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1 Transforming Field Data into Diagrammatic Indexes: An 2 Artistic Technological Approach in Contemporary Interior 3 Design Process 5 4 Diana Thamrin1, Ronald Hasudungan Irianto Sitindjak2 1,2

Interior Design Department, Faculty of Art and Design, Petra Christian University 1

7 6 8 Siwalankerto 142-144, Surabaya 60236, East Java, Indonesia 10 9 E-mail: 1dianath@petra.ac.id, 2ronald_his@petra.ac.id 11 12 13 Abstract. Interior design is a complex multi-disciplinary field of study. As 14 novice designers, interior design students require effective methods to convert 15 the multitude of field data in the early stages of the design process into those that 16 can be understood for further analysis. This paper develops the idea of 17 transforming field data on site into diagrammatical indexes with the help of 18 digital software. The aim is to provide a more practical method of analyzing user 19 behavior and site conditions in which students focus on identifying intensities or 20 patterns of the data observed on site rather than making descriptions of physical 21 details as often done in conventional field surveys. Methods include identifying 22 the aspects to be analyzed (occupancy, lighting, circulation, noise, ventilation, 23 etc), creating suitable graphic indexes for each aspect of analysis, overlapping 24 each diagrammatic index into one single diagram and analyzing the holistic data 25 based on the interconnections between indexes formed. Results show that this 26 method of representing data provide a visually artistic yet efficient way of 27 making quick readings of the site as compared to conventional ways of 28 collecting field data. Interior designers can also directly provide design solutions 29 and produce innovative designs based on the site patterns observed. 30 Keywords: interior design; diagrammatic index; design process; technology; 31 graphic thinking 32 1 Introduction 33 Interior design is a complex, multi-faceted field of study requiring connections 34 to other fields of knowledge in the design process [1]. This is especially the case 35 at the initial stage of the process when designers need to observe information in 36 order to understand various types of problems before devising a suitable 37 solution through design. The information to be analyzed can range from those 38 related to the human aspect, such as user behavior, activity, occupancy and 39 circulation, to physical aspects of the interior space such as the lighting quality, 40 ventilation, view, access, acoustics, etc. With a wide range of different data that 41 needs to be observed, interior design students as novice designers need an 42 efficient way of viewing, documenting as well as communicating the data 43 observed as the resulting designs must respond to the physical location as well 44 as the social context of the design project [2]. This paper aims to develop a new 45 artistic method for analyzing user behavior and

site conditions using vectored 46 digital software. In this method, students focus on identifying intensities or 47 patterns of the data observed on site rather than making descriptions of physical 48 details as often done in conventional field surveys. The paper starts with 49 analyzing the flaws of documenting conventional field surveys, and identifies 50 the significance of visual presentation in the whole part of an interior design 51 process. It then proposes a new technological perspective on viewing field data 52 using graphic indexes, inspired by contemporary landscape urbanism techniques 53 With this new method, it is hoped that students can make a quick holistic 54 reading from a given site through a more quantitative graphical method of 55 observation. Consequently, novel design solutions can be produced based on the 56 graphic patterns observed. 57 2 The Role of Graphic Thinking in Interior Design Process 58 The teaching process of interior design often begins with an understanding of 59 the problems that need to be solved in connection to a physical site and the 60 context of its user. This requires the process of visually decoding the 61 relationships among spaces, and evaluating their performance with regard to a 62 set of criteria [3]. However, much of visual coding performed in an interior 63 design process today are mainly focused on the ideation or the design phase 64 rather than from the very beginning of the design process itself. Meanwhile, the 65 important stage of gathering information through field surveys depend on 66 photographs, written descriptions or rigid database tables as the popular modes 67 of recording information (figure 1). Hence, interior design education has been 68 disadvantaged from a shortcoming of documentation of the many possible 69 modes of presentation and a scarcity of specific information for students [4]. As 70 a result, there is often a gap in the connection of the information gathered at the 71 beginning to the design offered by the students, as novice designers. This is 72 because the data are gathered and documented in such a way that they are 73 visually disconnected from the site and the template they work with in the 74 ideation phase. 