Abstract. The paper discusses the following problem: How can digital technology are integrated with urban composition teaching to provide a better understanding of the aesthetical and emotional aspects of the city? It argues for the current need for an integration of computer modelling and the approaches developed form the work of K. Lynch, G. Cullen, R. Krier, and F. Ching. The paper is based on the experience in design studio teaching and an experiment completed with students. The exercise shows the students that different spatial organization may cause different emotions according to the treatment of space-defining elements. The paper presents the background and context as well as describes the experimental environment and the student work.

Keywords. urban composition, serial vision, computer animation.

INTRODUCTION
“Formal and functional analyses do not eliminate the need to consider scale, proportion, dimension and level. (...) The relationship between the whole and the parts is bound up with general and well-known categories such as those of anaphora, metonymy and metaphor...” (Lefebre, 1991, p. 158) A city plan is not only about an optimal distribution of different functions. Designing of a city is a complex activity in which the designer should analyse and take into consideration ecological, sociological, economical or even political aspects. But quite often one forgets that an important piece of knowledge that makes it possible to reach the “good city form” is the knowledge of the urban composition - notion of harmony, proportion, rhythm and other compositional principles. We would like to look at the urban forms as a composition of physical elements and as a mental image. In our pedagogical approach we would like to go back to the roots of urban design and show students how important the compositional principles are.

Since Vitruvius, the architects were interested in the urban landscape. In this paper, we take an interest in the creation of the urban landscape by using computer media. This approach is a part of a more general discussion focusing on the question - How to introduce CAD software into the process of urban composition teaching? How can technology be integrated with urban design to provide a better (deeper) understanding of aesthetic and emotional aspects of city creation and perception? This paper argues for the current need for an integration of computer modelling and the approaches developed from the work of R. Krier, K. Lynch, G. Cullen, and F. Ching.
In this paper an experiment which helps students understand the basic principles of urban composition is presented. The paper consists of four parts. The first part concerns the urban background. As the start point, the definition of an urban space and its main structural elements are discussed in the context of its usefulness in the process of creating abstract digital urban environments and the possibilities for computer usage. In the second part, different inspirations for the proposed teaching method are presented, followed by a description of the experimental environment (a database of spatial elements and procedures of creation) in the third part. In the fourth part, students’ work is presented and discussed. In the conclusion we discuss the results and propose a plan for future research.

**URBAN BACKGROUND**

Since the dawn of time, a city has been a special space enabling its inhabitants to define their relationships with the world and outer space. A city is the man's point of reference. A city in its historical development has formed a characteristic model related to the hierarchical structure of spaces. A city enables its inhabitants to realize social behaviours through their partnership in urban life. People are attracted to cities by an appealing offer of urban buildings and public spaces as well as some characteristic features of the identity of an urban space (especially readable in the oldest fragments of cities), such as the beauty and the unique atmosphere of urban complexes with a centuries-old history. The standard of living in a city depends on the harmonious shaping of all the elements that constitute an urban living environment. The public spaces in a city – squares, streets, parks, beaches, boulevards – are commonly accessible places, remembered from the past and their characteristic atmosphere is attracting both the city dwellers and strangers for various meetings and contacts. Public space has been the arena for everyday life of urban communities, people’s meeting place throughout the centuries. (Fig. 1.) Public space and buildings make an unusually attractive offer for everyday life. Only knowledge of the theory of urban composition will make it possible to reach the “good city form”. Since buildings are perceived at different distances - on the skyline, down the street, across the square, or close to eye level and people walking about, their visual impact needs consideration.

Humans walk about receiving lots of raw sensory information and their brains use this information in order to build a model of the world that they may use to predict and exploit the environment. The path of our movement can be conceived as the perceptual thread that links different interior and exterior spaces together. All paths of movement or of people

*Figure 1*
The old Polish cities: Wroclaw and Kalisz.
are linear in nature. Linear composition can be characterised by interrelations between spatial forms (solid planes and space between them) and by time and movement. The sequence of elements making up the spatial configuration of urban assumption is a sequence of spatial pictures which we perceive as we get to know a part of the entire configuration. It is a perfect embodiment of Sequence as a certain type of architectural story. As Ching said – “Since we move in Time through a Sequence of Spaces we experience a space in relation to where we’ve been and where we anticipate going”. (2007, p. 240)

