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The Use of Metaphors as Design Communication Tools in an Architectural Team

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Abstract

Metaphors play a key role in architectural practice. These tools are seen as critical heuristics supporting cognitive and communicative necessities in design problem solving. By structuring the way architects think about problems, reasoning by metaphor enables to approach design situations from unorthodox perspectives, and to produce innovative ideas. This paper investigates empirically the use of metaphors during the early stages of the architectural design process. In particular, it explores the effect that external stimuli in the form of text have on metaphor generation, and classifies into main categories the metaphors that are produced by architects during discourse interactions. It is concluded that in design problem solving, the availability of external stimuli enhances metaphor generation. Architects, on the other hand, make fluent use of metaphors as a rhetorical mechanism that helps them develop and communicate their ideas in a coherent and efficient way.

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1. Introduction

Design problem-solving is a complex activity that frequently requires teams working in collaboration. A major claim is that the shared understanding of team members can be supported by the use of metaphors. Metaphors are frequently used as linguistic devices in daily communication, e.g., [1], which can be also found in a diversity of domains such as science, art, and design. They are viewed by cognitive psychologists [2] and linguistics [3] as effective heuristics aiding problem solving. Reasoning by metaphors has shown to play a critical role in both the development of creative ideas, and in the process of communicating them among team members. Moreover, the theory proposed by Lakoff and Johnson [1] and by Lakoff [3, 4] considers metaphor as a mechanism that allows categorizing experiences according to a conceptual system. In their view, this is determinant in the way people think, perceive, understand, and classify experiences in their minds. Metaphorical reasoning enables the identification of overlooked similarities despite of the existence of vast difference. As an outcome of this, conceptual meaning emerges and new categories of knowledge are created [5].

One of the disciplines where the study of metaphor has come to the foreground is in design [6]. Metaphor is especially suitable in the solving of architectural problems that by definition are ill-structured and involve unconventional thinking. Scholars have drawn attention to the contribution of metaphors as a cognitive resource that is particularly useful in the early, most creative stage of generating design ideas. One reason is because it offers unlimited possibilities for transforming and displacing concepts, by enabling to approach architectural problems from unorthodox perspectives. Another reason is because metaphors aid in integrating individual knowledge, and enhancing communicative interaction between team members, all of which promote the potential emergence of successful design outcomes.

In the architecture literature, there is a comprehensive number of buildings designed by outstanding architects using metaphors. An example can be found in the Sydney Opera House, by Jorn Utzon [7]. The identity of this building can be related to its soaring roofs shells modelled on the idea of the 'movement of the sailboats of Sydney Harbour' as a central metaphor. In Saint John the Divine, Santiago Calatrava uses the tree as the structural metaphor for the cathedral. One of his first drawings for this building reflects an interpretation of the tripartite section as foliage (roof), trunk (nave), and roots (crypt) [8]. In spite of the frequent use of metaphor in architectural design practice, except for a few exceptions, e.g. [9] no empirical works about its role during the design process were carried out).

Metaphors generated during design interaction can be stimulated by the availability of external inspiration sources, such as texts. Depending on the type of contexts that the sources and the design problem are embedded, a metaphor can be related to within-domain or between-domain sources. Whereas the former fits into a situation in which both source and problem belong to a same or very close knowledge domain, the latter refers to two conceptually distant domains that share a common explanatory structure. Scales of different level of detail have been considered to categorize the distance between source and problem. Examples are the bipartite scales of highly-related and distantly-related to the problem [10], and near and far distance [11], the tripartite scales of near, medium, and distant [12], and the quadripartite scale of near, near distant, medium distant, and distant [13]. While most of these studies explored the use of different types of sources for the generation of design ideas based on analogical reasoning, none of them was carried out to investigate how these sources can be used to generate ideas based on metaphors.

