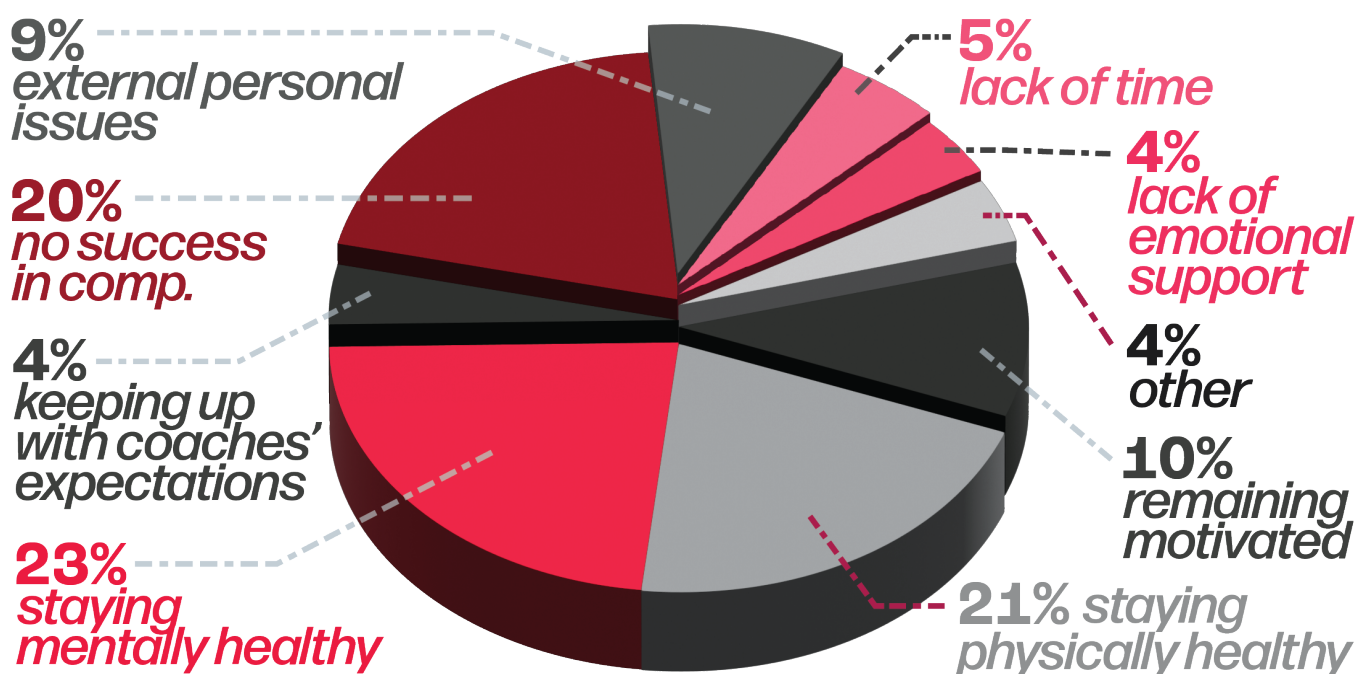


Figure 16. What is your greatest obstacle when it comes to training successfully? Respondents were able to select all that applied. Red color represents the percentage of respondents that selected each response.

Discovering what athletes did to take care of their mental health was next in the survey. Participants were able to select numerous responses and results are shown in Figures 17 and 18. The most selected responses in order were spending time with teammates, spending time outdoors, and scheduling downtime. Ways this can translate to the design of a facility can be large windows to bring nature indoors and including areas that foster relationships between the athletes. Having this knowledge helps reduce athletic burnout since mental health issues were indicated to be a great contributor.

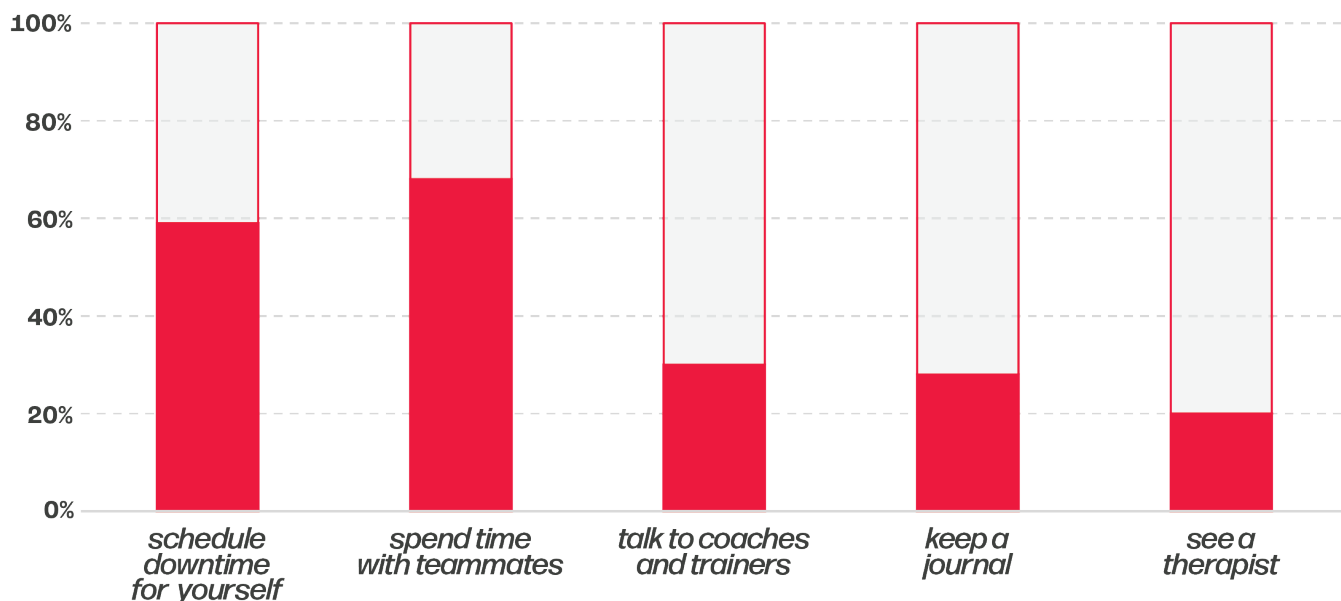


Figure 17. What is your greatest obstacle when it comes to training successfully? Respondents were able to select all that applied. Red color represents the percentage of respondents that selected each response.

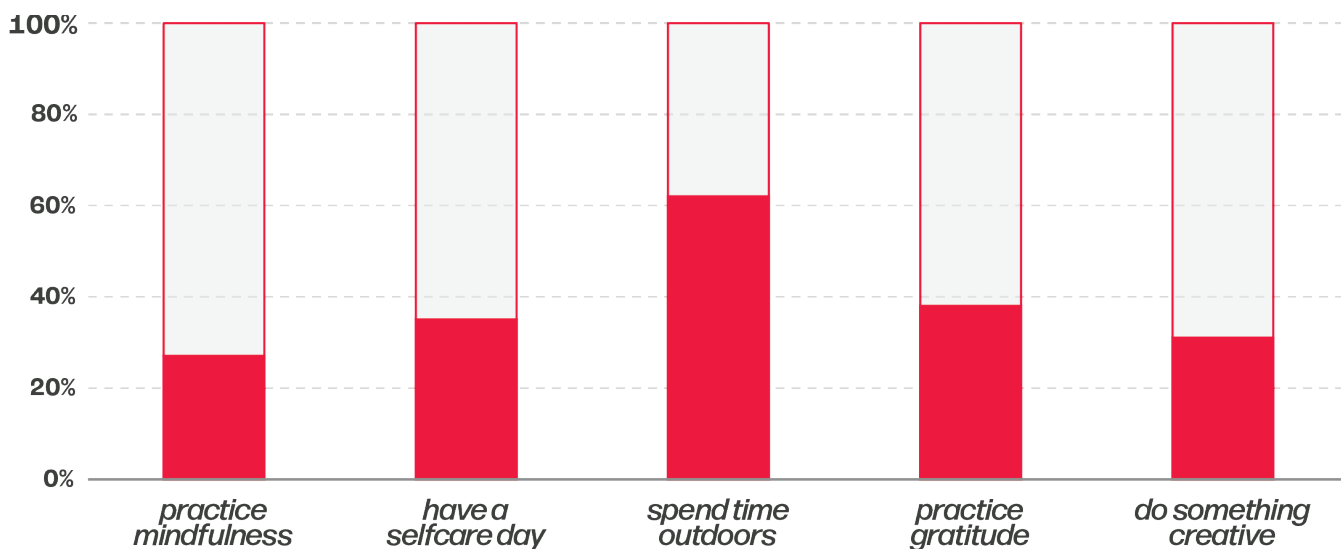


Figure 18. What is your greatest obstacle when it comes to training successfully? Cont. Respondents were able to select all that applied. Red color represents the percentage of respondents that selected each response.