The concept of a sequence of spatial pictures – the “serial vision”, which defines the urban landscape as a series of related spaces was created by Gordon Cullen’s in “The Concise Townscape”, first published in 1961. Serial visions are a drama of juxtapositions that come alive when we walk down the street and experience the contrasts between, for instance, the street and the courtyard, light and darkness etc. Having two contrasting pictures in mind “a vivid contrast is felt and the town becomes visible in a deeper sense. It comes alive through the drama of juxtapositions. Unless this happens the town will slip past us featureless and inert” (Cullen, 1961, p.8)

Cullen has analysed the perception of the city by studying of how pedestrians moved around. The dynamic perception was Venturi’s area of interest, too. He was interested in the way people experience the city by moving through it. Las Vegas is a car based city, so the conception of the moving eye in the moving body was essential to their work. In Las Vegas the average speed was around 35 miles per hour (rather than 3), and this determined the work, both in regard to the themes mapped and the relationships between them. (Venturi, 2000)

**INSPIRATIONS**

Many researchers stress the importance of model implementation in design teaching. H. Kramel has written: “Particularly promising seems to be the models role in education. The model could serve as a kind of library integrating present and future research.” (Kramel, 1995, p. 4) Creating a 3D geometric urban model is essential to an urban visualization system. In our approaches we decided to elaborate a library of patterns (blocks) making it possible to play with these elements while creating the city. We found several inspirations when researching the idea of experimental city space designing. (Fig. 2.) The first of the inspirations were LEGO plates, which allow the creation of a city grid. The second one was the mock-up of “futuristic Brussels”, which was the result of the workshop at Hogeschoole voor Wetenschaap & Kunst in Brussels a few years ago. The city centre was divided into squares and each of them was redesigned by a group of students. These blocks were then connected and as a result a new version of the Brussels city centre was achieved. The third inspiration was R. Krier’s book “Urban Space” and his view that “in our modern cities we have lost sight of the traditional understanding of urban space”. (1993, p.15) It includes a comprehensive analysis of significant urban spaces in different cities throughout Europe. Krier breaks down urban space into two basic elements – the street and the square. According to Krier, man first discovered urban space in a square which was developed by grouping houses around a courtyard for security reasons. He shows that the urban spaces in Europe have three main forms: square, circular or triangular. Each may be twisted, divided, added to others, penetrated, overlapped or alienated. They are framed by facades, which in turn can take many forms from solid, unrelieved masonry, through masonry with openings of various kinds: windows, doors, arcades, colonnades, to facades which are entirely glazed. Krier has sketched a series of basic square shapes. This selection of shapes is not complete, as the Krier himself said, but indicates that urban designers “must incorporate spatial considerations more exactly into their overall view of architecture and town planning. Such considerations have in fact been criminally neglected.” (1993, p. 30)

Work by Krier focuses on understanding the relationships between individual pieces of architecture
and the city. Using his theories, a city can be generated with different shapes. The fourth inspiration is a thesis that we create the space around us in a kinetic way, and our body's moving plays an important role in this process. A non-moving person can’t perceive space or geometry. In fact, when we describe locations of objects, we imagine movements which would be performed to touch these objects.

EXPERIMENTAL ENVIRONMENT OVERVIEW

A living city is made up of parts, but the problem is the choice of which components of a complex city system are important. We have decided that a city will be examined as a collection of paths guided by buildings and as set of spaces connected by paths and reinforced by buildings (Salingaros, 2005). Following K. Lynch and R. Krier we have described a city as the network consisting of nodes (squares) and edges (streets) (Krier 1993, Lynch 1960).

The most widespread design method used for structuring of a city is the orthogonal grid. It is significant in urban design because it appears in the whole verticum of urban history. The orthogonal structure was used not only as a form, but also as a method of establishing an urban system. In our exercise we use the grid system because of its simplicity and great flexibility.

The first step was the decision concerning the type of the urban grid. Initially we considered a simple grid - system of parallel lines on modular distance. Analysis of the block set created by Krier shows that we need gaps between separate blocks. Simple block connections are impossible due to different possible positions of the street starting from the square. We decide to use a tartan grid - system of parallel lines using two alternating modules of different size. This makes it possible to create a space for the placement of “connectors” between each of the pattern “blocks”. The connectors are forms (buildings) which help connect different blocks. After analysis of various European squares we have decided that the size of the grid will be 200 x 200 m and the gap size – 100 m.