Whereas studies of metaphors in the cognitive and linguistic domains are vast, only few works attempted to integrate cognitive theory with discourse analytic procedures in order to investigate their function in communication in general, and in the domain of architecture specifically [14]. This is regrettable given the importance of metaphors in discourse interaction in design. This situation was criticized by several researchers, who stressed the importance of the real communicative contexts in which metaphors are generated to gain a deeper insight about this phenomenon [15]. In this regard, Gibbs [16] argued that an accurate understanding of the connection between linguistic expressions and conceptual schemas cannot take place disregarding 'the cultural contexts in which conceptual metaphors arise and support particular uses of language'. Consequently, studying the types of metaphors that are produced when solving design tasks entails the consideration of cognitive and linguistic schemas developed in this singular context. Such an approach may allow the identification of the use of the specific language that articulates discourse interactions, also known as the genre, in disciplines such as architecture. Genre can be defined as the semiotic patterns and relationships that respond to recurring situations, which is viewed as a maker of meaning [17].

Our aim in this study is to explore empirically the generation of metaphors during the most creative stage of the design process concerned with the production of idea-solutions. A major goal is to investigate the type of metaphors produced by architects as they come out in architectural design, considered as the genre that expresses their discourse interactions. This entails analyzing the phenomena in its real context, while considering essential issues of metaphor description in cognitive linguistics that are concerned with the identification and categorization of dominant metaphors. Given that when dealing with design problems architects use to make resource of a variety of external displays, another goal is to investigate the effect that different type of external stimuli may have on the generation of metaphorical ideas. The research questions that guided our study were the following:

- What types of metaphors were generated during the discourse interactions maintained by the architects during the design process, and what can be learned when approaching metaphors from a genre perspective?
- How the availability of external stimuli such as texts contributed to the generation of metaphors?

2. Methodology of research

2.1. Participants and set up

A team composed by three architects, which are PhD students belonging to the Faculty of Architecture and Urbanism, Department of Urbanism at TU Delft participated in the design session. They were informally approached in their offices, and invited to take part in the experiment. They received 15 Euros as a reward for their participation. The architects were requested to use the external text stimuli and to generate as much ideas as possible to solve the design problem.

2.2. Design task, procedure and instruments

The task called for the design a square in order to revitalize an awkward area of the Faculty of Architecture and Urbanism, TUDelft University. To this aim, architects were requested to propose design ideas about functions and spaces that could make the area a more enjoyable

place. The plaza was situated at the least used entrance of the faculty. Architects were well acquainted with the physical, cultural, and social aspects of the problem. Since the experiment focused on the preliminary stages of the process, also known as conceptual phase, the produced solutions were expected to be schematic and therefore not completed in every detail.

Participants were given a task sheet containing general instructions, a design problem, and a map and photographs of the site. In addition, they were provided with a set of four texts about poems, two of which were within-domain sources (i.e., an amusement park, and a harbour), and another two were between-domain sources (i.e., a volcano, and a mother board of a computer). Participants were told that they have to use the text information in order to deal with the problem at hand. They were also supplied with a set of A3 numbered sheets of paper, and were requested to produce and discuss as many idea solutions as possible.

The session lasted 30 minutes, from which 7 minutes were assigned to produce a final solution to the design problem, including a brief description of how the solution works. Students were told to think aloud as the team session was videotaped. Following the standard procedure of analysing verbal data, the recordings were transcribed, and analysed independently by the author and another researcher who is an expert in linguistics and metaphors.

3. Identification and categorisation of metaphors

The study was informed by the cognitive linguistic theory of metaphor originally developed by Lakoff and Johnson [1]. The analytical procedure included identifying metaphorical expressions in the transcript, and classifying them into diverse experiential domains. Expressions were tagged as metaphorical in cases that they represented any domain incongruity; i.e., a reference to a domain different from architecture [14]. The researchers analysed independently the raw data produced by the participants. Provided that the identification of some cross-domain incongruities is subjective and often a matter of disagreement, some cases were discussed by both researchers until full agreement was achieved.

Thereafter, a categorization system intended for organizing the identified metaphorical expressions into four experiential domains was proposed, which are illustrated below. These are part of a larger categorization system developed in the research, in which more design sessions were analysed.

