

Eötvös Loránd University  
Faculty of Education and Psychology

EDIT LIPPAI

Legible School – environmental psychological  
analysis of learning environments

PHD THESIS BOOKLET

2014

Doctoral School: Eötvös Loránd University  
Faculty of Education and Psychology  
Doctoral School of Psychology

Head of School: **Prof. Dr. György Hunyady**

Doctoral program: Behavioral Psychology Program

Head of program: **Prof. Dr. Éva Bányai**

Supervisor: **Dr. Andrea Dúll**

## **Introduction: the subject of the research**

Analyses presented in the dissertation were inspired by the institution that serves as **a scene of learning**, which in the environmental psychology literature is referred to as **educational environment** (Dúll, 2007). Schools can be interpreted as one of the institutional places of socialization, since beyond knowledge transmission they serve for learning social norms.

Schools are special spaces as they represent **meeting interfaces** between families and society, signified by a cross-section of various user groups, where **requirements of the homes and the society**, classic values and actual needs coexist – and in an ideal case, when rhyming to each other in the environment, they **shape the future generation**. In the dissertation I was seeking for answer to the question, whether legibility (see below) is included in those sociophysical features of the environment, which (compared to the original macro level) at mezzo level supports more efficient (in this case school) use of environment. Legibility, as elaborated on later was introduced by Kevin Lynch as follows: **legibility is the measure of the easiness with which features of an environment are recognizable and with which they can be organized into clear and uniform patterns**. (Lynch, 1960). The term typically applies to describing large spaces, and its application in environmental psychology often occurs. In order to conceptualize legibility for mezzo environments, I applied the environmental psychology approach and methodology.

## **Legibility**

The term legibility was introduced by the American architect Lynch with the purpose of explaining orientation in urban environments. According to the original concept, legible spaces are those, in which users find it easy to orientate themselves, and of which they can easily sketch a **cognitive map**. Mental or cognitive maps are individual, simplified and distorted interpretation of a geographical location or certain details of that. (Downs, Stea, 1977)

In brief, the perceivable, characteristic physical elements of the mental image of the city can be clustered in the following system (Lynch, 1960):

**Paths:** pathways, roads, pavements, avenues, channels – along which traffic goes in the city, therefore these structures organize the mental image of the city. **In a school, these can be:** corridors, alleys and paths in the schoolyard, desks, canteen tables, etc.

**Edges:** angles, margins, side-lines, edges, riverbanks or lakeshores, walls, borders of new construction sites - linear elements that do not serve as pathways. They are less like a coordination axis as paths, yet they orientate people, and create cohesion between elements. **In a school, these can be:** parapets, hedges, etc.

**Districts:** districts, sectors, parts of the city – these create the base of the city. They are distinct, recognisable medium or large places. **In a school, these can be:** alas, certain parts of the schoolyard, sports fields, etc.

**Nodes:** crossroads, forks, assemblies, plazas, places – the strategic centres of the city, where structures (for example roads) meet and change to one another. **In a school, these can be:** assembly halls, staffrooms, meeting rooms, coffee machines, canteens.

**Landmarks:** land objects, buildings, graphic signs, geographical features – there are many landmarks in a city. These are important keys in identifying the city as well as orientating people, while many of them become a symbol for the city (as Eiffel Tower). **In a school these can be:** entrances, sculptures, fountains, etc.

Lynch claimed that when designing or redesigning built environments, the base of this work should be the image that is formed from the key elements listed above. Thus the mental map based on daily experience and impressions of environment users can become the basis of conscious construction of the environmental.

### **Theoretical outline: the environmental psychology approach**

Environmental psychology examines phenomena with the prediction that both physical and psychological-social aspects coexist in the environment (see Dúll, 2009), operating in an inseparable unit, therefore it exceeds both the traditional definition of environments and the traditional approach of psychology. When making inquiries about human nature,

environmental psychologists study how people react to the condition of their physical environment, and how they use their environment to fulfil their needs. (Holahan, 1982).

Environmental psychology not only considers the activity of the environment users at the ordinary daily activities, but since its apparition, it has been fostering inclusion of users into the planning process; the idea of **participation** (participative planning or partnership in planning) appears already in the literature of the 70's. (Porteous, 1971).

Although environmental psychology broadens the traditional approach of psychology with the physical aspect of environments, basically it reveals the psychological processes induced by the environment, while searching for rules that enrich the knowledge of human nature in general. Research in environmental psychology focuses on interconnection between spatial elements and behaviour, but beyond these investigations, it is continuously recognising and communicating the relevance of learning about psychic processes for every expert dealing with the environment, for instance architects. (Krupat, 1985).

