

Modelling Nature in Ecologically Oriented Urban Context

Krzysztof M. Rostański
Silesian University of Technology
Poland

1. Introduction

Although every model implies simplification, it also indicates the most vital elements of a given structure to follow, which is the basic assumption of the present article. Modelling could also be understood as the shaping of an existing natural object. The question remains how this could be implemented in harmony with nature. Greenery makes human-ordered space clearer and more complete. When formed after the aesthetic norms of the related architecture, the greenery usually acquires geometrical shapes. However, when natural systems are followed closely, the structures thus obtained with their free form and ecological values emphasised, are able to improve our living conditions. The present work attempts to prove that even if we try to be in keeping with nature only in form, both the aesthetic and the ecologic aims are possible to achieve. The quality of designed greenery cannot be ignored, considering the need to preserve nature in our neighbourhood, and to provide the maximal biological efficiency. The main aim of the present work is to show the importance of nature in our surroundings while discussing various aspects of its role in the urban greenery. The use of the local plants with their particular features could make the architecture look exceptional, adding a strong local identity. On the other hand, using foreign ornamental plants without proper consideration leads to the formal homogeneity of modern cities, despite all their aesthetic value. The integration of built up space and local natural landscape implements the goals of The Convention on Biological Diversity and The European Landscape Convention, being also a principle of rational naturalism. Moreover, natural and naturalistic greenery, functioning beyond our consciousness at the level of biological reaction, is conducive to the proper functioning of living organisms, including human beings.

The thesis of the work could be expressed by the statement that the human being is part of his local nature together with the products of civilisation created by himself. However, a more suitable habitat for him should be simple, emerging from the natural surroundings organically, yet still being human-made. This very idea is supported by naturalism.

Naturalism is understood as the idea of following natural processes and creating naturalistic relations modelled on them. It supports our healthy lifestyle and provides us with tools to implement its principles. Naturalistic features could be used for land developing in varying degrees. It is hard to say that the naturalistic form is always the best choice, as also geometry has its advantages and in some situations seems to be even better. Naturalism, however, has many advantages worth noticing. Some naturalistic elements are so flexible that they could be used even in the conditions under human pressure.

2. Subject and methods

The present work covers the moderate climate zone of the Northern Hemisphere. The time period discussed goes back to the 17th century but the last hundred years is considered to be the most significant. The subject of the research refers to the naturalistic elements of landscape architectural forms and the designed space components.

The issue of modelling nature in the urban context is described by means of aspects considered by the present author as vital. The adopted research method resembles the phenomenological attitude by describing firstly the particular aspects, and thus revealing the characteristic features, then providing a summary, and finally formulating a general view. The aspects considered involve the evolution of the naturalistic idea in design and the respective law regulations, the functional naturalism, the formal naturalism and the elements of perception and semiotics.

The first aspect to be considered is naturalism in the history of landscape architecture, which starts in the Far East gardens, inspiring the European journalism and, resulting in naturalistic elements of landscape parks and gardens. The present ideas of the ecological approach to design are supported by legal codifications and international agreements, charts and directives. The historical overview proves the significance of naturalistic greenery. The functional naturalism shows the influence of natural greenery on our habitat, human needs and health. The formal naturalism presents selected features of naturalistic elements in greenery compositions, their formal patterns and structures abstracted from the chosen natural communities. These factors constitute the basic framework of a naturalistic composition. In order to cause certain human reactions, the factors should be supplemented with the ideological content and the structural principles of a composition, which relates to the problem of semiotics and perception. Each aspect mentioned above leads to the conclusions describing the most important principles and targets of the naturalistic design, called models. The final effect of the reasoning is the heuristic model of the naturalistic design used by the author to demonstrate a selection of design styles based on the varying degrees of their correspondence to nature.

3. Development of the naturalistic idea in the historical context

3.1 The beginnings

One of the oldest examples of nature-inspired composed greenery comes from the Chinese gardens, where the landscape modelled on real places was built with plants and animals characteristic of the area. Its form was mostly free, and yet it was full of religious symbolism. The following words from the *Tao Te King*, Book 51, probably strongly influenced the Eastern gardening – “All things (...) receive their forms according to the nature of each, and are completed according to the circumstances of their condition. (...) A cart is more than the sum of its parts” (McDowell & Stewart, 1988).

The Japanese gardens were strongly dominated by metaphysical symbolism. The *Sakuteiki*, an 11th cent. gardening manual, stresses that gardens should not be a true copy of nature but rather its interpretation referring to the religious and literary content. (Takei & Keane, 2008). The Japanese garden was in harmony with local nature, which manifested itself in the use of the local plants exclusively and their arrangement after the natural habitat.

In Europe the religious symbolism was hard to find in naturalistic ideas in gardening. Generally, the ideas were expressed by means of the formal patterns e.g. the sublime style, imitating the dynamic and expressive natural phenomena, which seemed to be quite popular.

3.2 The picturesque or the natural

One of the first European manifestations of the naturalistic ideas was a statement by Henry Wotton (1568-1639), of 1624 – “First, I must note a certain contrariety between building & gardening: For as Fabrics should be regular, so Gardens should be irregular, or at least cast into a very wild Regularity” (Wotton, 1624). Following this way of thinking, William Temple (1628-1699) designed a waving path across the meadow in Moor Park (1680-1690), which set the trend for landscape parks. The beginnings, however, were not easy and for many years, gardening was dominated by geometry and the architectural way of thinking. Throughout the 18th and the 19th centuries, the reverse direction of inspiration, namely from nature to architecture, was gradually approached by W. Kent (1685-1748), L. Brown (1716-1783) and other designers. Humphry Repton (1752-1818) combined two different standpoints, those of an architect and of a gardener. J.C. Loudon’s (1783-1843) attempts to copy the natural dispersion of trees in gardens were also quite significant (Turner, 2005) .

The subject of naturalistic ideas was raised by journalists and philosophers, among whom a great impact was exerted by Jean-Jacques Rousseau (1712-1778), who was convinced that “sanctity lay in unadorned nature” (Shepard, 2002). The beauty of nature, however, was not generally valued. Greenery was often overwhelmed by the architecture of pavilions to such an extent that Archibald Alison (1757-1839) suggested founding parks without them so that the greenery was more visible (Alison, 1853). Improving nature was generally criticised, e.g. Friedrich Schiller did not want the designed greenery to stand out from the natural one (Kruft et al, 1994).

The approach encouraging to model nature artistically finally led to the cosmopolitan gardens with plants from all over the world, which is visible in the gardens of the picturesque and the gardenesque styles. Also, Central Park in New York (1858), was initially designed as a garden with many plants from different parts of the world (Treib, 1999). Only very few have still survived, with some of them invasive and hard to control. It is in the human nature to have a collecting instinct and a will to constantly enrich gardens. People still perceive nature, as Joan I. Nassauer writes, from the angle of a picturesque convention and not an ecological value (Nassauer 1995).

The natural aesthetics was widely adapted in the national style, very popular in England and Germany in the 19th century. In the works of Alexander Humboldt (1769-1859) and Ernst Haeckel (1834-1919), the natural aesthetics encompassed the ecological aspects of local nature, which helped to arouse ecological awareness and the appreciation of real natural simplicity.