The first experiential domain is labelled Artificial, and includes metaphors drawing upon human-made aspects. This was the richest set of metaphors of the study, and was decomposed into three groupings highlighting morphological or functional aspects of the design. These included: Built spaces are shapes or 3-D entities, Built spaces are machines, and Built spaces are built spaces. The expressions that represent spaces as shapes or 3-D entities specifically focus on formal and structural aspects. This is explicitly illustrated in example 1 below:

1 "...it (the built space) is a sail which is happening underneath, it's like a tent."

Within Built spaces are machines, spaces are equated to artifacts or devices working in a mechanical way. For example:

2 "… (the built space) is a computer chip.'"

Built spaces are built spaces reflects the view that certain designs can be described in terms of other designs. This metaphorical schema refers to establishing a mapping between the design problem, in this case a square, and an architectural typology that is remote to the problem. This is illustrated in example 3:

3 "This space is a theatre… a theatre with circles."

Human activity is an experiential domain referring to the manipulation of space in any form. It turns spaces as malleable and flexible artefacts that can be modelled or transformed. The expressions belonging to this category are best represented by the expression Architectural practice is a (manual) craft, which is mainly concerned with the action rather than the outcome. This is depicted in example 4:

4 "Because of this connection thing I also thought about that ..."

Another experiential domain corresponds to Motion, which reflects a kind of movement evoked by the metaphorical expressions. This category was organized into two ontological metaphors highlighting dynamic aspects of the design: Built spaces are journeys or motion experiences, and Built spaces are kinetic entities. The expressions that correspond to Built spaces are journeys or motion experiences equate space as a voyage or as an experiential passage. An example is:

5 "…these level changes take you out of the borders."

Metaphors in the form Built spaces are kinetic entities bring to mind the idea that spaces are animated entities with a life of their own. This is illustrated by:

6 "This (space) starts very small and then curves around …"

The last experiential domain refers to Nature, and draws upon physical non-man-made phenomena. These include Built spaces are geological entities or forces, and

Built spaces are water entities or forces. The former refers to expressions that equate spaces to geological things or geological processes. For example:

7 "It (the space) is not volcano-shaped… but there's still an eruption here"

Metaphorical expression incorporating natural sources concerned with water can be exemplified by:

8 "This (space) has something to do with waves… maybe we can do something with green waves"

In the next sections, we present an example about the generation of metaphors, and the use of external stimuli by the architects during the design task, followed by a quantitative analysis.

3.1. Illustrating the use of metaphors during the design session

From the outset, participants keep trying to use the ideas from the four inspiration sources - volcano, harbour, computer, and amusement park-, and apply them into the design. Constant references to these sources were observed along the process. As a result, to produce the final solution the architects attempted to combine metaphorical ideas retrieved from all the inspiration sources, which led to different types of metaphors. For example, Egbert said: "I think you should combine these two [in reference to previous sketches based on an octopus from the amusement park and the volcano] into one design because it's also the same shape; like it starts very small and then curves around…", which was categorized into the form "Built spaces are kinetic entities". In another example, Peter combined the volcano with the harbour stimulus: "it's a sail in a way of a tent eruption…for eruption is something like movement", generating metaphors that were categorized as "Built spaces are geological forces", and "Built spaces are shapes and 3D objects". Merging the volcano with the computer, Sally commented: "Yeah… eruption of computer shape, of computer chips, chips shape…" leading to the following types of metaphors: "Built spaces are geological forces", "Built spaces are shapes and 3D objects", and "Built spaces are machines". Figure 1 shows the final solution produced by the architects when designing the plaza, as an outcome of metaphor use.