The simplest definition of **environmental psychology** is that it is the study of individuals and their sociophysical (Dúll, 1998) environment. (Dúll, 2009) Its approach to environment therefore is broader than that of general psychology, ergonomics or social psychology, because it **includes the physical, psychological and social aspects of the environment in a single unit**.

### **Preliminary research on topic: Educating Spaces**

This project established an opportunity for an expert work and on-the-spot investigation, the interdisciplinarity of which inspired representatives of professions (teachers, architects, landscape designers, psychologists) involved to create publications presenting results and methods, which resulted in a practice-based recommendation book and a handbook. In Hungary, the intense transdisciplinary exchange was without predecessors, and can be envisioned as one of the most valuable „product” of the project. In schools linked to the project, we conducted on-the-spot investigations with photos. Partly thanks to the project, we gained an interdisciplinary overview of the role of exemplary schools recommended by the Hungarian Institute for Educational Research and Development as well as development projects in shaping school environments. As this work represents the precursor and basis for the key part of the dissertation, in the following section I give an outline of the most important moments of the project Educating Spaces.

## **The background of Educating Spaces and the environmental psychology approach**

The research presented in the dissertation is an environmental psychology “metaresearch” of one of my previous assignments, which was part of a school infrastructure development project called Educating Spaces (<http://tanitoter.ofi.hu>). Educating Spaces was funded by the project “21<sup>st</sup> Century Public Education: development, coordination” (No. 3.1.1-08/1-2008-0002) within the framework of the Social Renewal Operative Program, hosted by the Hungarian Institute for Educational Research and Development. The project lasted about three years, from 2009 to 2011, and was led by Attila Varga.

Two researchers were involved in the professional implementation: Mónika Réti was representing the sustainability and pedagogy approach, while myself the environmental psychology approach. My task in the program included editing a blueprint with recommendations about school environments for maintainers (mainly local government officers) and school principals.

**In Hungary, before Educating Spaces started in 2009, there has not been any attempt to prepare neither a concise theoretical work, nor a practice-orientated collection of recommendations, which (1) applied environmental psychology (2) initiated collaboration between experts involved in creating, shaping and using school environments.** Research was partially meant to bridge this gap, since, besides including environmental psychology, it created opportunities for exchange between several stakeholder groups (including teachers, architects, psychologists and educational policy-makers) about the possibilities to improve school infrastructure.

Results of this include (Lippai, 2011)

- transdisciplinary expert dialogues between representatives of stakeholder groups (teachers, architects, landscape designers and psychologists);
- underlining the state of the art and opportunities for participative planning in Hungary;
- establishing a systemic approach to the development of educational buildings;
- continuous communication of results and participative approach to both experts and wider public via printed, electronic and social media;
- prepared a research-based quality criteria framework for educational environments.

From all these points it is legibility that I highlight here, which is the most important concept for me both in connection with Educating Spaces project and the research presented in the thesis. I elaborate on the definition of and the environmental psychological approach to legibility when introducing that research; here I only emphasise that legibility as a criterion in the quality criteria framework of Educating Spaces project included the presentation and learnability of school building as well as the quality of orientation within. This criterion referred to a clear, simple and easy-to-remember spatial division, which lead to a clear mental representation. Continuous communication with future users as well as teaching them how to use the building are certainly essential for this, as we describe it in a paper with Mónika Réti. (Réti, Lippai, 2012) **The program** due to the environmental psychology approach therefore **included legibility in the set of criteria for the development of educational environment in Hungary**, the deeper analysis of which is the subject of the present thesis.

### **Summary of aims of analysis**

The research presented in the thesis was accompanied by the idea that engaging in the improvement of school environment establishes better environmental conditions for future generations; therefore it is needed to examine possible future scenarios of learning environments.

The main aim of this in the scope of my own research was to reveal the points underlying decisions in school development programs, since application of environmental psychology results will be possible along these visions of planning and the shaping of learning environments depends on concepts of the development.

I considered legibility as an environmental psychological background factor; and although the deeper exposition of it requires complex methodology, but **in general it can contribute to strengthening and emphasizing key elements of well-operating learning environment and to better organization of spaces in schools** (for detailed description of key elements see page 1-2). During on-the-spot investigation, I observed the intention for this in users of learning environments, which lead to the preliminary survey of the research of reflecting on images of legible learning environments aiming at revealing the preferences of legible environments. In the pre-research, I made inquiries about what concepts users link to legibility, which contributed to better understanding of the nature of this preference.

The overall aim of the dissertation was **to conceptualize and operationalize legibility in order to use that in mezzo-spaces**. Although the idea itself originated in examining school environments, the result takes environmental psychology closer to relevant application of legibility even in cities, public places or small-scale spaces too.

