



## A STUDY OF FURNITURE DESIGN INCORPORATING LIVING ORGANISMS WITH PARTICULAR REFERENCE TO BIOPHILIC AND EMOTIONAL DESIGN CRITERIA

Nurul ‘Ayn Ahmad Sayuti, Carlos Montana Hoyos and Elivio Bonollo

*University of Canberra, Australia*

This paper reports on the first (theoretical) stage of a two-part investigation of selected aspects of biophilia theory as applied in the design of furniture, and with particular reference to design criteria that designers may use, including emotional criteria. The second (empirical) part of this investigation will report on the results of surveys based on the findings of the first stage and, while some empirical findings will be previewed in this paper, the main findings will be published in a separate paper. The aims of this paper are twofold: firstly, to investigate the wide-ranging typology of published furniture designs incorporating living organisms (often with few logical explanations apart from anecdotal or implied axiomatic benefits) and, secondly, to identify the criteria designers and users may employ to make design-and-use decisions about such furniture with particular reference to biophilic and emotional design criteria. Biophilia theory proposes that humans have an instinctive and innate need to connect with nature. In general, biophilic design uses biophilic principles in the design process. Interestingly, a review of the literature has found that, although biophilic design has been widely reported in architecture and environmental design circles, few studies address the logical application of these principles in the context of furniture design. Following a critical literature review, this paper proposes a novel typology of furniture designs that incorporate living organisms (such as plants, animals and insects). This typology is based on at least 168 furniture designs classified into 4 main categories and 24 sub-categories. The underlying purpose being to provide a framework from which useful furniture design criteria may be inferred subject to empirical testing. For brevity, a synopsis of this typology is presented in the main body of the paper with the details given in the appendix along with source credits. This is followed by proposing a model of evaluation criteria, a metric which may be used to inform the design of furniture from a user and designer perspective. The paper also presents a brief preview of how these models have been applied in the empirical part of this investigation, along with a summary of findings and conclusions.

**Keywords:** Biophilia, Biophilic design, Furniture design, Emotional design criteria, Living organisms.

### INTRODUCTION

Biophilia, from the Greek *bios*: meaning life, and *philos*: love and bonding, is a theory which proposes that humans have an inherent affinity to affiliate with natural systems and processes (Wilson, 1984; Kellert et al, 2008). Although the ‘artificial’ built environment has often ‘protected’ people from nature,

humans and the natural surroundings are two things that cannot be separated because both are related to and benefit from each other. Moreover, humans tend to experience, reflect and bond with nature physically and mentally, and recent studies have proven the benefits of nature in the built environment for people's health and wellbeing (Kellert et al, 2008; Huelat et al, 2008; Park et al, 2009; Beatley, 2010; Reeve et al, 2012; Tracada, 2012; Reeve et al, 2013; Newman, 2014; Ryan et al, 2014; Terrapin, 2014; Zydervelt, 2014). There is also an emerging and well-known trend, especially in the architectural design of buildings, where biophilic design elements and principles are increasingly used. However, the links between "*furniture design with living organisms*" (referred to as FDLOs in this paper) and biophilic design have seldom been explored on a rational basis especially as to why designers use living organisms in their designs, or how consumers of such furniture react to such furniture designs from pragmatic, semantic or emotional points of view. It is not generally known if FDLOs are influenced by a variety of criteria including those based on emotional responses, although these are clearly important design criteria (Norman, 2004). A rational framework of these criteria needs to be developed so as to better inform and understand the design of such furniture. In addition, the range of FDLOs types, published in the literature, does not appear to have been classified into logical groups. Hence a typology of such designs is urgently needed especially for design research and design process purposes. The following review of the literature will outline much of what has been published in relation to these aspects as well as highlighting the need for additional research.

## LITERATURE REVIEW

**Definitions:** It is important to briefly review the meanings of the terms furniture design, biophilia and biophilic design, and emotional design, as follows below.

**Furniture design:** can be defined as the design of movable, functional objects that support human activities such as tables, chairs, sofas, beds and storages. Different types of furniture are designed to cater for different types of activities. Furniture designs can be classified based on the materials from which they are made, craftsmanship, function, styles, status, beliefs, cultures, eras, and psychographic and demographic factors (Hinchman, 2009; Pina, 2010). Current or contemporary designs are diverse because of new needs, trends, advances in ergonomics, and the development of new technologies in manufacturing and materials. Furthermore, furniture designs can also be historical artefacts that provide an overview on culture and ways of living. For example, a chair can be designed to be a throne for a king (a luxurious eclectic piece to show status), be used as part of religious ceremonies, or can just be used by all people in public areas such as offices, schools, parks and malls.

**Biophilia and Biophilic Design:** as defined by the Dictionary of Environment and Ecology Fifth Edition (2004), the prefix bio is '*referring to living organisms*' and the suffix philia is '*attraction towards or liking for something*'. As such, biophilia describes the innate feelings of people that are associated with nature and living organisms (Wilson, 1984). Moreover, biophilia theory proposes certain possible reactions and behaviours of humans towards their environment and how the surrounding environment affects their daily life. Wilson (1984, p 1) developed Biophilia theory and defined it as 'the innate tendency to focus on life and lifelike process.' Biophilia theory was further developed as 'biophilic design' by Kellert et al, (2008)—this is the application of biophilia theory in the design of the environment, where the effects of nature on the human mind, emotions and physical well-being are crucial (Kellert et al, 2008). According to Kellert et al (2008, p3), biophilic design is:

*'The deliberate attempt to translate an understanding of the inherent human affinity to affiliate with natural systems and processes – known as biophilia, into the design of built environment'*.

