Basic dimensions of experience of architectural objects' expressiveness: Effect of expertise

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The purpose of the present study was to compare the structure of experience of architectural expressiveness of architects and non-architects. Twenty architects and twenty non-architects rated twenty photographs of architectural objects on thirty expressiveness scales. Principal components analysis revealed four factors for both groups of participants: Aggressiveness, Regularity, Color and Aesthetics. In a cluster analysis two clusters of architectural objects were obtained: Choleric (high Aggressiveness and Color) and Phlegmatic (low Aggressiveness and Color, and high Regularity). All objects were highly rated on Aesthetics. Analysis of variance has shown that architects rated both clusters as less aggressive than non-architects. Also, experts rated the Phlegmatic cluster as more aesthetic, while non-experts rated the Choleric cluster as more aesthetic. These results supported the Processing Fluency model: compared to non-architects, architects processed the expressive information of minimalistic objects (Phlegmatic cluster) with ease, which led towards positive hedonic reactions and higher.

Key words: experience, expressiveness, architecture, expertise, basic dimensions

The experience of architectural objects is a mixture of two wide groups of impressions corresponding with two purposes of architectural performance. The first group relates to the functional aspect of architectural objects, i.e. their pragmatic or utilitarian properties, while the second group of impressions focuses on the aesthetic aspect, i.e. the appraisal of expressive and affective qualities of an architectural object. These two aspects can interact, since certain types of expressiveness are more suitable for specific purposes. For instance, ornate (detailed) articulation could be more suitable for a kindergarten, while memorial architecture is fit for a minimalist (subdued) expression. However, functionality and expressiveness are relatively independent aspects of architecture, so that

they can be explored as two distinct phenomena. Moreover, expressiveness in architecture can be aesthetic property of its own right, surpassing utilitarian aspect (residential purpose, production, etc.). Due to its "aesthetic independence", expressiveness puts architecture in artistic categories such as painting, music, literature, etc. which do not necessarily have direct pragmatic functions.

Expression and expressiveness

In this paper we use terms *expression* and *expressiveness* in their widest sense (see Robinson, 2007). The term *expression* refers to spontaneous manifestation of mental and physiological states (emotion, idea, fantasy, etc.) through various media (visual, auditory, verbal, etc.) and different material realization (ranging from body and face, through choice of clothes and design, to artistic performance). With this is mind, some authors emphasize the unconscious or spontaneous character of expression (Collingwood, 1938; Wenninger, 2005), while others emphasize its cognitive aspect (Dilworth, 2004).

Expression can also be defined as part of the communication process which consists of two complementary components, expression (transmitted information) and impression (received information) (Argan & Oliva, 2004; see also Robinson, 2007).

The term *expressiveness* we use to denote a collection of object properties, enabling the viewer to perceive and recognize different expressions of that object. The experience of expressiveness can be based on recognition of genuine expression. For example, depressive expressiveness can be rooted in the expression of sorrow signified by body postures, facial expressions, etc. However, expressiveness can stem from pure subjective projection of certain meanings onto the object. Thus, for example, physical objects may seem depressive without having any real capacities to express emotions (e.g. willow tree, rainy day, etc.). Likewise, expressiveness of art products can be found in their composition and color, suggesting and inducing certain emotional states (Arnheim, 1969, 1980; Gombrich, 1969, 1973; Gooding, 2000; Graham, 1997; Moszynska, 1990; Perry, 2005).

According to Arnheim, the experience of an object's expressiveness is primarily perceptual phenomenon. It is grounded in perception of the so-called structural forces in visual field and dynamic expressions of the perceptual Gestalt, such as branching, crawling, jumping etc. (Arnheim, 1949, 1969, 1980). These structural and dynamic expressions are experienced as expressiveness of an object. More recently, through the concept of the so-called mirror neurons Rizzolatti & Craighero, 2004), some authors attempted to explain this "impression of expressiveness" as a special case of "neural empathy" (Freedberg & Gallese, 2007). In addition, some neuroimaging and electrophysiological studies have found specific cortical and sub-cortical areas that are involved in the visual processing and ratings of buildings (e.g., Aguirre, Zarahn, & D'Esposito, 1998; Epstein & Kanwisher, 1998; Ishai, Ungerleider,

Martin, Schouten, & Haxby, 1999; Mecklinger, Kriukova, Mühlmann, & Grunwald, 2014; Oppenheim et al., 2010).