4. Empirical results

A total of 89 metaphors were generated by the team of architects, from which 65 (73%) were based on the

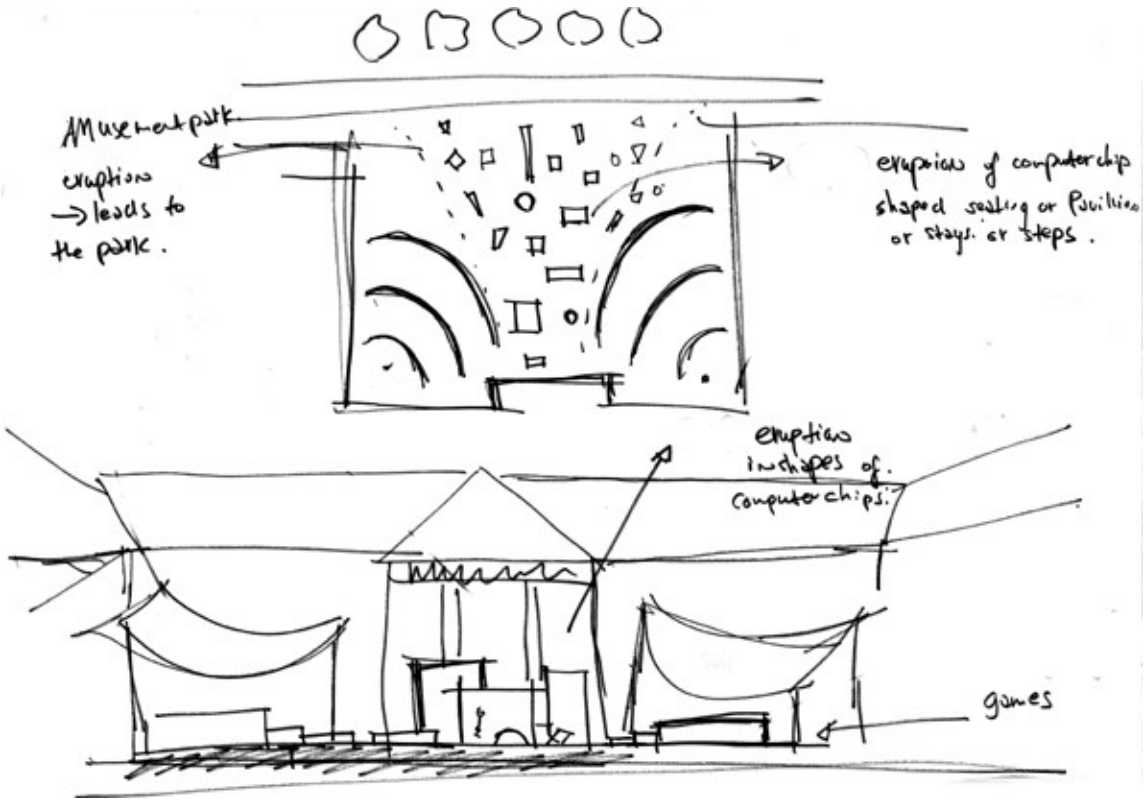

Figure 1. Design of the square located in the Faculty of Architecture and Urbanism, TUDelft University by the architects

Table 1: Frequencies and percentages for main metaphors of the categorization system according to the stimuli available to the architects

Names of the stimuli					Total
Volcano	Amusement Park	Harbor	Computer	Other	
29 (32.6%)	9 (10.1%)	23 (25.8%)	4 (4.5%)	24 (27.0%)	89 (100.0%)

Table 2: Frequencies and percentages of metaphors according to the categorization system

Main metaphors				Total
Artificial	Human activity	Motion	Nature	
42 (47.2%)	7 (7.9%)	10 (11.2%)	30 (33.7%)	89 (100.0%)

Table 3: Frequencies and percentages of groups of metaphors according to the stimuli available to the architects

Categories of metaphors	Name of the stimuli					Total
	Volcano	Amusement Park	Harbor	Computer	Other	
Artificial	1 (2.4%)	6 (14.3%)	15 (35.7%)	4 (9.5%)	16 (38.1%)	42 (100.0%)
Human activity	4 (57.1%)	2 (28.6%)	1 (14.3%)	-----	-----	7 (100.0%)
Motion	3 (30.0%)	1 (10.0%)	1 (10.0%)	-----	5 (50.0%)	10 (100.0%)
Nature	21 (70.0%)	-----	6 (20.0%)	-----	3 (10.0%)	30 (100.0%)
Total	29 (32.6%)	9 (10.1%)	23 (25.8%)	4 (4.5%)	24 (27.0%)	89 (100.0%)

available stimuli, and 24 (27%) were produced by other means. When focusing on the stimuli available to the participants, we found that the poem about the volcano was the source that led to the generation of the largest number of metaphors, followed by the harbour, the amusement park, and the computer ones (see Table 1).