Kellert et al (2008, p7 - 15) have also divided biophilic design into six design elements. These elements can be a useful guide for designers and researchers to apply in designs that can bring nature closer to

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Kellert et al (2008, p7 - 15) have also divided biophilic design into six design elements. These elements can be a useful guide for designers and researchers to apply in designs that can bring nature closer to people. As interpreted by the writer in Figure 1, hereunder, these elements are generally applied to architecture and landscape design, but how they apply to furniture design is not that clear. As depicted in Figure 1 below, these six design elements are 1: *Environmental features*— which involve colour, water, air, sunlight, plants, animals, natural materials, views and vistas, facade greening, geology and landscape, habitats, ecosystems and fire in nature., 2: *Natural shapes and forms*— these are the man-made designs that include natural traits, motifs, forms or structures., 3: *Natural patterns and processes*— these comprise the integration of natural elements and cycles that are compatible with the built environment., 4: *Light and space*— involves the function of lights and spaces in outdoors and indoors of built environment., 5: *Place-based relationships*— these involve the merging of ecology into culture, for example the adaptation of Yin-Yang concepts into design, where the Chinese culture incorporates the natural elements into daily life, and, finally, 6: *Evolved human-nature relationships*— which describe the affiliations between human beings with nature and how nature has influenced them.

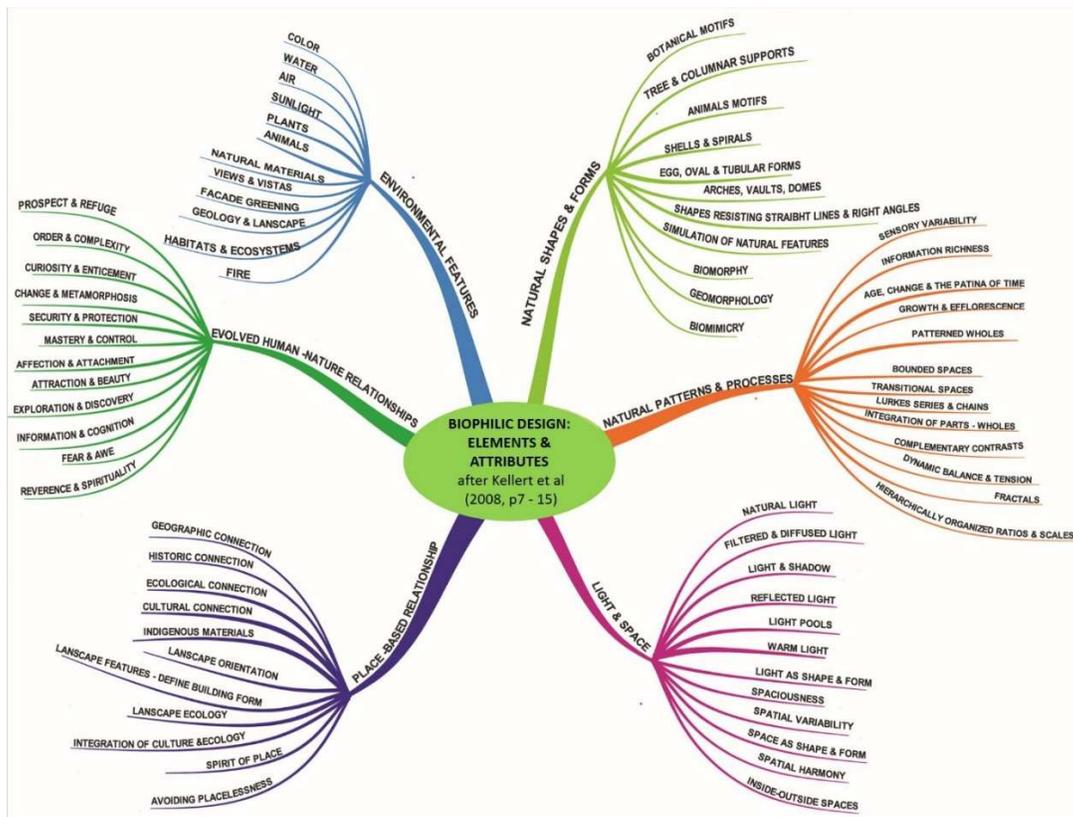


Figure 1: Graphic interpretation and summary of Biophilic design elements—after Kellert et al (2008, p7 - 15)

Although all of these biophilic design elements are useful from a preliminary and general point of view, it is not clear how they may be applied in the development of a related typology and specific design criteria for FDLOs.

from the literature, although emotional responses are well known in terms of their effects on design decisions as well as consumer choices or preferences. Emotions can be defined as subjective biological conscious or non-conscious expressions which involve facial and vocal expressions, physiological symptoms and occur depending on certain events that can be experienced in daily life (Niedenthal et al, 2006). In order to further understand emotion, Plutchik (2001) developed an emotion circumplex model using a colour wheel where he categorized and placed similar emotions close to each other.

Norman (2004) proposed three levels of *'emotional design'*, which are; 1: *visceral level*, 2: *behavioural level* and 3: *reflective level*. Meanwhile, Desmet (2012) has developed a typology of 25 positive emotions that were divided into nine categories. According to Khalid and Helander (2006), user interactions with products are influenced by emotion, and there are five main methods to measure emotions: these are 1: *Semantic Scales* developed by Kuller in 1975, 2: *Positive Affect Negative Affect Schedule (PANAS)* developed by Watson et al in 1988, 3: *Questionnaire for Measuring Pleasure in Products* used by Philips Design and developed by Jordan in 2000, 4: *Product Emotion Measurement Instrument (PrEmo)* developed by Desmet in 2003, and finally 5: *Kansei Engineering* developed by Nagamachi in 2005.