My research is rooted in practice, linking my ten-year experience as a psychologist and a teacher working in educational environment to the environmental psychology approach. I hope that the results will support creating school environments that provide all school users with direct or indirect benefits and will lead to creating a positive attitude in them towards learning arenas. The target of the work presented in the dissertation is therefore to communicate the value of environmental psychology in this otherwise rich and living design process.

### **Impressions about legibility in field investigations in Educating Spaces**

While analysing photo documentation of participating schools during field investigation within Educating Spaces project, I observed that the “exemplary schools” of Educating Spaces (the selection criteria of which is described later) “instinctively” applied environmental elements, which increased legibility. For example, they used various materials for surfaces to indicate paths, they emphasised edges by putting flowers on them, or marked districts by using different coloured curtains or various symbols, they created nodes by separating spaces, or used landmarks to highlight the characteristics of the environment. Via interviews with teachers, on-the-spot observations and photo analysis, it became clear that this user behaviour (emphasising key elements of legibility) originates in the processes of pedagogical practice without conscious, systemic concepts of environmental design – yet educational institutions with different opportunities found similar solutions.

This instinctive transformation of the environment imposed the question for me, whether legibility can be defined in mezzo and micro environments; if it could be increased by interventions in the environment (here I add that these are not necessarily costly); and if individuals prefer places where legibility is present at a higher degree.

## **Field work and pre-research leading to hypotheses**

In my pre-research an expert group (including Andrea Dúll environmental psychologist, Mónika Réti teacher and Edit Lippai psychologist and teacher) selected the images from photos taken during on-the-spot investigations (572 images), which corresponded to categorise of legible and non-legible environments. Only images where the opinion of the three experts coincided about legibility were selected in a specific group. The criteria for the legibility of images of spaces were: clear and visible Lynch's key elements (path, edge, district, node, landmarks) can be identified on them. The criteria for the non-legible images were: hectic, with non or barely identifiable key elements of legibility according to Lynch (path, edge, district, node, landmark). The pre-research survey contained 11 images of both categories each.

In order to have a larger quantity and diversity of responders, the survey was distributed via snowball method using the web page and mailing list of project partners (for example the Hungarian Research Teachers' Association, [www.kuttanar.hu](http://www.kuttanar.hu)) and on the platform of an online game (Thrillion's Treasures, [www.tk2.hu](http://www.tk2.hu), which no longer exist). The responders were mainly secondary school students, who provided no personal information about themselves. Responses were in all cases anonymous and voluntary.

The survey was available for responses at the site <https://www.emailmeform.com> between 27/11/2010 and 19/12/2010, but still can be viewed at: <http://www.emailmeform.com/builder/form/Ee9dfwnAsZ7O1aTXP2Kh>. Data was processed using Excel and SPSS software.

Based on pre-research results, responders had a preference for images of legible environments to non-legible ones ( $m$  (legible environments) = 0,622;  $p=0,05$ ,  $N=430$ ), therefore based on this research we can state that 62.2% of responders preferred legible school environments ( $N = 430$ ;  $m$  (entire sample) = 0,473;  $d = 0,499$ ). Preference for legibility showed no differences to the whole samples in either responder categories (gender, age, education), and subjects preferred legible environments in the cases of exterior and interior spaces too.

Although we concluded that there is a preference for legible places, but it did not result in a better understanding of the nature of this preference. Further reflection on the experiences of field work and the pre-research results lead to formulating hypotheses, the verification of which is the aim of the research presented in the dissertation.

## Questions and hypotheses

1. Which values and contents are represented in the descriptions of legible mezzo environments?

**Hypothesis 1: In the description of legible mezzo environments, characteristics of perspicuity and good orientation along with key elements according to Lynch are present.**

It can be supposed that in the descriptions of legible mezzo environments the key elements of legibility, namely paths, edges, districts, nodes and landmarks are well represented as well as contents referring to good orientation, perspicuity and order.

2. Which values and contents are represented in the description of legible mezzo environments by using pairs of adjectives?

**Hypothesis 2: In the description of legible mezzo environments by using pairs of adjectives there is a greater likelihood of representation of adjectives referring to perspicuity and good orientation.**

It can be supposed, that when describing legible mezzo environments using pairs of adjectives, adjectives referring to perspicuity, good orientation, order, cleanliness, clarity are more likely to occur, and responders couple contents with these images that are listed as positive characteristics in the Environmental Semantic Difference Scale.

3. Do responders have a preference for images of legible mezzo environments?

**Hypothesis 3: Responders prefer legible learning scenes to non-legible ones.**

Supposing that findings in school environments are correct, both content analysis and findings of adjective pairs of the Environmental Semantic Scale will show that responders appreciate the image of legible mezzo environments. In order to conceptualize the term, it is important to clarify if legibility appears as a value. We can suppose that in forced choice, responders make no significant differences between legible environments.