The next couple of questions aimed to compare which emotions athlete felt during competition compared to which emotions they felt allowed them to perform at their best. Figure 13 displays the emotions that were felt the most by survey respondents. 88% of respondents said they felt excitement during competition while 76% said they were focused- these were the most selected positive emotions. Some negative emotions that had high response rates were “nervous, anxious, and pressure” (Naranjo Mata, 2023). When comparing Figure 19 to Figure 20, which displays which emotions are desired, it’s shown that there are more bars on the right side of the graph, meaning that the emotions that athletes didn’t feel very much during competition

are the ones they want to experience. The emotions that respondents felt the most, but did not want to, were “nervous, anger, and frustration” while the emotion that respondents didn’t feel but desired greatly was “confidence” (Naranjo Mata, 2023).

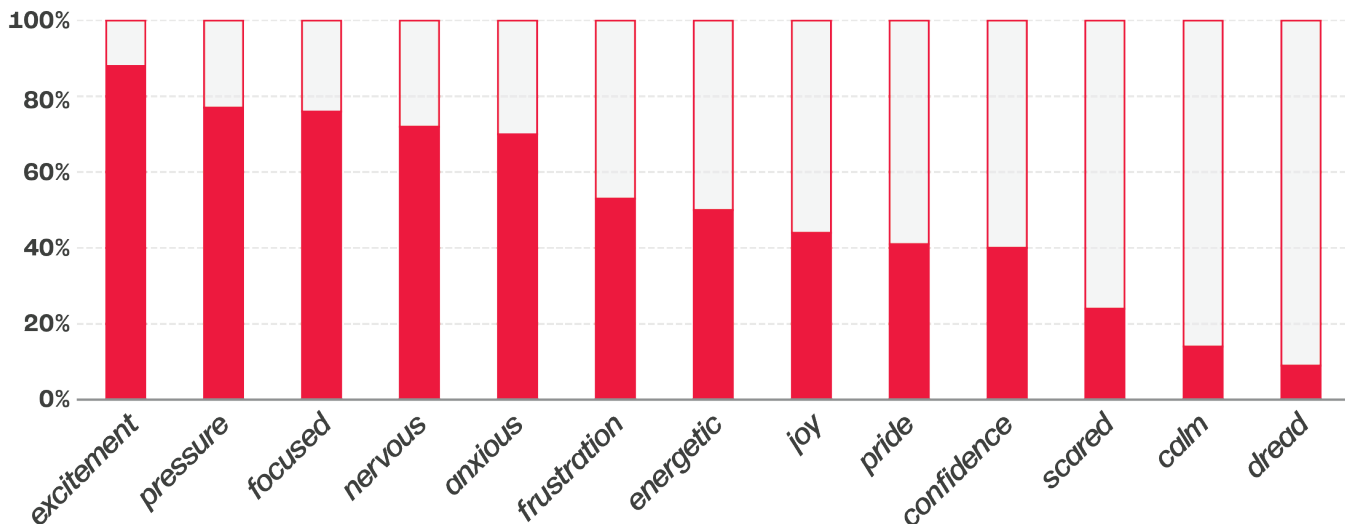


Figure 19. Which of these emotions are heightened during competition? Respondents were able to select all that applied. Red color represents the percentage of respondents that selected each response.

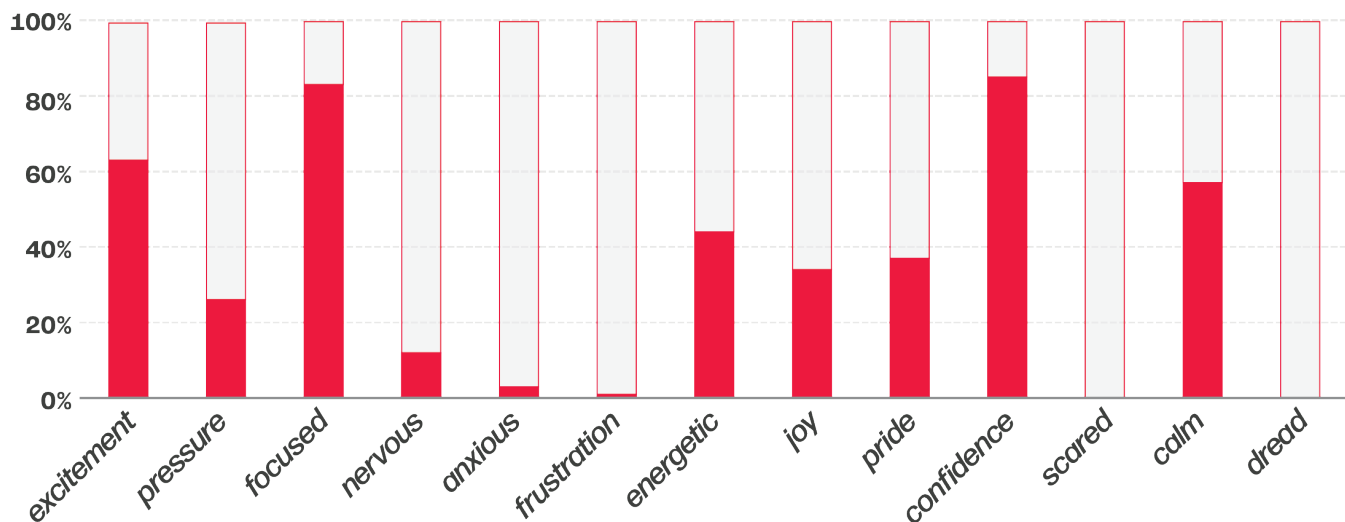


Figure 20. Which emotions help you to compete at your best? Respondents were able to select all that applied. Red color represents the percentage of respondents that selected each response.

A consistency between the two questions was that many athletes said they felt focused during competition and that it helped them to compete at their best. Some potential design solutions that can be decided from these responses are implementing spaces in training facilities that encourage practices of mindfulness and having focus enhancement features in areas for warm up so that this emotion desired for performance is encouraged.

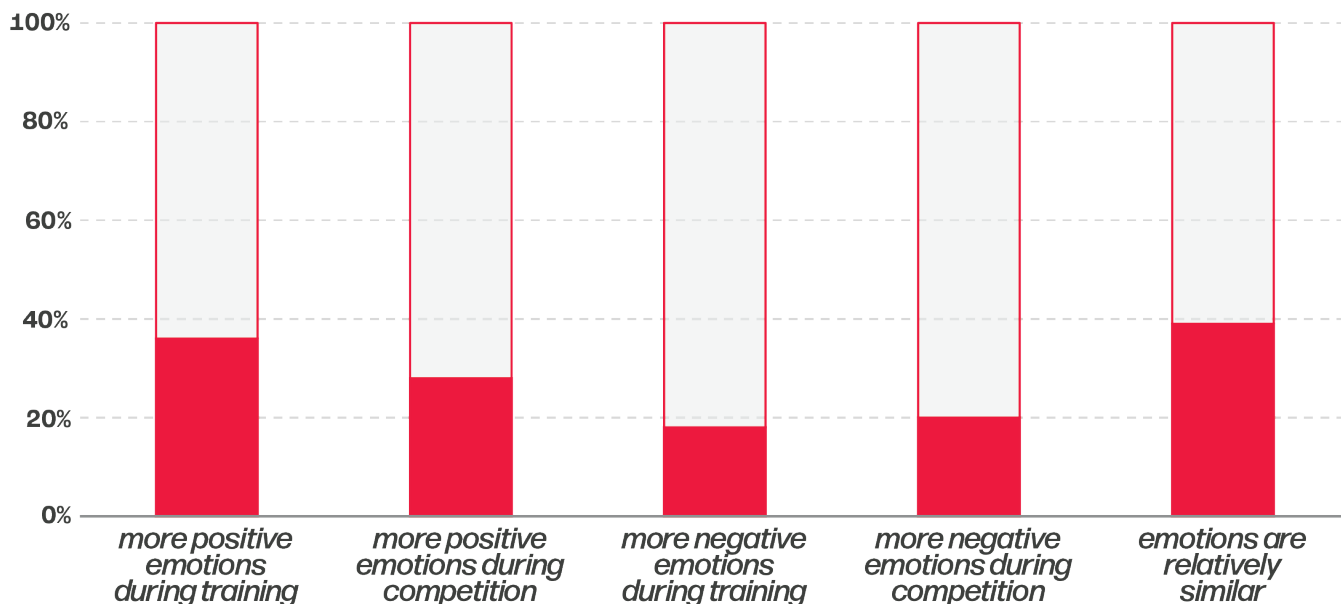


Figure 21. How do your emotions differ from training to competition? Survey respondents were able to select all that applied. Red color represents the percentage of survey respondents that selected each response.

