

PERCEIVED SAFETY IN URBAN RESTORATIVE ENVIRONMENTS: A STUDY WITH REFERENCE TO PROSPECT-REFUGE SYMBOLS

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Abstract

The importance of the relationship between human and landscape has been the main focus of many studies as a result of the urbanization. The complex lifestyles of urbanites have proven the necessity of 'the sense of belongingness' while inhabiting common urban environments. Anxiety, distress or uneasiness due to the lack of sense of belongingness is the reason for seeking the sense of safety in urban spaces by the urbanites. The Habitat theory states that human feel safer in environments which assures the biological needs of man. Similarly, Prospect and Refuge claims that the environments which provides the ability to see (Prospect) without being seen (Refuge) is preferred by the human. With this; four scenarios have been developed as Strong prospect, inversely balanced, perfectly balanced and Strong refuge to assess the perceived safety. Information processing theory, Prospect and Refuge Theory and the derived framework of Biophilia Hypothesis were accompanied to build up a set of physical attributes (complexity, coherence, naturalness, mystery and locomotion) which were tested for the perceived safety in the selected case study, Beddagana wetland park, Sri Jayawardenepura Kotte and Diyasaru Park, Thalawathugoda. (30 experts from each case study). The users selected the perfectly balanced scenario (open view and closed observing point - conditions which support the ability to see without being seen) as the space with highest perceived safety. The coherence (the openness or the enclosure of the surrounding) has been selected as the most impacted physical attribute for the aforementioned perception. This proves the Appleton's theory which claims that the human still feels safe in environments which assures the basic biological needs of human and; the openness and enclosure of the physical surrounding impacts mainly to this preference. The final result can be accommodated in the future planning and other related disciplines.

Keywords: Perceived safety, urban restorative environments, Prospect and Refuge

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Introduction

The sense of safety while inhabiting an urban space is a must to consider for that particular space to be frequently used by the users and to finally restore it as an active and lived space among the users. But there has been some shortcomings of this expectations and as a result many urban public spaces have been underused or neglected as a result (Dillon, 2005). These shortcomings should be answered to built up user friendly urban public spaces. This paper attempts to answer the aforementioned shortcomings while incorporating the Prospect and Refuge theory by Appleton. This paper attempts to;

- explore the level of perceived safety in selected spaces which incorporates the prospect refuge theory
- examine the impact of selected variables from the physical environment on the level of perceived safety

The comprehensive literature is mentioned below along with the procedure of selecting the scenarios which incorporate the prospect refuge theory and the procedure where the variables are derived considering the physical properties of the selected scenarios.

Perceived Safety

Recent researches in cognitive psychology have explored that the urban lifestyle as a stressful life (Abbott, 2012). As a result of deteriorating environmental aspects and other social vulnerabilities, urbanites are under a huge stress and this eventually creates the anxiety and uneasiness while inhabiting the urban realm (Brighenti & Pavoni, 2019). This feeling of anxiety may rarely due to the clinical neurotic anxiety of an individual. But mostly it is the realistic anxiety related to a known trigger from the surrounding variables (Dillon, 2005). There have been many attempts to reduce the feeling of anxiety and uneasiness. (Carter, 2002) (Williams, 2004) (Davis, 1999) The factors affected to the anxiety can be stress, genetics, brain chemistry, traumatic events or environmental factors. (Andrews, 2018)

The terms perceived safety, designing against crime, fear of crime, psychological comfort is being used interchangeably with the with the studies related to the causes of anxiety and distress in urban realm specially in the discipline of Social sciences and psychological studies (Dillon, 2005) (Mak & Jim, 2018) (Maruthaveeran & van den Bosh, 2015) (Askari & Soltani, 2019). The psychological safety is the 'the need of humans to have control over their environment, to know where there are in space and in time, to not be socially or physically lost' (Feagan, 2011).

Although both the security and safety sound similar, security is more towards the protection from crime and the safety is the state of feeling safe, stable and free from any negative feelings like anxiety or fear (Albrechtsen, 2003). Hence it can be concluded that the term safety is much more related to this study when compared with the term security as this study concerns more on the psychological and sociological aspects which causes the anxiety in the urban public spaces. Higher the perceived levels of safety, the comfort will be achieved eventually. The urban design and architectural fields have been working on developing designs with perceived comfort and safety, to ensure a user friendly urban public realm (Hashim, Thani, Jamaludin, & Yatim, 2016).