The metaphors generated by the architects were organized into the four major categories presented in section 3. From Table 2 it can be seen that almost half of the metaphors belong to the category labelled Artificial, followed by Nature, Motion, and Human activity.

In order to understand the influence of the available stimuli to the metaphorical ideas, the above categories were analysed according to the different stimuli used during the design process. Table 3 shows that in the artificial category, the stimuli that contributed most was the harbour. Remarkably, the volcano was the stimulus with a higher contribution in the other three categories. Generally speaking, this source was the most frequently used along the design process, followed by the harbour, the amusement park and the computer. It should be noted that most of the metaphors created by the architects were based on the available stimuli, whereas less than a third was produced without regard to these sources.

In a more refined analysis, the input of the stimuli was examined in relation to the sub-categories of metaphors. Table 4 indicates that within the human activity category, and regarding the 'architectural practice is a (manual) craft' specifically, the volcano was the most recurrently employed stimulus, followed by the amusement park, and the harbour. In the nature category, specifically in 'built spaces are natural entities/forces', the harbour was largely, whereas in 'built spaces are geological entities/forces', the volcano was predominant. Within the motion category, in 'built spaces are kinetic entities' again the volcano prevailed.

Notably, metaphors labelled 'built spaces are journey/motion experiences' were not related by any available stimuli. Moreover, in the artificial category, specifically in 'built spaces are machines', the computer was most frequent, whereas in 'built spaces are shapes/3D entities', the use of the harbour and the amusement park was more recurrent. Remarkably, metaphors labelled 'built spaces are built spaces' were not based on any available stimuli.

Independently of the existing stimuli, two types of metaphor were the most recurrent ones. More than a forty percent of these correspond to 'built spaces are shapes/3D entities', whereas a quarter belongs to 'built spaces are geological entities/forces' (see Table 5).

5. Discussion

Bearing in mind the exploratory nature of the study and the small sample, we do not intend to generalize findings observed along the design process. Together with this, the case study provided a suitable framework to explore what types of metaphors were generated during the problem-solving task, to propose a categorization system, and to analyse what type of stimuli was related to what kind of metaphors.

The analysed utterances indicated that most of the metaphors generated by the architects were based on the external stimuli. This important finding suggests that the availability of different type of stimuli can enhance the generation of metaphorical ideas in communicative contexts such as architecture [14].

Regarding the use of external stimuli during the design task, the two sources that contributed most to the generation of metaphors were the volcano and the harbour. Whereas the first one can be seen as a between-domain-close source, the second one corresponds to a within-domain-far source [10, 11, 12]. From the two available between-domain sources, architects preferred to use the closer one. In spite that

Table 4: Frequencies and percentages of groups of metaphors according to the stimuli available to the architects

Category	Sub-category	Name of the stimuli					Total
		Volcano	Amusement Park	Harbor	Computer	Other	
Human activity	Architectural practice is a (manual) craft	4 (57.1%)	2 (28.6%)	1 (14.3%)	-----	-----	7 (100.0%)
Nature	Built spaces are water entities/forces	-----	-----	6 (75.0%)	-----	2 (25.0%)	8 (100.0%)
	Built spaces are geological entities/forces	21 (95.5%)	-----	-----	-----	1 (4.5%)	22 (100.0%)
Motion	Built spaces are journeys/motion experiences	-----	-----	-----	-----	1 (100.0%)	1 (100.0%)
	Built spaces are kinetic entities	3 (33.3%)	1 (11.1%)	1 (11.1%)	-----	4 (44.4%)	9 (100.0%)
Artificial	Built spaces are machines	-----	-----	-----	3(100.0%)	-----	3 (100.0%)
	Built spaces are shapes/3-D entities	1 (2.7%)	6 (16.2%)	15 (40.5%)	1 (2.7%)	14 (37.8%)	37 (100.0%)
	Built spaces are built spaces	-----	-----	-----	-----	2 (100.0%)	2 (100.0%)