76 77 78 Figure 1 Conventional documentation of field data on lighting and ventilation in the form of photographs and written descriptions that remain visually detached from the site observed. 79 A holistic design process is one where the designerâ€™s creativity is put to use 80 throughout the design process even from the first phase: the preparation or the 81 fact-finding phase [5]. The method in which designers study and understand 82 information is a crucial factor in influencing idea generation [6]. Hence, when 83 teaching the process of interior design, graphic thinking should not only be 84 adopted during the ideation phase but at the beginning from data exploration or 85 Understand-Observe phase before proceeding to Programming, Ideation, 86 Prototype and Test phases. With the implementation of graphical 75 87 communication and documentation from the start of the design process, the 88 problems discovered at the initial stage can lead to a more concrete form of 89 ideation that is tightly connected to the site and the template for implementing 90 design ideas. 91 3 Diagrammatic Index Method of Field Data Observation 92 At present, the design methodologies of the built environment have staggeringly 93 developed in line with the emergence of various digital software. Contemporary 94 landscape and architectural design concept visualizations have become more 95 structured, dimensioned and tend to become more quantified in the nature of 96 their form with the aid of parametric digital software. In contemporary 97 landscape urbanism process, designers often convert the data analyzed on site 98 into patterned diagrams known as indexes, in which each index correspond to 99 different landscape variables such as topography, streams, roads, land use, etc 100 [7]. According to Charles Sanders Peirceâ€™s theory of Semiotics, an index is an 101 implicated sign having a close, causal or tactile relationship with the object it 102 signifies [8]. In this case, the index of topography is usually signified by curved 103 vectored lines in which the proximity of lines correspond to the steepness of the 104 slope. When different landscape indexes are overlapped into a single image, 105 landscape designers can find a relation between one variable to another (i.e. 106 how topography influence the dimensions and nature of the streams, etc.) [9]. 107 This research develops the same technique of transforming interior design field 108 data into diagrammatic indexes such that interior design students can make 109 quick readings of site but also document them in a professional and artistic

110 manner as popularly done today in contemporary landscape urbanism. In this 111 research students were given a task to observe a public space and document all 112 the variables of their field data into different diagrams of index, with the 113 boundaries of the site or the floor plan as the background template for each 114 index. Methods include identifying the aspects to be analyzed (occupancy, 115 lighting, circulation, noise, ventilation, etc), creating suitable graphic indexes 116 for each aspect of analysis, drawing the indexes with the use of any vectored 117 software (i.e. Autocad, Rhino, Grasshopper, Adobe Illustrator, Corel Draw, etc) 118 and then overlapping each diagrammatic index into one single diagram. In this 119 way, the role of computer technology in contemporary design process does not 120 merely act as medium for presentation but as a partner in the design process of 121 knowledge integration, decision support and design tools, as argued by Reffat 122 (2007) [10]. Students were then expected to analyze the overlapped index in a 123 holistic approach based on the interconnections between the indexes they could 124 observe and make statements of the site problems that need to be solved before 125 proceeding to the stage of interior design programming and ideation. 126 4 Results and Discussion 127 There were two objects taken as samples for this research. The first object for 128 field analysis is a local serviced restaurant located in an electronics mall in 129 Surabaya, Indonesia. Visitors have to pay for their meals first before they get 130 seated. When ready, the food will then be served to the table by the employees. 131 132 133 Figure 2 Initial documentation of field data of a local restaurant on a weekday afternoon. 134 The field survey was conducted during a weekday in the afternoon. In this 135 research, the goal of the observation was to students are requie were required to 136 analyze user occupancy in relation to the interior design quality observed. At 137 initial stage of the observation, students first measured the dimensions of the 138 restaurant and drew out the floor plan (figure 2). 139 140 Figure 3 Diagrammatic Index of Occupancy. 