## Methods

The survey contained 8 images chosen by consequences of pre-research findings; significantly ( $p < 0,05$ ) preferred legible images and significantly less preferred legible images were included in the survey. Descriptions of images were analysed using Atlas.ti content analysis software. We considered quantitative data those, which were manifest text elements identified and countable by the program. (Ehmann, 2002) I also visualised findings by word clouds (Wordle.net). Pairs of adjectives were chosen from items of Environmental Semantic Differential Scale (Dúll, Urbán, 1997), in accordance with my supervisor. The 7 elements linked to the content of the definition of legibility were selected from the 36 pairs of adjectives in Environmental Semantic Differential Scale. In this work phase, my supervisor collaborated with me in the selection. The eight item on the list, the school-adult adjective pair served as a filter: by this I counter-checked how much it is perceivable in the images that the photos were taken in a school environment.

Adjective pairs used in sampling:

RELAXING	o o o o o o o o	IRRITATING
COSY	o o o o o o o o	STRANGE
SIMPLE	o o o o o o o o	DIFFICULT
ORDERED	o o o o o o o o	DISORDERED
EXCITING	o o o o o o o o	BORING
DARK	o o o o o o o o	CLEAR
CHARACTERISTIC	o o o o o o o o	DULL
SCHOOL-LIKE	o o o o o o o o	ADULT-LIKE

Table 1: Adjective pairs in the survey (source: Dúll, Urbán, 1997)

## The survey

The survey took place in the spring of 2014 with 947 people. Responses in all cases were online, voluntary and anonymous. The link of the survey was distributed in collaboration with partners in Educating Spaces project, via mailing lists, professional community sites and newsletters. The survey was available at <https://esurv.org> between 30/03/2014 and 22/04/2014, but is still available at: [http://esurv.org/online-survey.php?surveyID=OBILJF\\_674a320a&u=phd\\_survey](http://esurv.org/online-survey.php?surveyID=OBILJF_674a320a&u=phd_survey)

Due to environmental psychology implications, the sampling methods followed the following order:

1. Recording basic demographic data (gender, age, habitation).
2. Reflecting on own actual environment using items of Environmental semantic Differential Scale, This partly served as a psyching up since it invited responders to **focus on environment** and to consciously examine it (looking around), and partly it was meant to validate if the responses were consequent in the survey. I supposed that if I compare the results with those responses to images, they will not be random (which is a danger with anonymous online questionnaires).
3. In the next step, subjects saw images, which they were supposed to describe by own words, **freely**, without limitation of volume.
4. Images appeared in another order, and subjects were required to describe them by **given adjective pairs** (items of Environmental Semantic Differential Scale).
5. Finally, images appeared in pairs, and subjects had to choose one of these. The only way to proceed in the survey was to indicate preference this way. In this section, each image appeared twice, each time coupled with a different image.

## **Descriptive statistics**

930 persons participated in the survey, the responses of whom provided valid data. According to descriptive statistics of SPSS, gender repartition was as follows: 531 (57.1%) female, 399 (42.9%) male.

As for habitation, 229 persons (24.6%) indicated Budapest, 416 persons (45.8%) a chief town of a county, 184 persons (19.8%) other cities, and 91 persons (9.8%) villages. In the sample persons from larger cities were overrepresented.

So as to expand age scale, primary (339 persons, 46.4%) and secondary (74 persons, 7.9%) school students were reached via newsletters to have an opportunity to contribute with a response to the survey, in a voluntary, anonymous and online way.

In the sample, the two largest groups were those of the primary school students and the adults, which is advantageous for the investigation, as it allows comparison between environmental preferences and coupled contents of children and adults. The repartition of education showed that the majority of responders between the ages of 13-18 were formed by 13-14 year children, who have not yet finished primary school and most likely live in chief towns of counties.

Sampling aimed to include other users of educational environments than students (teachers, 137 persons, 14.7%) as well as designers (architects, 26 persons, 2.8%). The reason for this was to compare attitudes, preferences and associations linked to those via a given (in this case school) environment.

## **Results**

Data procession was implemented using Excel and SPSS software packages.