All of this work provides useful, design-relevant information although no specific studies applying to FDLOs have been detected in the literature regarding criteria that designers may use in the design process for FDLOs. In view of the above findings, it follows that a potential framework for evaluating the design of FDLOs in relation to biophilic design elements would need to take into account criteria influenced by human emotions. It is important to note that although many examples of FDLOs (especially with plants) are related to green design, Eco design or sustainable design, this research will focus on biophilic design, rather than design for sustainability.

## PREVIOUS RESEARCH & KNOWLEDGE GAP IN THE LITERATURE

After reviewing several studies related to biophilia, biophilic design and emotional design in the literature, it is found that there are few research studies regarding biophilia theory, biophilic design or emotional design conducted in the context of furniture design and more specifically in FDLO's. For example, Ulrich (1981) demonstrated the effects of natural and urban scenes towards psychophysiological (psychology and physiology) aspects. A related study was conducted by Balling and Falk (1982), where they assessed the visual preferences of 548 subjects towards natural landscapes.

Many studies have been conducted to understand the effects of real plants and natural elements towards psychology, health and attention in human-environment relationships (Kaplan, 1995; Tennessen and Cimprich, 1995; Frumkin, 2001; Bringslimark et al, 2009; Grinde and Patil, 2009; Howell et al 2011; Joye and Van den Berg, 2011). In addition, different studies on emotion and experience with nature were also developed by Perkins (2010) and Hinds and Sparks (2011). Kahn Jr. (1997) conducted research on children's affiliation with nature in education and human development. All these studies showed that nature and natural elements have important effects on the mental, physical, behavioural and emotional aspects of human beings.

Interestingly, a study relevant to this investigation was conducted by Windhager et al in 2010, who studied the effects of an aquarium with fish placed in an exhibition in a Mall (a European shopping mall in Austria). This study used a direct behavioural observation method (by using a hidden video camera) to observe respondent reactions, with a view to understanding human behaviour when confronted by living organisms in non-natural surroundings. Although admittedly not necessarily conclusive, they suggested that living organisms influenced passers-by emotionally as well as attracting people's attention. Another relevant study on the perception of greenery in residential buildings was conducted by White and Gatersleben (2011) who surveyed 188 participants who rated digitally modified images of houses with or without vegetation. Similarly, a study in landscape architecture conducted by Roth (2005) explored the

validity of online surveys to evaluate and to visually assess the scenic quality of 17 German landscape sites.

Other studies related to emotional design, user experiences and product design have been published by Chitturi (2009), Blijlevens et al (2009), Lenay (2010), Dazkir and Read (2011), Fokkinga and Desmet (2013), Hassenzahl et al (2013) and Desmet and Pohlmeier (2013). In addition, an interesting study on emotion design was conducted by where they researched furniture forms and their influences on emotional responses in interior environments. Specifically, they used a simulated setting consisting of curvilinear and rectilinear sofas, and the data were collected from 111 participants were analysed by means of Mehrabian and Russell's nine-point semantic differential scale (as cited in Dazkir and Read, 2011).

From the literature above, it is apparent that there is a serious gap in knowledge in this field. It follows that there is an urgent need to develop a new typology or classification for FDLOs mindful of biophilic and emotional design criteria.

### **A PROPOSED TYPOLOGY FOR FDLOs**

Based on compilations of FDLOs published in design books and on the web, the lead author has identified at least 168 designs embedded with living organisms (refer to Appendix I for the source credits for these designs). These design examples are classified by context (outdoor or indoor) as well as by type of furniture (chair, table, other). Through further analysis of the different types of FDLOs found, a typology is proposed as shown in Figure 2 below (shown in partial form). After analysis of the noted 168 designs (some examples are shown in Figure 3), it is found that these designs have different purposes, such as furniture for learning, food consumption and farming, generating energy, purifying water or air, experiencing nature, to heal, to calm and to lower stress (Appendix II contains the details of the proposed FDLOs typology).

Examples of Furniture Design with Living Organisms (FDLOs)					
Indoor	Chair/ Bench	 1	 2	 3	 4
		 13	 14	 15	 16
		 25	 26	 27	 28
	Table	 37	 38	 39	 40
		 49	 50	 51	 52
		 61	 62	 63	 64
		 73	 74	 75	 76
	Others	 85	 86	 87	 88
		 97	 98	 99	 100
		 109	 110	 111	 112
		 121	 122	 123	 124
	Outdoor	Chair/ Bench	 133	 134	 135
 145			 146	 147	 148
 157			 158	 159	 160
Table		 109	 110	 111	 112

Figure 2: A proposed typology for FDLOs (for brevity only a partial typology structure is shown – the full typology is shown in Appendix II) (source: authors)



Figure 3: Selected examples of FDLOs (sources: see appendix I)

The proposed typology was used to provide a theoretical background for the research project and development of a new model of evaluation criteria which describes the characteristics and *purposes* of the various types of FDLOs —as related to the four categories of criteria-purposes as discussed hereunder.

### CONCEPTUAL DEVELOPMENT & RESEARCH METHODS

**Conceptual Development:** From analysis of the above typology, and through several iterations, a model with twenty four different *purposes* organized into four main categories of criteria is proposed as shown in Figure 4, namely:

*A: Function and Practicality, B: Aesthetic and Semantic, C: Experience, D: Experimental.* The *Function and Practicality* category is divided into six purposes, namely, *A1: to learn, A2: farming or food, A3: purify air or water, A4: generate energy, A5: to encourage hobbies, and A6: other reasons.* The six purposes under the *Aesthetic and Semantic* category are *B1: aesthetic value or decoration, B2: collection and display, B3: communication or to convey a message, B4: artistic reasons, B5: contemplation and B6: other reasons.* Under the *Experience* category, six purposes are identified namely, *C1: to experience or interact with nature, C2: environmental consciousness, C3: to heal, calm or lower stress, C4: entertainment, C5: to stimulate senses and C6: other reasons.* Finally, in the fourth *Experimental* category, the six purposes identified are as follows: *D1: conceptual design, D2: part of a research project, D3: exploration of new materials, D4: exploration of new technologies, D5: to break the rules or be different and D6: other reasons.*