Figure 21 displays the comparison in the amount of negative and positive emotions that athletes experienced between training and competition. Participants were able to select multiple choices, but response rates were low for this question. Responses indicated that emotions tended to be relatively similar between training and competition, with a slight lean towards having more positive emotions during training. The figure below shows when in the competition were emotions the greatest.

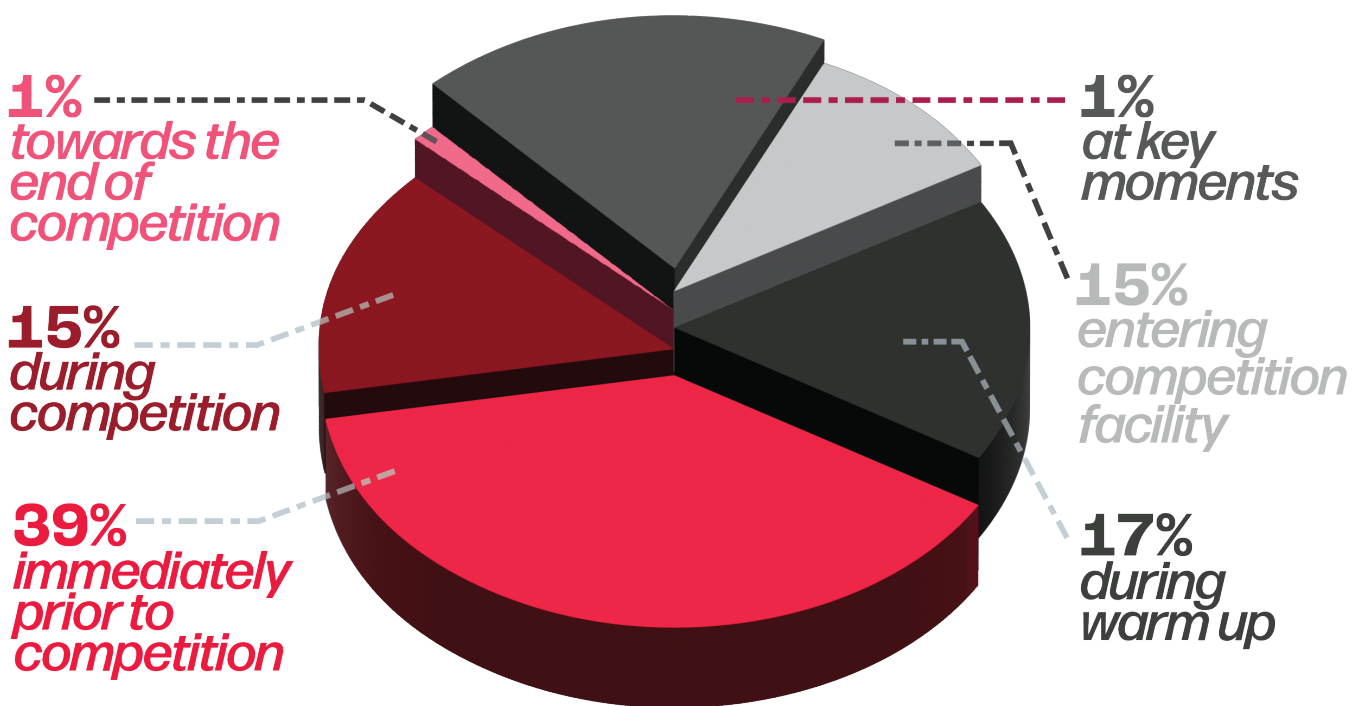


Figure 22. At what point in the competition are these emotions peaking? Respondents were asked to select during which part of competition were their emotions felt the greatest.

39% of respondents selected that their emotions peaked immediately prior to competition and 17% said it was during warm up. Though some emotions are necessary to be successful, many can have negative effects on an athlete’s mindset and are not desired as shown in Figure 20. By including design features in warm up and starting areas that are calming and stress reducing, it can help athletes not be overwhelmed by these emotions. Environments that promote mindfulness would also be beneficial in areas where stressful points of competition occur so that potential negative effects are minimized.

Responses shared in Figure 23 also demonstrate the importance of designing a space to encourage mindfulness practices. When participants were asked what they felt was most significant for athletic success, 40% responded with “having the right mindset” and the next closest response was having a “relationship with coaches, teammates, trainers and staff”, which was selected by 24% of respondents (Naranjo Mata, 2023).

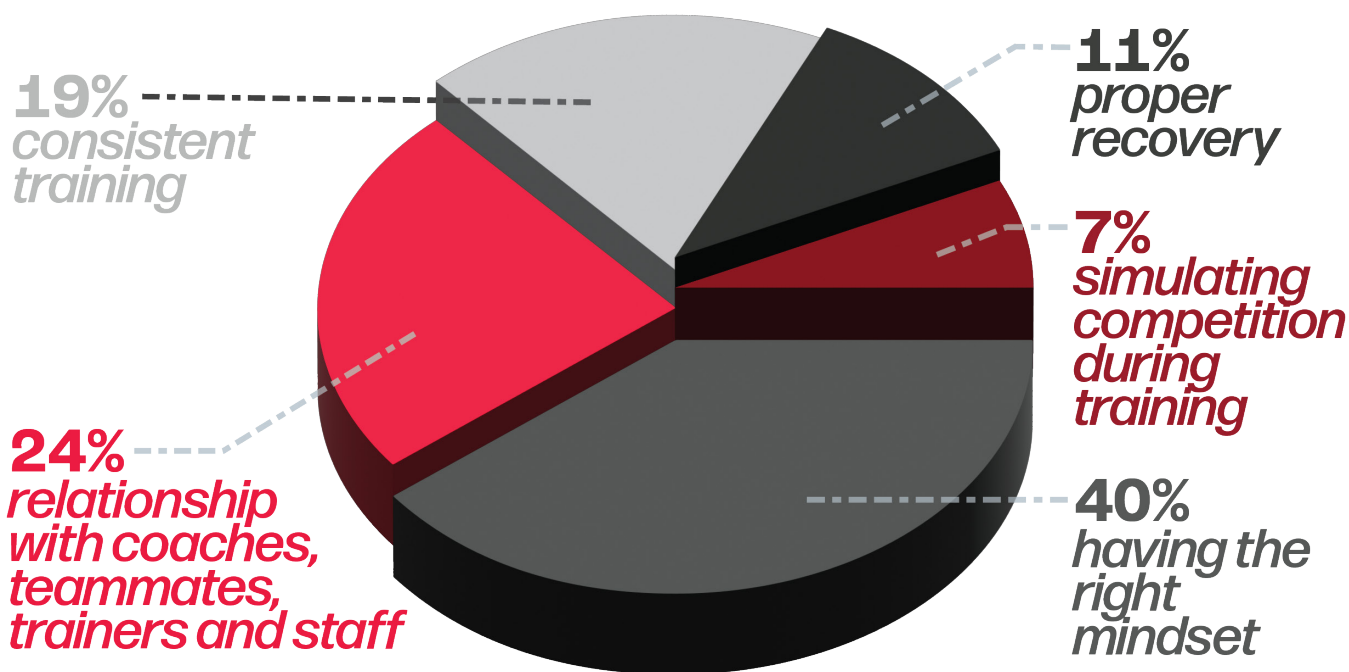


Figure 23. Which of these items do you believe is most crucial for success? Participants were asked to select a single answer for what they believed was most essential for success.

The self-determination theory states that when the desire for autonomy is fulfilled by a task, that people are more motivated in completing that task and likely to repeat it (Hollembek & Amorose, 2005) which is an important aspect in successful training. Figure 24 displays that a total of 82% of respondents said that having a choice in training was useful for staying motivated. To promote autonomy in training facilities to increase intrinsic motivation, a variety of training areas and methods can be offered that achieve the same results so athletes can complete their need for autonomy.