Numerous studies have shown that even simple visual features (e.g. colors, shapes) can induce elementary implicit meanings such as dynamics, warmth, aggression, relaxation etc. (Burr, 2000; Gori, Pedersini, & Giora, 2008; Janković & Marković, 2001; Oyama et al., 2008; Palmer & Schloss, 2010). These implicit meanings can be applied in art and architecture to create expressiveness. For instance, the use of vivid red color can emphasize passion, the use of diagonal lines can induce dynamics, the use of sharp angular lines can be associated with aggression, danger etc. In addition, some visual and auditory stimuli can perceptually and emotionally give rise to impression that they posses similar expressiveness. For instance, Köhler (1949) had demonstrated that some phonemic patterns (pseudo-words) can be associated with visual patterns, e.g. phonemic string *Takete* is associated with sharp, angular patterns, and *Maluma* with smooth, curvilinear patterns (see also Janković & Marković, 2001).

Gombrich's conceptualistic theory opposes approach to expressiveness based on perception. Namely, Gombrich specified artistic expressiveness as a conventional, language-like system (Gombrich, 1972, 1973; see also Black, 1972; Kreitler & Kreitler, 1972; Penrose, 1973; see also Kennedy, 1984). Artworks are not illusions or perceptual copies of reality, but rather construction of new realities in which certain elements and rules of artistic 'language' are applied. In other words, expressions are parts of subjective (emotional) reality, codified and symbolically represented in pictorial domain.

Studies of experience of architectural expressiveness

Dealing with mutual relation of expressiveness and architecture we focus on Terzidis' analysis of relation between expressiveness and architectural design (Terzidis, 2003). Terzidis analyzed the following formal aspects of architectural expressiveness: the aspect of being caricatural, hybrid, kinesthetic, bent, wrapped and algorithmic. He claimed that expressiveness reflects essential and unique qualities of architectural form, its character and identity. Poriau was also of the opinion that expressiveness is the central aesthetic category in architecture: terms such as *expressiveness* and *aesthetic value* of an artwork coincide to a great extent (Poriau, 1986).

Expressiveness is a central concept in number of studies dealing with experience of various aspects of architectural objects (for review see Nasar, 1994). Most of these studies are based on different versions of the semantic differential methodology introduced by Osgood and associates (Osgood, Succi, & Tannenbaum, 1957; Osgood, May, & Miron, 1975).

In his original study Osgood asked the participants to rate verbally expressed concepts on bipolar seven-step scales with opposite adjectives on the poles (e.g. pleasant-unpleasant, strong-weak, passive-active, etc.). Through factor analyses he extracted three distinct factors: Evaluation, Potency and Activity. Similar approach was applied by Berlyne and associates in the domain of visual stimuli, including

artworks (Berlyne & Ogilvie, 1974; Cupchik, 1974). Berlyne and Ogilvie (1974) generated a set of stylistic properties (scales): scales referred to semantic, syntactic and expressive information, and scales referring to physical features of paintings, such as dominance of color, lines, shape and texture.

Although the use of semantic differential in investigating the subjective experience of architecture has long history (cf. Canter, 1970; Cass & Hershberger, 1972; Craik, 1968; Kasmar, 1970; for review see Nasar, 1994), only few studies were done in recent years. Applying Berlyne's methodology, some of the more recent studies specified *a priori* the categories that cover different aspects of experience. For instance, Franz, von der Heyde and Bülthoff (2003) used bipolar scales to measure hedonic tone (pleasure), arousal (interestingness), aesthetic dimension (beauty), cognition (normality), activity (calmness), and different formal aspects of architectural design (spaciousness, brightness and openness).

Bishop (2007) specified a priori three categories of attributes: Aesthetic response, Typicality and Formal attributes. Aesthetic response included two attributes: positive effect measured by pleasantness (unpleasant-pleasant) and arousal measured by interestingness (boring-interesting). Typicality was measured by single scale (commonplace-unusual). Finally, Formal attributes included three attributes: openness measured by spaciousness (cramped-spacious), complexity measured by ornateness (plain-ornate), and clarity measured by organization (organized-disorganized).

Alp (1993) used 26 unipolar scales selected to refer only to "aesthetic dimension" of architectural experience (sensuous, impressive, interesting, sophisticated, pleasant, beautiful, subtle, unique, appealing, stylish, attractive, cheerful, fashionable, inviting, tasteful, elegant, uplifting, fine, bright, lively, expressive, inspiring, idyllic, exhilarating and likeable). Hung and Nieh (2009) investigated the evaluation on twenty *Kansei*[1] impressions of architectural objects using semantic differential technique. Through factor analysis they extracted three factors: Mental Feeling or Evaluation (transparent, urban, brilliant, contemporary, beautiful etc.), Physical Feeling or Activity (unsteady, chaotic, twisted etc.) and Tendency Value or Potency (gorgeous, dynamical, glowing etc).