Secondly, we have created the set of blocks with squares and streets. It was based on the series of spatial forms sketched by Krier. As a result, we have prepared the database, consisting of the main matrix (3 x 3 grid spaces) and 42 preliminary square models. (Fig. 3.) The size of the matrix is 800 x 800 m, squares size are between 50 to 70 m in each direction, i.e. square sizes of 50 x 50 m, 50 x 70 m or 70 x 70 m are possible. The height of the buildings is 10 m. The street’s width (the distance between buildings walls) range from 10 to 30 m. Cinema 4D was the software of choice for modelling.

THE INITIAL INFORMATION FOR STUDENTS’ WORK

The students’ task was to compose a “city” using the provided blocks. But they were allowed to change the buildings height or add individual elements, such as colonnades, arches, sculptures, etc. They built different
city spaces with different emotional values and of varied durations and intensity. Creative space articulation is the most important aspect of urban design. In the traditional approach the visual elements of a street, including the road, adjoining buildings, street furniture, trees or open spaces, are combined to form the street’s character. In our exercise we asked the students to create completely abstract spaces with no relation to the real city space. Abstract spaces have no function other than evoking emotions. The forms are more poetic and metaphoric. In our experiment we have decided to concentrate on abstract spaces, as in order to create sequences of urban spaces, we should start our work from more abstract concepts. (Hillier, 1996) As an inspiration we collected a set of impressionistic video clips from YouTube, such as: “Short story about the man with a suitcase who leaves impartment signs during his hike across Warsaw”, “Enigma Warsaw - city game for everybody”, “Global Vision China Shanghai City impression”, “Light Show at Las Vegas Downtown”, or “Las Vegas Strip at Night May 2010”.

At the beginning the concept of emotional values in spatial constructs was analysed and justified in the proposed implementation. Public spaces around the world are like diaries of each country and its people: they remind of revolutions, celebrations, mourning, entertainment, etc. We have decided to split these spaces into three types based on their value: monumental, cosy and dynamic, each having a different function: celebration, contemplation or action respectively.

Monumental space had been a central feature of the most historical squares. How does a monumental space become visible? Monumental can be described as very large, massive, enduring, historically notable, important, and colossal. At the same time any work of art of grandeur and simplicity may be called “monumental”, regardless of its size, although it often connotes great size.

Cosy space is an exact opposite. It may be defined as: warm and snug; intimate, friendly; having or fostering a warm or friendly and informal

![Preliminary square models.](image-url)
Cosy space may be described as silence, charm and softness. Dynamic can be defined as relating to energy or to objects in motion; characterized by continuous change; marked by intensity and vigour; forceful; relating to variation of intensity. Dynamic space is the space in which one's eye vision is in motion because of the size of the forms or their expressive shapes.

Of course, city spaces often cannot be defined conclusively. On the contrary, they can use a mix of aforementioned types. As a means to highlight these types, their parameters can be altered. This can be done, for example, by amending the elevation colour and texture, using different colour of lights and changing the light's parameters, such as colour, visibility or time of lighting. While modelling a harmonic city space the students should use artistic principles such as: proportion, order, hierarchy, scale, balance, contrast, rhythm, detail, colour and texture.

Creating an abstract space is based on the students' own experiences, memories and expresses their emotions. In fact, they created “their own places”. The difference between a space and a place is a problem discussed in many works. In short, we may describe the difference between the two as follows. A space is an objective being and may be measured by objective parameters. A place is a metaphysical being determined by images and emotions. Lefebre searched for reconciliation between a mental space and a real space. He moved from metaphysical and ideological considerations of the meaning of space to its experience in the everyday life of city. (Lefebre, 1991) One of the most important factors in urban design is making a connection between people and places.

**MODEL PREPARATION**

1. The students selected three square models and put them into the plate with the grid. The separate squares could be arranged in any of the nine possibilities and placed in one line or in a zigzag.

2. The students created the model, consisting of the three squares and any appropriate streets, according to the exercise description. (Fig. 4.)