3.3 The geometric or the free line style

From the very beginning greenery arrangement had two parallel styles: the free form and the geometric style. The latter was preferred by those accustomed to the baroque forms, but it also had its critics, e.g. Hermann Pückler-Muskau (1785-1871), a landscape planner. His opinion was supported by the Laputians, the crazy philosophers from Swift’s *Gulliver’s Travels*, who “conceived the idea of regulating vegetation by geometry, and exhibiting

Euclid's diagrams on a plot of ground, they could not have devised any thing more preposterous than trees clipped into cubes and other mathematical figures, or disposed in formal rank and file" (Cochrane, 1835).

A considerable degree of refinement was noticeable in the gardens designed by Gertrude Jekyll (1843-1932), being sometimes free in their form, and sometimes making use of geometrical forms, with the geometrical flowerbed edgings which surrounded freely mixed groups of plants (Bisgrove, 1992). William Robinson (1838-1935) in turn, enchanted by a variety of plant arrangements in nature, fostered naturalistic gardens of ornamental plants (Robinson, 2009). Similarly, J.P. Thijsse (1865-1945), a Dutch designer, showed the possibility of creating naturally-looking arrangements of mixing local plants with ornamental ones. The examples above prove that geometry and free form are often hard to separate.

3.4 In harmony with ecology

The issue of native plants in the garden and the similarity of their arrangement to the natural plant communities appeared in the works of Elisabeth Holden (1871-1920) in England in 1906 (Andrews, 2003). At the same time a similar idea of imitating nature in park designing was developed in the United States by Jens Jensen (1860-1951) (Hobhouse, 2005). He composed naturalistic gardens and is best-known for his prairie gardens, proving that it is possible to build attractive natural-looking gardens. Jensen's achievements undermine the validity of the statement made in 1909 by one of the garden city designers, Raymond Unwin (1863-1940) that "any attempt to copy nature must be futile, for the conditions of natural growth are so complex as to be quite beyond the power of the gardener to understand or reproduce. He can only hope at best to parody, and is much more likely to caricature" (Unwin, 1994). At the turn of the 20th century the International Style was developed which brought examples of fully geometric gardens, totally alien to nature, such as the garden round the Noailles Villa at Hyères, France (1927) designed by Gabriel Guevrekian (1900-1970) (Turner, 2005).

In the first half of the 20th century the most fully integrated designs of buildings and their natural surroundings are represented by the selected designs of F.L. Wright (1867-1959). His prairie houses adjusted to the landscape and the native greenery, especially his Fallingwater, Penn. (1937), which despite, probably, being damp, shaded and cold, shows an absolutely exceptional idea of creating a building in the form corresponding to the human way of thinking i.e. the Euclidean coordinates, and blending into the natural wood. The house is a true house, the wood around is natural and everything seems to be linked organically. A similar idea can be found in Dessau, Germany, where The Bauhaus Master Houses (1926) stand only among pine trees, which are characteristic of the surrounding local woods. The examples of using native plants supported somehow the modernistic idea of preserving the natural features of the material used.

The ideas included in the plans made by Ian McHarg (1920-2001) were inspiring for the city authorities planning their ecological policy. He claims that using the natural conditions will always give better and more permanent solutions than transforming everything when following the arbitral decisions dictated by the artistic vision (McHarg, 1992). He defined the adapted environment as "requiring the least work of adaptation". On the other hand,

when analyzing people's needs, we have to acknowledge their rights to culture and even to fashion. This is probably when the idea of the sustainable development was born.

3.5 The time after modernism

The end of the 20th century brought many ideas, some of them popular and controversial. In the works of Martha Schwarz (1950-), the art reaches a state where the greenery is sometimes made of plastic, e.g. Splice Garden in Whitehead, Mass. (1986). Whereas in modernism the popular slogan was "form follows function", Bernard Tschumi (1944-) states that now "form follows form" (Nesbitt, 1996), which results from the increasing domination of the artificial world. The La Vilette Park, Paris, France (1982-1993) designed by Tschumi – "the largest discontinuous building in the world" was planned as an aesthetic pattern (Turner, 2005). The art is delightful and attractive but the real life follows its own way, gathering people together under the canopy of trees which form an ordinary little wood in the eastern part, while the unusual interior of the park remains empty. Frederick Gibberd (1908-1984) had an idea of the park space which should surprise people rather than lead them, resembling the way nature is perceived by a nature lover whose walk in the woods often looks like the Brownian motion. Such space, however, will not be clear to the majority of people because it requires the appropriate knowledge and interest. The greenery of the Lanxmeer district in Culemborg, Holland (1993-) was developed as both a creation of semi-natural habitats and a limited aesthetic design of ornamental plants. Michel Desvigne (1958-) and Christine Dalnoky (1956-) designed a park imitating the form of a riverine forest in the post-industrial land near Millenium Village (1999) in London (Donadieu, 2006). Although it looks very natural, it is noticeable that the trees are planted in regular spaces. The naturalistic ideas are common in the postindustrial areas. The size of those areas prevents their full and accurate management, thus creating room for common plants and their free succession, which happens very often. The existence of the "Berlin Wall" is the origin of the Nature-Park Südgelände, Berlin (2000), where common and alien plants form a bird sanctuary there. The place is of low value for botanists, but its local function is considerable. The experience of the Ruhr region parks in Germany shows that the highly adaptable alien plants can make communities of long durability. It is argued what influence they will have on the natural plant communities and what is the meaning of the term natural in this context. It is a fact that expansive non-native plants have been spreading, which will lead to the catastrophic uniformity of greenery, with the only differences resulting from the climate zones, and this is only a question of time. Some hope, however, is in the growth of the ecological awareness. Owing to them the features of the post-modern urbanism are beginning to include those referring to naturalism: respect for the regional values, the ecological approach to urbanisation and spontaneity (Baňka 2002). Those feature could be found in the four gardens designed by Richard Haag at Bloedel Reserve (1978) near Seattle, WA (Cooper, 2003). He preserved the growing trees and initiated the undergrowth reconstruction and development in its natural form. He also placed the logs of cut tree stumps, leaving them to decay naturally. Particularly, objects of the Land-Art type use the natural context for the background of their installation. Following a similar principle, Susan F. Child built a garden in Grande Island, VT, by placing footbridges and other small architecture elements in the natural area (Cooper, 2003).

3.6 The historical model

When summarizing the development of the naturalistic tendencies one can notice two approaches to the relation between built-up areas and greenery. The first one treats greenery as totally different from human creations, the second one views nature and culture as related to each other, both being elements of the human environment. Culture is seen here as the evolutionary consequence of the world development.