Prospect – Refuge theory

Through the Prospect and Refuge theory, Appleton suggests that the humans prefer and feel safe in spaces where there is the 'ability to see, without being seen'. Thus, Appleton states "where he has an unimpeded opportunity to see, we call it a prospect and where he has an opportunity to hide, a refuge". (Appleton, 1996) This concept of prospect and refuge was derived from the

Appleton's Habitat Theory (1957) which was originated from the Darwin's theory of evolution. Appleton states that the genes of the ancestors where they were always attentive to the environment hazards, have passed down generations and is still within the present generations. The concept of hunting was to catch the prey while hiding, as Appleton claims, this type of behaviors are still there within us.

It is clear that the prospect and refuge comes into play whenever there is a problem of safety or a hazard. Appleton introduces the Hazard symbol in his works of Prospect and Refuge Theory. The definition of hazard may not be a specific physical hazard, but this can even be a symbolism of a hazard which is felt but not actually be there. (Appleton, 1996). As Appleton (1996) implies, the prospect refuge concepts are always related with a third variable as 'hazard'. So, the symbolism of prospect and refuge is always connected with the symbolism of hazard. The symbolism of hazard or danger may not represent a real danger or a hazard. But still it will create a sense of danger in the human.

An environment which suggests the symbolism of prospect, which satisfies the user that his/her immediate environment is free from any form of danger will actually consists of a poisonous gas or it may be really vulnerable and full of dangers like poisonous reptiles or any other danger. And also, an environment which suggests a perfect refuge may consider of life-threatening dangers and will not guarantee a full security. Still the sense or the symbolism of such an environment assures more secure surrounding despite of the fact whether there is an actual danger or not. The different kinds of environments can suggest prospect symbols, refuge symbols or hazard symbols. These symbolism can be of different levels which means, the degree of symbolism can be high or low depending on the factors which helps to suggest the appropriate symbolism in each case. Simply an exposure to a strongly refuge (Ramanujam, 2006) Environment may feel a non-existent threat or a danger. But a non-exposed environment may suggest a rather strong sense of danger than in the case of strongly open environment.

A prospect symbol should not be a prospect symbol just because someone suggests it so. Any feature, situation or an object which directly or indirectly facilitates the observation or any scene which eventually suggests a panorama or a vista falls into the category of prospect symbolism. In the same manner any situation which suggests an opportunity to hide or shelter will eventually fit in the category of refuge symbolism. (Appleton, 1996)

Appleton suggests that, by abolishing the prospect and refuge symbolism can eliminate the hazard completely. These two terms prospect and refuge cannot be identified as dichotomy opposites. It is crystal clear that the opposite of "to see" is not "not to be seen". A landscape which affords both a good opportunity to see and a good opportunity to hide is aesthetically more satisfying and safer than one which affords neither, but again weakness in prospect or in refuge may be compensated for by strength in the other. In short prospect and refuge do not constitute a dichotomy or dualism in the sense. (Appleton, 1996) The most important concept Appleton mentions is the balance of the prospect, refuge and hazard symbols. These symbols may differ in the magnitude, frequency and strength, still the feel of any landscape is determined by the mix of opposite or complementary symbols. (Dosen & Ostwald, 2013)

Urban Restorative Environments

The simplest interpretation of the restorative landscape is the natural or built environment which is capable of restoring the stressed mental status of the user back into a comfortable state. The results of the studies by the van Berg et al. (2003) proves that the human preference lies in the natural environments than in the built environments. Many other researches have proved that the viewing natural environment than the urban settings lead to a better concentration and an improved psychological state of an individual. The researches by, Baron & Kenny (1986), Hartig et

al., (1997), Herzog et al., (1997) have proved that the natural environments have a great ability to restore the psychological mind of an individual, restore and reflect. Thus, such natural environments are categorized as “restorative environments”. The researchers like Van Den Berg et al., (2003), , Wilkie & Stavridou (2013) proved that the individuals prefer the environments where they can feel the higher restorative potential (Mutso, 2014). Along with the restorative environments, the preference for such environments may also differ. An individual living his/her whole life in a congested town area may feel the positive restorative feelings even in a small area of greenery although many views can be obstructed by built mass. This might not be similar for a person already living in an area filled with trees. Sometimes the restorative quality for another individual can be just a view of something they prefer other than the green.