The first question of the survey referred to the description using specifically selected and agreed elements of the Environmental Semantic Differential Scale of **the environment, where they were staying at the time of completing the questionnaire**. Comparing the scores for the responses (N=947) to the scores of the images in the other section, the nature of preference was outlined. Student pair t-probe was used for comparison and at 95% confidence

interval in all cases it showed significant correspondence ( $p < 0.000$ , see table 2<sup>1</sup>) except for the “student-adult” item ( $p = 0.263$ ).

		t	df	Sig. (2-tailed)
Pair 1	relaxed- prefrelaxed	5.893	865	.000 ( $p < 0,000$ )
Pair 2	relaxed - nonprefrelaxed	-20.118	865	.000 ( $p < 0,000$ )
Pair 3	cosy - prefcosy	-7.126	865	.000 ( $p < 0,000$ )
Pair 4	cosy - nonprefcosy	-17.966	865	.000 ( $p < 0,000$ )
Pair 5	simple - prefsimple	3.422	865	.000 ( $p < 0,000$ )
Pair 6	simple - nonprefsimple	4.385	865	.001 ( $p = 0,001$ )
Pair 7	ordered - prefordered	15.079	865	.000 ( $p < 0,000$ )
Pair 8	ordered - nonprefordered	-14.376	865	.000 ( $p < 0,000$ )
Pair 9	exciting - prefexciting	3.732	865	.000 ( $p < 0,000$ )
Pair 10	exciting - nonprefexciting	-7.273	865	.000 ( $p < 0,000$ )
Pair 11	dark - prefdark	9.045	865	.000 ( $p < 0,000$ )
Pair 12	dark - nonprefdark	37.511	865	.000 ( $p < 0,000$ )
Pair 13	characteristic - prefcharacteristic	2.625	865	.009 ( $p < 0,01$ )
Pair 14	characteristic - nonprefcharacteristic	-12.423	865	.000 ( $p < 0,000$ )
Pair 15	schoollike - prefschoollike	1.120	865	.263
Pair 16	schoollike - nonprefschoollike	9.110	865	.000 ( $p < 0,000$ )

Table 2: Nature of preference

Results show that concept structures in images and real environments show correspondence (except for one), therefore **the anonym, online test was not randomly filled in** by participating subjects.

The suitable method to examine the description patterns of reflecting on specific locations is multidimensional scaling, which allows to **seize the deeper, less conscious factors in subjects**, which influence their preference of location.

The own environments – described by subjects in the survey – as well as the averages of scores of eight different locations are as follows:

<sup>1</sup> The first adjectives (e.g. relaxing) mean the responses to the first question, the words marked with prefix (“pref”) refer to sum of responses to images above average preferred in the pre-research survey (Image01, image05, Image07, Image09, Image13), whereas the prefix “nonpref” indicate responses to under average preferred images in the pre-research survey (Image02, Image17, Image20) (for example nonprefrelaxed).

dim 2		dim 1	
1	OWN	,9407	-,4154
3	IMG01	,2549	,4972
5	IMG02	-1,7725	,1602
4	IMG05	,0978	,2568
8	IMG07	,8797	,1501
7	IMG09	1,3546	-,0272
2	IMG13	1,8827	-,1486
6	IMG17	-1,3925	-,4560
9	IMG20	-2,2453	-,0171

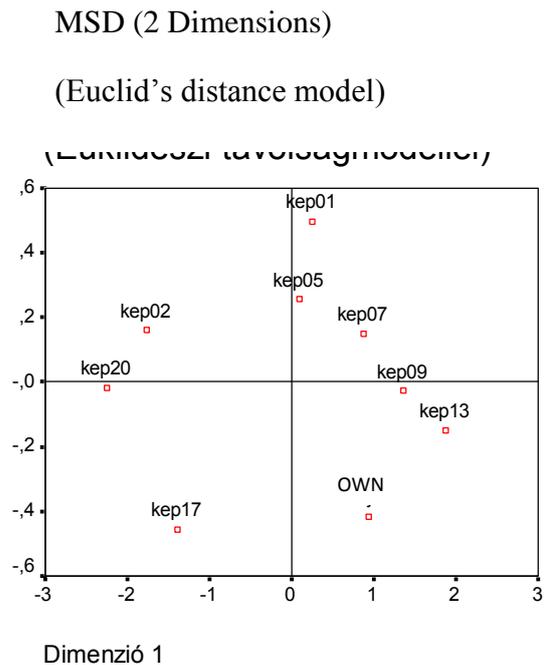


Figure 1: Pattern of places' preferences

The Euclid's distance two-dimension model (Figure 1) corresponds well (Stress = 0.01345; RSQ = 0.99929). **The non-referred images of the pre-research survey (Image02, Image20, Image17) formed a distinct group** (Dimension 2 axis). At the same time both the "own" and Image17 is distant from images preferred in the pre-research survey (Dimension 1 axis).

### Content analysis of description of images

Data procession (N=940; Number of words = 25299) was performed using Atlas.ti, partly by word counting, also represented in word clouds. In general, we claim the preferred legible environments were coupled with contents like **spacious, nice, ordered**, while non-preferred legible images we coupled with ones like narrow, cosy.