Finally, Rezazadeh (2011) empirically specified the initial set of scales for rating streets and buildings in the city of Shiraz (Iran). The set of 22 bipolar scales was obtained in a pilot-study in which the participants produced the relevant attributes. A factor analysis revealed three factors. The first factor Rezazadeh named Organization. It refers to a physical organization represented by the following scales: harmonious-disharmonious, continuous-disrupted, ordered-disordered, fitting-unfitting, peaceful-disturbing, tidy-chaotic and typical-atypical. The second factor is Affective dimension which comprised the following scales: enchanting-dull, interesting-boring, happy-sad, cheerful-cheerless, diverse-monotonous and peaceful-disturbing. The third factor is

1   *Kansei* is a Japanese word which denotes the impression the observer acquires from some artifact, environment or situation.

Historical Significance. It encompassed the scales traditional-modern, old-new, historical-ahistorical and outdated-trendy.

Purpose of the study

The main purpose of the present study is to identify the basic factorial structure underlying the expressive aspect of experience of architectural objects. We applied Osgood's Semantic Differential methodology (Osgood, Succi, & Tannenbaum, 1957; Osgood, May, & Miron, 1975). Contrary to Berlyne, who created scales on the basis of *a priori* theoretical criteria (Berlyne & Ogilvie, 1974), Osgood empirically selected the representative set of descriptors to cover the widest possible range of affective meaning. Such a method enabled extraction of factorial structure which provides a good basis for generalization.

Following these methodological lines we specified several steps in our investigation. In the preliminary study representative sample of descriptors (scales) and architectural objects (stimuli) were selected. In the main experiment the set of selected architectural objects was rated on a set of selected scales. Finally, factor analysis of the ratings should reveal the basic dimensions of experiencing the architectural expressiveness.

The second purpose of this study is to specify clusters of architectural objects using the profile of ratings on extracted dimensions. In other words, ratings on subjective dimensions of expressiveness are used as a basis for classification of architectural objects.

Finally, the third aim was to investigate the effect of expertise on experience of architectural expressiveness. Many studies have shown the crucial role of *art expertise* (mastering, training) in aesthetic judgment (Augustin & Leder, 2006; Bordens, 2010; Cupchik, 1992; Cupchik & Gebotys, 1990; Leder, Belke, Oeberst, & Augustin 2004; Nodine, Locher, & Krupinski, 1993; O'Hare, 1976; Russell, 2003; Silvia, 2005; Specht, 2007; Temme, 1992; Winston & Cupchik, 1992). With this in mind, we intend to specify the similarities/differences between experts (professional architects) and non-experts (novices) in their experience of architectural expressiveness.

Our departure point is that experts and non-experts share similar structure of experience of expressiveness and therefore their ratings are expected to converge towards similar basic dimensions (factorial structures). However, we expect their ratings of particular architectural objects to differ. These expectations are based on the initial idea of semantic differential that connotative meaning has a universal (culturally independent) structure, but in different cultures the same objects would be judged differently on specified dimensions. For instance, ratings of descriptors *beautiful*, *pleasant* and *interesting* can be highly inter-correlated and covered by the same dimension (factor in both expertise groups), but the intensity of ratings on the same descriptors may differ. Put differently, some architectural objects can be rated as more beautiful, pleasant and interesting by experts than by non-experts.

Preliminary study 1: Selection of descriptors

In the Preliminary study 1 we extract elementary descriptors of expressiveness of architectural objects. A group of participants, experts in architecture and cognitive psychology were asked to list (write down) all attributes that describe different aspects of experience and interaction with architectural objects. The obtained descriptors could be classified into several categories. One group of descriptors referred to formal and physical characteristics of the object, such as shape, structure, texture and color, while other descriptors referred to subjective experience, such as affective and aesthetic impressions. We eliminated professional terminology from the list to be sure that participants who were not closely connected to architecture could fully understand them. We also avoided descriptors that had clear or more frequent synonyms. The final list of descriptors is given in Table 1.