Theoretical Framework

The sense of safety mainly depends on how an individual perceived their immediate environment and this perception of a landscape consists of 2 main aspects as the “landscape” and the “human”. The same aspects are compiled in the works of with different perspective. As Lothian (1999) claims, there are 2 contrasting paradigms in landscape perception as the objectivism and the subjectivism where these claim that preference is based on the physical attributes and on the individual observer respectively. (Cheng, 2007)

This paradigm is to be incorporated in building up a theoretical framework to measure the sense of safety associated with perception through the objective perspective as compiled by the author.

The objective perspective suggested by the Lothian (1999) implies that the aesthetical preference is found in the physical attributes of the selected environment. The physical attributes to be measured in this study is a final result of the analyzing of many theories and theoretical frameworks. The main theory which explains the prospect and refuge concepts is the Appleton’s Prospect-Refuge theory. Apart from this, there are many other theories related to the prospect – refuge concepts like, Information processing theory by Kaplan and Kaplan (1989), biophilia hypothesis, conceptual framework for analyzing visual landscape character by (Tveit, Ode, & Fry, 2006) and many more.

From the aspects discussed in the prospect – refuge theory, information processing theory and biophilia hypothesis the author proposes a framework to measure the objective perspective of perception

1. Habitat theory

Darwin’s theory of Evolution states that a process called natural selection is there, which passes down the genetically advantageous genetic mutations through generations. These functionally advantageous genetics will assure the survival of the species in the wild. The concept of “survival of the fittest” came into play with Darwin’s theory of Evolution. (“Darwin’s Theory of Evolution,” n.d.)

With the concept of Darwin’s theory (1958); Appleton (1957), a geographer derives the Habitat theory which implies that, an individual’s perceived environment is same as that of an organism’s relationship with its habitat. Despite of the fact, that an environment is favourable for survival or not, if that particular environment provides aesthetic satisfaction through spontaneous perception; then such a proposition is called “Habitat Theory” (Appleton, 1996, p. 62)

“Habitat Theory, in short is about the ability of a place to satisfy all our biological needs.”(Appleton, 1996, p. 63). Appleton (1996), further discusses that the aesthetical satisfaction that one may obtain from an environment will be higher when that individual feels no harm, although there actually may be some harm. This theory suggests that the aesthetic

satisfaction for a particular environment is the result of the instinctive sense of safety from the spatial qualities of the environment favourable for survival.

2. Prospect – Refuge Theory

The origin of this theory extends to the Lorenz's (1964) phrase "*to see without being seen*" as a primitive human behavior. This theory narrows the scope of the Habitat theory. From all the factors which cause the aesthetical satisfaction, this theory considers about the prospect, refuge and hazard symbols only. (Appleton, 1996).

Appleton (1996) further describes that whenever there is a chance to observe without being noticed by the others, then the aesthetic perception is attended with pleasure with no anxiety thus, sense of safety is perceived. Primarily this theory discusses the primitive behavior of human, which is the defensive behavior. This behavior analyses mainly two abilities which is the ability to move and the ability to perceive. (Ramanujam, 2006)

Obviously, there are infinite number of combinations of prospects and refuges in order to provide a better experience for the human. According to Appleton (1996), the experience of landscape with an aesthetic experience is derived from varying different variables. (Appleton, 1996, p. 67). The following factors play a main role in providing a variety of aesthetic experience to the user.

- The objects employed to symbolize prospects and refuges
- The manner and intensity with which they symbolize them
- The spatial arrangement of the symbols
- The equilibrium of prospect and refuge symbols
- The physical media by which such an arrangement is communicated to the user

With this Appleton contributes one chapter in the formation of framework which can be accustomed in building up a strong basis for the theory. He categorizes the basic imagery and symbolism of prospect and refuge by discussing the variables,

- Surfaces
- Light and darkness
- Levels of symbolism
- Scale
- Locomotion

which collaborates to represent different feelings in different spaces.