In the data of group responses (for group composition see in Descriptive statistics) it is observable that students described each preferred legible images as nice (487 persons, 2443 words, 893 types, TR=0.36), while the responses of teachers and architects showed a greater diversity: they described **the same images as spacious, ordered, pleasing**, etc. Architects differed from other groups in the aspect that they used negative contents (for example slushy,

arty) for preferred legible images, whereas they did not criticise non-preferred legible images as much as teachers and students did.

With regards to Lynch’s key elements, **only nodes** (191 occurrence) and **landmarks** (248 occurrence) were articulately present in description of mezzo environments.

### Description of images using elements of the Environmental Semantic Differential Scale

The chi-square test applied to the responses given to the agreed selected elements of Environmental Semantic Differential Scale made the descriptions of preferred and non-preferred legible environments comparable.

Assessing descriptions using adjectives answered the question if subjects couple **contents referring to perspicuity, order and distinctiveness** to legible images – both with preferred and non-preferred (but legible!) environments. Averages show that this tendency ( $p < 0.000$ ) is **present with preferred legible images**.

Comparison of the categories of preferred and non-preferred images (ANOVA) it is clear that the most frequent response was 1 within the item “ordered-disordered”, therefore on the Likert scale the strongest value was marked by responders. It seems that **the concept of order is strongly interconnected with preferred and legible places**.

		Sum of Square	df	Mean Square	F	Sig.
preferred	Between groups	134.240	5	26.848	25.096	.000 ( $p < 0,000$ )
	Within groups	988.517	924	1.070		
	Total	1122.757	929			
nonpreferred	Between groups	1135.460	5	227.092	53.078	.000 ( $p < 0,000$ )
	Within groups	3953.320	924	4.278		
	Total	5088.780	929			

Table 3: Legibility and order

Examining the same using paired t-probe (Student, N=720) one can reveal the factors along which responders selected the two types (preferred and non-preferred) legible environments. This was **disorder**, light and the relaxing atmosphere of the place.

Comparing judgements about actual own environment along the items of Environmental Semantic Differential Scale to that of survey images along agreed selected items of Environmental Semantic Differential Scale, lead to recognising that there is **a tendency (P<0.000) of more negative judgements given to non-preferred images** of the pre-research survey than preferred ones – also than own actual environments – in this survey too.

### **Comparison of groups**

Frequency of responses to images was compared in three groups (students, teachers, architects). Groups were formed by categories based on self-reporting on demographic data (see Descriptive statistics sample).

Although in the case of **architects** (with significance level  $p<0.05$ , N=26) the disorder of a place also represents a relatively important “borderline”, in general they **judged preferred and non-preferred legible locations in a more uniform way** than the entire sample.

**Teachers selected** the two (preferred and non-preferred) **legible environments along the criterion of light** ( $p<0.000$ , n=137), but similarly to the entire sample, relaxing atmosphere and disorder imposed a great influence on their judgement.

Like the rest of the sample, **students**, representing a majority in the sample (52.5%) selected environments **primarily along disorder** and the relaxing atmosphere ( $p<0.000$ , N=496). This is supported by the fact that analysing the responses given by a fourth group of other adults (not included in these three groups, N=271,  $p<0.000$ ) repeated the preference pattern of teachers. Another interesting difference is that students made less difference between images along the “school-adult” scale than other groups ( $p<0.000$ ).

Plotting results against age groups one can observe a repetitive pattern: it seems that age has an influence on judgements about environments. The lowest scores were given by age group 19-24, thus this group coupled legible images to adjectives “ordered”, “clear”, “characteristic” in the strongest way, while the age group 13-18 was the opposite: giving the highest score, they proved to be the most critical.

All groups are similar in the aspect that they did not split **legible images** (regardless if they liked them or not) in groups of more simple and more sophisticated. In the table showing judgements about images one can see that this difference is small but not significant ( $p=0.150$ ), while similarly there is no detectable difference in distinctiveness ( $p<0.000$ ) either: **they did not divide legible images as more or less characteristic.**

		Sum of Square	df	Mean Square	F	Sig.
prefcharacteristic	Between groups	92.389	5	18.478	7.833	.000 ( $p<0,000$ )
	Within groups	2179.735	924	2.359		
	Total	2272.125	929			
nonprefcharacteristic	Between groups	801.684	5	160.337	33.407	.000 ( $p<0,000$ )
	Within groups	4434.685	924	4.799		
	Total	5236.370	929			