Table 1
A list of 30 descriptor pairs selected in Preliminary study 1

Undeformed	Deformed
Peaceful	Aggressive
Restful	Playful
Disintegrated	Integrated
Simple	Complex
Irregular	Regular
Right-angled	Sharp-angled
Curved lines	Straight lines
Arrhythmic	Rhythmic
Messy	Tidy
Monotonous	Diverse
Harsh	Gentle
Ragged	Smooth
Uneven	Even
Unornamented	Ornate
Single-colored	Multi-colored
Cold colors	Warm colors
Pastel colors	Vivid colors
Introverted	Extroverted
Ugly	Beautiful
Tense	Relaxed
Passive	Active
Unpleasant	Pleasant
Ordinary	Unusual
Unmemorable	Memorable
Unclear	Clear
Unobtrusive	Intrusive
Spontaneous	Deliberate
Disharmonious	Harmonious
Boring	Interesting

Preliminary study 2: Selection of stimuli

The key criterion in selection of stimuli was to achieve the highest possible representativeness, that is, to select architectural objects which represent the most characteristic examples of expressiveness in architecture. Relying on architectural reviews and historiography the most prominent architectural accomplishments of the 20th century were selected, representing different styles and periods – from minimalist objects and abstract architectural expressions (Modernism, Minimalism and International Style), to objects whose dynamic characteristics define them as complex compositional structures (Art-Nouveau, Brutalism and Deconstructivism) (Cerver, 2000; Gössel & Leuthäuser, 1990; Jencks, 1973, 1993; Jodidio, 2001–2012). The selected objects were typical within their categories (style movements).

Bibliography enabled us to find proper photographs to illustrate the basic characteristics of objects in a clear and thorough way (Cerver, 2000; Gössel & Leuthäuser, 1990; Jencks, 1973, 1993; Jodidio, 2001–2012). The photographs have been digitally processed, so that irrelevant information (i.e. immediate surroundings of the architectural object) have been transformed into light monochromatic tone, while the central object relevant for the research remained colored. We did this in order to emphasize the object of interest and minimize the effect of interfering surroundings (i.e. the background information which could be distracting). The list of selected stimuli is given in Table 2 and shown in Table 4.

Table 2
Representative architectural objects designed during 20 century

	Name of object	Place	Author	Style movement
1	Guggenheim museum	Bilbao	Frank Gehry	Deconstructivism
2	Nationale Nederlanden Building	Prague	Frank Gehry	Deconstructivism
3	Jewish museum	Berlin	Daniel Libeskind	Deconstructivism
4	Departamento de Sanidad	Bilbao	Juan Coll Barreu	Deconstructivism
5	ING Headquarters	Budapest	Erick Van Egeraat	Deconstructivism
6	Wozoco apartments	Osdorp	MVRDV	Neo-Modernism
7	'Habitat' housing complex	Montreal	Moshe Safdie	Brutalism
8	Casa Batllo	Barcelona	Antonio Gaudi	Art Nouveau
9	Casa Mila 'La Pedrera'	Barcelona	Antonio Gaudi	Art Nouveau
10	Hundertwasser house	Vienna	Friedensreich Hundertwasser	Art Nouveau
11	German pavilion	Barcelona	Mies Van Der Rohe	Modernism
12	Portugal pavilion	Lisbon	Alvaro Siza	Minimalism
13	Villa Savoye	Poissy	Le Corbusier	Modernism
14	World Trade Center	New York	Minoru Yamasaki	International Style
15	Arche de la Défense	Paris	Otto van Spreckelsen	International Style
16	Casa Gaspar	Cadiz	Alberto Campo Baeza	Minimalism
17	Casa Guerrero	Cadiz	Alberto Campo Baeza	Minimalism
18	Olnick-Spanu House	Garrison	Alberto Campo Baeza	Minimalism
19	New Museum of Contemporary Art	New York	SANAA	Minimalism
20	Glass museum	Toledo	SANAA	Minimalism

Experiment

In this experiment we investigated the ratings on set of descriptors of expressiveness of architectural objects in order to specify the factorial structure underlying the ratings of expressiveness.

Method

Participants. Twenty architects and twenty non-architects participated in the experiment (aged 18–30).

Stimuli. Twenty photographs of architectural objects that were selected in Preliminary study 2 (see Table 2).

Procedure. The twenty stimuli were presented to two separate groups of participants (architects and non-architects) in a different randomized order for each group. The stimuli were presented by an LCD projector on the screen. The stimuli were observed from a distance of 3,5 m and the dimensions of their screen projections were 1,5 x 1,5 m. Participants were asked to rate the stimuli on 30 seven-step bipolar scales with the descriptors on the poles (pairs of descriptors are shown in Table 1). They were told that grades *–3* and *3* indicate the highest intensity of descriptors expression. The time was not limited and only when all participants rated the stimulus on each of the 30 scales, the next slide with the stimulus was presented.

Results

Factor analysis. Data were organized in the 'string-out' matrix: the matrices for 20 stimuli were arranged one below the other (see Osgood et al., 1957, 1975). Two separate analyses for the groups of experts and non-experts were performed. A principal component analyses with Varimax rotation revealed four factors with equal values above 1 in both groups. The test of the congruence of two factorial structures has shown a satisfying Tucker's coefficient: .98. Having in mind that factors and their contents are almost identical, an additional factor analysis was performed: matrices of both experts and non-experts were merged in a unique string-out matrix. Common factors, with percentages of explained variance and scales with loading indexes above 0.500, are shown in Table 3.