Table 5: Frequencies and percentages of sub-categories of metaphors according to the categorization system

Metaphorical system								Total
Human	Artificial			Motion		Nature		
Architectural practice is a (manual) craft	Built spaces are built spaces	Built spaces are machines	Built spaces are shapes/3-D entities	Built spaces are kinetic entities	Built spaces are journeys /motion experiences	Built spaces are geological entities/forces	Built spaces are water entities/forces	
7 (7.9%)	2 (2.2%)	3 (3.4%)	37 (41.6%)	9 (10.1%)	1 (1.1%)	22 (24.7%)	8 (9.0%)	89 (100.0%)

between-domain-far sources are considered to help in the production of creative solutions [13], it is probable that architects found difficulties to identify and establish metaphorical relations between the computer (between-domain-far source) and the problem at hand. On the other hand, from the two available within-domain sources, architects favoured to use the farther one. Possibly, the amusement park (within-domain-close source) was too near to the problem at hand to stimulate the generation of metaphors, and therefore they were prone to use the harbour stimuli, which was at a relatively mid-distance to the problem [12].

Additional analyses centre on the categorization system upon which metaphors were organized. It is interesting that most of the metaphors created during the design process belong to two contrasting groupings: 'artificial' and 'natural'. This may not come as a surprise considering that the assigned task had to do with the design of a square which, by definition, is concerned with both man-made and nature issues. The existence of metaphors belonging to the motion category reconfirms that an experience of implied movement is always present in architecture [18]. The motion metaphors were useful to signify that architecture – or in this case the square- can express or imply movement without actually moving.

Other findings centred on the relation of the external stimuli to the distinct categories of metaphors. That most metaphors from the 'artificial' category were based on the 'harbour' and the 'amusement park' can be explained by the fact that these stimuli are within-domain sources, which are considered to belong to the same domain of the problem at hand, in this case the architectural domain. In contrast, the vast majority of metaphors in the 'nature' category was generated from the 'volcano', a between-domain source considered to be remote to the design task. These suggest that the type of stimuli available to the architects plays a key role on the kinds of metaphors produced during the task, and possibly on the final outcome as well.

Finally, the study focused on the relation between the sub-categories of metaphors and stimuli. The most frequent sub-category was 'built spaces are shapes/3D entities', which was largely based on the harbour, a within-domain-far stimulus. This important finding suggests that, besides that different types of metaphors aid in dealing with a variety of aspects of the design activity, issues related to morphology are probably at the core of the metaphorical language in architecture. Moreover, that the harbour and the volcano were the most frequently used displays in all sub-categories of metaphors suggest that mid-distance sources are the preferred inspiration sources for the creation of metaphors.

6. Conclusions

Studying metaphor from a genre perspective contributed to transcend disciplinary jargon, and enhance our understanding into how these rhetorical devices are approached in the architectural design community. The study allowed identifying main genre conventions, and it informed about some of the most usual categories of metaphors that architects employ during discourse interaction.

Moreover, the present work pioneered the analysis of the role of text stimuli in the generation of metaphors in design problem solving. The availability of poems was found to be an effective mean to enhance and enrich metaphorical expressions, and it also demonstrated to have a strong influence on the category and type of metaphors created. Thinking in terms of metaphors not only helped designers to define and understand many aspects of the problem at hand, but also to develop, communicate, and discuss a variety of idea solutions throughout the design process. An indication of this is

the large number of metaphorical expressions of various kinds that were used in reference to the different aspects of the design problem.

