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## FEATURES OF VISUAL PERCEPTION AND ARCHITECTURAL COMPOSITION OF SMALL AND MEDIUM SKI RESORTS

### CECHY PERCEPCJI WZROKOWEJ I KOMPOZYCJI ARCHITEKTONICZNEJ MAŁYCH I ŚREDNICH OŚRODKÓW NARCIARSKICH

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#### ABSTRACT

In this article the features of visual perception of ski resorts of small and medium capacities are considered. Interdependence between levels of visual perception and compositional characteristics of buildings is established. A number of architectural and compositional techniques, which are used in the design of ski resorts of small and medium capacity, are determined.

Key words: ski resorts of small and medium capacity, architectural-spatial composition, levels of visual perception.

#### STRESZCZENIE

Cechy wizualnej percepcji kompleksów narciarskich o małej i średniej pojemności są rozpatrywane w tym artykule. Stwierdzono współzależność między poziomami percepcji wzrokowej a charakterystyką kompozycyjną budynku. Szereg technik architektonicznych i kompozycyjnych, które są wykorzystywane w projektowaniu kompleksów narciarskich o małej i średniej pojemności, są zidentyfikowane.

Słowa kluczowe: kompleksy narciarskie o małej i średniej pojemności, kompozycja architektoniczno-przestrzenna, poziomy percepcji wzrokowej.

## 1. INTRODUCTION

The problem of ski resort's designing is relevant due to the popularity of active winter recreation among people. Ski resort is one large enterprise or a group of tourist enterprises that have a unified system of public and economic services, united by a common architectural and planning solution of the territory and intended for winter sports with the predominance of skiing [10]. Today, in the Carpathians, there are already about 70 ski complexes of various sizes, most of which belong to small and medium-sized complexes, which can accommodate up to 1200 people per day. The current trends in the development of small and medium-sized ski resorts in Ukraine include the territorial expansion and reconstruction of existing sports bases or small areas of skiing, as well as the development of new territories, in particular in the suburban area of large cities [17]. In particular, from the small ski complexes that were built in recent years in Ukraine, the following can be called: "Myhovo" ski resort in Chernivtsi region (2012), ski resort "Sun Valley" in Boyany village of the Chernivtsi region (2011), ski resort "Sunny glade" in Polyana village of Mykolaiv region of Lviv region (2012), ski resort "Maidan" in Zhovkivsky district of Lviv region (2014), ski resort in Yavoriv village of Turka district of Lviv region (2010), ski resort on Rebrovach Mountain in Vorokhta urban village of Ivano-Frankivsk region (2010) and others.

Small and medium-sized skiing complexes differ from large and very large complexes by composition of elements. So mandatory components of the ski complex, even the smallest capacity, are the following planning elements: cable car construction, parking, administration, information service, rescue and meteorological services, ticket office, public toilets, room for ski instructors, inventory storage facilities, boxes for storage of equipment, cafe-bar. In addition, ski resort may include items such as equipment rental, souvenir kiosks and grocery stores, a storage room, a restaurant, a hotel, a spa complex, a health center, a skating rink, and more. Buildings for entertainment and other public buildings, designed for a large number of visitors, are not usually designed as part of small and medium-sized ski resorts.

Ski resorts are studied by scientists-architects already for a long time from the beginning of designing such specialized complexes. The history of skiing in the Carpathians begins at the end of XIX - beginning of XX century with intensification of active rest and with the creation of the first ski clubs [18]; however, there were no organized complexes in this period. Construction of organized ski complexes in Europe began only in the 30-50th years of the twentieth century [7], since that time, scientific studies of this type of objects began. The studies of the main aspects of mountain recreational areas and objects planning were undertaken by such Ukrainian and foreign scientists as Gorodskoy V. [4], Maksimov O. and Opolovnikova E. [7], Melik-Pashayev A. [8], Orekhov V. [12], Panchenko T. [13], Stauskas V. [20], Shulyk V. [15], Shulga G. [16], Doward S. [3], Soltys J. [19], Supplee-Smith M. [21], Tyrvaainen L. [22] and others.