Table 3

Results of the principal component analysis with Varimax rotation are shown. Four extracted factors with the percent of explained variance and the loadings indexes of most loaded scales (above .500). Full titles of scales (positive and negative poles) are shown in Table 1.

F1: AGGRESSIVENESS	14,96 %	F2: REGULARITY	9,61 %	F4: AESTHETICS	4,50 %
Tense	0.823	Straight Lines	0.785	Interesting	0.806
Aggressive	0.819	Plane	0.777	Beautiful	0.761
Rough	0.785	Regular	0.720	Pleasant	0.688
Disintegrated	0.779	Sharp Angles	0.676	Unusual	0.631
Complex	0.777	Clear	0.579	Impressive	0.569
Undefined	0.772	Defined	0.443		
Arhythmic	0.771				
Playful	0.769	F3: COLOR	6,32 %		
Active	0.763	Multicolored	0.786		
Messy	0.724	Vivid Colors	0.774		
Variable	0.694	Warm Colors	0.716		
Imposing	0.685	Rugged	0.629		
Diverse	0.626	Ornate	0.585		
Disharmonious	0.601				
Curved	0.528				

Cluster analysis. In order to examine grouping of 20 architectural objects similar in ratings profile for four dimensions of expressiveness, we carried out K-means cluster analysis. Values on the dimensions were obtained by averaging each set of three most loaded scales: Aggressiveness (Tense, Aggressive and Rough), Regularity (Straight Lines, Plane and Regular), Color (Multicolored, Vivid Colors and Warm Colors) and Aesthetics (Interesting, Beautiful and Pleasant). In solutions with three and four clusters we obtained a large difference in the number of objects per cluster (e.g. the first two clusters contained four objects, the third included only two objects and the fourth contained a total of ten objects). The most balanced distribution of objects was obtained in the solution with two sets clusters where the objects were distributed evenly – ten in each cluster (see Table 4). The first cluster was named *Choleric*. It includes objects rated highly on Aggressiveness and Color and low on Regularity. The second cluster was named *Phlegmatic*. It contains objects with low rates on Aggressiveness and Color and high rates on Aesthetic.

Table 4
Results of the cluster analysis

	Cluster 1: CHOLERIC EXPRESSIVENESS	Cluster 2: PHLEGMATIC EXPRESSIVENESS
Aggressiveness	5.47	2.16
Regularity	3.48	6.39
Color	4.21	2.21
Aesthetics	5.51	5.44
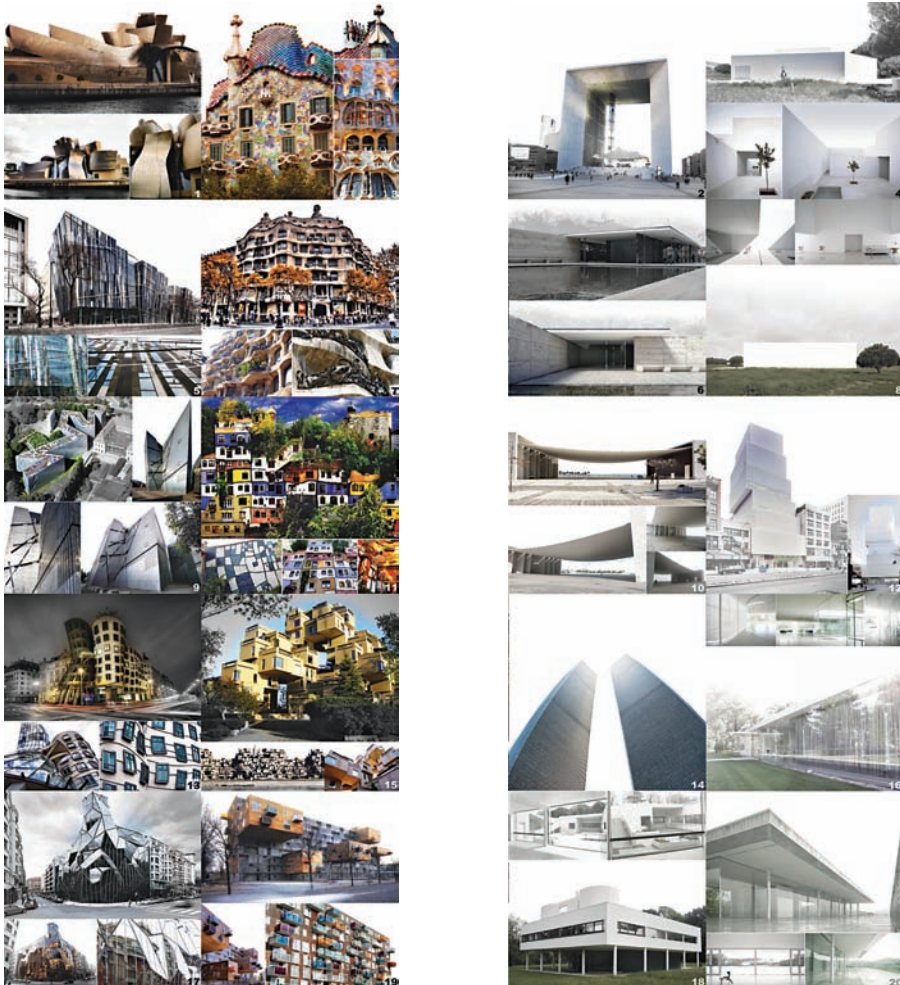
Analysis of variance. Participants' ratings were further analyzed using a two-way mixed-design ANOVA with Expertise as a between-subjects factor (*experts* and *non-experts*) and Cluster as a within-subjects factor (*Choleric* and *Phlegmatic* cluster). Ratings for the two clusters were averaged stimuli

