METHODS OF LANDSCAPE RESEARCH
Dissertations Commission of Cultural Landscape No. 8
Commission of Cultural Landscape of Polish Geographical Society, Sosnowiec, 2008

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LANDSCAPE ASSESSMENT OF GOLF COURSE AS METHOD OF VALUATION LANDSCAPE TRANSFORMED BY HUMAN

key words: golf course, landscape assessment, potential vegetation, Poland, Krzyżanowice

INTRODUCTION

The date of beginning and place of origin of golf are not known exactly. In medieval Europe a few games existed whose rule was hitting a ball and directing it to a selected point. The first documented mention about golf comes from Spain, from 1360. It is considered that the most probable ancestor of the golf is a Danish game **colf** (XIII century). The golf homeland is regarded to be Scotland, where a XV century documentation of the game was found. Golf courses were built on waste land or in areas between seashore and farmlands – called links. Their surface was naturally formed. Today, building and functioning of golf courses is a strong intervenetion in the natural environment. Therefore it should proceed in a way that is least invasive on the surroundings. A good design of a golf course should consider the landscape value of the area of golf course location. For the players the turf is as important as the landscape, vegetation and topographic features, that have a significant influence on game course and general impression (Wolski, Lewiński, 2005).

The valuation of a golf course is multifaceted and multilevel. Universally know and used are methods of turf assessment, both visual and functional aspects (Turgeon, 2004; Jankowski et al., 2005; Domański, 2005), but they have not been used for any uniform assessment of the golf course landscape as an area transformed by man so far. The methodology of golf course landscape analysis should consider the player's feelings first, but also the effect of the object on the surroundings and harmony of execution. Here are applicable instrumental valuations of the environmental conditions and usefulness, which entail methods of determination the human influ-

ence on the natural environment and its components as well as usefulness of the environment to perform specific functions (Kostrowicki, 1992). The basis in the proposed methodology of golf course landscape valuation were instructions for designing golf courses (Hurdzan, 1996; Fream, 2004) and conversations with players. Into consideration were also taken the elements, recognized by Radziejowski (1979), that increase and decrease the tourist attraction of a region, whereas individual elements were scored on the basis of the results from publications by Krzymowska-Kostrowicka (1988, 1991, 1993) concerning the tourist and health values of environ-ment.
The aim of the present study was to present the proposed method of landscape golf course valuation. Toya Golf and Country Club – Wrocław was taken as an example for presenting a practical application of the assessment.

METHODS OF RESEARCH

The assessment of golf course landscape contains the following issues:

Valuation of accordance of the golf course and surroundings

Harmony of vegetation and the natural vegetation of the area where the golf course is to be situated.

Of all the sports objects golf courses are the investments most connected with the surrounding natural environment. No other object occupies so huge an area. Therefore the influence of a golf course on the surroundings should be precisely analyzed. One of the disturbing aspects to development of natural environment is the introduction of alien plant species to a given region. The choice of grass species is crucial for visual and functional value of a golf course. Of necessity those are alien species and varieties, though in designing solitary trees, forestation and vegetation around water bodies we should follow the surrounding flora. When determining the species composition of a tree group we should follow the potential vegetation map of a particular region (Matuszkiewicz, 1997). For waterside vegetation a model should be the surrounding vegetation that covers the sides of water bodies and natural courses and pounds.

Rules of scoring the vegetation in golf course:

+50 p. – species composition of trees and scrubs is in accordance with the potential vegetation of particular region.

+20 p. – species composition of waterside vegetation is in accordance with the natural vegetation of particular region.

+10 p. – solitary trees belong to species naturally occurring in a given region and occur in forestation of the golf course.

0 p. – species composition of trees and scrubs are not in accordance with the potential vegetation of particular region, but the species are not alien or invasive species.
-10 p. – solitary trees belong to species alien for a given region.
-20 p. – species composition of waterside vegetation are alien for particular region.
-50 p. – forest vegetation on a golf course is alien.

Architectural harmony with a region.

This point includes the valuation of the architectural style of the club house and other buildings in a golf course area. The objects must not be 'alien' for the surrounding landscape. High valued are buildings that are in harmony with the architecture of the region where the golf course is planned.

Rules of scoring of the architecture elements:
+10 p. – building development style in accordance with regional architecture
0 p. – styleless building development

-10 p. - building development unharmonious, originating from other region.

Effect of a golf course on immediate surroundings.

The net of ecological paths and corridors should be retained in a golf course design. It is important to retain or reconstruct the seedlings of plants and animals destroyed during construction work (Fortuna, 1993). Intensive turf nurturing could be the cause of pollution of ground waters by fertilizers and pesticides. As an effect of drainage system could be changed water conditions in the surroundings. A significant burden for the environment seems to be the development of driveways and car parks for a golf course.