	Composition	Greenery	Aesthetic value	Example
1.	Formal	geometry; sometimes lack of greenery	designed, modelled elements	Unwin, Schwartz
2.		natural greenery outside or the filling of geometric elements like boskets; buildings and greenery create a compact system of interiors		Augustan style
3.	Sublime	naturalistic greenery with expressive accents; natural greenery penetrating the composition; buildings in contrast to greenery; connection with ornamental green elements		sublime style
4.	Buildings placed in the greenery	hardly designed	contrast between architecture and nature	Le Corbusier

Table 1. Greenery as an environment different from human creations

	Composition	Greenery	Aesthetic value of greenery and architecture	Example
1.	Formal	geometric, treated as a building element of permanent formal features; architecture and greenery penetrate and complete each other	coherent	Guevrekian
2.		modelled after natural patterns; ornamental plants; architecture and greenery penetrate each other		Jekyll
3.	Free form	modelled after natural patterns; ornamental and native plants; plant succession accepted; harmony between buildings and greenery	to a large extent independent	Robinson
4.		resembling natural patterns; ornamental and native plants; architecture and greenery of similar form	coherent	The Güell Park
5.	Buildings and greenery as an organic whole	minimal intervention	synergic	The Fallingwater

Table 2. Nature and culture as complementary elements of human habitat

4. The naturalistic idea in law

The idea of sustainable development is considered as significant in the urban area planning. Surprisingly enough, the term is understood differently by various specialists. It seems important to show its significance, especially the treatment of native plants, in three aspects: urban conventions, general principles of sustainable development, and finally biodiversity protection. The most important legal acts concerning the issue of native plants in the urban area planning are presented below.

4.1 Urban conventions

The first to recognize recreational areas and their greenery as an important element of a municipal structure was the Athens Card of 1933, which was followed by general legal acts. At the Vancouver conference (Habitat I) of 1978, ecological aspects related to human settlements were acknowledged to be essential for their proper development. In order to counteract any symptoms of unsustainable development, the Habitat agenda was accepted at the Istanbul conference (Habitat II) of 1996. The degradation of native plants results from the lack of balance, although it was not explicit in the document. The European Landscape Convention of 2000 emphasised the necessity of protecting the local landscape values both human-created and natural, which implies native plants protection. A similar idea is conveyed by The New Charter of Athens 2003, which recommends that cultural environment and natural environment be joined in harmony. The biodiversity protection seems to be understood as only protecting existing objects. Although greenery is given an important role, it is treated as vague mass. No attention is paid to its quality resulting from its correspondence with local nature.

4.2 Sustainable development

According to the Declaration of the UN Conference on Human Habitat (Stockholm 1972), human environment is to be created in cooperation with nature, which implies the necessity of noticing the processes occurring in nature, strengthening their positive manifestations and limiting the negative ones. A similar idea was expressed at the *Paris Convention on the Protection of the World Cultural and Natural Heritage* of 1972, which discussed the natural areas of value but omitted the significance of the areas transformed by man, e.g. wasteland and its big potential for the free plant succession. The turning point was the *Report of The World Commission on Environment and Development* of 1987 compiled by Gro Harlem Brundtland, which introduced the definition of sustainable development. Its consequence was the Rio de Janeiro Conference of 1992 and its Agenda 21, which discusses the issue of synergy in the civilisation development, i.e. a full and effective development requires mutual respect of its elements. Nature, meant as greenery and the natural processes, is as important as economy, society and space order. The duration of this system requires the possibility of self-regeneration, which entails allowing the process of natural succession. The aim of the eco-development is to maintain biodiversity and human health, which is included in the *European Cities Card for Eco-Development* passed in Aalborg in 1994, and also confirmed by the *United Nations Millennium Declaration* of 2000. One of the main remarks of the *Local Agenda 21* of 2002 is the threatening of natural environment by the spreading of invasive

alien species, which will lead to biodiversity degradation. Unfortunately, the invasive species are often treated initially as ornamental plants or ones very effective in land reclamation. The problem is that nature and biodiversity are understood differently by various specialists.

4.3 Biodiversity

Starting with the urban acts regulating space in its broad meaning, through the principles of sustainable development, which try to link all the activities conducted in the environment, one encounters the issue of biodiversity, i.e. the role of the native species and their communities in the human environment, including the urban areas. The *Council Directive 79/409/EEC on the conservation of wild birds*, known as the 'bird directive' suggests that the attention should be paid to the state of biodiversity in the areas not covered by legal protection. The *Bern Convention* of 1979 on the protection of European wild flora and fauna and their habitats claims that human action is not an element of the natural processes and must be controlled. Introducing alien species to native nature is not desirable, especially when they are expansive species which are able to transform natural communities destructively. For the *Council Directive 92/43/EEC on the conservation of natural habitats and of wild flora and fauna*, known as the 'habitat directive' it is important to protect and reconstruct the habitats significant for the EU. Its aim is to provide habitats for the more and more rare animal species, which could also apply to the greenery in the urban areas. This directive points out to the species under strict protection. Their appearance even in the urban areas should result in determining preservation zones. The problem is with its practical implementation, as such species sometimes occur in the municipal wastelands, which are usually treated as areas excluded from protection. This is the case, for instance, in the post-industrial areas of Upper Silesia, Poland. According to the *Convention on Biological Diversity*, ratified by the EU in 1993, counteracting the threats to the environment by various forms of protection and sustainable use of biodiversity is to be implemented also in the areas beyond the protected zones. The Convention formulates the following protection targets: natural ecosystems, trends in preserving wild species, the local supply of genes of wild and domesticated species, including the local varieties of crops and farm animals. Introducing species modified genetically and expansive alien species to the environment poses a threat to biodiversity. The announcement of the Committee for the European Council and the European Parliament referring to the thematic strategy on the urban environment of 2006 postulates limiting the loss of natural habitats and biodiversity in the urban areas. The 3rd Meeting of the Cartagena Protocol Parties on biologic safety, held in Curitiba, Brazil, in 2006, points to the existence of the direct link between the maintaining of biodiversity and the profit derived from nature, i.e. food production, clean water, nutrients circulation and climate regulation. More detailed conclusions from the research on the changes in the state of biodiversity could be found in the cyclic publications of the CONTUREC conferences. National legal acts sometimes make it obligatory not only to protect but also to actively act in order to support biodiversity. For instance, the Polish Environment Protection Law, of 2009, mentions e.g. reconstructing plant habitats, which should be implemented in land development projects. It also points to the necessity of forestation, afforestation, or concentrations of plants. This should be all done to protect the soil, animals, to shape the

climate or to meet other needs related to providing biodiversity, natural balance and recreational needs of people.

4.3 The legal model

A number of international legal acts stress the cooperation between man and greenery without any confrontation. They express their appreciation of the local identity and protest against the global space homogeneity. The impact of human activities in the natural processes is especially clear in the case of synanthropic plants, colonising the areas transformed by man. The native species of this kind seem to play a positive role in the urban areas. However, ruderal plants are omitted in the legal acts and conventions, and the justification for their appreciation could be derived only indirectly. That may result from their absence in communities regarded as valuable naturally, or from their peculiar aesthetics they represent, or finally from their defiance of human activities. People have a peculiar idea of cleanliness and order, thus fighting whatever is accidental and destroys the order. But is it really desirable? Without the natural succession there is no evolution of communities registered in the natural processes. Human intervention is necessary, however, to control the spreading of alien species in local nature.