included in either *Choleric* or *Phlegmatic* cluster (10 stimuli per cluster, see Table 4). Separate analyses were conducted for the ratings of four dimensions of expressiveness. Each dimension was represented by the mean value of the three most loaded scales: Aggressiveness (Tense, Aggressive and Rough), Regularity (Straight Lines, Plane and Regular), Color (Multicolored, Vivid Colors and Warm Colors) and Aesthetics (Interesting, Beautiful and Pleasant). Ratings for all dimensions were shown in Figure 1).
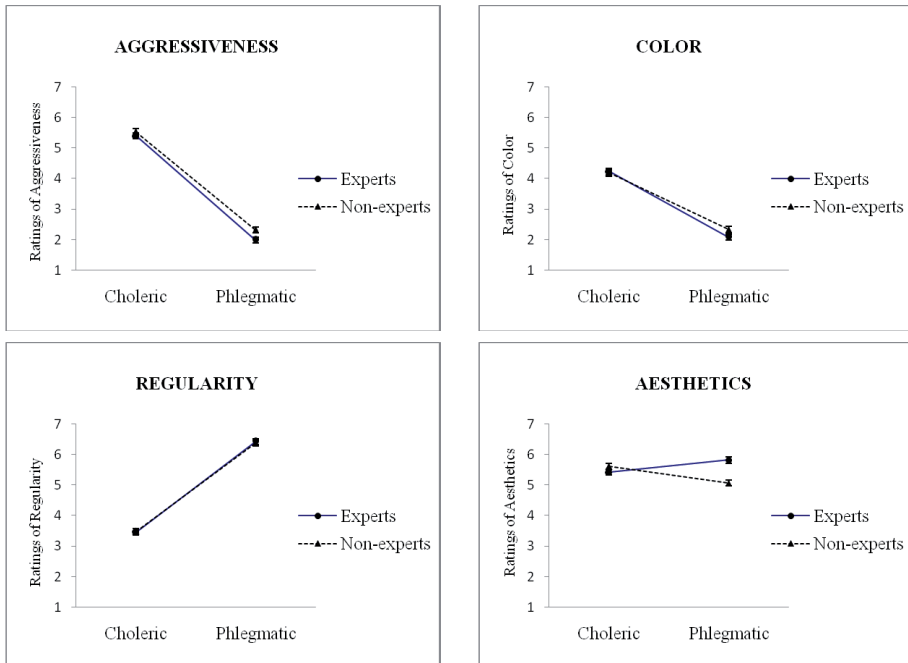

Figure 1. Experts' and non-experts' ratings of *Choleric* and *Phlegmatic* architectural objects on four dimensions of experience of expressiveness: Aggressiveness, Regularity, Color and Aesthetics.

Aggressiveness. The main effect of Expertise was significant, $F_{(1, 19)} = 13.19$, $p<.01$: non-experts rated the architectural objects as more aggressive than experts. The main effect of Cluster was significant as well, $F_{(1, 19)} = 1210.57$, $p<.01$: *Choleric* cluster was rated as more aggressive than *Phlegmatic* cluster. The interaction was not significant.

Regularity. The effect of Expertise did not reach significance, while the effect of Cluster was significant: $F_{(1, 19)} = 1984.39$, $p<.01$: *Phlegmatic* cluster was rated as more regular than *Choleric* cluster. The interaction was not significant.