3. When model was finished, the students were asked to complete a photographic survey of the “city”. This was done as a set of renderings (10 intervals in which 4 photographs were taken). (Fig. 5.) The inspiration for this approach was Cullen’s concept of “serial vision”, which defines the urban landscape as series of related spaces. (Cullen 1970)

4. The next step was preparing the animation. As the best cities are the ones that elevate the experience of the pedestrian while minimizing the dominance of cars, the students were asked to prepare two animations. The first animation was a view from a moving car with a speed of about 30 km/h. The second was from a man’s
point of view with a man's speed of moving (approximately 5 km/h). In the first case the animation lasted 2 minutes (2400 frames) and in the second - 12 minutes (14400 frames). Due to the long calculation time we used Cinema 4D NetRender module and created the movie in a small resolution (640 x 480 pixels).

5. Students were then invited to submit short design statements with their proposals in which they explained the design idea and principles behind it, as well as provided explanations on compositional matters, e.g. why is the corner of this building curved?; is the entrance clear?; is it the right height and form for this particular square and street?; etc.

**FUTURE RESEARCH**

In the old days the main parameters of path were its distance (km) and speed (km/h). Nowadays, when we prepare an animation of a digitally created space we measure the distance in frames and the speed in the numbers of frames per second. As a result the main parameter of perception is not distance but time. We go back to the time when the answer to “How far is to ...?” was - “two days’ journey”. In animation we observe the time acceleration which is determined by “real-time” actions, which are undertaken in the digital space in “real time”. There is no, typical for any human being, time for reflection. Animation as a tool for urban spaces presentation seems inadequate. The

![Figure 5](The models of the squares.)
path of perception is determined. The speed of the sequence of visual images doesn’t give us the possibility to stop at any moment and think about what we see. We have to seek the solution to this problem and decide what tools to use for future research in the immersive virtual environment. In traditional simple computer animations the viewer is “outside the space”, they are just an onlooker. In VR models they are “in the space”, they become active participants in the space. The perception process becomes dynamic and the onlooker’s emotional engagement increases. It is possible now to convey the emotional message of the designed spaces more precisely. This helps to better understand the relations between composition elements as well as their influence on emotions. Therefore, we are planning an experiment using the Cave Automatic Virtual Environment (CAVE) in order to analyse the strengths and weaknesses of the virtual realm.

CONCLUSION
We propose a new computing approach in urban composition teaching. Modelling an “abstract city” provides the students with the knowledge about compositional principles. At the same time this approach allows to explore the possible cohesiveness between the physical urban space and the urban place. Our exercise provides an understanding of how emotional places can be created. Created model permits the evaluation of space-based emotions. Each street and square ought to be analyzed by means of “space categories” and “emotional values”. Space denotes the three-dimensional organization of the elements which make up the place. The emotional value denotes the “atmosphere”, the feelings which are an inherent property of any place.

The new digital media for modelling urban forms give us new possibilities but at the same time create new problems. Thanks to the new information technology we have a chance to change the process of thinking about city shape creation. The attention focused on exploring the possibilities that are characteristic for computers and not available with traditional modelling methods. One of the important aspects is dynamic perception. Men – observers of the city – are inside a space. In this space they experience sequences of the form in an established order. Static picture of a city isn’t equal to the reality. Real perception of a city needs to consider the time factor. When we compared the different speed of men’s movement, we observed that the speed influences the perception of digitally created spaces. Speed becomes a factor, which influences the form and scale of signs, symbols, and spaces.

Considering the problem of the truthfulness of computer animations, we have observed a discrepancy between walk-through movies and the real perception of the urban space. There are two aspects of this phenomenon. One aspect concerns the duration of the animation, the second is a number of details which observer needs for understanding and remembering the perceived space.

Animation time with the car speed is about 2 minutes. Walk-through animation requires 12 minutes. When students prepared the walk-through animations they observed that they were too long and that nothing interesting was happening. Moreover, they said that watching such long movies was unbearable. The reason for this is the lack of details.

Another aspect of the truthfulness of dynamic images perception is the linear character of the movie, whereby the pictures produced by the camera become the material for the director’s argumentation. Through the pictures, the movie leads spectators to the director’s conclusions, director’s truths. That’s why in future research we plan to use an immersive virtual environment where the observer may decide about the speed and direction of their movement.

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