In this article the architectural and compositional solutions of the development of ski resorts of small and medium capacity are analyzed through the prism of the visual perception of the observer, that is, the skier. The human perception of the environment is a complex phenomenon that combines two aspects: the physiological (the 'senses') and the psychological (the 'brain'). All aspects of the physiological perception can be measured in an objective way. The psychological process is individual and thus substantially subjective and determines the experience of the landscape and ultimately affects our behavior and actions [9]. There are many works devoted to the study of this complex phenomenon of perception of space, but these works are not taken into account, as the article analyzes only the physiological aspect of visual perception. Instead, work on the architectural composition and, in particular, the peculiarities of the visual perception of architecture in the natural landscape are closely related to the subject of the study of this article. In the context of this problem the scientific works of Idak [5], Kurbatov [6], Shcherban [14], Yargina [24], Bell S. [1], Bogdanowski [2], Wejchert [23] were analyzed.

An important feature of the visual perception of architecture in the ski complex is the combination of dynamic and static perception. Within the study, only the static perception of the development zone, located in the valley at the foot of the mountain, was considered.

Nowadays the analysis of modern architectural and compositional methods of solving the development of ski complexes of small and medium capacity through the prism of the perception of visitors of complexes is very topical. The application of this approach in the study, which is based on visual perception, demonstrates the relationship between the architecture of the complexes, the natural environment and a skier.

## 2. MATERIAL AND METHODS

The study of the features of visual perception of ski resorts was conducted on the basis of analysis of 6 ski complexes of small and medium capacity, 2 of which are located in Poland, 2 - in Romania and 2 - in Ukraine. Ski complexes in the Ukrainian Carpathians were analyzed by the author with help of field surveys; skiing complexes in Poland and Romania were analyzed using the Internet resources of Google Maps, Wikimapia, etc.

The research of ski complexes is carried out with the help of architectural and composition analysis of photographs and 3D models of ski complexes, during which geometrical characteristics of the form of buildings, their size, proportions, scale, color, texture and light colors are determined. An important aspect of architectural and composition analysis of building in the ski complex is the definition of the main points of perception within the visual range [11]. The architectural and compositional analysis of building in this article takes into account the diversity of perception of buildings and reflects the various levels of visual perception of building [14]: at the level of general visual orientation in space (from the upper station of the lifts or from the route at a distance from the building more than 500 m), at the level of perception of fragments of the building as the person approaches the object - the goals of motion (at a distance of 100-500 m from the building), at the level of concentration of human attention on the object - goals (at a distance up to 100 m from the building). Depending on the level of perception, certain characteristics of the composition are determined, which are available to the observer, namely: at the level of the general visual orientation in space - the basic geometric characteristics of the shape of the silhouette, at the level of perception of the fragments of the building as the person approaches the object - the magnitude, scale and the proportions of buildings, at the level of concentration of human attention on the object - the color, texture and illumination of the facades of buildings.

At the final stage of the study with the help of the comparative analysis method a comparison of architectural and compositional features of ski complexes is carried out. Applying the method of generalization, characteristic features of the construction of architectural forms and typical architectural and compositional techniques that are used in designing of ski complexes of small and medium capacity at different levels of visual perception are determined.

## 3. RESULTS

For the study of ski resorts in Poland, 2 examples were selected: ski resort "Kaniowka" (medium capacity) in Białka Tatrzańska and ski resort "Nowa Osada" (small capacity) in Wisła. These complexes differ in capacity, which is reflected in different scales and area of development zone (see Table 1).

The following functional elements are included in the development zone of ski resort "Kaniowka ": hotels, spa complex, technical building, lower lift station, cafe, ticket office, rental point, ski school, toilets, souvenir kiosks, parking.

Table 1. Architectural and compositional analysis of selected ski complexes of small and medium capacity in Poland. Source: Google Maps, wikimapia.org.