Along the process, the designers were able to transform abstract metaphorical expressions into concrete sketches, and to combine and integrate different metaphorical ideas into an unconventional and creative solution. Based on the present findings, implications for architectural practice, and design education, should be taken into consideration. Teachers can develop intervention programs aimed to promote the use of metaphors in the architectural design studio. Such an approach may help support communication needs among designers, guide the design process, and contribute to produce original solutions.

In sum, departing from the works of Lakoff and Johnson and combining discursive and cognitive perspectives, this paper offered a comprehensive approach that allowed gaining insight into how metaphor, as a domain specific scheme, works in architectural design. In a future study, we will extend our analysis on the characterization of metaphorical instances to include a larger number of design teams with different levels of expertise. In addition to text stimuli, we will explore the effect that other types of inspiration sources - such as visual images- have on metaphorical reasoning in architectural design.

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References

[1] Lakoff, G., & Johnson, M. *Metaphors we live by*, University of Chicago Press, Chicago, USA, 1980.

[2] Gentner, D., Bowdle, B., Wolff, P., & Boronat, C. Metaphor is like analogy, in *The analogical mind: Perspectives from cognitive science*, (Gentner, D. Holyoak, K. J. & Kokinov, B. N.), MIT Press, Cambridge, MA:, USA, 2001, pp. 199–253.

[3] Lakoff, G. *Women, fire and dangerous things: What categories reveal about the mind.* University of Chicago Press, Chicago, USA, 1987.

[4] Lakoff, G., The contemporary theory of metaphor, in *Metaphor and thought*, (Ortony, A), Cambridge University Press, New York, USA, 1993, pp. 202–251.

[5] Coyne, R., *Designing information technology in the postmodern age: From method to metaphor,* MIT Press, Cambridge, MA, USA, 1995.

[6] Casakin, H. An empirical assessment of metaphor use in the design studio: Analysis, reflection and restructuring of architectural design, *International Journal of Technology and Design Education*, 2012, 22, 329-344.

[7] Drew, P. *Sydney Opera House: Jorn Utzon*, Phaidon Press, London, UK, 1995.

[8] McQuaid, M. *Santiago Calatrava: structure and expression*. The Museum of Modern Art, NY, USA, 1993.

[9] Casakin, H., & Kreitler, S., Meaning profiles of metaphors and design products in architecture, *European Journal of Engineering Education,* 2016, http://dx.doi.org/10.1080/03043797.2016.1236073

[10] Tseng, I., Moss, J., Cagan, J., & Kotovsky, K., The role of timing and analogical similarity in the stimulation of idea generation in design, *Design Studies,* 2008, *29*, 203-221.

[11] Chan, J., & Schunn, C., The impact of analogies on creative concept generation: Lessons from an in vivo study in engineering design, *Cognitive science,* 2015, 39, 126-155.

[12] Chai, C., Cen, F., Ruan, W., Yang, C., & Li, H., Behavioral analysis of analogical reasoning in design: Differences among designers with different expertise levels, *Design Studies,* 2015, 36, 3-33.

[13] Ozkan, O., & Dogan, F., Cognitive strategies of analogical reasoning in design: Differences between expert and novice designers, *Design Studies,* 2013, 34, 161-192.

[14] Caballero, R.M., Metaphor and genre: The presence and role of metaphor in the building review, *Applied Linguistics*, 2009, 24, 145-167.

[15] Cameron, L., Operationalising ‘metaphor’ for applied linguistic research, in *Researching and Appling Metaphor*, (Cameron, L. & Low, G.), Cambridge University Press, Cambridge, USA, 1999. pp. 3-28.

[16] Gibbs, R., Taking metaphor out of our heads and putting it into the cultural world, in *Metaphor in Cognitive Linguistics*, (Gibbs, R.W. & Steen, G.), John Benjamins, Amsterdam/Philadelphia, 1999, pp. 145-166.

[17] Devitt, A.J., Generalizing about genre: New conceptions of an old concept. *College Composition and Communication*, 1993, 44, 573-586.

[18] Hardy, H., The expression of movement in architecture, *The Journal of Architecture*, 2011, 16, 471-497.