	Principles	Actions	Effects
1.	sustainable development	combining cultural and natural aims	synergy
2.	using resources in a way assuring conditions for their recreation	protecting and actively supporting the natural processes	recovering the lost values
3.	identity as the basic culture value, biodiversity as the essential biologic value	combining cultural and natural uniqueness	value diversity
4.	control of human arbitrary decisions	contextual planning in the field of culture and nature	limitation of space homogenization and the spread of alien species
5.	monitoring the state of the environment in the protected and not protected areas because they both affect the quality of the natural system	wastelands treated as an important source of genetic material in the urban areas; monitoring the state of greenery and possible threats	limiting the expansion of alien species; evolutionary recreation of natural habitats
6.	durability and desired ecological value of habitats	using native plants and their varieties; keeping the sources of natural succession	a high quality and a high ecological potential of greenery in the urban areas

Table 3. The legal model

5. Functional naturalism

The real functional value of an urban structure manifests itself in harmonizing civilisation with nature. When separated, both are hostile environments for people, when combined,

they provide living conditions. Any simplification will result in a faulty solution, which refers both to 'the world of technology' and 'the world of false nature'. Discussing the function of naturalistic greenery in human environment requires distinguishing at least the basic principles governing nature as a system. It is important to show its usefulness values resulting from those principles. The building of such structures requires, in practice, conducting the appropriate land evaluation and accepting the suitable implementation principles. Discussing those issues leads to defining the natural and functional model, i.e. collecting all the basic features of naturalistic greenery in its functional aspect.

5.1 Nature as a system

A system is a collection of elements and relations among them. A natural system is a hierarchic arrangement: organism - population - biocenosis/biotope - ecosystem - biosphere. Each layer is related to the others and cannot be eliminated from the system. The ecosystem is the most essential unit for the designed implementation scales. The borders among the ecosystems are not distinct, being established statistically. Henryk Zimny compares an ecosystem to an orchestra, whose individual elements may act independently, but it is in the tuned up team that they form a unit being more than their sum (Zimny, 2002). Ecosystems evolve, depending on the changes in their environment. The mature ones have a dynamic balance of biocenoses and a stability of the system. Greenery elements in the urban area create a natural system. All its elements generate relations among each other, which results in the influence of their location in the structure upon their development (Alexander, 2002). The natural value of the area depends on the number of species (McHarg, 1992). Each species plays a role, so when two of them happen to have the same role, one is always eliminated. Taking it into consideration, it is possible to claim that the number of species corresponds to the number of roles played in the area, i.e. it determines the measure of complexity of processes occurring there. The stable state is alive, not stagnant. It is kept owing to the natural processes, which are permanent, whereas the form or composition are not permanent. Thus nature teaches us that the essential features are freedom, changeability, usefulness and competence.

One can distinguish a few fundamental principles for creating natural structures. First, the holistic principle resulting from the metapopulation theory, according to which it is impossible to predict any changes of a given population without identifying changes of all the populations of the same species within a region. In order to get a full picture of all the changes in a given population, one has to consider not only the habitat occupied, but also other habitats potentially possible to settle (Mitka, 2004). Second, the islands theory, according to which the number of species depends clearly on the size of the island. It is applied successfully to the so-called habitat islands, e.g. forest enclaves (Kornaś & Medwecka-Kornaś, 2002). Third, the seasonal rhythmic one, based on the clear seasonal changes in communities dominated by deciduous plants, which is characteristic of the moderate climate. It is related to the seasonal changes in the lighting conditions, the composition of the undergrowth and the microclimatic conditions. By contrast, coniferous forests are almost uniform all year round. Fourth, the form in nature results from the function and is an information carrier. Nothing is accidental. Following this principle, even the size has its optimum and is limited. Fifth, a characteristic feature of natural forests is possessing trees in different ages, which helps to make them durable and able to revive

naturally. Natural forests have different layers: tree canopies, young trees, bushes and forest floor. A variety of species helps to protect forests from pest, frost, pathogenic mould and crunching by animals because each species has a different resistance to those factors (Wika (ed.), 1999). Municipal parks usually have a simplified structure and trees of a similar age, which makes them grow old and lose their values due to illnesses.

5.2 Usefulness value

In the contemporary world an important issue is whether greenery, natural or naturalistic, is useful to people. Civilisation complements nature but requires harmony. We are impressed with geometric forms. Naturalistic greenery, which is generally admired, does not impose on the observer. Thus, it is not surprising that our holiday places differ from our working or living places. We feel good in nature because, among other things, the natural sounds do not require any response. A city dweller may get away from everyday activities in a place different from his usual environment. Natural or naturalistic greenery offers such a possibility. According to sociological research, the closeness of green areas increases the feeling of satisfaction and is conducive to mental health. When staying in a forest park, the feeling of stress and headache disappears, and the speed of the process depends on the time spent there and the physical effort made. (Henderson et al, 2009). It seems important that naturalistic greenery should be modelled in a way providing visual penetration, which is essential for the feeling of safety. In this aspect it is difficult to accept the full freedom of development. An important issue is always the cost of the land maintenance. Naturalistic forms, designed as possibly permanent solid structures, are very expensive to preserve their form and layout, e.g. typical Japanese stroll gardens. A naturalistic garden being a kind of a wild garden allows spontaneous succession and lush growth without frequent intervention, which is not possible in the case of a geometric garden. It could be left without any care for a season or two and it will not be destroyed. On the other hand, trees and bushes grow, taking up more and more space. The moment comes, however, when the original function of the area may lose its value due to too much shade, dampness or undergrowth. A natural forest with trees in different ages has always the same function, whose value will not decrease despite the age of the oldest trees.

5.3 Assessment of the area receptivity to naturalistic development

Sherwin Greene determined four factors essential in an urban layout assessment (Greene, 1992). They could all well be easily applied to naturalistic greenery.

Criterion	Aim	Feature
function	comfort	continuity, safety, comfort, variety
space order	orientation and comprehension	cohesion, clarity, continuity, balance
identity	surrounding image, its unique features	focusing attention, unity, character, form, particular features
charm and attraction	willingness to stay	scale, suitability, matching, right choice, vitality, harmony

Table 4. Assessment criteria by Sherwin Greene

Criterion	Aim	Feature
levels of scale	a large diversity of the wholeness at various levels of scale	diversity degree; centre accentuation, combining with the surroundings through rhythms and similarities; intensification of the strengths of centres through the order of sizes and scales
strong centres	distinct centres control the surroundings	existence of centres; their strength as centres of attention
boundaries	forming a field of visual forces clarifying the centre	distinctiveness; separation power and its need
alternating repetitions	alternating repetitions and rhythms strengthening centres, intensifying one another	degree of interlock of interior and exterior forms
positive space	positive spaces of organized character and function with a dominant centre	space cohesion and its complexity degree
good shape	harmonious, often symmetrical, dense, with a well-marked centre, standing out from the surroundings	biomorphic, geometrical, with a degree of mutual penetration
local symmetries	strengthening local centres with symmetry	harmony with accentuation and power of domination
deep interlock and ambiguity	local centres related strongly to the surroundings	relations clarity; degree of diversity and distinctiveness
contrast	distinct centres and variety	diversity degree; accentuation
gradients	gradual transition of structures	harmony; reference
roughness	lack of live objects identity; authenticity, morphological roughness	form perfection; uniqueness
echoes	rhythms of similar elements repetitions	repeatability; similarity
the void	the most profound centres as a perfect wholeness with a kind of void inside	balance of background and accent; diversity of accents
simplicity and inner calm	live objects forming a wholeness simple and pure in form	form adequacy; a degree of domination and complexity
not-separateness	many layers of centres turning smoothly into the surroundings	a degree of monotony and binding with the surroundings; accentuation

Table 5. Assessment criteria by Christopher Alexander

Another useful idea is that of Christopher Alexander, the author of fifteen fundamental characteristics (Alexander, 2002). Although, originally described as the features of the degree of form vitality, they could be also used to describe the degree of structure organic development. Alexander creates the theory of natural structures based on the idea of

'wholeness', expressing an arrangement with a degree of 'life'. "The wholeness of any portion of the world is this system of larger and smaller centres, in their connection and overlap" (ibid.). All the elements tend to cooperate in synergy generated by the configuration as a whole.