Finally, Appleton J claims, that the balance of prospect, refuge and hazard symbols will create environments which is preferred more by the users.

3. Information Processing Theory

Among the theories in perception, the information processing theory takes an important place. This theory has been introduced by Rachel and Stephan Kaplan of University of Michigan who are distinctive figures in the field of Environmental Psychology. (Kaymaz, 2012)

Kaplan and Kaplan claims that the information is a fundamental concept in human perception and the survival of the humans through the process of evolution. Despite of the fact that information is a necessary attribute in the survival; an individual may value the information as it becomes a tool for exploration in the experience of the landscape. An individual's understanding of what is going around him will feel better since he can take necessary measures to secure if he senses that there is any threat. Or else he can perceive the surrounding freely and function well in that particular environment. (Kaplan & Kaplan, 1989)

We tend to gather information around us with our senses, mostly through the visual sense, thus visual perception is important in this theory also. Kaplan suggests that the information is derived through the arrangement of the elements in a particular space, since this organization of an environment is an important variable in Landscape perception.

In the framework of developing the informational theory, Kaplan and Kaplan (1989) claims that there are 4 domains of environmental attributes based on different kinds of rationales in the context of a particular considered setting. The information provided by spatial organization of the setting is further classifies as informational variables and the perception-based variables.

Informational Variables;

Table 3 - Informational variables of Information Processing theory by Kaplan and Kaplan (1989)

	Understanding	Exploration
Immediate	Coherence <i>Orderly 'hangs together' or a unity, balance, harmony of a scene</i>	Complexity <i>Diversity or the spatial combination of a space</i>
Inferred	Legibility <i>Being clear enough to read and finding one's way there and back</i>	Mystery <i>With the promise to learn more and new but related information</i>

Perception – based variables;

- Openness – Amount of space perceivable to viewer
- Smoothness – Uniformity of and shortness of ground texture
- Locomotion – Ease of traversing without undue effect

With these attributes, Kaplan and Kaplan (1989) built their informational theory and this theory is now frequently used in the social researches.

4. Biophilia Hypothesis

The Biophilia Hypothesis is a recognized framework in the studies related to the perception. E.O. Wilson (1984) introduced biophilia hypothesis for the first time as "*the urge to affiliate with other forms of life, lifelike processes and other living organisms*". (Kellert & Wilson, 1993) This hypothesis suggests that there is an unbreakable and instinctive bond between the human and the other living systems in the environment.

The hypothesis claims that the human being biased to the life or lifelike processes can be explained with the biological aspects, as a stage in the evolutionary stage, genetic fitness and competitive advantages, personal fulfilment and the basis of ethics related with the conservation of nature and the diversity of life.

Derived framework from Biophilia hypothesis

Recently in USA, (Browning, Ryan, & Joseph, 2014) have proposed a framework of 14 patterns of biophilic design as a subsidiary design tool enhancing the design opportunities. Biophilic designing means the process of sustainable design strategies incorporating people and the natural environment. This framework is an edited version of the biophilia hypothesis to make this hypothesis a practical tool to be established, still this provides how to accompany the natural elements in understanding design opportunities and make this biophilia hypothesis to work in the actual and real environment. (Downton, Jones, Zeunert, & Roos, 2017)

Under this study of 'objective perspective', the following factors will be considered.

Table 4 - Categorizing 14 patters with attributes of objective perspectives (Source author)

Context	Patterns
Nature in the Space	Visual Connection with nature
	Non-visual connection with nature
	Non – Rhythmic sensory stimuli
	Thermal and airflow variability
	Presence of water
	Dynamic and diffuse light
	Connection with natural systems
Natural Analogues	Biomorphic connection with nature
	Material connection with nature
	Complexity and order
Nature of the Space	Mystery
	Prospect
	Refuge
	Risk / Peril

Objectivism
(Objective Perspective)

Framework composed by the author

The prospect refuge theory is the central theory throughout this study. So, in order to support the aspects mentioned in the prospect – refuge theory, other frameworks like information theory and biophilia hypothesis are adapted and analysed to form a framework.