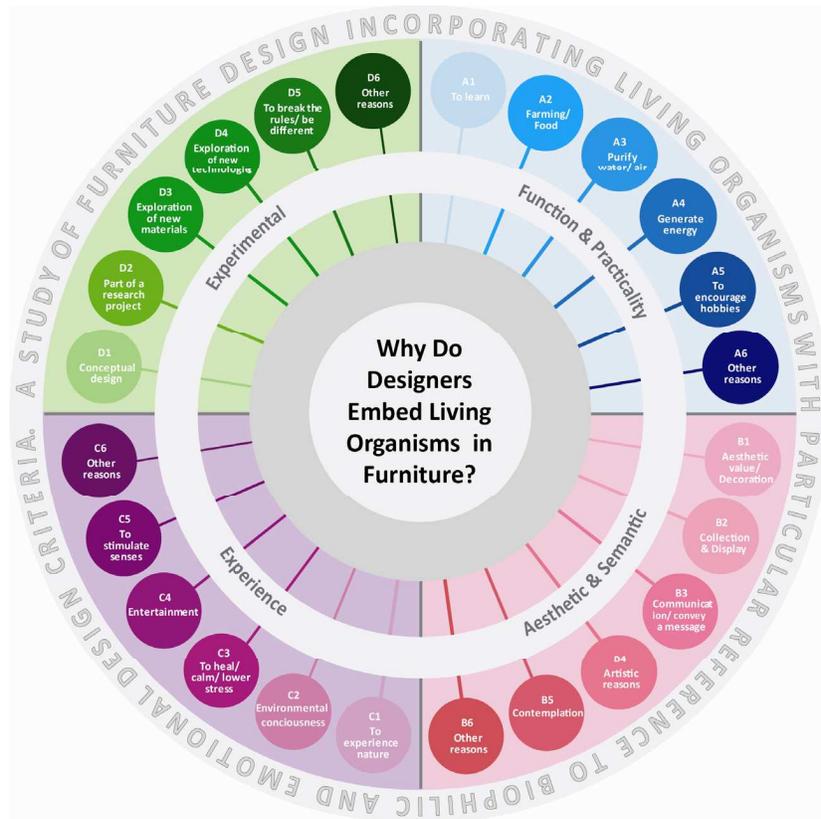


Figure 4: Proposed model of design criteria/purposes underpinning FDLOs (source; authors)

**Research Methods:** In order to achieve the aims noted in the abstract, this research is being conducted by; 1: *observations* of current FDLOs (as categorised in the above typology), 2: *interviews*, to gather information from current furniture designers, and 3: *questionnaire-based surveys* to obtain quantitative and qualitative data from potential users about how they perceive and interpret the images of FDLOs.

**Interviews:** To date, twelve one-on-one interviews have been carried out in order to gather information from designers involved in designing FDLOs. These interviews were conducted using Skype, on a semi-structured basis and the response data is being analysed in keeping with recommended survey methods. (Bryman, 2012; [www.sociology.org.uk/methfi.pdf](http://www.sociology.org.uk/methfi.pdf), 2013). These interview data are currently being processed (detailed empirical results will be presented in a subsequent paper).

**Survey:** As informed by the literature review, a valid way of conducting this type of research is by using images (both original as well as digitally altered) embedded in online surveys (White and Gatersleben 2011, Roth 2005). The testing of the noted design criteria/purposes model uses sets of images of FDLOs and digitally altered versions to compare and survey respondents' perceptions and emotional responses towards FDLOs as well as similar furniture designs that do not incorporate living organisms. This model (noted in Figure 4) was adapted for survey design purposes as shown in Figure 5 hereunder. A corresponding online survey employed closed format questions that proposed a combination of radio button, image selection, 7- point semantic scales, and 5-point Likert scales.

After experimentation with diverse online survey tools (e.g., SurveyGizmo, Survey Monkey, ACSPRI/ Lime Survey, Free online surveys), SurveyGizmo was selected because the web host produced a user friendly, vibrant and colourful format adequate for the type of visual research employed in this project. According to Schmidt (1997) Zhang (2000), Sills and Song (2002), Evans and Mathur (2005), Kiernan et al (2005), Roth (2005) and Behrend et al (2011); web-based surveys are a powerful communication tool for research because of the vast use of the internet. Even though there are disadvantages, online surveys still provide strengths such as global reach, flexibility, convenience, low cost, ease of data entry and analysis, among others.

In order to validate the proposed model of design criteria for FDLO's, in the survey respondents were required to select a minimum of four answers from the twenty four purposes, according to what they considered best describes the given images. The answers given by the respondents will be evaluated and compare according to the actual reasons and explanation of the design, provided by the designers.