Color. The main effect of Expertise was not significant but the effect of Cluster reached significance: $F_{(1, 19)} = 535.43$, $p<.01$: *Choleric* cluster was rated as more colorful than *Phlegmatic* cluster. The interaction was not significant.

Aesthetics. Neither Expertise nor Cluster has shown the significant main effects. However, Expertise x Cluster interaction was significant, $F (1, 19) = 22.22$, $p<.01$. Post hoc tests (Bonferroni) indicate that this interaction is based on difference in ratings of *Phlegmatic* cluster on Aesthetics ($p<.01$), whereas the difference in ratings of *Choleric* cluster was not significant: experts rated the Phlegmatic cluster as more aesthetic than non-experts (see Figure 1d). The interaction can be observed from the perspective of the differences within groups as well: experts rated *Phlegmatic* cluster as more aesthetic than the *Choleric* cluster, while non-experts showed the inverse ratings – the *Phlegmatic* cluster was rated as less aesthetic than the *Choleric* cluster ($p<.01$).

Discussion

The purpose of the present study was to identify the basic dimensions of subjective experience of expressiveness in architecture defined as a collection of elementary impressions (descriptors) operationalized as ratings on semantic differential scales. Factor analysis of ratings of architectural objects on set of scales revealed four factors (dimensions): Aggressiveness (descriptors: tense, aggressive, rough, etc.), Regularity (plane, regular, straight lines, etc.), Color (multicolored, vivid colors, warm colors, etc.) and Aesthetic (interesting, beautiful, pleasant, etc.).

The above factors correspond to different domains of expressiveness. Aggressiveness and Aesthetics cover two subjective (affective) domains. Both refer to affective states of higher arousal, but with inverse valence. The arousal of Aggressiveness has negative valence (tension, roughness), whereas the arousal of Aesthetics has positive valence (interestingness, pleasure). On the other hand, Regularity and Color cover the perception of two physical (perceptual) aspects of expressiveness (i.e. surface regularity and color) (for more details on objective and subjective dimensions of experience see Marković & Radonjić, 2008).

Factors obtained in our study parallel those specified in previous studies which investigated the subjective experience of paintings. Aggressiveness corresponds to the negative pole of Relaxation (Marković & Radonjić, 2008), while Aesthetics is similar to Hedonic Tone (Berlyne, 1974a, 1974b; Berlyne & Ogilvie, 1974; Berlyne, Robbins, & Thompson, 1974; Marković & Radonjić, 2008), Evaluation (Evans & Day, 1971; Libby, Lacey, & Lacey, 1973) and Valence (Ertel, 1973). Regularity is similar to Regularity from Marković and Radonjić study (2008), to negative pole of Uncertainty (Berlyne, 1974b; Berlyne & Ogilvie, 1974; Berlyne et al., 1974) and to Classicism/Order (Berlyne & Ogilvie, 1974). Color is almost identical with previously specified Color from Marković and Radonjić (2008) study and similar to Expressionism (Berlyne & Ogilvie, 1974). With respect to classical stylistic dichotomies Regularity may be taken as a representative of the so-called linear style, and Color for a painterly style (Wölfflin, 1915/1950).

In order to specify more general forms of expressiveness in architecture we used cluster analysis. Two large clusters with opposite rating profiles

were specified: (a) cluster named the Choleric Expressiveness encompassed architectural objects with high ratings on Aggressiveness and Color, and low ratings on Regularity and (b) the cluster named Phlegmatic Expressiveness included objects with high ratings on Regularity, and low ratings on Aggressiveness and Color. The analysis of variance indicated significant differences between clusters: the Choleric cluster had higher Aggressiveness, higher Color and lower Regularity than the Phlegmatic cluster. From the perspective of theory of architecture these findings are interesting as they indicate two antipodes in architectural performance – expressionistic and minimalistic tendency. On the one hand, we grouped architectural objects with distinct energetic and aggressive character (mainly expressionistic and deconstructivist objects), while on the other hand we grouped minimalist and extremely abstract architectural solutions (examples of Moderna and minimalism).

Note that both clusters had high ratings on Aesthetics. This suggests that although they differ in expressiveness, the two groups of architectural objects are experienced as aesthetically almost equally pleasing. The generality of aesthetic dimension across various forms of expressiveness is in line with the idea that beauty has many different facets. Umberto Eco (2004/2002), for example, offered a list of different kinds of beauty, including the beauty of both forms of expressiveness: (a) dangerous beauty, wild beauty, beauty of monsters, and the like, and (b) classicistic beauty, beauty of harmony and good proportion, calm and decent beauty etc.