Ski resort Kaniowka w Bialka Tatrzańska	Ski resort Nowa Osada w Wiśle
<b>Plan of development zone</b>	
	
<b>At the level of general visual orientation in the space</b>	
	
<p><b>Basic geometric characteristics of the forms:</b> prevailing horizontal plane; irregular form of silhouette; forms are located very close to each other and subordinated to the landscape</p>	<p><b>Basic geometric characteristics of the forms:</b> prevailing horizontal plane; irregular form of silhouette; forms are dispersed and subordinated to the landscape</p>
<b>At the level of perception of building fragments as the person approaches the object – the goal of motion</b>	
	
<p><b>Size:</b> three and one-story houses (3-10 m height) the building of hotel dominates in the space <b>Scale:</b> structures correspond to human scale <b>Proportions:</b> the buildings are proportional to a person due to horizontal division on the facades</p>	<p><b>Size:</b> one-story houses (3-4 m height) <b>Scale:</b> structures correspond to human scale <b>Proportions:</b> the buildings are proportional to a person</p>
<b>At the level of concentration of human attention on the object - goal</b>	
	
<p><b>Color:</b> facades - natural color of the light wood, roof - dark brown <b>Texture:</b> natural texture of the wooden polished timber <b>Lighting:</b> due to meridian location of the buildings the facades are well lit during the day</p>	<p><b>Color:</b> facades - natural color of the light wood, roof - dark brown <b>Texture:</b> natural texture of the wooden polished timber <b>Lighting:</b> lower part of the building is shaded during the day</p>

In the building system of ski resort there are both individually placed and blocked structures. Buildings are grouped around two ski subzones: primary and secondary (for children). In the analysis of development at the level of the general visual orientation in the space, the basic geometric characteristics of the shape of the silhouette of the building were determined, where horizontal planes predominate in "Kaniowka" ski resort. The general shape of the silhouette is irregular, with the placement of buildings close to each other. At the level of perception of fragments of building as human approach to the development zone the magnitude, scale and proportions of structures were determined. In ski resort one and three-story buildings (3-10 m high) prevail, but the structure of the hotel clearly dominates in space by its size. Despite the massive nature of the structures, they correspond to the scale of a person, which is achieved through the horizontal division of the facades. The planes of the facades are divided not only horizontal, but also vertical, which reduces the impression of massiveness. When perceived at the level of focusing human attention on building, it is possible to distinguish color, texture and illumination. The walls of the buildings of "Kaniowka" ski resort are made of wooden beams, which have a natural color and a texture of polished wood. Due to the meridialation of buildings, all facades of houses are well lit throughout the day.

Compared to "Kaniowka" ski resort, the scale of construction at "Nova Osada" ski resort is much lower. The following facilities are included in the development zone of ski resort "Nova Osada": lower lift station, toilets, cafes, ticket offices, rental office, ski school, parking. In the building system of ski resort there are both individually placed and blocked structures. In the analysis of development at the level of perception of the silhouette in ski resort "Nova Osada" the horizontal planes dominate. The general form of the silhouette is irregular, and the buildings are scattered across the territory and completely subordinated to the landscape. In particular, in the vertical planning of the terrain, a technique of terracing with a cutting into a slope for the placement of a rental point and box for storing equipment has been applied. There are one-storey buildings (3-4 m high) in the ski resort, which are approximately of the same size.









Buildings correspond to the scale of a person, there are no big dominants in the space. The walls of the "Novaya Osada" ski resort's buildings are made of wooden beams, which have a natural color and texture of polished wood. The lower part of the building, which is built into the slope is shaded, through the advancing console.

On the territory of Romania, 2 ski complexes were investigated, namely the The Stone Grăitoare-Vartop and the Pârțile Roata Cavnic (see Table 2). These complexes have approximately the same capacity and, accordingly, the same scale, but have a slightly different functional content. So, in Vartop ski resort, there is no hotel, which is present in Cavnic ski resort, instead there is a rental point for outfit that is not available in Cavnic.

At Vartop at the level of general visual orientation in space horizontal planes predominate, which are formed by a building built into a slope and forms the upper terrace, where the ski area and the lower chair lift station are located. This building, about 6 meters high, is a complex that contains the main functions. The scale of the structure does not quite correspond to the scale of the person, as evidenced by the large glass doors and windows that are located on the facade above human growth. The building is plastered in light beige tint, the roof of the building (terrace) is fenced. The lower part of the building is shaded throughout the day, as it is oriented toward the north.