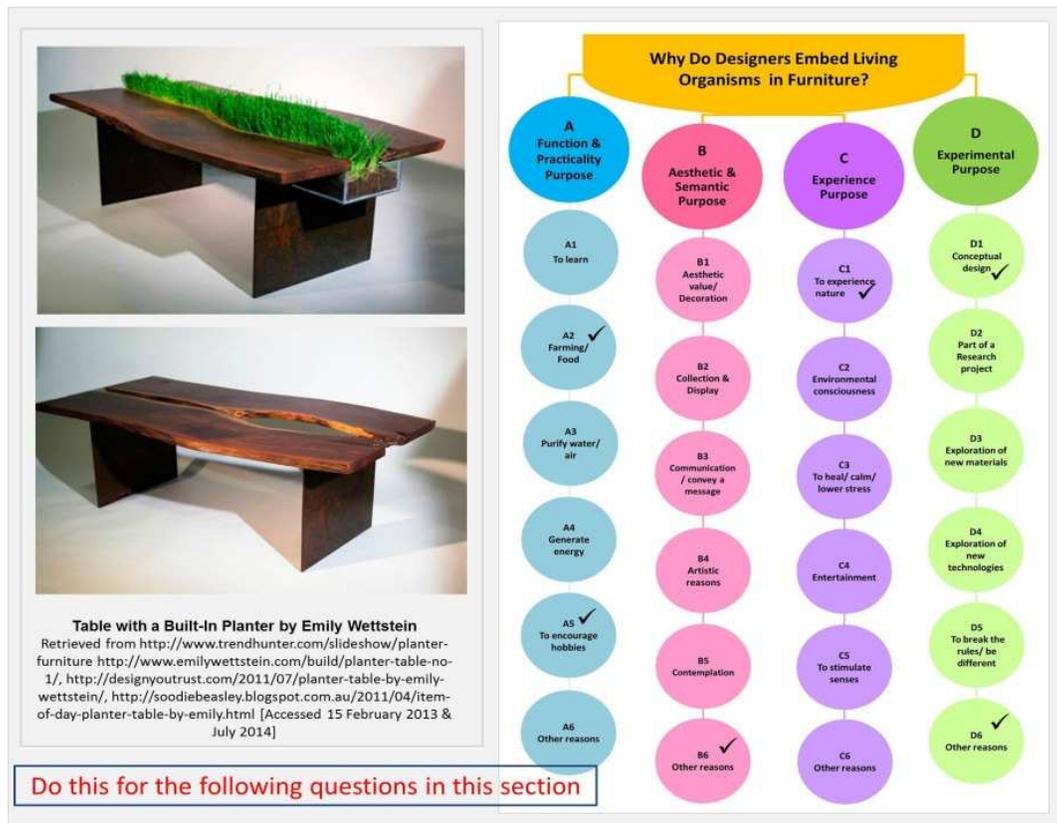


Figure 5: The proposed design criteria/purposes model, reformatted for the online survey (source: authors)

## SELECTED FINDINGS & RESULTS

**Respondent Background:** Interview data obtained from specific FDLO designers (as noted under item 2 of the research methods above) are currently being processed. Further online surveys with specific groups of participants, including design professionals and design educators, are also currently in train so statistical comparison may be made between different groups of respondents.

Initially, and after several trial tests, a preliminary online survey was launched in August 2014 aimed at a general sample of the population. A total of 252 respondents answered the survey and a general overview of the demographics of participants (professional and geographical backgrounds) is shown in Figures 6.

Respondents came from Asia (59.1%), Australia and Oceania (18.3%), Americas (11.9%), Europe (7.5%) and Africa (3.2%). As shown in Figure 6, bearing in mind the nature and topic of the study, the highest number of respondents come from an educational or academic background (28.5 %), followed by art and design/ creative disciplines with 24.1% and students with 21.3%.

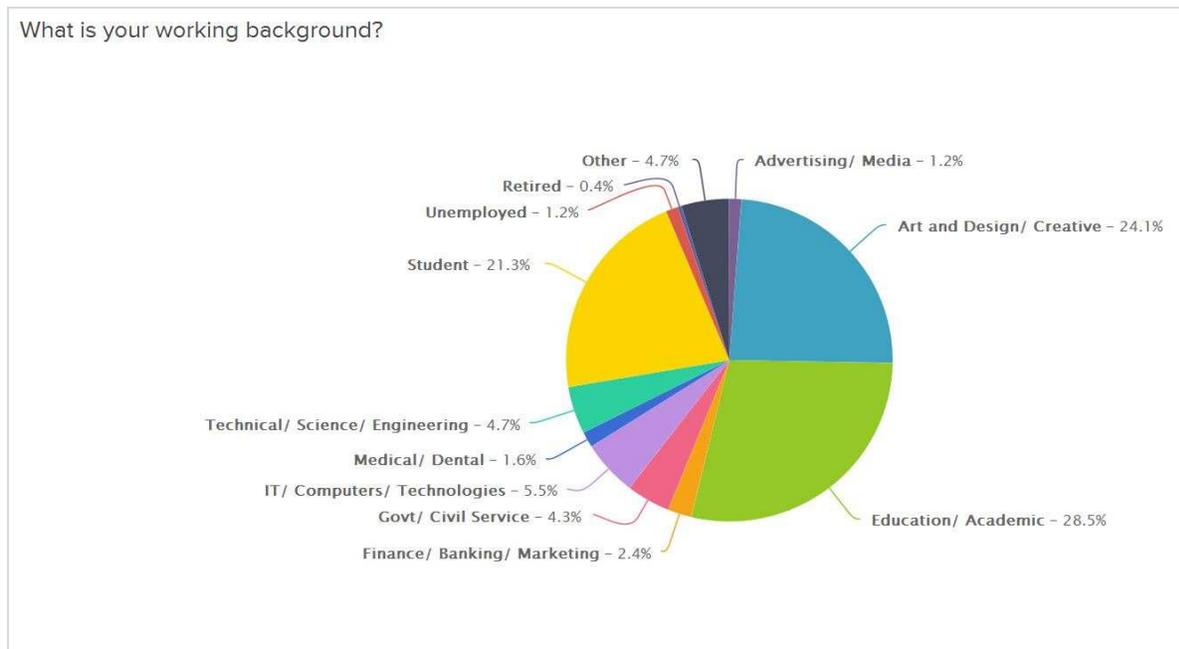


Figure 6: Respondent's professional background (source: authors)

Hence, it is possible to make some preliminary (but cautious) comparisons between the three largest groups (i.e., Education/Academic, Art and Design/creative and Students; by using statistical tests such as the Mann Whitney U Test (for comparing two groups) and the Kruskal Wallis test for comparing three or more groups (assuming that the data are not normally distributed). The remaining groups of respondents' could be grouped together but may not be indicative of the general population interested in FDLOs. However, it is realised that comparisons between specific groups of designers/respondents would be more reliable and this inquiry is currently in progress.