Valuation of the influence of a golf course on immediate surroundings:
-50 p. – drying water bodies, noticeable in the surroundings
-50 p. – noticeable eutrophication (due to fertilizer washout) in the form of water blooms in the water bodies around
-10 p. – removal of weeds and others plants from the area bordering on a golf course
-10 p. – removal of trees, scrubs and their leaves from forests bordering on a golf course.

Evaluation of the project and execution harmony

The golf course should be diversified and in harmony wit the surrounding landscape. Its visual quality should have a positive effect on the player's psyche (Fortuna, 1993). However, these objects are often designed by foreign specialists who make them perfect in technical way, but do not consider the characteristics of the local landscape. The harmony of a product is influenced by a lot of elements.

Landscape dominants.

Dominants are points that attract the eye and make the area diverse. Such a role can played by a grand solitary tree, group of trees or water pond. In a golf course territory the arrangement and kind of dominants are closely linked to the golf function, because they mark out game paths and constitute a variety and impedement in golf play.
The rules of scoring the landscape dominants are:
+20 p. – landscape dominants are diverse and constitute a harmoneous and interesting arrangement on the golf course area
-20 p. - landscape dominants are not varied and do not constitute harmony nor interesting arrangement.

View axis.

The view axis location in a golf course depends on practical golf playing requirements – they are game paths (**fairway**).
Valuation of correctness of fairways delineation:
+20 p. – particular fairways are delineated well and separated from others, forming a self-contained entity
-20 p. – particular fairways are not delineated well and do not separated from others.

Perspective illusions.

The basis of visual illusions is an impression of convergence of two parallels lines in one point (Suzin, 1998). Contrast also disturbs distance valuation, e.g. high trees next to flat green with a flag cause the flag seem smaller and more distant (Sanders, 2003). The use of these effects on a golf course makes the game more varied and interesting, though a distance in meters is exactly known to players.
Value of correctness of perspective illusions:
+20 p. – correct use of perspective illusions
0 p. – no perspective illusion applied
-20 p. - incorrect use of perspective illusions.

Color selection in space perception.

Color selection has a crucial role in space perception and distance valuation (Suzin, 1998), it could apply to the color of the club house, the color of flags on greens and tones of the green of plants on a golf course. It is known that nearer and bigger seem to be objects in warm colors – yellow, red; while further and smaller seem the objects in cold and grey colors (Zeugner, 1965).
Rules for scoring the color:
+20 p. – competent use of color
-20 p. – incompetent use of color.

Helioplastics in golf course landscape.

Designing pictures based on varied illumination of its elements at different times of day and year results in creating many compositions which will acquire new artistic values (Suzin, 1998; Twardowski, 1996). On the golf course the artistic values we can obtain using definite combinations of green and highlighting the composition using the back illumination of trees.
Value of helioplastic effects:
+20 p. – competent use of the game of light and shadow in composition of the golf course area.
0 p. – lack of the light and shadow game.

Evaluation of the height and habitat diversity of a golf course

The number, kind and correctness of obstacle distribution in a golf course. The so called hazards have a strategic value on a golf course and are precisely defined in „Golf play rules", where the hazards are defined as every sandy bunker or water obstacle (randa.org, usga.org). The right use of the hazards and other elements adds variety to golf course view, e.g. vegetation, hillsides, slopes of embankments, hills, topographic lows, ditches, grass traps, rocks and stones or human made constructions, augment the character of a golf course, making it more interesting and unusual both with respect to landscape and the game of golf.
Each of the mentioned hazards should be valued separately:
+20 p. – correct use of hazards or varieties
0 p. – lack of hazards or varieties
-20 p. – wrong used of hazards or varieties.

Functional evaluation

Game safety.
Game safety is one of the most important criterions of functional value of a golf course. The most often made efforts in golf course planning are: increase of tee, planting trees and shrubs or placing cover barriers near the tee, for control of failed punches. Stairs, bridges, high rocks, old trees or watersides should be well marked (Hurzan, 1996).
Rules for scoring game safety:
-20 p. – application of elements is not in accordance with rules of safety
-20 p. – lack of safety measures at dangerous places, eg.: stairs, bridges, high rocks, old trees or watersides.
+20 p. – application of varieties in accord with rules of safety
+20 p. – good safety barriers at dangerous places
+20 p. – good visibility of the place of ball landing.