The Pârțile Roata Cavnic ski resort at the perception level from a distance of more than 500 m is characterized by a combination of vertical and horizontal shapes that form an irregular line of silhouette. The forms are closely spaced apart. Significantly dominates the size and massivity of the hotel's building, which in terms of the observer standing on the slope harmoniously fits into the landscape, as the roof slope of the hotel repeats the mountain slope. The buildings on its surface are single- and three-story, which corresponds to a height of 3 to 12 meters. In the building of the hotel there are features that are inherent in the Romanesque style of defense architecture. This is manifested in

Table 2. Architectural and compositional analysis of selected small and medium ski complexes in Romania. Source: Google Maps, wikimapia.org, arieseni.pro.

Ski resort "The stone Grăitoare– Vartop"	Ski resort Pârtille Roata Cavnic
<b>Plan of development zone</b>	
	
<b>At the level of general visual orientation in the space</b>	
 <p><b>Basic geometric characteristics of the forms:</b> prevailing horizontal plane; form of silhouette imitates the form of the landscape - the building is built into the slope; forms are located very close to each other</p>	 <p><b>Basic geometric characteristics of the forms:</b> combination of vertical and horizontal planes; irregular form of silhouette; forms are located very close to each other; the form of hotel's roof imitates the form of the hill</p>
<b>At the level of perception of building fragments as the person approaches the object – the goal of motion</b>	
 <p><b>Size:</b> one-story buildings (5-6 m height) <b>Scale:</b> structures do not completely correspond to human scale <b>Proportions:</b> too large windows and doors in relation to the person, the windows are located above the height of the person</p>	 <p><b>Size:</b> one and three-story houses (3-12 m height); hotel dominates in the space by its size <b>Scale:</b> some structures correspond to human scale and some not <b>Proportions:</b> the buildings are not proportional to a person</p>
<b>At the level of concentration of human attention on the object - goal</b>	
 <p><b>Color:</b> facades - shade of light beige; exploited roof is visually underlined by dark brown wooden fence <b>Texture:</b> walls are plastered <b>Lighting:</b> lower part of the building is shaded during the day</p>	 <p><b>Color:</b> facades – combination of light beige and light green, roof of lift station - dark red <b>Texture:</b> walls are plastered <b>Lighting:</b> different insolation conditions –the southern facades are lighted very good, the northern facades are shaded during the day</p>

the accommodation of the hotel on the elevation, which is reinforced with a retaining wall made of stone quadrangles. The western facade of the hotel also resembles a medieval architecture, due to the small size of the windows resembling a loophole. The walls of the hotel are painted in light beige and light green shades. The construction of the lower station of the lift is formed by a double-skinned roof, covered with red tile. The illumination of the surfaces of buildings is different depending on the orientation, facades that are turned to the northern side are shaded during the day.









In Ukraine, ski resort "Kراسiya" in the village Vyshka of the Velyky Berezny district of Zakarpattia region and ski resort "Myhovo" in Myhovo village of Vyzhnytsya district of Chernivtsi region were analyzed (Table 3). In ski resort "Kрасiya" there are three development zones, as this complex is polycentric with several planning centers and refers to large ones with an approximate capacity of 2500 persons per hour [10]. However, for the present study, according to the authors of the article, it is permissible to analyze one of the planning nuclei, which will correspond to the capacity of the average ski resort. In "Kрасia" a characteristic feature of the development is that it is the only building of elongated shape, containing a set of functional blocks, which includes a ski school, cafe, toilet, ticket office, equipment rental. The silhouette of this complex structure is an even horizontal line, which completely repeats the line of the slope terrace and visually frames it. The flat surface of the terrace, where the complex is located, on the northern side ends with a steep slope. The entrance to the complex is carried out on the steep stairs on the northern slope. The visitor rises through the wooden gate, which is attached to the building, gets to the terrace that is located near an elongated structure. The building is one-story with a rise in the form of a small terrace on the second floor above the cafe and reaches a height of 3 to 6 m. The length of the front of the building is about 100 m, that is, the ratio of height to length is about 1:20. When perceived from a close distance to the building you can characterize the color decision and the texture of the facade, which is made of wood, painted in yellow. From this angle one can also see a roof cover with red metal tiles. The main facade of the building is oriented towards the southern side in a direction towards a shallow slope, which provides good illumination.