Associating architectural objects with naturalistic greenery requires creating elements of greenery whose features are similar to natural communities with a similar species composition and located in similar habitats. To assess the possibilities of creating such habitats, Firbank suggests six criteria (Firbank et al, 1993)

Criterion	Aim	Feature
site selection	optimal localization	physical characteristics, local natural attributes, management history, current techniques, time and means available
consequences of other developments	optimal target	
implementation assessment	plan correction	implementation characteristics, soil quality, water conditions, species richness, presence of indicator plants, synanthropic and invasive plants, habitat structure
implications of different management options	optimal maintenance method	degradation during implementation, compensatory actions and those resulting from maintenance, implementation time, expenses expected and unexpected
predicting the off-site impacts	preparing protection from possible inconveniences	habitat conducive to pest, conditions for predators

Table 6. Assessment criteria by L.G. Firbank

Creating naturalistic space requires a pre-assessment of the area. The most essential criteria for deciding whether to provide aid to the existing biodiversity by introducing missing native plants are given below. The decision depends on the present biological value of an object and on its other features (Rostański, 2007).

Factor	Criterion	Feature
ecological	role in natural structure	local nature reserves, element of ecological corridor, additional element
	contact with natural structure	effective contacts, island elements
	habitat diversity	high or low, depending on the area
	land form	dense; with developed shoreline; segmented
	size of the area (Supuka 1998)	above 2 ha; 0.5-2 ha; below 0.5 ha
	soil conditions	acceptable; requiring partial change; requiring full change
	water conditions	acceptable, requiring retention increase

Factor	Criterion	Feature
floristic	habitat potential	potential natural flora, synanthropic flora, alien ornamental species
	floristic value	protected and rare plants, natural and degraded plant communities, native plants, synanthropic flora
	tendencies	increasing role of native plants, synanthropic or expansive alien ones
faunal	biodiversity	existence of mammals and other animals, existence of birds
cultural	role in urban structure	ordering elements, aesthetic value, natural value

Table 7. Assessment criteria by Krzysztof M. Rostański

5.3 Greenery layout

Naturalistic greenery, planned to counteract nature degradation or as a place of a particular aesthetic role, requires appropriate implementation methods in its developed form. The important factors here are the area size, the afforestation density, the percentage of the area not covered by greenery and the number of people to penetrate the area.

Nature degradation is counteracted by the habitat restoration, protection of spontaneous re-naturalization processes, habitat transportation and habitat creation (Tokarska-Guzik, 2001). When discussing the principles of the habitat creation, Trueman (2006) states that “a spontaneous community is likely to be more valuable than a created community”. It is essential to adjust the designed species and the target community type to the habitat without strictly imitating a species composition found in books and changing the habitat conditions, which is usually very expensive. And finally, it is important to have the support of the local community for the created object (Trueman, 2006). According to J. Supuka (Supuka 1998), an important role in the natural system is played by greenery areas of more than 2 hectares.

According to the research conducted in 1995 by the present author in two districts of Katowice, Poland - Koszutka and Ligota – the border maximum value of tree canopy density is about 30% of the open area. Higher values cause too much shading, which is inconvenient for the inhabitants. It is equivalent to approximately 120 trees/ hectare. Natural forests have a definite recreational absorbency. For pine forests the value is 2 - 10 people/hectare/day. For oak-hornbeam forests and floodplain forests the value is 15 - 17 people/hectare/day. The highest absorbency is of meadows, pastures and ruderal plant areas. Their value is up to a 100 people/hectare/day (Krzyszowska-Kostrowicka, 1991).

5.4 The functional model

This model describes general functional features of naturalistic greenery. It has been determined on the basis of the analysis of the functioning of the essential natural elements, the assessment of the possibility of using naturalistic greenery and the principles of its creation.

	Principles	Operations	Effects
1.	sustainable development	distinguishing natural and cultural processes	obtaining basis for design
		holism	
		conflict mitigation	optimizing solutions and lowering maintenance costs
		maintaining relations supporting essential processes	
following natural processes			
2.	good environment functioning	maintaining hierarchic system	element synergy
		providing structural continuity	
		controlling autonomous and free succession	self-regulation ability
		providing structure receptiveness to changes	
		securing variety	functionality
		preserving well-functioning elements	
		transforming badly-functioning elements	
		securing harmony of form and function	
creating socially acceptable aesthetics in places requiring accents	clarity		
counteracting element fragmentation	process durability		
3.	human friendly environment	selecting plant communities with anticipated and recognized impacts	modification of the physical functions of an organism
		securing access to green areas	impact on well-being
		limiting psychic stimuli typical of urban environment	

Table 8. The functional model

6. Formal naturalism

Creating naturalistic greenery requires identifying typical natural forms by imitating natural communities, matching species with habitat conditions, or just following natural dispersion of accents. One can assume that formal naturalism is imitating aesthetic features of natural communities in a greenery arrangement. The degree of faithfulness may vary from the exact copy to the accent placement method discussed above. Designers may go further by shaping greenery after inanimate nature elements, plant or animal forms. Their arrangements of ornamental plants are even shaped after particularly attractive communities.

6.1 Accent geometric dispersion pattern

Natural plant dispersion in green areas usually seems chaotic and accidental. It turns out, however, that certain geometric structures, often known for many years, are able to describe such spatial structures. The chaos reveals to be a highly organised order, and not pure accident. The basic mathematical construction, exciting people since the ancient times, is the golden ratio, called by Euclid the “extreme and mean ratio” at the turn of IV and III cent. B.C. (Livio, 2003). In fact, as supported by examples, this ratio when applied to complex spatial structures uses up the space maximally. As this ratio occurs in nature, it could be assumed that it bridges the gap between nature and technology. For instance, the flowers of Biting Stonecrop (*Sedum acre*) reflect the golden ratio structure based on the pentagram.

Another example of the golden ratio in nature is the phenomenon of phyllotaxis. The succeeding leaves occur on the stem with a place shift angle whose ratio to the full angle corresponds to the following numbers of the Fibonacci sequence. The larger sequence numbers are taken, the closer their proportion to the golden ratio is. It turns out that phyllotaxis represents the state of minimal energy needed to maintain the form. In the sunflower it enables to pack the seeds maximally (Livio, 2003).