**Design perceptions:** This section of the preliminary questionnaire was designed to identify the preferences of respondents toward selected FDLO images, using an image selection format that compared two similar furniture designs, one with, and one without living organisms—a relevant extract from the questionnaire is shown in Appendix III. As shown in figure 7, the design with living organisms that was most favoured (to date but subject to further investigation) by the respondents in the noted preliminary survey is the design by Greg Zulkie, *The Stitch Table*, with 78.6% positive answers (labelled B in Figure 7; 198 respondents). The design with living organisms that was least favoured by the respondents (as compared to its similar counterpart) was the design by Deger Cengiz, *Threatening Cactus Terrarium Chair*, with 22.6% negative answers (labelled B in Figure 8, 57 respondents)



Figure 7: Most favoured FDLO, as compared to counterpart without living organisms (source: authors)



Figure 8: Least favoured FDLO, as compared to counterpart without living organisms (source: authors)

**Emotional Design:** This section of the preliminary questionnaire was designed to identify emotional responses towards FDLO images. The questions in this section used a 7-point emotion scale rating, based on adjectives, as follows: 1: *Disgusted*, 2: *Uneasy*, 3: *Bored*, 4: *Neutral*, 5: *Pleasantly Surprised*, 6: *Admired*, 7: *Fascinated*. This 7-point emotion scale was developed ad hoc for this study, and adapted

from the diverse existing emotional design scales found during the literature review. The design which received the highest positive emotional response was, again, the design by Greg Zulkie, *The Stitch Table* with 78.1% positive responses by 197 respondents.

Not surprisingly (due to the artistic, provocative and controversial nature of the design, as evidenced by the title), the design which received the highest negative emotional response was again the design by Deger Cengiz, *The Threatening Cactus Terrarium Chair* with 55.6% negative responses from 140 respondents. Most respondents stated that they felt *Uneasy* (40.1%) and only 28.3% responded with positive emotions.

**Biophilic Design:** Based on the other studies about Biophilia theory and Biophilic design as identified in the literature review, respondents were asked questions about potential positive or negative effects that they believed living organisms in the interior environment could cause. Examples of positive effects were “to heal, calm or lower stress”, and examples of negative effects were “causing allergies” (as in the case of pets). These questions used a 5-point Likert scale rating of 1: *Strongly disagree*, 2: *Disagree*, 3: *Neither Agree or Disagree*, 4: *Agree* and 5: *Strongly Agree*.

When asked about the effects of having nature indoors or nearby, nearly half of the respondents *agreed* (125 respondents, 49.6%), and one third of the respondents *strongly agreed* (81 respondents, 32.1%) that having natural elements and living organisms indoors can release stress and calm people, as shown in figure 9, below.

### Having natural elements and living organisms indoors can: A. Release stress/ calm you

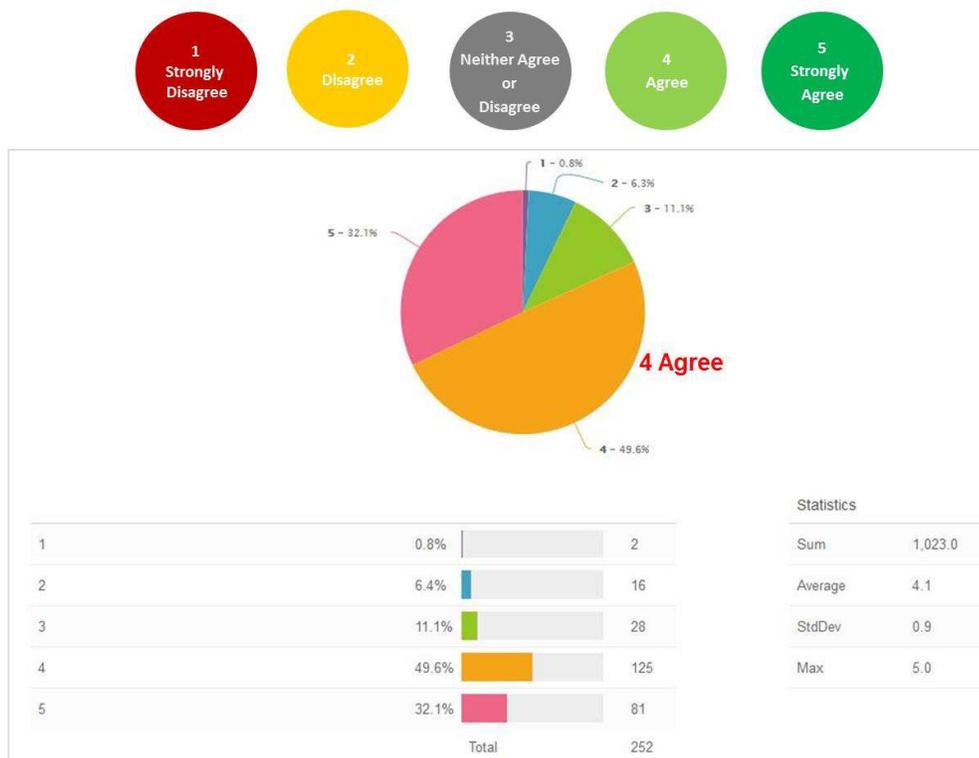


Figure 9: The effect of FDLOs towards respondents (source: authors)