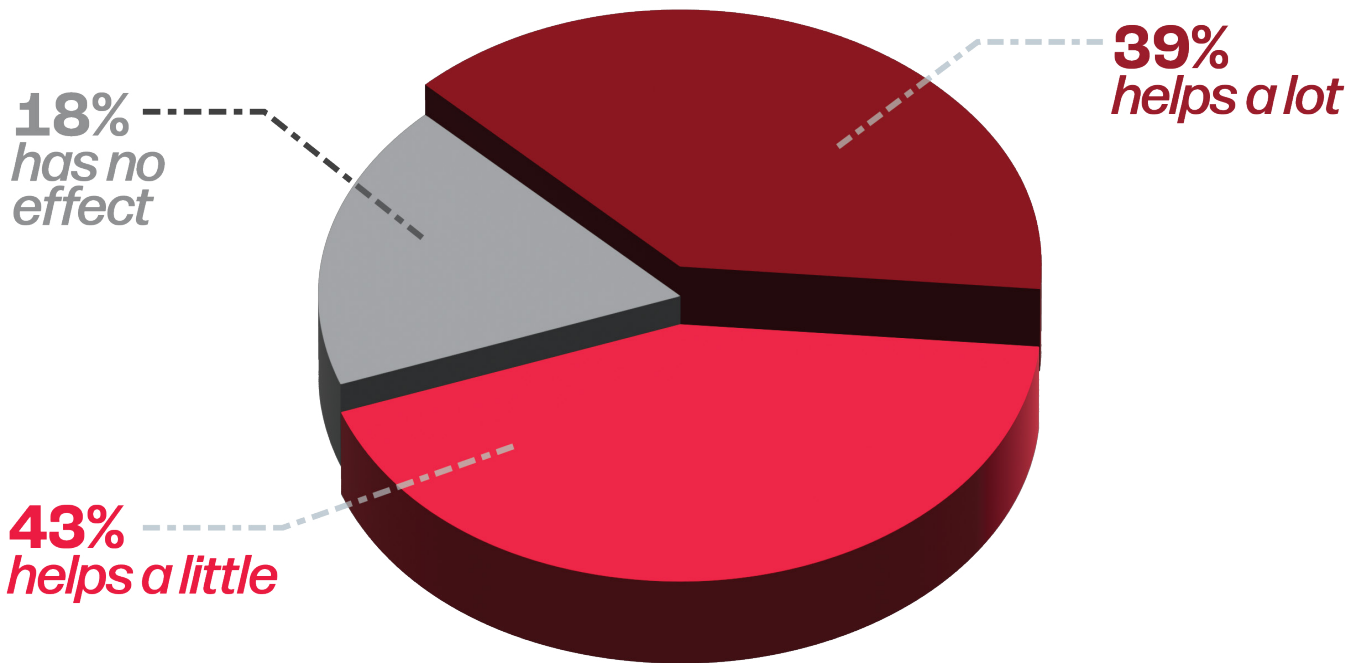


Figure 24. Does having a choice in your training help you stay motivated? Respondents were asked to indicate if having autonomy in their training helped their motivation.

The self-determination theory states that when the desire for autonomy is fulfilled by a task, that people are more motivated and likely to repeat it (Hollembek & Amorose, 2005) which is an important aspect in successful training. Figure 25 displays that a total of 82% of respondents said that having a choice in training was useful for staying motivated. To promote autonomy in training facilities to increase intrinsic motivation, a variety of training areas and methods can be offered that achieve the same results so athletes can complete their need for autonomy.

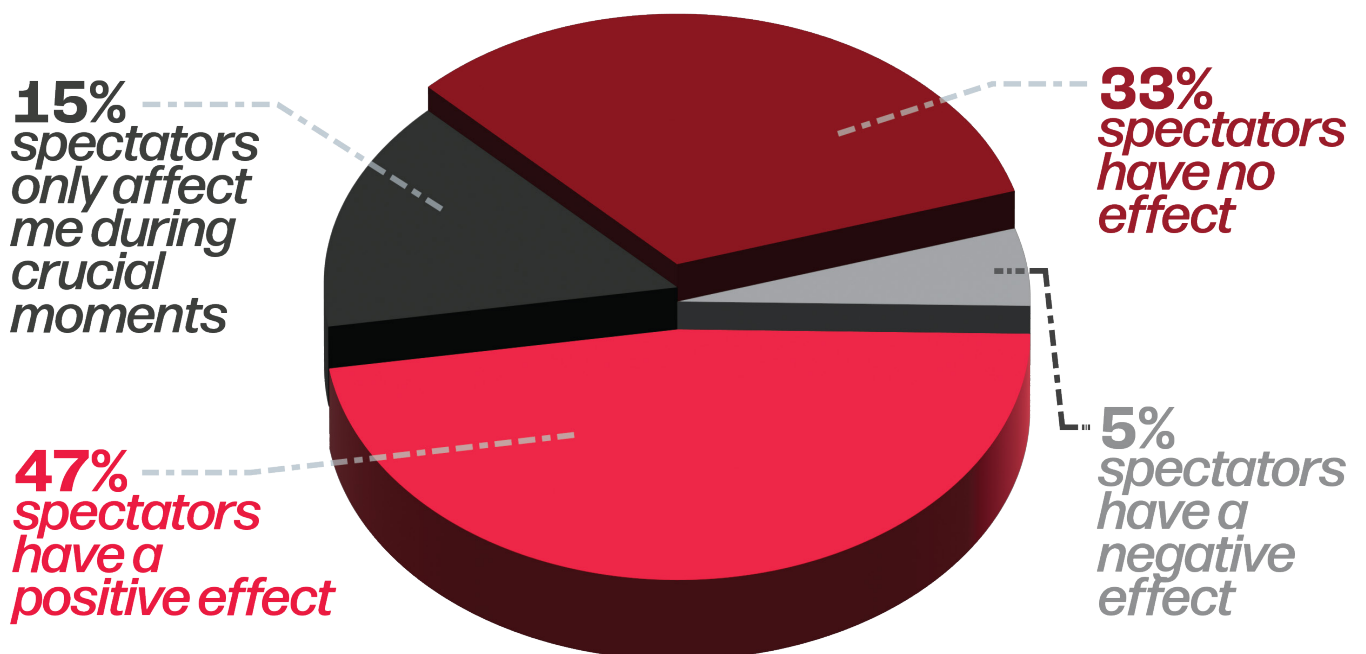


Figure 25. How do spectators affect you during competition? Participants were asked whether spectators had a positive, negative or no effect on their performance.

The next question explored what effects spectators have on athletes. Figure 26 displays the results, with almost half of respondents stating that spectators had a positive effect and 33% indicated that they had no effect. These results can influence the design of the spectators' proximity to the competition area in training facilities that also host competitions, which is a large majority of them.