Universal character of golf course

Each golf course should make allowance for skills and physical abilities of players of different age, sex, fitness and strength. To provide an elastic character of a course, the designers consider mean distances of ball putting by different categories of players. They provide for multiple tees to make the field adaptable for different player groups (Walsh, 2005). The beginners need also more wide fairways, and it should be considered in golf course design (Fortuna, 1993).

Score rules:

+20 p. – the design of a golf course considers skills and physical abilities of players of different age, sex, fitness and strength

-20 p. – the design of a golf course does not consider skills and physical abilities of players of different age, sex, fitness and strength.

Valuation of originality

Originality is a very important criterion in golf course valuation, as it has a strong influence on player's impressions. Individual character and uniqueness are the reasons for the players comeback to a golf course. This effect can be achieved by using in a course composition the elements that occur in the area and are connected with the surrounding landscape.

The originality score:

-20 p. – golf course without expression, passive duplication of a conventional style design

+20 p. – golf course design and performing originality is unique and in accordance with esthetic rules.

The final value of a golf course landscape is the sum of scores of individual issues. The maximum number of points that a golf course could score is 350.

EXAMPLE OF APPLICATION OF LANDSCAPE VALUATION – GOLF COURSE AT KRZYŻANOWICE

The golf course Toya Golf & Country Club, by way of specific example of landscape valuation, is at Krzyżanowice village, located in Wisznia Mała district, Lower Silesia province, in the vicinity of Wrocław (fig. 1).

The Toya Golf &Country Club has been built on a former military training ground (photo 1). The remains of the previous use of this area are military bunkers, which are well integrated into the course landscape, giving the golf course a unique character. The hills and pounds, which are human made, have become an inherent part of the golf course landscape (photo 2).

The elements of the golf center Toya Golf & Country Club are: 18-holes course, 9 - holes course (where quick games and practices take place), training part, club house, utility rooms and residential part. Total area of the facility is 160 ha. The inner area of the golf course has been planned in the links style, so there are no many trees and scrubs on this area. The outer area contains buildings in the parkland style, therefore high individuals of oaks, alders and willows dominate there.
They create a framework around the golf center. The nearest neighborhood of the golf course make farmlands and forests.

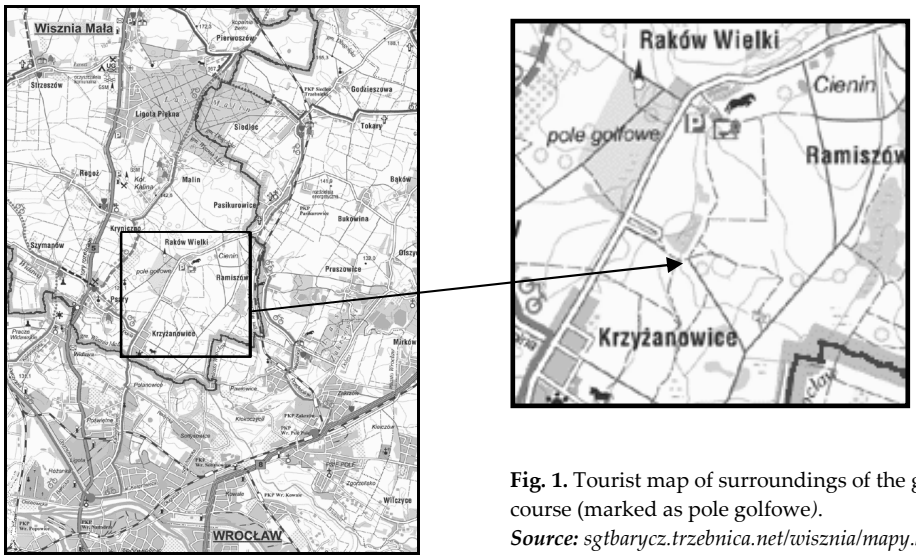

Fig. 1. Tourist map of surroundings of the golf course (marked as pole golfowe*)*.
Source: *sgtbarycz.trzebnica.net/wisznia/mapy.htm.*

According to Matuszkiewicz (1997), species typical for this area are: Scots pine (*Pinus sylvestris* L.), common alder (*Alnus glutinosa* (L.) Gaertn.), oaks (*Quercus robur* L., *Q. petrea* (Matt.) Liebl.), sycamore (*Acer pseudoplatanus* L.), European beech (*Fagus sylvatica* L.) and European ash (*Fraxinus excelsior* L.). These species were observed on the 18-hole golf course, only on the area near club house alien species were found to be planted. The riparian vegetation was assessed and found compatible with the species growing on the surrounding water courses and pounds. It was not noticed the presence of invasive plants on the analyzed area.