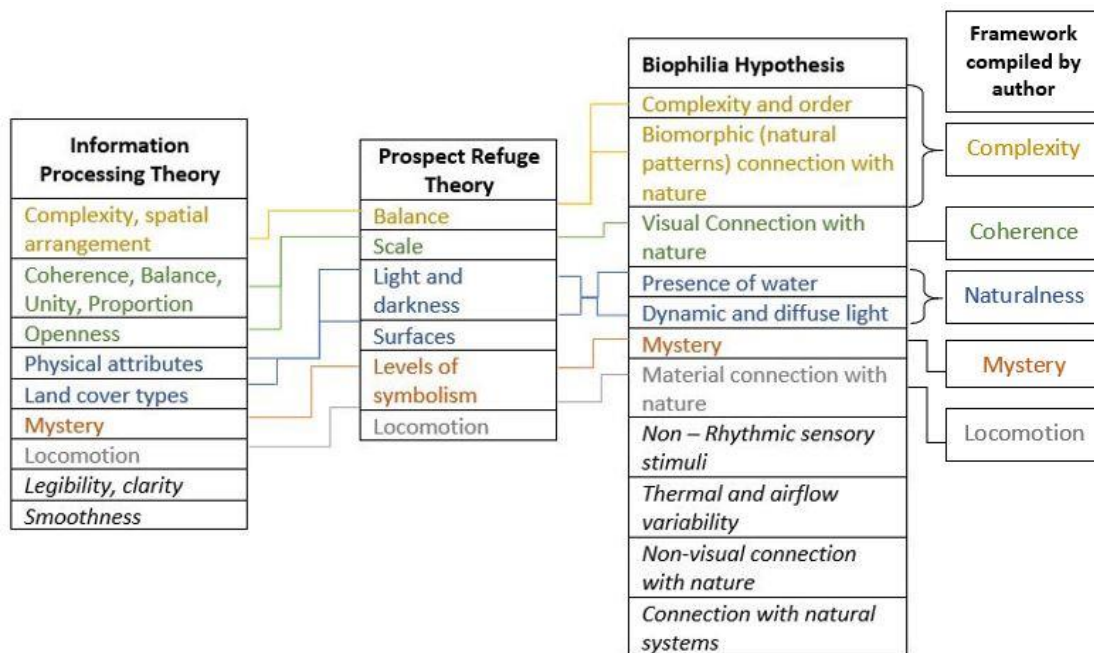


Figure 15 - Framework of Objective Perspective (Compiled by the Author)

The above figure interprets the concepts with the same meanings or similar types of meanings in the three theories. The concepts mentioned in the Prospect-Refuge theory has been the central idea in order to create this framework. After analysing the similar types of concepts, the author suggests appropriate variables for each category to use further in this study.

The summary of the above classification and the derivation of the variables of the objective perspective is as follows,

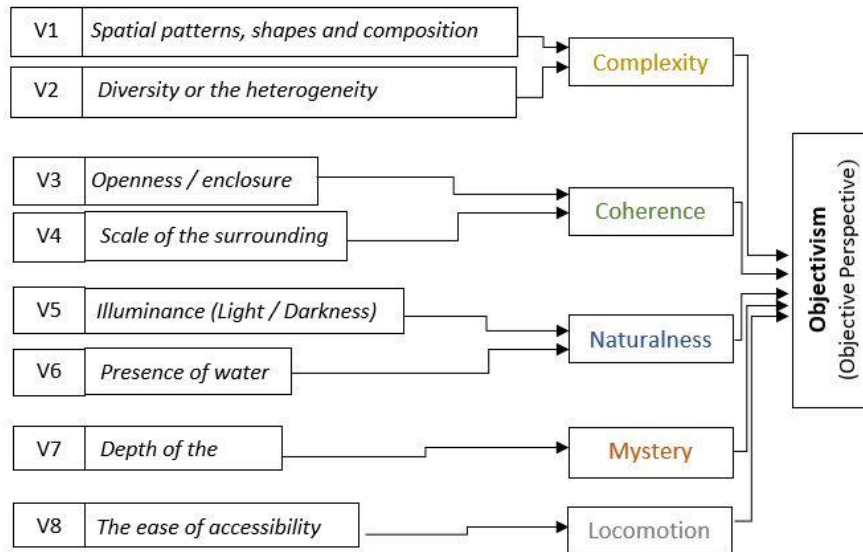


Figure 16 - Summary of the objective perspective with the variables (Compiled by the Author)

Methodology

The following criterion was derived from the study of Jack L. Nasar (1983) and his team. He used scenarios with closed view, open view from a protected or non-protected observation point. (Dosen & Ostwald, 2013). The author has accompanied the above methodology and the following scenarios were developed.