The second analyzed ski resort "Myhovo" with a medium capacity according to the type of development completely differs from ski resort "Kрасiya". The building here is characterized by a pavilion type and accommodates on the two terraces of the mountain slope. The functional structure of the complex is diverse and includes many additional functions that are not always present in medium-capacity complexes. On the territory of the complex there are several hotels and a cottage town, several restaurants, an entertainment complex, a skating rink, etc. The silhouette of the complex is characterized by a combination of vertical and horizontal planes, which are compactly located on a relatively small area, forming an irregular line of silhouette. Building of the complex refers to one- and three-story houses. The size of the buildings on the territory of the complex is generally equivalent, among them the most dominated are hotel complexes, located on the highest mark of the slope and the restaurant "Get'man" thanks to its massive architecture that imitates the defensive style. In general, the development of a complex corresponds to the scale of a person. In the close distance to the buildings, you can estimate the color solution and the texture of the facade surfaces, which are mostly made of wood, and some buildings, such as Hetman restaurant, are plastered into light beige color with bricks. The southern facades of the buildings are well lit throughout the day, and the northern ones are shaded.

#### 4. DISCUSSION

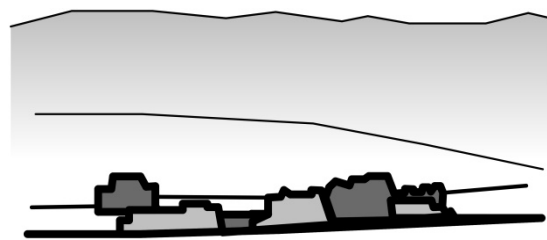
On the basis of the composition analysis of the selected ski resorts in Poland, Romania and Ukraine, typical composition characteristics depending on the level of visual perception are formulated. At the level of the general visual orientation in the space, the following basic composition characteristics of ski resort's silhouette are determined (Fig. 1):

Table 3. Architectural and compositional analysis of selected small and medium size ski complexes in Ukraine. Source: photos by Onufriv Y. (2015-2017); plans are made using wikimapia.org.

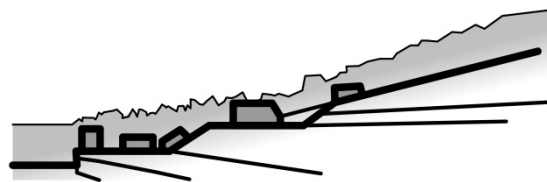
Ski resort "Kراسiya" in the village Vyshka of Zakarpattya region	Ski resort "Myhovo" in Myhovo of Chernivtsi region
<b>Plan of development zone</b>	
 <ul style="list-style-type: none"> <li>1 - outbuilding</li> <li>2 - complex building (ski school, cafe, WC, ski service, ticket office)</li> <li>3 - the lower lift station</li> <li>4 - stage for public events</li> <li>5 - ski zone</li> <li>6 - parking</li> </ul>	 <ul style="list-style-type: none"> <li>1 - main entrance</li> <li>2 - shops</li> <li>3 - parking</li> <li>4 - hotel &amp; restaurant</li> <li>5 - hotel</li> <li>6 - residential cottages</li> <li>7 - the lower lift station</li> <li>8 - WC</li> <li>9 - ski service &amp; medical room</li> <li>10 - restaurant</li> <li>11 - skating rink</li> <li>12 - hotel &amp; disco complex</li> <li>13 - restaurant</li> <li>14 - hotel &amp; spa complex</li> <li>15 - hotel</li> <li>16 - ski zone</li> </ul>
<b>At the level of general visual orientation in the space</b>	
 <p><b>Basic geometric characteristics of the forms:</b> prevailing horizontal plane; linear form of silhouette; single form which is completely subordinated to the landscape</p>	 <p><b>Basic geometric characteristics of the forms:</b> combination of vertical and horizontal planes; irregular form of silhouette; forms are located close to each other</p>
<b>At the level of perception of building fragments as the person approaches the object – the goal of motion</b>	
 <p><b>Size:</b> two and one-story building (3-6 m height)  <b>Scale:</b> structures correspond to human scale  <b>Proportions:</b> the length of the building far exceeds its height (20:1)</p>	 <p><b>Size:</b> one and three-story houses (3-12 m height)  <b>Scale:</b> structures correspond to human scale  <b>Proportions:</b> the buildings are proportional to a person</p>
<b>At the level of concentration of human attention on the object - goal</b>	
 <p><b>Color:</b> facade - natural color of yellow wood, roof - dark red  <b>Texture:</b> natural texture of the wooden polished timber  <b>Lighting:</b> the facade is well lit during the day</p>	 <p><b>Color:</b> facades - natural color of the wood and light beige, roof - dark brown and green  <b>Texture:</b> natural texture of wooden polished timber and some buildings are plastered  <b>Lighting:</b> the facades of most of the buildings are well lit during the day</p>