## CONCLUSIONS

Current trends in design and architecture are looking for new ways to establish connections with nature, mostly motivated by environmental awareness. Biophilic design is the term used to describe an “innovative approach that emphasizes the necessity of maintaining, enhancing and restoring the beneficial experience of nature in the built environment.” (Kellert, Heerwagen & Maador, 2008). This approach is based on scientific evidence that shows that contact with nature has strong positive effects in human beings. As such, it tries to bring nature and natural elements back into the built environment, enhancing human well-being by connecting him to nature or to elements which remind him of nature. Biophilic design builds upon growing awareness in health, nutrition, medicine and psychology which shows that patients recover more quickly, students learn better and workplace productivity increases in built environments that offer an interaction with nature and natural elements. While Biophilia and Biophilic design have been widely studied in the built environment, especially landscape architecture and architecture, there are limited studies in terms of Interior, or Industrial Design, and more specifically within Furniture design. Being Furniture a very important aspect of interior design and of our current built environment, it was interesting to note the growing number of furniture designs which incorporated living organisms, such as plants and animals. As such, this type of furniture pieces, here described as FDLOs (Furniture Designs with Living Organisms) has been categorized, and a new typology which can help understand these furniture designs has been developed.

Although many current examples of FDLOs are currently motivated by eco-design or sustainable design trends, it is possible that Biophilia theory (our inherent affiliation to nature) plays a role in the designers' motivations, as well as in the users' emotions and experiences with this type of furniture. Studies in applications of the Biophilia theory have demonstrated the benefits that nature in the built environment brings to health and wellbeing of people. A literature review evidenced a gap in knowledge, as no studies were found which address Biophilia or Biophilic design within furniture design. The initial proposal described in this paper establishes a typology of FDLOs (furniture designs with living organisms, such as plants, animals and insects). Based on compilation and classification of at least 168 FDLOs, a typology and then a subsequent conceptual model were developed, in order to provide a theoretical background to be tested in the subsequent empirical research. Four main categories of FDLOs were identified which comprise *A: Function and Practicality*, *B: Aesthetic and Semantic*, *C: Experience*, *D: Experimental*. This model, which was developed from the typology described in this paper, is currently being validated through surveys, but has proven useful to further understand FDLOs

Although, still in progress and without definitive conclusive results yet, this project has proposed a new category of furniture (furniture designs with living organisms, or FDLO's), has proposed a typology to understand and potentially evaluate this type of furniture, and is uncovering the reasons behind these furniture designs, as well as the preferences and perceptions by users. As has been suggested by some of the interim results of the survey, interestingly and not surprisingly, the FDLOs which were most and least preferred by a majority of respondents (as compared with similar pieces without living organisms) have a direct correlation with positive and negative emotional responses. While the examples highlighted in this paper are the extremes, other examples are also being analysed, compared and discussed. Henceforward, the researchers are surveying different groups of respondents to make a comparison between the general respondents and specific target groups for more meaningful research results.

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## **Appendix II**

- 1) The typology of 168 FDLOs and The 4 Main Categories with 24 Purposes Typology Tables
- 2) The 4 Main Categories with 24 Purposes Typology Tables
  - Function and Practicality (A)
  - Aesthetic and Semantic (B)
  - Experience (C)
  - Experimental (D)

<b>Indoor</b>												<b>Outdoor</b>																																																																																																																																																											
<b>Chair/ Bench</b>				<b>Table</b>				<b>Others</b>				<b>Chair/ Bench</b>				<b>Table</b>				<b>Others</b>																																																																																																																																																			
																																																																																																																																																																							

Function and Practicality (A)											
A1: to learn	A2: farming or food		A3: purify air or water			A4: generate energy	A5: to encourage hobbies				A6: other reasons
	 41	 42	 18	 23	 24	 30	 4	 23	 37	 41	 61
	 43	 44	 27	 28	 30	 47	 42	 44	 49	 52	 75
	 49	 57	 33	 34	 36	 60	 57	 58	 63	 65	 81
	 65	 75	 37	 39	 45	 65	 78	 78	 91	 92	 102
	 79	 80	 51	 55	 58		 93	 99	 101	 102	 130
	 81	 83	 91	 92	 63		 105	 106	 112	 113	 150
	 88	 99	 64	 66	 67		 118	 126	 129	 135	 159
	 101	 104	 68	 69	 70		 146	 147	 148	 150	 163
	 126	 150	 75	 82	 85		 156	 157	 158	 159	
	 158	 162	 87	 94	 105		 161	 166	 167	 168	
			 106	 117	 108						

Aesthetic and Semantic (B)											
B1: aesthetic value or decoration	B2: collection and display		B3: communication or to convey a message		B4: artistic reasons		B5: contemplation		B6: other reasons.		
 5	 6	 7	 1	 4	 9	 2	 31	 4	 6	 35	 119
 8	 10	 14	 11	 22	 25	 32	 50	 8	 25	 120	 121
 16	 17	 24	 37	 40	 45	 32	 50	 8	 25	 120	 121
 28	 29	 31	 46	 48	 56	 81	 89	 13	 22	 13	 123
 32	 35	 38	 59	 61	 69	 91	 92	 31	 32	 46	 125
 51	 53	 58	 70	 73	 76	 91	 92	 31	 32	 46	 125
 63	 69	 74	 83	 84	 90	 93	 116	 110	 115	 48	 130
 86	 99	 101	 94	 95	 96	 117		 86	 103	 89	 131
 103	 106	 110	 97	 100	 105			 86	 103	 89	 131
 113	 115	 118	 108	 109	 119			 133	 141	 109	 138
 128	 131	 138	 126	 130	 157			 133	 141	 109	 142
 144	 151	 154	 158	 159	 163			 144	 167	 168	 143
 155	 160	 165	 166	 167	 168			 144	 167	 168	 164

Experience (C)																		
C1: to experience or interact with nature										C2: environmental consciousness		C3: to heal, calm or lower stress		C4: entertainment	C5: to stimulate senses		C6: other reasons	
																		