Table 5 - Features of the four selected spaces from each case study

	Space 1	Space 2	Space 3	Space 4
Observing point (Place where you stand – standing place)	open	open	close	close
The view (What you see from the place you stand – Projected scene)	open	close	open	close

- ✓ Space 1 – Strong prospect symbol
- ✓ Space 2 – Inversely balanced prospect – refuge symbol (Enclosed view from an open view)
- ✓ **Space 3 – Perfectly balanced prospect – refuge symbolism**
- ✓ Space 4 – Strong refuge symbol

Space 3 is the ideal circumstance of the balanced prospect – Refuge Symbolism. Which satisfies the concept of “*To see without being seen*”. Thus, this scenario was categorized as perfectly balanced while space 2 provides completely opposite circumstances, it is named as inversely balanced.

Four spaces which matched the above scenario was selected from the two case studies (total of 8 spaces), Beddagana wetland park, Sri Jayawardenepura Kotte and the Diyasaru wetland park, Thalawathugoda. These selected 8 spaces are the fixed variables throughout the study. The followings are the selected spaces from the two case studies.

Four selected spaces from Beddagana wetland park



Figure 3: Space 1 – Strong Prospect Symbolism ; Source: Author



Figure 4: Space 2 – Inversely balanced Prospect Symbolism ; Source: Author



Figure 5: Space 3 – Perfectly balanced Prospect Symbolism ; Source: Author



Figure 6: Space 4 – Strong Refuge Symbolism; Source: Author

Four selected spaces from Diyasaru park



Figure 7: Space 1 – Strong Prospect Symbolism; Source: Author



Figure 8: Space 2 – Inversely balanced Prospect Symbolism; Source: Author



Figure 9: Space 3 – Perfectly balanced Prospect Symbolism; Source: Author



Figure 10: Space 4 – Strong Refuge Symbolism; Source: Author

The data was collected from 30 experts with a basic knowledge on design (30 undergraduates from Bachelors degree of Landscape Architecture and Bachelors degree of Architecture) were selected for the data collection. Data was collected through a structured questionnaire and open-ended walking interviews. The experts were asked to answer the questionnaire on the spot as illustrated above, mainly considering the properties of the view and the standing place. The overall perceived safety of the selected scenarios (*Table 3*) was assessed first using a structured questionnaire. Then the corresponding impact from the selected variables (complexity, coherence, naturalness, mystery and locomotion) on the earlier mentioned safety level were assessed (*the sample questions were as V1 – V8 in figure 2*). Further walking interviews were carried out for collecting more comprehensive data. All the questionnaire data were obtained through Likert scales. Then using a statistical analysis, the relationships between the aforementioned levels were compared.

Spearman's Correlation coefficient was used to elaborate the relationship between the scores between the variables corresponding to the selected scenarios and the Mann-Whitney U test was carried out to check whether the contribution from the two case studies (Beddagana wetland park and Diyasaru park) was different or not.

Data Analysis

First the safety scores were assessed to check the safest scenario from the above selected 4 scenarios and the following observations could be observed with the two selected case studies.