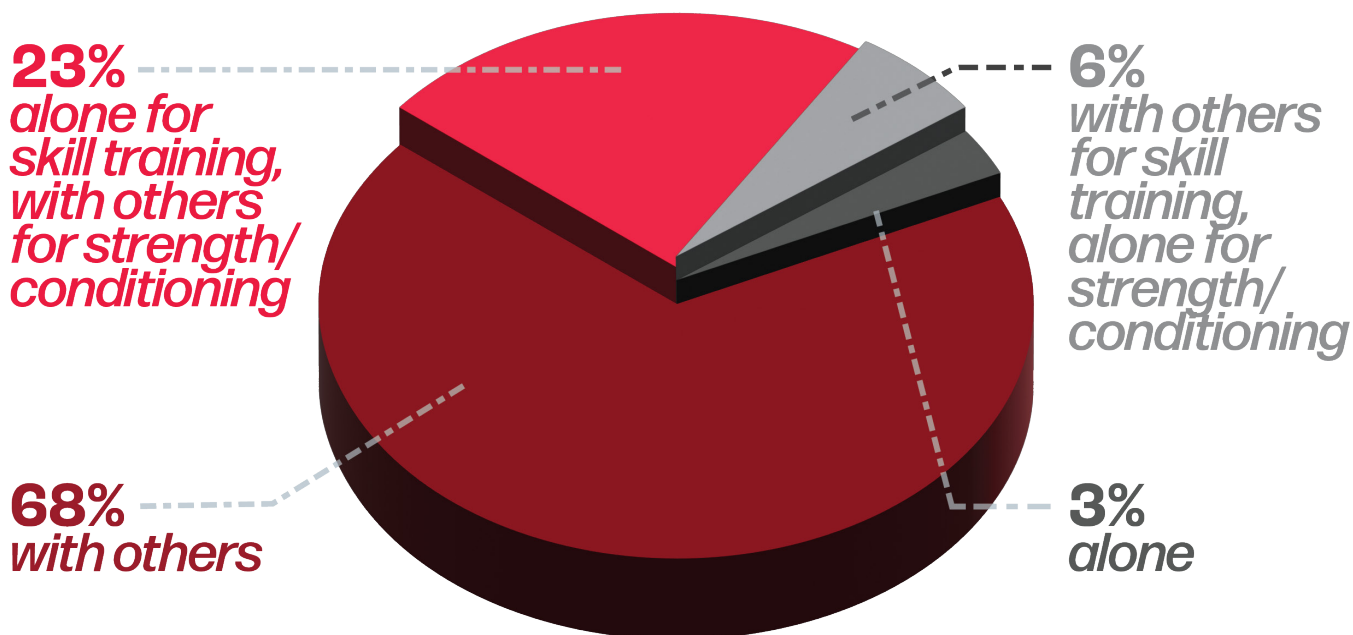


Figure 26. Do you train better alone, or with others? Respondents were asked whether they trained better with others or alone. The two options were also broken down further by providing different responses for different types of training.

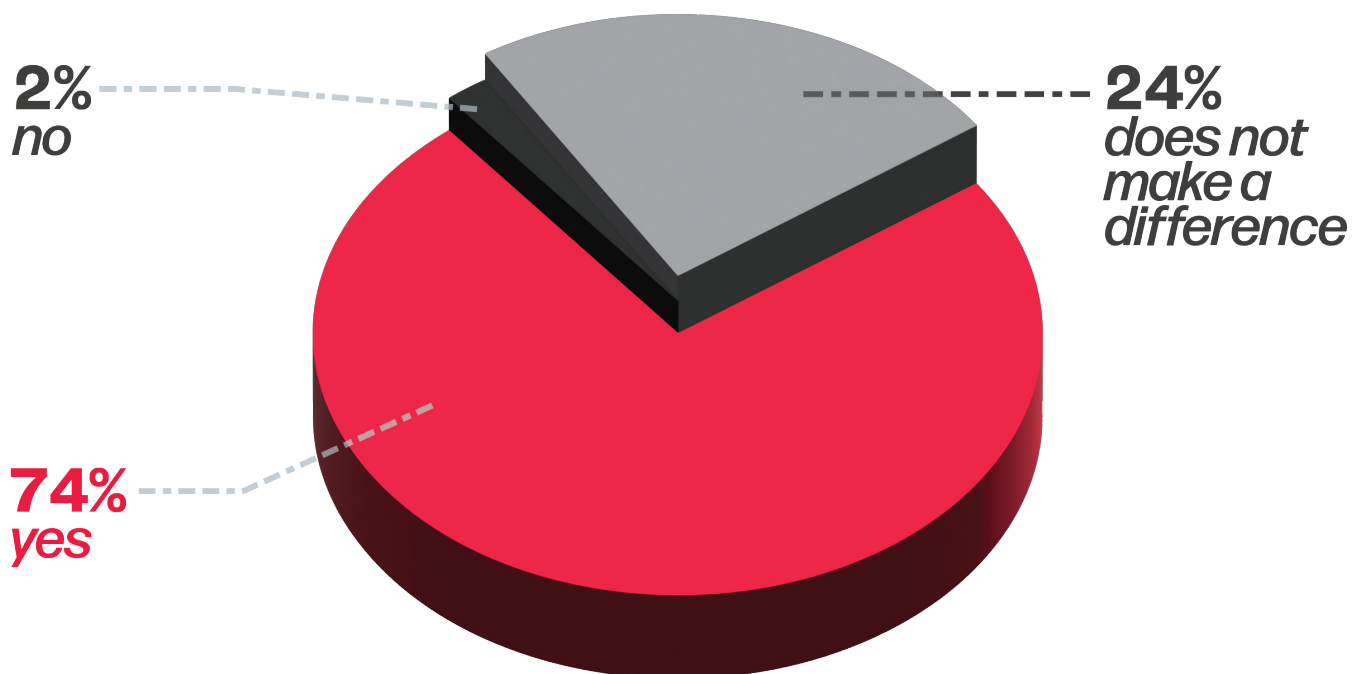


Figure 27. Is a change of scenery, environment, or location helpful in avoiding burnout? Respondents answered whether or not changing the scenery, environment, or location of their training helped them feel less burnt out.

The next question inquired whether changing the scenery, environment, or location of training helped avoid burnout. 74% of respondents selected that it helped. This creates even more incentive to include a variety of training areas within athletic facilities to ensure that the athlete has change in pace every so often.

To finish the survey, the athletes were asked direct questions regarding training facilities to understand what they felt would be the most important design features. Because the aim of this research was to recenter the athletes’ needs in designing athletic facilities, these questions were crucial. Two questions of this sort were asked and had the same format. Respondents were asked to rank lists of design features based on how important they thought each one would be in a training center, with one being the most important. The first question inquired about specific design attributes and responses are shared in Figure 28. Participants indicated that “strong team branding and visual representation of goals” was the most important to have in a training facility with “high air quality” being the second most important (Naranjo Mata, 2023). This corresponds with previous data showing that many athletes are motivated inwardly and having reminders of these goals can help that motivation to not waver. The second question asked specifics in regard to the building programming. Over half of the respondents said that having a variety of training areas was most important, with the second most important being similar, just with recovery areas. The next closest response was having proximity to fuel and hydration. This backs up data from questions regarding the athletes’ motivation and causes of burnout- having a variety of training areas in facility is crucial.

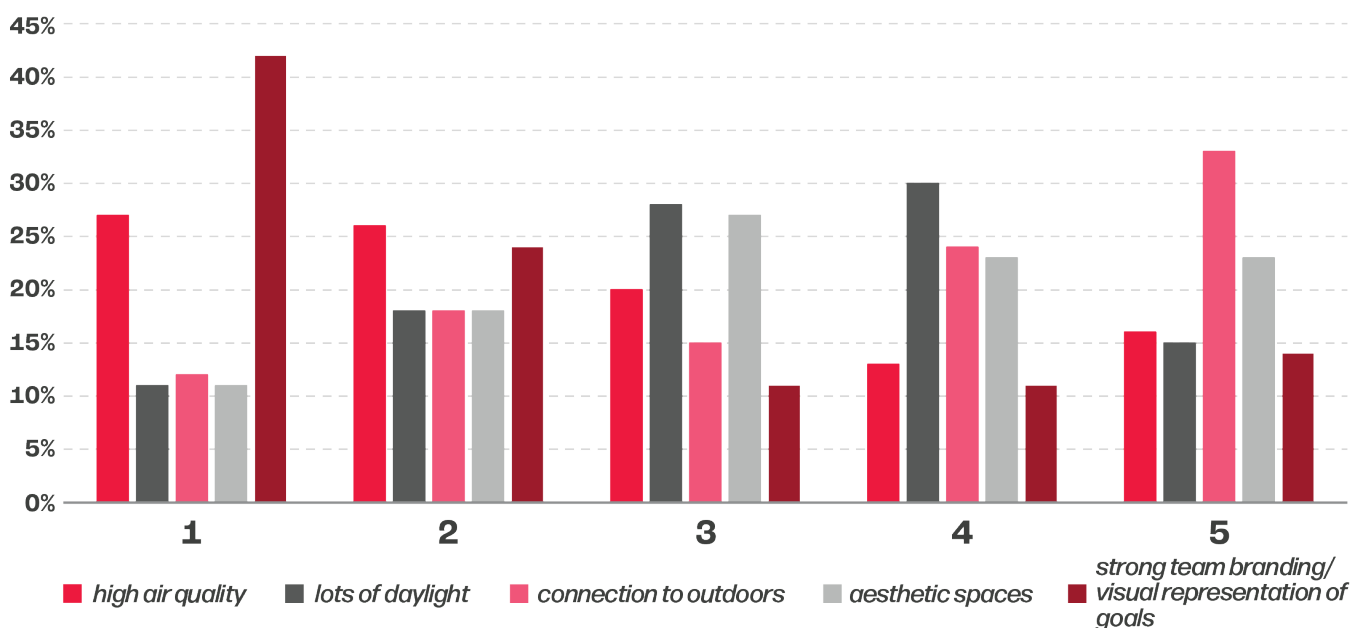


Figure 28. Which of these items are most important in a high quality training facility? Question one. Survey respondents were asked to rank the list of items in the key below the graph by importance, with one being most important and five being least important.