**Table 4:** Legibility and characteristicness

### Image choice along preference

In the final section of the survey the analysis of dichotomous variables took place, as subjects were required to choose between two locations based on their preference. Comparing average scores by chi-square test, we can state that **the difference between preferences was the greatest** when subjects had to choose **between legible and non-legible environments** ( $m=1.10$ ;  $\chi^2=499.236$ ;  $d=0.296$ ,  $p<0.001$ ). Similar difference ( $m=1.93$ ;  $\chi^2=519.203$ ;  $d=0.253$ ,  $p<0.000$ ) was only detectable when images were coupled which in the pre-research survey represented the significantly ( $p=0.05$ ) most preferred and the significantly less preferred legible images. This means that in general legible environments were more preferred if they were forced to choose, while the deviation of choices was greater than in the case of legible and non-legible images.

## Conclusions

1. Which values and contents are represented in the descriptions of legible mezzo environments?

**The first hypothesis stated that in the description of legible mezzo environments, characteristics of perspicuity and good orientation along with key elements according to Lynch are present.** I tested the assumption by providing images for subjects which they were supposed to describe in their own words, freely, without volume restrictions, and then by analysing results using Atlas.ti content analysis program. It was presumable that in the description of legible mezzo environments the key elements of legible environments (paths, edges, districts, nodes and landmarks) as well as contents referring to good orientation, perspicuity and order would represent high frequency.

Assessing the results of word frequency analysis (N=940, Number of words= 25299) **verified this in the case of order**, since subjects described legible environments by concepts as spacious, nice, ordered. However, from Lynch's key elements of legibility **only nodes** (191 occurrence) **and landmarks** (248 occurrence) were expressly present in descriptions of environments, whereas paths and edges hardly, and references to districts were missing from descriptions.

**In conclusion, results partly verified the hypothesis.**

In descriptions of legible mezzo environments **contents referring to space, beauty or order were frequently present, but only in the case of preferred legible images.**

From the key elements of legibility (paths, edges, districts, nodes and landmarks), **only two, nodes and landmarks were present in descriptions.** A possible explanation for this can be the size of spaces. In mezzo level, probably larger compartments of the environment are not so clearly separable as at macro level – or they can be perceived differently.

2. Which values and contents are represented in the description of legible mezzo environments by using adjective pairs?

**The second hypothesis stated that in the description of legible mezzo environments by using pairs of adjectives there is a greater likelihood of representation of adjectives referring to perspicuity and good orientation.**

The assumption was tested by giving the subjects in the online survey images that they judged along the agreed selected items of Environmental Semantic Differential Scale.

It was presumable that in the description of legible mezzo environments by adjective pairs, **contents referring to good orientation, perspicuity, order, clarity and light would be more frequently present in case of preferred legible images**, and that subjects link them to contents that correspond to positive environmental features in the Environmental Semantic Differential Scale. This was needed for the conceptualisation of legibility.

Assessing the chi-square test results of averages of description by adjective pairs supported that **concepts referring to perspicuity, order and distinctiveness appeared in case of preferred legible images**. This was also reinforced by variance analysis (ANOVA), which suggests that **the concept of order was strongly linked to preferred and legible locations**. Analysis of the same using pair t-probe (Student) showed that **disorder**, light and the relaxing atmosphere of the location were the characteristics along which subjects divided the legible environments into two distinct (preferred and non-preferred) groups.

**Thus the hypothesis was verified.**

As for groups, similarly to the rest of the sample, the group of students, which was the most numerous in the sample (52.5%) made significant differences between images based **primarily on disorder**, secondarily on the relaxing atmosphere of the place. Although order is a relatively important “borderline” in case of **architects** as well, they also **judged legible locations in a more uniform way** than the entire sample or any of the other groups. **Teachers separated** preferred from non-preferred legible environments **primarily by light**, but similarly to the entire sample, relaxing atmosphere and disorder also highly influenced their judgements of the environment.

In general, all groups **considered legible images** (irrespectively of preferences) **neither simpler nor more sophisticated** ( $p=0.150$ ), also they found **no differences along distinctiveness** ( $p<0.000$ ).

The differences between groups can be detected in the different perception of architects, supporting the evidences of content analysis: thus, **experts designing the environment and users of these environments linked different values and content** to given locations. This is a result, which must be taken into account when designing environments; and even with administrative tools efficient collaboration should be fostered, like in Building Schools for the Future, or initiating communication between partners providing opportunity to conflict different points of views and to compromise, as in Educating Spaces project.