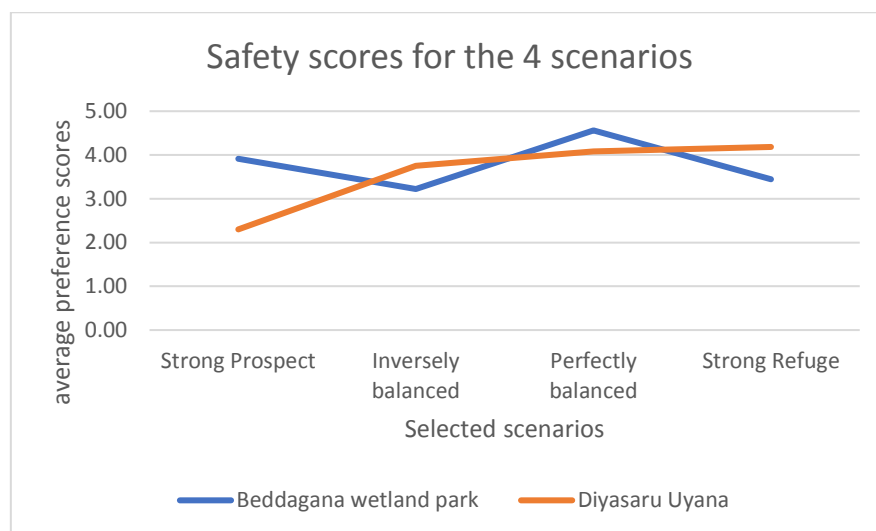


Figure 11 – Combined safety scores of experts for selected scenarios in each case study

The above graph clearly shows that the perfectly balanced scenario is the safest case for the selected sample of users irrespective of the case study considered (Beddagana wetland park or Diyasaru wetland park). With this further analysis of the objective data was done as follows.

As all the scenarios from Beddagana wetland park and Diyasaru Uyana has same properties, a combined result will be analysed with the corresponding physical attributes. The analysis of the objective perception was entirely carried out with the statistical analysis with the data obtained from the experts. The Spearman's correlation was assessed to compare the correlation between the safety scores with the five selected physical attributes. And the Mann Whitney U test was used to conclude the contribution from the two case studies (Beddagana wetland park and Diyasaru Park) for this correlation.

Objective data analysis for separate scenarios

The summary of the safety scores for the 4 scenarios and the correlation with the attributes are shown below. The Spearman's correlation coefficients are stated.

Table 6 - Summary of the objective analysis with the scenarios. - Spearman's correlation coefficients

	Strong prospect	Inversely balanced	Perfectly balanced	Strong refuge
Complexity	.521**	.320#	.154	.326#
	.003	.085	.418	.079
Coherence	.384*	.013	.457*	.312#
	.036	.948	.011	.093
Naturalness	.657**	.065	.032	.447*
	.000	.733	.866	.013
Mystery	.491**	.103	.082	.188
	.006	.587	.668	.319
Locomotion	.249	-.010	.149	.404*
	.185	.957	.433	.027

** - Correlation is significant at the 0.01 level (2-tailed).

* - Correlation is significant at the 0.05 level (2-tailed).

- Correlation is significant at the 0.1 level (2-tailed)

.469	Correlation Coefficient
.009	Sig. (2-tailed) α

For the strong prospect scenario 4 attributes has affected to the sense of safety where naturalness has impacted the most. The presence of water in the scenery and in Beddagana park has impacted more for this correlation. For the inversely balanced scenario, complexity has a significant impact for the safety score provided by the experts. In the perfectly balanced scenario, which provides the ideal circumstances for the 'ability to see without being seen', coherence has a significant impact. The openness of the surrounding view and the enclosure of the standing point has impacted for the safety score of the perfectly balanced prospect refuge scenario. Apart from this the scale of the surrounding also had a same impact for the sense of safety at this point. The Mann Whitney U test concludes that the contribution from both the case studies for this result is not different. In which case, we can assume that the contribution is almost the same. For strong refuge scenario naturalness has made a significant impact following the locomotion, complexity and coherence.

The above overall summary of the four scenarios with the level safety and the impact from the physical attribute is as follows.