The effect of expertise was generally in line with our initial hypothesis that basic dimensions of experiencing expressiveness in experts and non-experts should be similar. These findings support Arnheim's idea that artists and observers use the same "coordinate system" when perceiving visual expressions in nature and art (Arnheim, 1980). Invariance of basic dimensions of subjective experience was also observed in other areas of research, as was the case in Osgood extensive cross-cultural study of affective meaning (Osgood, May, & Miron, 1975).

Analysis of ratings of expressiveness dimensions showed a clear effect of expertise on dimensions referring to subjective (affective) domain of experience (Aggressiveness and Aesthetic), and absence of the effect on the so-called objective (formal) dimensions (Regularity and Color). Absence of the effect on objective properties is due to the fact that these characteristics are perceived similarly by both groups of respondents. For instance, both groups agree that architectural objects from *Phlegmatic* cluster are more regular and less colorful than those from *Choleric* cluster, because the two groups of objects differ in form and style precisely on these two dimensions. On the other hand, the difference between experts and non-experts was evident in ratings of the two subjective (affective) dimensions.

Overall, non-experts experience objects as more aggressive than experts. This finding is in accordance with previous studies which show that artistic knowledge creates feeling of being more competent and safe, and therefore less negatively aroused (Silvia, 2005). In contrast, non-experts perceive unusual style

expressions (for instance abstraction) as incomprehensible and presumptuous (Hekkert, 1995; Hekkert & van Wieringen, 1996; Neperud, 1989). Speaking in terms of Berlyne's theory of optimal arousal this outcome may illustrate different levels of arousal provoked by modern architectural objects (cf. Berlyne, 1971). Being less adapted to modern architecture, it may be assumed that the non-expert group exhibits higher level of arousal and, consequently, experiences higher level of Aggressiveness.

On Aesthetic dimension the expertise interacts with two clusters of architectural objects. On *Aesthetic* experts attributed higher rating to *Phlegmatic* cluster, while non-experts gave higher ratings to *Choleric* cluster. This finding is in accordance with findings of research focusing on experience of artistic paintings where it was demonstrated that non-experts prefer paintings rich in color (Hekkert & van Wieringen, 1996). These stimuli would correspond to our Choleric cluster (mainly art-nouveau objects with high ratings on the dimension Color). In contrast, experts preferred more abstract content – these stimuli would match our Phlegmatic cluster (mainly minimalist, geometrical objects with high ratings on the dimension Regularity).

A distinct difference between experts and non-experts in aesthetic preference of the *Phlegmatic* cluster can be interpreted in terms of individual differences. It can be assumed that architects (experts) belong to the group of creative people, and thus, as suggested by numerous findings, being more susceptible to new experiences (cf. Gelade, 2002; McCrae, 1987; for detailed review see Feist, 2005). There are also studies that show that participants who were more responsive to new experience prefer abstract and less comprehensible content, while those less responsive to new experience prefer clearer and pleasant content (Rawlings, 2000, 2003). Having this in mind, we assume that objects from *Phlegmatic* cluster proved to be more interesting, inspiring and thus more pleasant and more beautiful to architects, while non-experts found these objects boring, incomprehensible, less pleasant and not as beautiful. Finally, this idea supports the model of Processing Fluency, where aesthetic preference is due to ease with which aesthetic information is processed (Russell, 2003). Experts found it easier to process *Phlegmatic* cluster, while non-experts processed it with more effort, which resulted in different affective response and aesthetic preference.

Previous studies of experience of expressiveness of architectural objects were either focused on individual, previously theoretically defined aspects of expressiveness (Alp, 1993; Bishop, 2007; Franz, von der Heyde, & Bülthoff, 2003) or on specific type of objects (Bishop, 2007; Rezazadeh, 2011). In contrast, our study included a set of representative descriptors of expressiveness and wide range of architectural objects which differ in formally defined expressiveness (ranging from Art-Nouveau to Minimalism). These two methodological specificities contributed to better generalization of our findings.

Further studies of expressiveness in architecture should focus on more strict specification of subtle differences in forms of expressiveness. This would require wider spectrum of styles that would include traditional architecture and

architecture with no intent to convey expressive information. In addition, some theoretical approaches suggest that neural processing models could help us to establish a unique framework for subjective experience of both artistic objects (including architecture) and other natural scenes (Ramachandran & Hirstein, 1999; Redies, 2007; Zeki, 1999). Also, of interest is more detailed examination of specific relations between hedonic aspect of experience of expressiveness and aesthetic experience that includes in-depth symbolic elaboration and aesthetic fascination (cf. Marković, 2010, 2012).

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