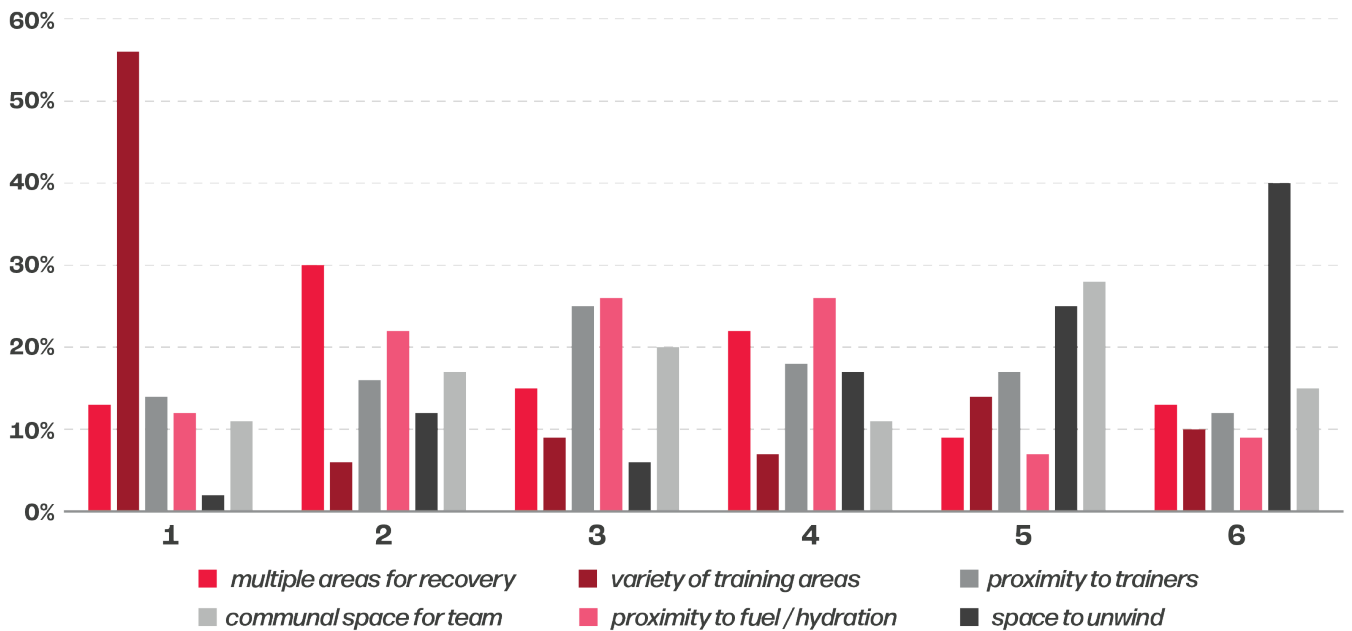


Figure 29. Which of these items are most important in a high quality training facility? Question two. Survey respondents were asked to rank the list of items in the key below the graph by importance, with one being most important and five being least important.

To summarize the results, there are many takeaways that will help in developing a design protocol for sports training facilities. One of the main points is that athletes who make it to this level have a high amount of intrinsic motivation. Participants also stated that having the right mindset was most crucial for success. To support this motivation and encourage the proper mindset, supporting the athlete’s well-being as a whole is vital. Creating facilities that fulfill needs of autonomy, competence, and relatedness can create an environment that strengthens their inner motivation (Hollembek & Amorose, 2005) and fosters the best headspace for the athlete. The second takeaway is that the inability to stay healthy mentally and physically was the greatest deterrent to training for participants. With stress being a great contributor to physical injury (Schinke et al., 2018), designing facilities to alleviate stress can assist in keeping athletes healthy. Next, results indicated that emotions were relatively similar between training and competition. The emotions that athletes desired the most for their performance were focus and confidence, with confidence being the emotion that very few athletes said they experienced. Athletes stated that their emotions peak immediately prior to competition. To combat the negative emotions athletes feel prior to competing, warm up areas should be specifically designed to ease negative symptoms and promote confidence. The results from the next questions shared that participants had a strong preference for training with others instead of training on their own and that changing the environment where training occurs helped prevent burnout. These answers encourage the inclusion of a variety of training areas within facilities that accommodate group training so that

athlete's desires are catered to. Lastly, strong team branding and the visual representation of goals was the design feature athlete's believed to be most crucial for a training facility with the most important programming need being a variety of training areas. By using this survey to influence the design protocol, the goal of recentring the athletes' needs in the design of training facilities is achieved, ensuring that this user group is adequately considered for this building type.

3.3 Interview Results and Analysis

To obtain more knowledge regarding athletes' experiences in training and competition facilities, an interview was conducted with a professional athlete. The goal of this interview was to ask more specific questions that couldn't be included in the survey, compare the differences between collegiate and professional athletics, and gain knowledge about all the facilities the athlete had trained and competed in. This athlete has been a professional for five years now and throws shot put in the sport of track and field. They have competed in many Diamond League events, which are the top track and field meets in the world, the 2020 Tokyo Olympics and the recent 2023 World Athletics Championship. They were shared a starter set of questions prior to the interview so that they had sufficient time to think of their responses.

To begin the interview, the athlete was asked what their favorite place they had competed in was. Their response was the stadium for this past year's World Athletics Championship, which took place in Budapest, Hungary. This location is a campus that has an outdoor track stadium along with an indoor one. The athlete described how everything was brand new, very well lit, and how the lights changed colors nearly every day. This location also had their favorite warm up area, which had throwing areas where athletes could throw indoors but have their implements go outdoors and both an indoor and outdoor weightroom that were all state-of-the-art. The one downside from this warm up area was the distance there was between there and the competition area. Walking between the two worked the body a greater amount and comparing results from this competition to results from a competition where the warm up area was much closer shows how perhaps the extra expenditure of energy affected the competition, with the average throw being further in the other competition. Another negative experience the athlete encountered in warm up areas was an insufficient amount of room.

The crowds from the competition in Budapest were what made this competition their favorite. The athlete details how "the atmosphere was just crazy [and how] they did a slow clap for [them] all when [they] were throwing ... it was the whole stadium of some 40,000 people doing it." This response segued the interview to the next question, which questioned how big of an influence crowds had on competitions. The athlete stated that it was "the single most important

thing” that there was, but more specifically, the energy of the crowd. The athlete recounted how even a small crowd of 200 spectators could produce a great atmosphere and that their excitement for the sport translated into competition. They recounted how when they competed in a brand new stadium during the 2020 Tokyo Olympics that the lack of spectators lessened the excitement in the atmosphere. There is a great preference to have large crowds during events, but athletes that compete at this level are less likely to depend on outside sources for their performance and compete at their best no matter what.

Shifting the conversation from competition to training, the athlete was asked to compare their experience training in their collegiate facility to where they trained currently. Both places are universities in the Midwest and besides where he currently trains having greater resources and more training areas only for track, there wasn't a very noticeable difference between the two. The athlete did state that both facilities were windowless and desperately lacked natural daylight, which made training inside during the long winters hard. Being under artificial lights in a facility where athletes spends lots of time every day can be draining and “being able to train [in] natural light makes a huge difference”. They also expressed how the ability to allow fresh air into the facility is wanted. The athlete went on to compare his current facility to other ones he had visited, stating that his current facility lacked school branding and was somewhat “boring”. A different university was the complete opposite and “oozed” their school colors and mascot everywhere, creating a unique atmosphere inside. They expressed how valuable a tool that would be for recruiting as well as uplifting people's mood during long training cycles.