141 Students then determine the variables they were going to analyze and planned 142 the form of index for each of the variables. They observed the user activity and 143 site conditions for a duration of two hours. The first aspect they analyzed was 144 occupancy. The index for occupancy was signified by dots in which each dot 145 correspond to a single user (figure 3). Many dots in an area signified high 146 occupancy while little or no dots signified low occupancy. Based on the 147 observation, there were twice more visitors who preferred sitting on the west 148 than the east area of the restaurant, despite the same capacity on both areas. To 149 identify what aspects influenced the visitors to prefer sitting on the west area, 150 the students observed the interior quality of the restaurant. The first aspect they 151 observed was the lighting quality. As the field survey was conducted in the 152 afternoon, most of the lighting used at that time was natural lighting. Hence, 153 154 155 156 157 158 159 they analyze the spread of natural light inside the restaurant. The index for natural light was signified by a gradient of yellow colour (figure 4). Darker shades of colour signified low light intensity whereas lighter shades of colour signified high light intensity. Based on observation, areas close to the windows on the north and the south received much more light intensity, whereas the middle areas were darker. The area on the west wall was also well lit due to the presence of mirrors on the wall. 160 161 Figure 4 Diagrammatic Index of Natural Light. 162 The next aspect observed was the noise intensity of the resaturant. This was 163 signified by a range of circles, having three different diameters (figure 5). 164 165 Figure 5 Diagrammatic Index of Noise. 166 Noisier areas were signified by circles with larger diameters whereas quieter 167 areas were signified by smaller diameters of circles. It was found that the area 168 on the north-west was the noisiest area because it was close to the kitchen. 169 Areas close to the main entrance was also noisy because of the activities outside 170 the restaurant. Hence, the direction of noise came mostly from the kitchen and 171 from the mall visitors outside the restaurant. 172 The next aspect analysed was ventilation. This restaurant only used artificial 173 ventilation through a central air conditioner. Hence, the index of the ventilation 174 was the mapping of the location of the air diffusers with a blue square shape. 175 The air diffusers were equally distributed in all the areas of the restaurant. 176 177 Figure 6 Diagrammatic Index of AC diffuser location. 178 The last aspect analysed was

the seating facility. This was important in 179 determining which form of seating facility was prefered by the visitors. There 180 were two types of seating that was used in the restaurant. The first type of 181 seating facility was a plastic chair, that was the dominant seating facility in the 182 restaurant, placed around every rectangular table. This was signified by a brown 183 square. The second type of seating facility was a rectagular sofa placed in right 184 in front of the west wall, the middle south sitting area and on the south east 185 along the glasswall of the entrance area. This was signified by a red rectangle 186 (figure 7). 187 188 Figure 7 Diagrammatic Index of Seating Facility 189 With the completion of variables to be analyzed, students then overlapped the 190 indexes into a single diagram and observed the data by drawing relations 191 between the variables observed (figure 8). From the indexical observations, 192 several conclusions could be drawn. First visitors favored the areas that were 193 brighter and closer to natural light. This could be seen from the diagram that 194 shows that the lighter areas on the west appear to have more dots that signified 195 more occupancy. Second, visitors also preferred sofa seats compared to the 196 plastic chairs. This is evident from the diagram that out of there were twenty 197 dots on the red rectangles (sofa) and only eight dots on the brown squares 198 (plastic chairs). Noisier areas close to the kitchen on the north-east tended to 199 also be avoided by the visitors. Meanwhile, the design of artificial ventilation 200 did not have any significant effect on the occupancy. Hence, based on analysis 201 of the diagrammatic indexes, the areas close to the kitchen were areas that 202 needed design solutions as they were areas that were least favored by the 203 visitors. 204 205 Figure 8 Overlapped Diagrammatic Index of Field Data 206 Another indexical observation project conducted was a school canteen of a 207 private university. Students were required to analyze the visitor behavior in 208 relation to the interior design elements of the canteen. The canteen has a buffet 209 mode of service in which visitors first pay their lunch with their smart cards 210 before entering the building and proceed directly to the buffet table on the 211 north-east to collect their food before eating them on the table. With the same 212 diagrammatical indexing method, students analyzed various aspects they could 213 determine such as the occupancy, circulation, lighting, wind flow, views and 214 greeneries. Based on the overlapped diagrammatical indexes produced (figure 215 9), the students have observed that visitors of this canteen prefer the tables that 216 were far from the high flow of circulation from the entrance to the buffet 217 counters. They also prefer the areas on the south because of the mild wind from 218 the windows, views to greeneries outside and the brightness of the space. 