Fig. 1. The point layout in the basic attractor of the 'dragon' fractal

In order to create a plane arrangement of elements with an impression of natural randomness, the most useful is the spiral construction of the golden ratio. It makes use of another mathematical construction, bringing us closer to the 'chaos' of nature, that of the fractal calculus. It is popular to build visual presentations of fractal formulas called fractal attractors. One of the fractals, called 'dragon', when built with the appropriate parameters (using GCFract software), has the spiral of the golden ratio as its attractor. The basic parameters of a typical 'dragon' cause its inside to be filled with points in a free way, visually very 'chaotic'. The point distribution reflects in a perfect way the habitat arrangement of a given species in the natural meadow. It also reflects the 'chaotic' distribution of trees in the forest grown in natural succession.

6.2 Patterns referring to the features of natural elements

Formal naturalism draws its forms from nature observation. In contrast to natural functionalism, the observation is based on the admiration of natural aesthetics, being close to an artistic view in its treatment of nature as inspiration rather than an immediate pattern. This is a transformation of the given reality into a reality emphasizing only selected features. The patterns are drawn from the features of inanimate nature, plants, animals or selected ecosystems. Inanimate nature inspires geomorphic patterns, which is seen, for instance, in the shapes of rocks, hills, waterfalls rendered by means of plants shaped appropriately or matched so that their species or variety features imitate the desired features. The tamarisk (*Tamarix sp.*) forms a green mist, when in bloom the mist is pink. In the Kenroku-en garden, Kanazawa, Japan, the azaleas are shaped into boulders surrounding the creek and the gravel bank has its equivalent in the group of irises. Plants create certain characteristic forms naturally, which is an inspiration for phytomorphic patterns, e.g. the motives of corridors along streams or animal paths with the canopy of trees forming a vault seen at a distance. Interesting phytomorphic patterns are created by Patricia Johanson, who enlarges the form sizes of authentic flowers or their shoots and fills in the resultant patterns with plants, e.g.

her design of 2004 called The Ellis Creek Water Recycling Facility – ‘Morning Glory Pools’. Zoomorphic patterns, inspired by the shapes of animals, are popular particularly as a way of hedge modeling. Forms closer to naturalism, though, are single tufts of grass looking like curled up cats. The shapes resembling animals could sometimes be achieved by delicate pruning, supporting a branch, and, finally appropriate lighting up.

The formal reference to selected features of natural plant communities could be called as drawing from ecomorphic patterns. The most popular example is rock gardens. Ecomorphic patterns are very close to the real habitat creation.

6.3 Plant communities as a pattern of form

The form closest to nature is a greenery arrangement patterned after natural plant communities. Apart from the form itself, an important role is also played by the native species composition. Those areas are not suitable for intensive recreation, but they may constitute, instead, the background or the ecological accent in the park. It may be necessary to thin out the forest floor and the shrub layer near buildings, as too dense greenery is not healthy for people. Environmental conditions determine the possibility of plant growth to a large extent. The species best adjusted win, owing to the mutual competence, thus similar habitats have similar plants. In nature this order manifests itself in natural plant communities. They have also a characteristic artistic expression consisting of the plastic features typical of the plants, the tree stand density degree, the division into layers, the density and diversity of the forest floor, the spread of greenery, leafage, conifer needles, the uncovering of the land surface (uncovered soil, sand, other rock material), the share of water area, the degree of shading, the colour, the changeability of the aspects in time. Each region has its characteristic communities. Even each location has its particular aspect, a particular species set and domination. Thus, it is difficult to create a standard table of species composition and their percentage share. A botanist should pay attention to important elements and to assess a given place thoroughly every time. It is also suggested that in order to preserve the clarity of the community origin, and its artificial creation in particular, rare and indicator species of the natural origin feature should not be used in designs. One of the most frequent forest communities in Poland is the oak-hornbeam forest.

6.4 Oak-hornbeam forests

The forests have a clear division into two layers of tree levels. The upper level is formed by oaks (*Quercus sp.*), linden trees (*Tilia sp.*) and partly by ashes (*Fraxinus excelsior*). A few metres below, the forest is dominated by hornbeams (*Carpinus betulus*) and Norway maples (*Acer platanoides*). The shrub level is diverse but not dense, due to the considerable overshadowing. The most popular trees of the lower level are hazels (*Corylus avellana*), spindles (*Euonymus sp.*), dogwoods (*Cornus sanguinea*), guelder roses (*Viburnum opulus*) and honeysuckles (*Lonicera sp.*). The forest floor plants usually occur in patches forming distinct textures. In the spring, before the trees come into leaf, oak-hornbeam forests are sunny and the undergrowth comes into bloom luxuriantly. The area is dominated by white, yellow and blue flowers against the vivid greenery. In the autumn, the green forest floor forms the background for the white and beige leaves of Solomon’s-seal (*Polygonatum multiflorum*), gradually enriched with the yellow and beige colours of the shed tree leaves.



Fig. 2. The characteristic features of the oak-hornbeam forest are the tree trunks, the clearly visible shrub level and the forest floor divided into patches of different colour and texture.

Oak-hornbeam forests in Poland occur in rich soil with a high oxygen production. The groundwater level depends on the habitat. The air humidity varies from 40-80%, and is visibly higher at night. The shrubs and the forest floor provide a high germicidal ability. The air circulation is minimal when the undergrowth is thick but the impact on the human body is positive when it is looser. Then it is stimulating, by improving our natural immunity, blood circulation and pressure. The recreational absorbency varies from 15 people/hectare/day in oak-hornbeam forests in barren soil to 6 people/hectare/day in rich soil (Krzyszowska-Kostrowicka 1991).



Fig. 3. A scheme of the oak-hornbeam forest arrangement from Fig. 2

6.5 The formal model

In the process of designing naturalistic greenery it is not only the beautiful and unique phenomena that are essential but also the structural patterns which decide the aesthetic form of plant arrangements as a whole and their connections with the surroundings.

	Principles	Actions	Effects
1.	Structural	in distance relations, making reference to the ratio between numbers in the Fibonacci sequence, incl. the golden ratio	habitat conditions diversified, self-regulation abilities facilitated, arrangement imperfection covered up
		dispersing accents in imitation of the fractal structure	
		using a hierarchic order of centres-accent	space clarity and functionality
2.	Formal	free distribution of elements	visual naturalness of structure
		imitating a variety of patterns: geomorphic, fitomorphic, zoomorphic and ecomorphic ones	aesthetic creation
		grading faithfulness to nature	different degree of durability and self-regulation
		referring to natural plant communities	adjusting to different habitats
			predictable bio-climate
			local uniqueness

Table 9. The formal model

7. Nature modelled in the aspect of spatial perception

The way in which greenery is observed is marked with the quality of our perception. The ability to perceive depends on the structural features of the object and the observer's sensitivity. For a greenery designer, it is the basic tool of creating a form.