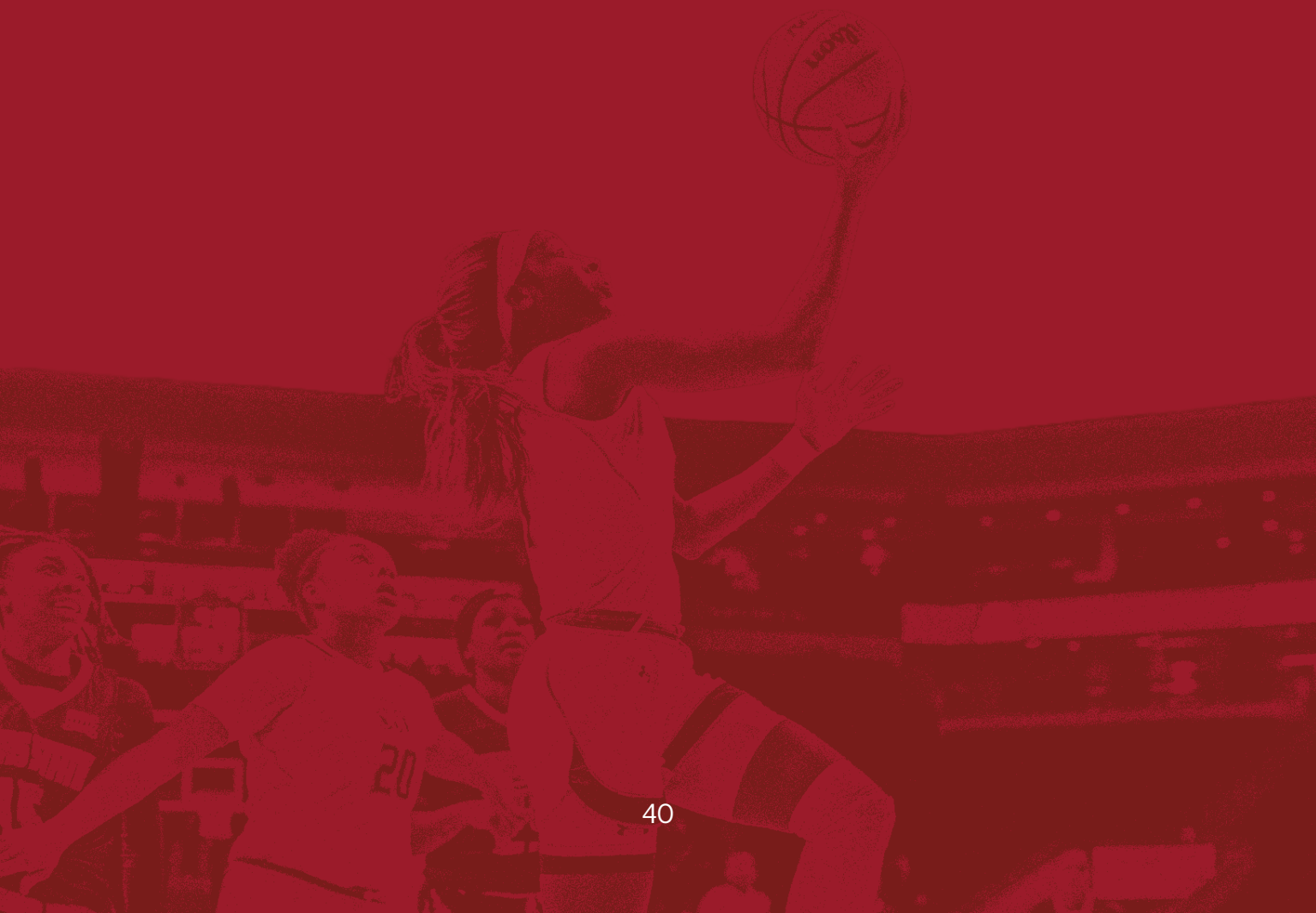
After gaining information about an athlete's experiences in different facilities, the conversation shifted to the mental aspects of being an athlete. The athlete was asked to describe the biggest mental difference between collegiate and professional athletics. They described how especially in the sport of track and field, much of the focus was on themselves and the things they could control. Confidence was the emotion they felt most important for competing and it was necessary to confide in their training and their ability to execute. There is a fine balance between not getting in one's head too much to making sure that there are a couple mental points guiding the motions of the athlete. The athlete continued by stating that on days where motivations ran low, they focused on “try[ing] to get 1% better than yesterday” and taking it day by day. They ended the interview by emphasizing the importance of writing down their goals so that they could have a reminder of why they were there is the first place.

Looking at the interview as a whole, an interesting aspect is that the athlete responded alike to many of the responses from the survey, which the athlete did not take. Some similarities

include the desire for natural light, exposure to the outdoors, the importance of strong team branding within training facilities and how much of their motivation was driven by the desire for personal achievement. Some of their responses also were design features presented by researchers to give useful qualities to the environment and promote mindfulness. Light is helpful for improving moods and improving visual accuracy (Connellan et al., 2013) while showing natural scenes reduced stress (Ulrich et al., 2008). This survey helped gain intel from an athlete who had greater and wider experience in different athletic facilities and what mental characteristics are needed to be one of the top throwers in the world. All extra knowledge is beneficial for making creative design solutions for athletic performance.

04

synthesis



04 *synthesis*

4.1 Design Protocol

Through a synthesis of literature reviews, survey results and analysis, and interview analysis, a design protocol can now be created. The goal of this protocol is to be a basis of design for athletic training and competition facilities to promote the wellbeing of the athlete in hopes of optimizing their athletic performance. These features were made to be broad so that they could be applied to every sport. Figure 31 displays the features of this design protocol. The subsections below provides a description for each of the features, an explanation for why it is beneficial to the athlete, and an example of how it can be applied. Although these conclusions have been made through literature research and athlete input, it should be noted that further research regarding how design can affect athletes specifically still needs to be conducted.



Figure 31. Design protocol for a holistic environment for athletic performance. This figure displays the 10 steps for designing environments that optimize athletic performance.



Figure 32

4.1.1 Multiple Areas For Training

By providing a variety of training areas within a facility, there are less chances of the athlete becoming burnt out and their intrinsic motivation is better supported. 56% of survey respondents said that a variety of training areas is the most crucial for a high quality training facility. Also, 74% of respondents stated that changing the scenery, environment and location of their training helped them avoid burnout. Implementing multiple training areas in a building fulfils what the athletes want. Autonomy, an essential human desire as described by the self-determination theory, states that people want their actions to be their own (Hollembek & Amorose, 2005). 82% of athletes indicated that having a choice in training offers some support to their motivation and allowing them to choose their method of training can help their need for autonomy to be satisfied. A way these training areas can vary are designing them for large group training or individual training. 68% of participants said they trained best with others, but there were many who said that it depended on whether it was skill training or conditioning and strength training. Another way that this can translate into design is for swimmers to have a variety of pool sizes to choose from, different pool options, and many areas for different cardio options that the athlete can choose from.

4.1.2 Team Branding and Goal Visualization

Personal achievement, pride, and a sense of belonging was the source of many athlete's inner motivation. Additionally, 71% of athletes indicated that they had a greater amount of intrinsic motivation than extrinsic motivation. Adding strong team branding through the building and providing athletes with a visual of their goals can fuel the drive of athletes and create an encouraging atmosphere. 42% of respondents said that having strong team branding logos for the



Figure 33

organization can be a strong recruiting technique. Visualizing goals is also significant as over 60% of respondents said they remembered their personal goals and reminded themselves of how hard they worked to keep their motivations high. Ways to implement this can be utilizing team colors in materials, displaying logos for the organization, and strategically placing decals and displays of the organization's goals.

4.1.3 Natural Light

Natural light plays key roles in managing stress, making the environment more pleasant, and promoting practices of mindfulness. The professional athlete states how monotonous and draining being under constant artificial light can be. Multiple sources in the literature review mention light and its positive effects. Light improves the emotional state of users, their outlooks, their health (Connellan et al., 2013), and helps users feel more relaxed and focused (Ergan et al., 2019). Light also reduced levels of stress in users (Connellan et al., 2013), which in turn reduces the likelihood of physical injury (Appaneal et al., 2014) and athletic burnout (Li et al., 2013). Light is also a component of biophilic design and Buddhist contemplative spaces, both of which are said to promote practices of mindfulness (Thampanichwat et al., 2023), which support an athlete's wellbeing (Schinke et al., 2018). Training facilities can be designed to have large windows, skylights, and lots of fenestrations to help user's feel these positive effects. Though natural daylight is preferred, a high level of luminosity is a factor in positive environments (Ergan et al., 2019) and should be implemented when natural light is limited.