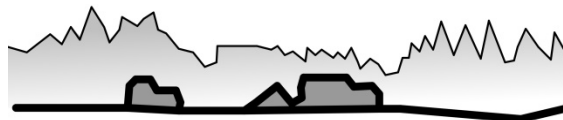
- Irregular contour of the silhouette, concentration of buildings in the development zone, multiplicity of composition;
- Stepped contour of the silhouette; fragmentation of buildings on the territory of the complex; multiplicity of composition;
- Irregular contour of the silhouette; the buildings are located on both sides of the ski route
- Linear silhouette with one focus - the lower lift station
- Linear horizontal silhouette - one solid building.



A - Irregular contour of the silhouette; concentration of buildings in the development zone; multiplicity of composition



B - Stepped contour of the silhouette; fragmentation of buildings on the territory of the complex; multiplicity of composition



C - Irregular contour of the silhouette; the buildings are located on both sides of the ski route



D - Linear silhouette with one focus - the lower lift station



E - Linear horizontal silhouette - one solid building

Figure 1. Perception at the level of general visual orientation in the space - characteristic of building silhouette (silhouette contour, planes). Source: Onufriv Y.

At the level of building fragments perception as a person approaches to the object - the objectives of the movement were determined by the characteristics of the overall size, scale and proportions of buildings in ski complexes. In the analyzed ski complexes, the small and medium-storey buildings (from 1 to 3 floors) dominate (Fig. 2). Buildings are located both separately and blocked, and there are also integrated complexes, where in

one building all the facilities are located. It should be noted that the larger 2-3-storey buildings are perceived holistically in a complex with nearby located one-story smaller buildings due to the application of horizontal and vertical divisions of the facades (roofs and walls). Such a horizontal and vertical division of buildings visually divides the plane of the facades into smaller elements, which in turn makes these buildings closer to the observer's scale. In most of the analyzed examples, the buildings were compact in size, except for one ski resort (Fig. 2C), where the length of the building was significantly (approximately 20 times) higher than the height. To improve the perception of the complex, architects used the reception of a variable surface, adding another floor not along the entire length of the structure, but in two places - in the middle and on the right edge (if you look from the mountain). This solution added a variety of facades with a closer perception of the construction as the skier approaches it. In several ski complexes the buildings were arranged in such a way that for a skier who is skiing downhill and approaches the lower lift station, they are not visible at all because they are inscribed into the slope of the mountain and accordingly the entrance to them is carried out from the lower slope terrace. In order to see this building a skier needs to go down, take off his ski and get closer, where in fact the observer fully focuses his attention on this building.