																		
																		
																		
																		
																		
																		
																		
																		
																		
																		
																		
																		
																		
																		
																		
																		
																		
																		
																		

Experimental (D)											
D1: conceptual design		D2: part of a research project		D3: exploration of new materials		D4: exploration of new technologies		D5: to break the rules or be different		D6: other reasons.	
 1	 6	 2	 9	 6	 10	 38	 47	 13	 60	 12	 13
 12	 13	 13	 38	 31	 32	 60	 77	 110	 115	 52	 164
 38	 47	 51	 143	 38	 47	 79	 80	 116	 133		
 80	 75			 50	 77	 81	 85	 141	 155		
 77	 78			 89	 150	 89	 162				
 79	 80										
 81	 85										
 89	 121										
 122	 123										
 126	 164										

**Appendix III - Relevant extract from the questionnaires (sample questions of each of the sections)**

**Section A – Background of Respondent**

Page 2: Section A - Respondent Background

**What is your gender? \***

- Male
- Female

**What is your age? \***

- 18 - 25
- 25 - 30
- 31 - 40
- 41 - 50
- 51 - 60
- more than 60

**What is your working background? \***

- Advertising/ Media
- Art and Design/ Creative
- Education/ Academic
- Finance/ Banking/ Marketing

**Section B – Design**

**Question 2**  
\*



A



B

### Section C – Emotional Design

Question 1



Chair I: Rococo Armchair Retrofit by David L. Hays, Kevin Stewart & Shuangshuang Wu.(2010). Lucas, D., (2011) Green Design, Germany: Braun Publishing AG., <http://inhabitat.com/a-chair-that-welcomes-plants-and-insects-into-your-home/> [Accessed 15 February 2013/2014]

- 1**  
Disgusted
- 2**  
Uneasy
- 3**  
Bored
- 4**  
Neutral
- 5**  
Pleasantly Surprised
- 6**  
Admired
- 7**  
Fascinated

Section D – Conceptual Model



Local River by Mathieu Lehanneur and Anthony van den Bossche (2008).  
 Fairs M., (2009). Green Design. Dubai: Carlton Books Limited., <http://www.designboom.com/design/local-river-by-mathieu-lehanneur-with-anthony-van-den-bossche/>, <http://www.treehugger.com/sustainable-product-design/local-river-by-mathieu-lehanneur.html>, <http://drumofglass.blogspot.com.au/2011/04/matthieu-lehanneur.html> [Accessed February & August 2014]

Please look carefully at the furniture design above, then select which sub categories you think are suitable. You may choose minimum FOUR (4) answers.

<p>A1 To learn</p> <p>Function &amp; Practicality (A1)</p>	<p>B1 Aesthetic value/ Decoration</p> <p>Aesthetic &amp; Semantic (B1)</p>	<p>C1 To experience nature</p> <p>Experience (C1)</p>	<p>D1 Conceptual design</p> <p>Experimental (D1)</p>
<p>A2 Farming/ Food</p> <p>Function &amp; Practicality (A2)</p>	<p>B2 Collection &amp; Display</p> <p>Aesthetic &amp; Semantic (B2)</p>	<p>C2 Environmental consciousness</p> <p>Experience (C2)</p>	<p>D2 Part of a research project</p> <p>Experimental (D2)</p>
<p>A3 Purify water/ air</p> <p>Function &amp; Practicality (A3)</p>	<p>B3 Communication / convey a message</p> <p>Aesthetic &amp; Semantic (B3)</p>	<p>C3 To heal/ calm/ lower stress</p> <p>Experience (C3)</p>	<p>D3 Exploration of new materials</p> <p>Experimental (D3)</p>
<p>A4 Generate energy</p> <p>Function &amp; Practicality (A4)</p>	<p>B4 Artistic reasons</p> <p>Aesthetic &amp; Semantic (B4)</p>	<p>C4 Entertainment</p> <p>Experience (C4)</p>	<p>D4 Exploration of new technologies</p> <p>Experimental (D4)</p>
<p>A5 To encourage hobbies</p> <p>Function &amp; Practicality (A5)</p>	<p>B5 Contemplation</p> <p>Aesthetic &amp; Semantic (B5)</p>	<p>C5 To stimulate senses</p> <p>Experience (C5)</p>	<p>D5 To break the rules/ be different</p> <p>Experimental (D5)</p>
<p>A6 Other reasons</p> <p>Function &amp; Practicality (A6)</p>	<p>B6 Other reasons</p> <p>Aesthetic &amp; Semantic (B6)</p>	<p>C6 Other reasons</p> <p>Experience (C6)</p>	<p>D6 Other reasons</p> <p>Experimental (D6)</p>

## Section E – Biophilic Design

Having natural elements and living organisms indoors can:

**A. Release stress/ calm you \***

<b>1</b> Strongly Disagree	<b>2</b> Disagree	<b>3</b> Neither Agree or Disagree	<b>4</b> Agree	<b>5</b> Strongly Agree
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**B. Create awareness of nature and ecological impact \***

<b>1</b> Strongly Disagree	<b>2</b> Disagree	<b>3</b> Neither Agree or Disagree	<b>4</b> Agree	<b>5</b> Strongly Agree
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**C. Foster a sense of care (as living organisms need to be watered or fed) \***

<b>1</b> Strongly Disagree	<b>2</b> Disagree	<b>3</b> Neither Agree or Disagree	<b>4</b> Agree	<b>5</b> Strongly Agree
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**D. Be educational (especially for children) \***

<b>1</b> Strongly Disagree	<b>2</b> Disagree	<b>3</b> Neither Agree or Disagree	<b>4</b> Agree	<b>5</b> Strongly Agree
----------------------------------	----------------------	---	-------------------	-------------------------------