7.1 Perceiving elements of a naturalistic arrangement

It is essential to perceive the following elements: forces binding the arrangement, its dynamism, harmony with the surroundings and the hierarchy conducting the observer. Arnheim uses the term of the field of visual forces, which fills the arrangement and in which particular elements attract or repel one another (Arnheim, 1977). The balance of the composition, like in nature, consists in minimizing the energy of the tensions. The dynamic effect appears when the balance is disturbed. The power of the tensions depends on the distinctiveness of the objects, their sizes, location and similarity. Solids which are hung higher appear heavier. Thus, trees with high crowns seem heavier than trees whose crowns reach the ground. The greenery covering an area seems to mainly raise its level. For the dynamism to appear in the composition, it is essential to provide a stable arrangement pattern as its frame of reference. The impression of stability is created by healthy, straight plants and by harmony with the natural composition of the habitat, whose perception is accessible only to observers with some knowledge of nature.

Although in natural communities plants are arranged freely, there are visible repetitions and rhythms e.g. tree trunks, tufts of grass. The arrangement dynamism could be achieved by introducing rhythm disturbances. Thus, tilted trunks, undergrowth locally concentrated, or deformed elements make distinct and dynamic accents as long as the number of accents is not too high. Their excess, however, introduces real chaos and blurs the composition. A whole is more than the sum of its components. Distinct groups of objects create interactions where not only particular objects have weight but also their common outline. One tends to look for accent points by following the range of looks with one's eyes. When creating a composition, it is important to consciously locate those points. The natural order consists in reducing any potential tensions, which makes it very similar to the principles of a balance creation in a composition. Distinct contours, being against nature, are eliminated spontaneously. Any geometrizing of greenery elements increases the tensions of visual forces.

7.2 Naturalistic greenery perception in the sphere of reaction

Walking in the forest produces impressions often difficult to describe. Their sources are as abstract as those related to music. They, probably, have a similar mechanism of creating aesthetic feelings. Following the concept of creating feelings in music (Lissa, 2008), we could try to describe the process of greenery perception. At first, the observer notices the image of particular objects (flowers, leaves, branches), sounds (insects, leaves), smells of plants, which builds characteristic creations forming representations and as a result structures, e.g. meadows and forests. They are associated with the impressions stored in our memory by recalling past events or stirring imagination, which is followed by reactions producing aesthetic feelings. If the thinking process leading to greenery assessment could be presented in this way, its critical element would be comparison with one's own experience, whose lack or association with unpleasant situations, will stifle our ability to assess positively. Such assessment mechanisms are associated with e.g. perception filters described by Amos Rapoport (Rapoport, 1977). According to him, the perceived world consists of the real world elements which remain in the observer's mind after filtering information through the filters of one's cultural and one's personal experiences. Following the Maslow needs pyramid (Koster, 2005), the green area should provide the feeling of security in the first place.

An important aspect of naturalistic greenery, which should be mentioned, is catering for people's sense of direction. In the Amager Commons in Copenhagen, each intersection of the alleys is planted with different native trees or shrubs, which provides people who have natural knowledge or are observant enough with clear directions. Points of reference are always needed and they could be created by means of naturalistic greenery. Natural space is perceived in pictures with hidden archetypes directing our reactions subconsciously. Our reaction to some of them is biologically conditioned regardless of our experience with native nature, but others require formation by our early contact with nature. However, without suitable education stressing ecological values and contact with native nature, the functional naturalism will not be accepted by society, no matter whether our reactions are conscious or not.

7.3 Semiotic aspects of naturalism

People communicate by means of signs, so when getting to know their surroundings, they also look for meaningful elements. The ability to understand the semiotic layer in our surroundings is affected not only by our experience and cultural knowledge but also, in the case of greenery, by our ecological knowledge and consciousness. Nature creates places which we sometimes find nice, sometimes horrifying, exposing human weaknesses. One's experience of a place is more important than the physical objects in it, which is confirmed by Yi-Fu Tuan, for whom a place is created not only with material components but also with speech, gestures and meaningful objects (Bańka, 2002). A place full of meanings possesses its *genius loci*, or it is space with a soul, whose spirit is determined by the relations of five features-dimensions: things, order, character, light and time (Norberg-Schulz, 1980, as cited in Bańka, 2002). Their different combinations make different types of landscape. If referred to nature, it is possible to demonstrate a few examples formed accordingly. A greenery composition of native trees, e.g. birches, builds a relation with time through the spring youth, the vividness of green and also with light through the brightness of the trunks and leaves. If a trace of human order is introduced by planting the birches on an orthogonal grid, a particular character of coordinated space will be achieved. If the 'chaotic' natural order is preserved, as a result, the impression of freedom and vitality will be produced. By retaining the species composition typical of a birch wood, we will achieve the faithfulness to things, the natural hierarchy of space elements and the character in accordance with the birch wood archetype. The material dimension will be disturbed by introducing buildings, but a building placed here will be enriched with the particular character and colour of this type of wood.

The world of nature has always seemed to possess nonphysical meaning, which connects it closely with the culture of the area where it is found. The natural elements and phenomena have always been perceived as signs. In the created green space, the signs appear in a literal form, interpreted directly, e.g. thorns as a warning, tree shade as a promise of the cool. In naturalistic compositions, signs usually occur as archetypes deciphered beyond consciousness. Archetypes reach our consciousness in a complex as a symbol. It is not easy to create meanings conveying emotion, admiration or reflection. To do it indirectly, ambiguously and in a way hard to define requires great art. One could mention a few symbols related to naturalism: 'ancient forest' – a wild place, difficult to access, unfriendly to people; 'paradise' – a friendly place of bliss and peace. As Shepard put it, "scenery is not scenery without the right cultural baggage" (Shepard, 2002). An important role in spatial symbolism is played by quotations, which in naturalistic greenery is the area elements representing a specific habitat surrounded by the background with a different character. This quotation could be represented by the pine forest in the courtyard of the National Library in Paris.

When moving in a green area, we discover signs which form a kind of narration. Thus, when greenery is shaped with people - its users - in mind, it is important to introduce narrative elements. Just like in architecture. "A building in which nothing is designed for sequence is a depressing experience" (Arnheim, 1977). The consecutive elements of a set of places arranged in order create mood through the surprise and secret of the next step.

A park which is simplified and predictable discourages us from taking a walk. Ambiguity stimulates meditation, whereas unambiguous objects escape our conscious attention. It should be pointed out that the richness of narration increases if all the senses are engaged.

7.4 The perception model

Although a natural forest may seem to be devoid of any meanings, in fact it does have many. When shaping naturalistic greenery, its meanings could be enriched by those which will be clear in a given culture and will convey meanings worthy of deciphering. The meanings could be developed by comparing the design ideas with the model given below.