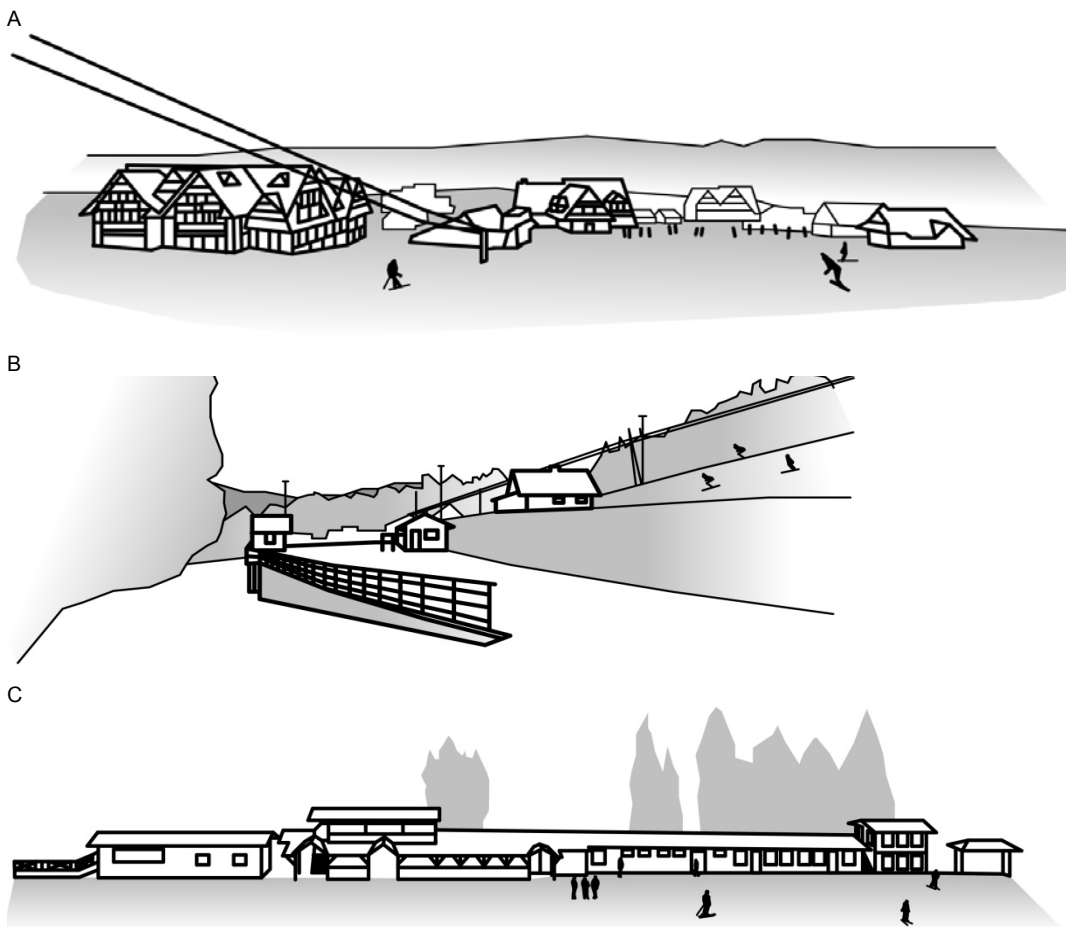


Figure 2. Perception at the level of building fragments as the person approaches the object - the goal of motion - characteristic of size, scale and proportions of the building: A - semidetached and separately located three-story houses (3-10 m height), which correspond to human scale due to horizontal division on the facades; B - separately located one-story houses (3-4 m height), which correspond to human scale; C - single building with variable storeys (3-6 m height), which corresponds to human scale; the length of the building far exceeds its height (20:1). Source: Onufriv Y.

At the level of focusing the person's attention on the object – goal the color, texture and illumination of the buildings facades were characterized. In most of the analyzed ski complexes natural materials are used in paved facades, namely: solid wooden beams, wooden panels, natural stone, brick, etc. The use of natural materials, in particular wood, forms the appropriate texture of the buildings: the natural texture of wood polished timber. Sometimes there is a combination of natural and artificial materials that have different texture and color, perceived disharmoniously (bright metal tiles and wooden timber walls). Lower lift stations made of metal structures are placed either separately or in combination with other structures. There are also different types of coverage of lower stations: pyramidal roofs are covered with metal tiles, flat metal-plastic or glass coverings. The illumination of buildings depends on their orientation towards the sun, the placement on the slope and the steepness of the slope. Most buildings in the complex are well-insulated except for individual facades of buildings.

## 5. CONCLUSIONS

Defined architectural and compositional techniques are typical for small and medium-sized ski complexes. Large and very large complexes are more complex objects, since the development zone in such complexes occupies much larger areas and buildings have bigger scale.

In addition, it should be noted that the identified typical architectural and compositional techniques do not cover all possible techniques that are used in the design of ski complexes of small and medium capacity. Therefore, further study of this problem is needed, with more examples of design and implementing practice of this type of complexes.

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