Another interesting difference is that of the perception of distinct age groups. **Content analysis** highlighted that **students described all preferred images as nice**, while responses of teachers and architects showed a greater diversity. Assessing results of **Environmental**

**Semantic Differential Scale** showed that teachers (N=137,  $p<0.000$ ) and non-architect adults (N=271,  $p<0.000$ ) primarily made difference based on light, while **students** (N=496,  $p<0.000$ ) did so primarily on **disorder**. This means that within the group of laic environmental users, there is a difference between children and adults. Moreover, students imageade **less difference** between environments captured in images **along “school-adult” scale** ( $p<0.000$ ).

Plotting results against age groups it became visible that age has an influence of the judgments of environments: **the age group of 13-18 years was more critical to all environments along all characteristics** ( $p<0.000$ ). This naturally can be explained by characteristics of that age group.

Even neglecting the critical attitude of 13-14 year-olds, it seems interesting that in all cases, the environments primarily labelled as nice, they described most likely as “ordered” in adjective pairs. This means that although at spontaneous, free opinion they use “nice” to describe their preferences to legible environments, but in reality it is order that is linked to legibility in case of students.

This could be clarified by a further research, where order-disorder, beautiful-ugly would also be included in the adjective pairs in the survey.

3. Do responders have a preference for images of legible mezzo environments?

**The third hypothesis stated that responders prefer legible learning scenes to non-legible ones.**

I tested this assumption by the exercise in which subjects were to opt for one of image pairs in the online survey. Based on the chi-square test of averages, we claim that the **difference between preferences is the strongest when subjects were forced to choose between a legible and a non-legible environment**. Similar difference could only be observed if images were coupled, where one in the pair (in the pre-research survey) was the most preferred legible image while the other was the less preferred legible image. Therefore **legible environments were generally more preferred**, because the deviation within legible image pairs was greater than in the case of legible-non-legible image pairs. Both the content analysis and the assessment of adjective pair choice showed that subjects **associated positive values** with legible environments, such as beauty, order, calm, clarity.

**The hypothesis was verified.** Research supported the validity of the assumption that in mezzo spaces like schools, creating legible environments, emphasising key elements, making order and perspicuity evoke positive attitudes in environment users. In case of educational

environments (learning environments) this effect influence efficacy – which still requires further research.

## References

Downs, R. M., Stea, D. (1977) *Maps in Minds. Reflections on Cognitive Mapping*. New York: Harper & Row

Dúll, A., Urbán, R. (1997) Az épített környezet konnotatív jelentésének vizsgálata: módszertani megfontolások. *Pszichológia*, 17(2), 151-179.

Dúll, A., Kovács Z. (eds) (1998) *Környezetpszichológiai szöveggyűjtemény*. Kossuth Egyetemi Kiadó, Debrecen

Dúll, A. (2007) Edukációs környezetek: oktatási és nevelési helyszínek környezetpszichológiája. In Demetrovics, Urbán, Kökönyei Gy. (eds) *Iskolai egészségpszichológia*. 44-69. L'Harmattan, Budapest.

Dúll, A. (2009) *A környezetpszichológia alapkérdései. Helyek, tárgyak, viselkedés*. L'Harmattan, Budapest.

Ehmann, B. (2002) *A szöveg mélyén*. Új Mandátum Kiadó.

Holahan, C. J. (1982/1998) A környezetpszichológia természete és története. In Dúll, A., Kovács Z. (eds) *Környezetpszichológiai szöveggyűjtemény*. 9-26. Kossuth Egyetemi Kiadó, Debrecen

Krupat, E. (1985) *People in Cities. The urban environment and its effects*. Cambridge: University Press.

Lippai, E. (eds) (2011) Az eredményes iskola infrastrukturális feltételei. URL: <http://tamop311.ofi.hu/6-7-2> (letöltve: 2012. szeptember 25.)

Lynch (1960) *The Image of the City*. The Mit Press, Cambridge, Massachusetts.

Porteous, J. D. (1971) Design with People: „The Quality of the Urban Environment”. *Environment and Behavior*, 3(2), 155-178.

Réti, M., Lippai, E. (2012) Educating spaces: quality learning environments for future schools. In Lindqvist, U. Pettersson, S. (eds) (2012) Create learning for all - what matters? <http://www.cidree.org/publications/goto.php?id=13f3cf8c531952d72e5847c4183e6910&type=docs> (letöltve: 2014. május 17.)

## Images of survey

Image01



Tokaji Ferenc Secondary School, Tokaj

Image02



Deák Diák Primary School, Budapest

Image05



Tamási Áron Primary and Secondary School,  
Budapest

Image07



Czuczor Gergely Benedictine Secondary  
School, Győr

Image09



Petőfi Sándor Lutheran Grammar School,  
Bonyhád

Image13



Petőfi Sándor Lutheran Grammar School,  
Bonyhád

Image17



Ványai Ambrus Primary School, Dévaványa

Image20



Deák Diák Primary School, Budapest