	Principles	Actions	Effects
1.	a high degree of complexity close to information noise	minimization of visual tensions	lack of enforced reactions
			reducing outlines of buildings
2.	lack of frame separation	constant completing a composition with all elements of the visual field, incl. the background with a particular weight	full unification with the surroundings
3.	arrangement hierarchy	stressing a wholeness focusing visual forces at different specification levels	depth of form
		characteristic size	efficiency
		ordering	minimal energy to maintain stability
		using the golden ratio and the fractal accent dispersion	a compromise between the stability impression and preserving the live visual tensions
4.	structure clarity	placing clear accents	securing Cartesian coordinates
		popularizing natural knowledge	ability to appreciate nature
		moderate use of semiotic elements	decreasing the observer's involvement
		harmony with the human needs hierarchy	functionality
		combining processes characteristic of nature and culture	organic design
5.	dynamism	creating static balance disturbance	raising visual tension
		intentional lack of closing a form	
		form repetition disturbance	
		lack of hierarchy	
		natural form deformation	
		seasonal changeability, growth, movement caused by wind	
introducing symmetry as an alien form			

	Principles	Actions	Effects
6.	aesthetic experience of nature	sensual perception of images, smells and sounds – creating impressions – associating structures – developing feelings	ability to appreciate natural aesthetics
		assessment: of the spatial layer – physical features, of the time layer – recollections and anticipations, of the emotional layer – mood and feelings	experiencing to the full
7.	semiotic aspect	sensitivity to archetypes	behaviour optimization, behaviour management
		conveying cultural meanings through space narration and symbolism	stirring imagination
		form ambiguity	
		using 'quotations' from local nature	giving a unique character

Table 10. The perception model

8. Holism in nature modeling

The considerations presented above lead to the conclusion that naturalism developing in Europe since the 17th century, appearing sporadically even earlier, is still important, at least in greenery modeling. Its origin is the growing social consciousness that the human being part of nature when opposing nature destroys also himself. Unfortunately, those tendencies, commonly called ecological, are often marred with the individuality of the point of view. Nature is sometimes protected in one aspect only with means degrading it in another. It is always essential to consider problems as holistically as possible. The problem is too complex for us to be able to fully control the relations between the human and surrounding nature. The human-caused damage could be minimized if the existence of the variety of aspects and their importance are realized. An illustration of this holistic attitude is the final model. The principle of nature modeling is the same for each model. However, it manifests itself in many ways which sometimes repeat themselves, and are sometimes visible only from the perspective of a definite aspect.

When analyzing the relation between modeling nature and the naturalness degree of formed structures, it is possible to distinguish four styles corresponding to the successive degrees of faithfulness to natural patterns and the presented holistic model. These are: the natural style, the organic style, the picturesque style and the geometric style.

The natural style is characterized by preserving the original natural elements to the largest degree possible. Architectural objects and plastic installations are placed in this context, using the natural values as the arrangement base. Designed greenery is a copy of the original and its aim is to mask the changes caused by the process of erecting buildings.

The organic style is represented by objects transformed by designers with an attempt to preserve their natural aspect. The basic principle is sustaining and stimulating natural processes together with developing the aesthetic layer by adding distinct human-formed elements, e.g. re-introduction of species or stimulation of natural plant succession.

The ecological aspect of greenery compositions designed in this style does not really lose its significance despite the geometry of native plants and a limited use of non-expansive ornamental plants. The style also tends to maintain a high level of building elements and tended greenery in contrast to spontaneous flora.

The picturesque style is characterized by combining ornamental and native plants. The final effect is to give deep aesthetic impressions. The spatial composition is free, close to the fractal geometry. The picturesque style uses a species diversity, which guarantees conformity with the habitat conditions and resistance to the periodic pest invasions.

The geometric style dominates spaces highly urbanized, e.g. roof gardens or vertical gardens. It is a form of art forced onto space, a sculptor's creation, often far from the local ecological aspects. Certain naturalism traces could be found in the form of a free accent dispersion, but only in the geometrically limited fields. There is no room for chance, everything being designed and given in its final form.

	Principles	Actions	Effects
1.	Naturalism as an idea	searching for harmony between nature and culture	influence on legal regulations
		promoting the living world	formal creation manifestations treated as expression of artificiality and stagnation
		imitating natural laws	building structures based on nature and accepting it
		searching for justification in nature of human actions as a negative idea	treating human actions as nature manifestation, leading to robbing nature of its resources
2.	Naturalism manifestations in culture	juxtaposing nature with culture	greenery closer to natural, not clearly bound to buildings
		creating structures combining nature and culture	structures binding greenery formally to buildings, tamed nature
			buildings as an organic consequence of natural forms, buildings placed in natural greenery
		creating naturalistic built-up area	considering natural processes in development
			preference for complexity and adjustment
			natural elements adaptation
			creating structures referring to natural ones
			minimizing energy needed for construction and maintaining
			creating optimal conditions for functioning based on self-regulation
			development of nature protection active methods
promoting native flora			
using wastelands for reconstructing local natural values			

	Principles	Actions	Effects
			referring to natural plant communities stressing the local uniqueness and identity
			using the predictable psychosomatic influence of natural communities
		sustainable development	synergy of building elements and greenery
			easing conflicts
			sustaining natural processes
			hierarchy and diversity
			development of legal regulations
			education in distinguishing and appreciating natural communities
3.	Naturalistic structure	building harmony of hierarchic wholeness	structure with a diverse force of accents at various levels of scale
		optimal size	functionality
		free composition	problem of spatial coordination
			naturalness impression
		spatial relations based on the golden ratio and fractal structures	using space optimally
			adjusting to human perception
		added geometrical elements	stressing important places
			artistic content message
		using material and intuitive elements	message affecting various senses
			narration
		securing the organic character of relations	harmony with habitat conditions, changeability in time, transience, complexity, free arrangement, border fluidity, form dynamism, subtle accents
4.	Perception of naturalistic structures	the field of observation is formed by a streak of looks, with the scene determined by the accent, and not by the frame	composition built with spatial objects, their context and background
		minimal visual tensions	lack of uncomfortable sense
		vague, implicit and complex forms	involvement, dissimilarity from everyday effort habitat, sense of freedom
		affecting all senses	causing and controlling reactions
		using meanings associated with archetypes or symbols	narration with references to native nature
		following the hierarchy of human needs	optimal functionality

Table 11. The holistic model

9. Conclusions

The richness of natural greenery, its complexity, and its unsurpassable potential are values not to be despised. Native plants could be included in greenery compositions even

in city centers. If the habitat conditions do not allow to create semi-natural communities, it is, at least, possible to adopt the species diversity degree or the plant placement, which brings notable ecologic and useful benefits. In the urbanized area, an important role is played by the aesthetic and useful factors. The question of being organic does not mean the so-called naturalness or the anthropogenic character of elements filling the space, but their connection with the processes generated by its users and its wider spatial context. The key here is naturalistic greenery. In order to secure the positive social attitude to naturalistic greenery, it is important to popularize its real values in the various aspects: faithfulness to natural processes, spatial pattern, changeability in time and the emotions related. The holistic model presented above is designed as the basis of the naturalistic approach to creating landscape enclosures. It is not necessarily the main design model, but recommended as one of its layers. The direction of the designed solution will show, at the successive stage of elaboration, which of the mentioned-above models could be useful in developing the essential themes of the design. The fundamental issue is getting to know the local conditions well and using them to the full, which will determine the style of the object. The environment, the human being and his needs constitute a system requiring harmony and mutual respect and it has to be realized that the synergy beneficial to everybody is at stake.

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University Campus STeP Ri
Slavka Krautzeka 83/A
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Unit 405, Office Block, Hotel Equatorial Shanghai
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中国上海市延安西路65号上海国际贵都大饭店办公楼405单元
Phone: +86-21-62489820
Fax: +86-21-62489821

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