The architecture of the buildings in the golf course area is in line with the buildings around , which have the character of new, suburb buildings.
Originally, the area where the golf course has been built was completely flat, therefore ground works on diversifying the terrain were done on the whole area.

However, their effect on the natural environment is not significant, because this area was already modified during its use as military training ground.
The lower score in this point is due to removing individual trees and scrubs when the investment works were in progress.

No negative influence was noticed of the nurturing works on the surrounding environment. Pesticides are used preventively only against snow mould, in other cases sprays are used when disease symptoms appear.
The employed irrigation allows to optimize water management. There should be emphasized that in spite of the application of the TG&CC drainage system, it was not observed its negative influence on the surroundings.

Photo 1, 2. The view from an observation tower before (photo 1) and after (photo 2) golf course establishment. ***Source:*** *oyagolf.pl.*

On the golf course assessed various dominants were applied, e.g. an island with common alder trees on a pond, a water body near the training part and an observation tower with a group of Scots pines. As dominants function also soliters, represented mainly by oaks, ashes, alders and hawthorns of interesting habit.

Analyzing the view axis it was noticed that the fairways are delineated by trees on theirs edges, also by water bodies and hills.

Among color accents, used as perspective illusions, the function of broad-leafed trees should be emphasized, which are changing the landscape of golf course in autumn. Then dominant are warm colors, yellow, orange, red and green of coniferrous trees and turfs, whereas in the spring-summer period the dominant colors are various shades of green. A combination of various shades of green is one of the methods used to get helioplastc effects (Twardowski, 1996). In golf course design there

were also used groups of trees, with back-side sunlight illumination at morning and evening hours, which emphasizes the composition.

On the golf course described many obstacles are applied, such as sandy bunkers on all holes in the 18-hole course. They are most abundant near the greens, which is the right distribution of hazards. Water hazards are in the form of fished ponds and water courses, composed into the eastern part of the golf course. They function as side obstacles rather than water hazards. There are also some varieties applied, such as hills, slopes, trees, scrubs and grass traps.

According to observations and information given by players, all the tees appear elevated, which improves the visibility of balls landing and prevents accidents (Hurzan, 1996). The elements that could be dangerous for people, e.g. watersides, are adequately marked.

Multiple tees contribute mainly to the universal character the golf course. On the full-sized field there are 5 tees for each hole, and two tees per hole on the 9-hole field.

Analyzing the golf course landscape, it can be stated that it is a course with a character. Its uniqueness is due mainly to the military bunkers - a left-over from a military training ground - and the observation tower surrounded by Scots pines, which is the golf course logo.

Recapitulating, according to the proposed method of landscape assessment, the Toya Golf & Country Club course scores 340 points (tab. 1).

Tab. 1. The score of respective aspects of landscape of the golf course TG & CC.

Feature	The score	Maximal score
Evaluation of the golf course accordance with surroundings		
Vegetation accordance with natural vegetation of the area of the golf course establishment	+80	+80
Architectural accordance with the region.	+10	+10
Influence of the golf course on the surroundings	-10	0
Evaluation of the project and execution harmony		
Landscape dominants	+20	+20
View axis	+20	+20
Perspective illusions	+20	+20
Color selection in space perception	+20	+20
Helioplastics in golf course landscape	+20	+20

Evaluation of height and habitat diversity of the golf course – number, kind and correctness of obstacle distribution		
Sandy bunkers	+20	+20
Water obstacles	+20	+20
Varieties	+20	+20
The functional evaluation		
Game safety	+60	+60
Universal character of the golf course	+20	+20
The solution originality	+20	+20
Total	340	350

Source: *by authors.*

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SUMMARY

The increase of interest in golf playing, observed in recent years in Poland, is a reason for the growing demand for building new golf courses. It generates the need for creating an assessment methodology for the solutions used when designing and realizing golf courses. Turf value is a crucial component that affects games quality, therefore valuation of turf is very important (Turgeon, 2004). However, for many players also important are landscape values, which create a setting for playing golf. For this reason, creating a separate, universally used methodology of valuation the golf course landscape is an important aspect. The present paper shows the methodology of golf course landscape assessment by the example of the Toya Golf & Country Club – Wroclaw at Krzyżanowice. The assessment presented includes five aspects: compatibility of the golf course with the surroundings (compatibility of trees and water plants, architectonics and influence on surroundings), the harmony of design and performance (analysis of the landscape dominants used, of view axis, selection of colors and use of helioplastics), the vertical and habitant variety that includes an assessment of distribution of obstacles on a golf course, functionality (play safety and universality) and originality of solutions applied in a golf course. The aspects mentioned are assessed using a point scale and the final value is the sum of partial values.