Figure 34



Figure 35

4.1.4 Connection to Nature

Helping the athletes feel connected to nature can improve their experience in a training facility. A view of nature is described as a space with lots of greenery, the incorporation of water, a lack of manmade features, and a great amount of curved lines (Ramadan & Kamel Ahmed, 2019). Views of nature helped in reducing people’s anxious and stressful emotions (Ulrich et al., 2008). Nature was a notable component of Japanese architecture, which people most associated with wellness. Views of nature are also included biophilic design and Buddhist contemplative spaces, the two other architecture types commonly associated with mindfulness (Thampanichwat et al., 2023). Bringing nature to the built environment through indoor plants is also beneficial (Connellan et al., 2013). Over 60% of athletes indicated that they spent time outdoors to take care of their mental health. Inviting nature into training facilities can help athletes care for their wellness. A large amount of fenestration can blur the line between the indoors and outdoors. Athletic facilities can incorporate indoor plant or garden areas, have designated parks and landscaping areas outside if the weather permits, or if limited nature is available or suitable for the location, images and pictures of nature are also helpful for users (Ramadan & Kamel Ahmed, 2019).

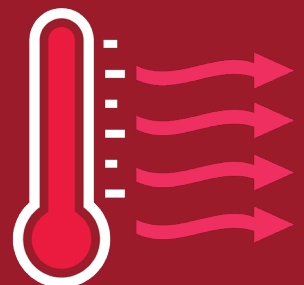


Figure 36

4.1.5 High Air Quality and Temperature Control

Though an athlete can control much of their performance, external factors do impact the performance of athletes. Some of these elements that can alter performance include “temperature, pollution,” and humidity (Kuok Ho, 2021). By understanding the effects of air quality and temperature on athletic performance, it can help create optimal conditions for training within the facility. 25.9% of respondents stated

that indoor air quality was the most important design feature for a high quality facility. A high rate of pollutants in the air can affect the function of the heart and lungs which are vital to athletic performance. These pollutants can also create the onset of respiratory illness and reduces the body's capability to train. High temperatures increases the body's heat, leading it to produce more sweat and dehydrating the athlete. On the other end, cold temperature can affect how much oxygen the body is able to consume (Kuok Ho, 2021). By ensuring that training and competition areas have optimal humidity, temperature and good air quality, the athlete is able to perform at their best. To apply this to design, passive temperature strategies can be implemented in areas of extreme temperature to control temperature without great energy expenditure. This step of the protocol should also be heavily considered when selecting HVAC and air handling systems to reduce the amount of pollutants that building users come into contact with.

4.1.6 Designated Area for Mental Training

An athletes mental state is vital when questioning how to improve their performance (Schinke et al., 2018). “Staying mentally healthy” was the greatest obstacle in successful training for athletes who participated in the survey (Naranjo Mata, 2023). 60% also selected that mental health issues were contributing to their burnout. Participating in sports at an elite level is not easy and athletes experience mental distress at higher rates compared to others. Reducing the stigma regarding athletes mental health is necessary, but difficult, as many have been praised for a long time for overcoming pain, showing no weakness, and refusing to ask for help (Schinke et al., 2018). This model must be stopped so that adequate mental health care is provided



Figure 37

for athletes. For facilities to be better equipped for handling the mental health issues for athletes, space should be programmed for designated areas where professionals are able to offer their help, but this feature may be difficult to implement in facilities for organizations that have lesser resources. A more accessible way to include areas for mental health is implementing small unwinding spaces and equipping these areas with resources to help.

4.1.7 Communal Spaces

Many lifelong relationships are created in the world of sports and people love to feel apart of something. Relatedness is another innate desire that people have (Hollembek & Amorose, 2005) and connecting with those within one's circle is a great way for this need to be fulfilled. The thing that participants depended on the most when motivations were low was their training partners and teammates. This was also the most selected response when asking what athletes did to take care of their mental health. The culture of training groups and teams are vital to its success, especially in regard to team sports. Communal spaces can also extend to coaches, faculty, staff and even the community in public competition facilities. Creating passion within the community for a sports team or organization helps create a passionate fanbase and this can all start in a gathering space. To translate this into design, large areas furnished to invite people can be a welcoming communal space, along with providing large rooms for team gatherings and spaces within locker rooms for teammates to connect.

4.1.8 Healthy Materials and Surfaces

Physical injury disrupts training, reverses progress for an athlete, and is a deterrent for being successful in sport. 21% of survey respondents said that physical injury was their greatest obstacle in successful training with 72% said



Figure 38



Figure 39

that physical injury contributed to their burnout. The selection of athletic surfaces and materials used within a building can influence the health of its users. The health of humans can be affected by material choices used for a building because of certain chemicals, pollutants and contaminants that the materials release into the air. This reduces the air quality and risks people's well-being (Esslinger, 2020). Similarly, certain choices for playing surfaces can increase the likelihood of injury in athletes. Certain studies have indicated that there are more injuries on field turf than on natural grass fields, with this number increasing significantly when reaching the professional level, such as the NFL (Taylor et al., 2012). Another example of this is the amount of impact felt on different running surfaces. Grass and synthetic track surfaces had lower levels of impact force recorded for participants compared to when they were running on concrete. Athletes must be able to accommodate this extra impact to avoid injury during training (Ferro-Sánchez et al., 2023). To combat these negative effects, designers must complete in-depth research to ensure the materials and surfaces selected for a building do not affect the health of its users. Examples of this include reducing materials that contain high amounts of volatile organic compounds, such as certain "carpet tile, vinyl wall coverings, [and] paints," (Esslinger, 2020) in all areas of the building, but especially in designated work out areas where these compounds will get inhaled at higher rates. For surfaces, this can include researching what brand of turf produces the least number of injuries or ensure sufficient thickness with synthetic track surfaces so the impact from the concrete underneath is felt less.

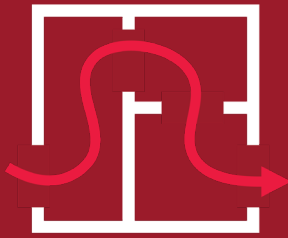


Figure 40

4.1.9 Intentional Layouts

The layout of the building is crucial in helping it achieve its purpose. To help the performance of athletes, floor plans must be intelligently planned out. A good layout may change from sport to sport. For example, sports where warm up happens on the same area they compete in will look different compared to when athletes need to warm up elsewhere. The interview participant voiced issues they had experienced when warm up areas were kept too far from areas of competition. Though this may allow better programming for other users of the building, it can potentially reduce the performance of the athlete. Survey results show that there are differences in opinions between what proximities within the programming are most necessary. An example of an intentional layout is stacking a warm up area and a competition area vertically instead of placing the warm up area far away so that athletes have to travel lesser amounts between their warm up and competition.

4.1.10 Intentional Use of Colors and Materials

Color and material choices can drastically alter the feel of an environment and change how users feel within it. There are many documented physical and psychological responses that the body has to different colors (Ramadan & Kamel Ahmed, 2019). When attempting to manage the health of building users, colors can be a valuable asset. The color red can heighten and stimulate strong emotions, blue is connected to tranquility and calmness while showing to boost productivity levels, and green is believed to soothe stress and present a healing environment to briefly summarize some of the effects that colors have (O'Connor, 2011). By understanding each color's impact, they can be designed into spaces to help the room execute the desired outcome. Materials also have a similar effect. An efficient



Figure 41

use of natural materials, such as wood, stone, leather and bamboo, can simulate a natural environment and creates comforting and authentic feelings. The characteristics of materials, such as porosity and gloss, should be correlated with a room's function to reduce future maintenance (Ramadan & Kamel Ahmed, 2019). A way to apply this step is by using a red color scheme in warm up areas to stimulate and arouse athletes prior to competition, or by using a large amount of wood in recovery spaces, as wood has been proven to decrease mental activity (Ramadan & Kamel Ahmed, 2019) which can help in restoring the athlete's mindset after demanding training.

4.2 Conclusion

Within the world of design, powerful things can be accomplished. For athletic facilities to keep up with the growth in popularity, demands and expectations in the world of sport, new information must be integrated into their designs. By directly taking feedback from the athletes, information regarding sports performance, and techniques used to improve the experience of the user within a building, a design protocol is made to create a prosperous environment for athletic development. Centering the athlete in the basis of design for these training facilities ensures that their needs are met and their well-being is considered. By promoting the longevity and outlook of these athletes, it can help their careers and performance succeed in the highly elite levels of talent there is currently present. Athletes are the foundation of the sports that so many people love- by prioritizing this group, it can be assured that the dominance in culture and love of the game continues for decades to come.

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Sofia Naranjo Mata
ARCH 771
Dr. Ganapathy Mahalingam

North Dakota State University
In partial fulfillment of a Master of Architecture
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