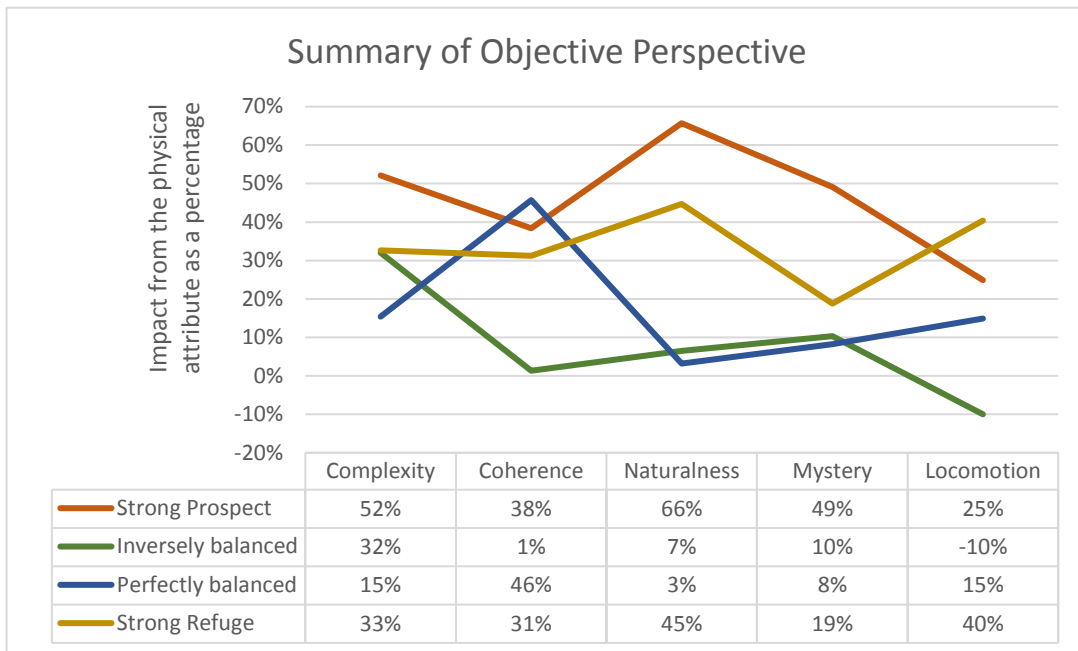


Figure 12 - Summary of the objective perspective (Physical attributes and their impact in four scenarios); Source Author

The summary of the objective perspective on the sense of safety can be interpreted as above with the percentages of the values obtained under the Spearman's correlation in each scenario (Strong Prospect, Inversely balanced, Perfectly balanced and Strong Refuge). The above graph shows the correlation coefficients for each physical attribute with respect to the scenarios.

Here we can observe that Inversely balanced scenario and strong refuge scenario has almost similar impact on the corresponding preferences and similar impact from coherence has been there in the case of strong prospect, perfectly balanced and strong refuge. Other similar of correlation coefficients of same range can be observed with naturalness and mystery where inversely balanced and perfectly balanced show similar values.

Conclusion

Appleton J claims that the genes which preferred the environments with high perceived safety are still within humans and he further elaborates this concept with his theory, Prospect and Refuge theory where prospect means the conditions which allow 'to see' and Refuge means the conditions which allow 'not to be observed by the others'. This study accommodated the above concept 'to see without being seen' and assess the variation of the sense of safety with the surrounding physical attributes (Objective perception)

Five physical attributes were selected for the objective analysis through the literature with the primary use of the Prospect and Refuge theory. With the reference to the Biophilia hypothesis and Information processing theory, five variables were formulated as the physical attributes which influence the preference. These five variables are complexity, coherence, naturalness, mystery and locomotion.

The ideal scenario which provides the ability to see without being seen is the Perfectly balanced prospect refuge symbolism. This has obtained the highest scores for the perceived safety proving the Appleton's theory. The only affected physical attribute for this scenario is the coherence which claims that the openness of the view, enclosure of the observing point and the scale of the elements has a significant impact for the sense of safety.

This proves the Appleton J where he claims that human feel safe when the conditions provide the 'ability to see without being seen'. And the prospect and refuge symbolism (provided the ability to observe the surrounding and the ability to hide from the others) created by the physical attributes in the environment has impacted more to the sense of safety than any other physical attribute considered.

This study was conducted within a limited time and with limited number of resources. So, the study was limited only to a selected number of variables and a small group of experts. This study can be extended further with more variables and with more users including the normal users who daily use the two parks (Beddagana wetland park and Diyasaru park). As there are many more urban spaces with varied functions, the same procedures can be incorporated for such spaces as well. Finally the results can be integrated in the future planning, where the qualities of spaces in urban public spaces can be designed accordingly.

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