219 Meanwhile, the areas on the north-west were less favored because of the 220 darkness and the high wind flow from the large windows. Hence, based on the 221 observation, the areas on the northwest would need some design solution in the 222 ideation phase. 223 224 Figure 9 Overlapped Field Data Diagrammatic Index of a School Canteen 225 5 Conclusion 226 Through this research, an artistic and technological approach of interior design 227 field observation and documentation has been developed. By adopting graphic 228 thinking from the early stages of an interior design process, interior design 229 students benefit from a more quantified and visual understanding of the 230 problems they need to solve. The use of the floor plan as the template or 231 boundary for indexing and the focus on patterns or intensities of the research 232 variables also assist in representing material conditions on site and target the 233 exploration more concretely. This addresses the problems frequently 234 encountered in interior design studio projects in which the design solutions 235 offered by students are often focused on the inside space while the atmosphere 236 rendered are disconnected from the material quality of the site [11]. Students 237 become more aware of the potentials of the site that should be maximized 238 through their designs, thus enabling a more environmentally-conscious mind-set 239 in the design process. 240 Moreover, with the use of vectored computer software not just in the ideation 241 and prototype phases but from the very beginning of the design process, interior 242 designers as art students become more accustomed to quantified and 243 dimensional thinking rather than purely abstract thinking. Hence, the role of 244 computer technology in art education becomes more as a partner for design 245 thinking rather than merely a medium for presentation

[10]. 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 6 [1] [2] [3] [4] [5] [6] [7] [8] References Cunningham, E., Navigating the Past: What Does History Offer the Discipline of Interior Design? Journal of Interior Design, 39(3), pp. 5-12, 2018. Brand, J. L., Physical Space and Social Interaction, Haworth, 2014. Laseau, P., Graphic Thinking for Architects and Designers, ed. 3, John Wiley & Sons, 2000. Mitton, M., Interior Design Visual Presentation: A Guide to Graphics, Models, and Presentation Techniques, ed. 2, John Wiley & Sons, 2004. Elsheshtawy, Y., Creativity, Science and Architecture: The Role of Research in the Design Studio, Design Studio Pedagogy: Horizons for the Future, Salama, A. M. and Wilkinson, N., eds, The Urban International Press, pp. 75-90, 2007 Mougenot, C., Bouchard, C., and Aoussat, A., Creativity in Design- How Designers Gather Information in the Preparation Phase., International Association of Societies of Design Research., pp. 1-16, 2007. Rico, E., RamÃrez, A., Castro, E., Projective Readings: Indexes and Diagrams in Landscape Urbanism, Representing Landscapes: A Visual Collection of Landscape Architectural Drawings, Amoroso, N., ed, Taylor and Francis, pp. 22-34, 2012 Dobson, T. and Dobson, S. C., Tip of the Icon: Examining Socially Symbolic Indexical Signage, Dialectic, 1(1), pp. 61-90, 2016. 268 [9] Gavrilidisa, A. A., CiocÄƒneaa, C. M.., NiÈ›Äƒa, M., R., Onosea, D. A., and 269 NÄƒstasea, I. I., Urban Landscape Quality Index â€“ planning tool for 270 evaluating urban landscapes and improving the quality of life, Procedia 271 Environmental Sciences, (32), pp. 155-167, 2016. 272 [10] Reffat, R., The Realm of IT in Architectural Education: A Partnership 273 Approach, Design Studio Pedagogy: Horizons for the Future, Salama, A. 274 M. and Wilkinson, N., eds, The Urban International Press, pp. 313-324, 275 2007 276 [11] Smith, C. D., Inside-Out: Speculating on the Interior, IDEA journal, (5), 277 pp. 93-102, 2004. 278 Acknowledgements 279 The authors would like to acknowledge students of the Konsep Teknologi (B) 280 course: Stephanie Ibrahim, Felita Fernanda, Immaculata and Felicia Santoso for 281 their participation in this research. Transforming Field Data into Diagrammatic Indexes: An Artistic Technological Approach in Contemporary Interior Design Process Transforming Field Data into Diagrammatic Indexes: An Artistic Technological Approach in Contemporary Interior Design Process Transforming Field Data into Diagrammatic Indexes: An Artistic Technological Approach in Contemporary Interior Design Process Transforming Field Data into Diagrammatic Indexes: An Artistic Technological Approach in Contemporary Interior Design Process Transforming Field Data into Diagrammatic Indexes: An Artistic Technological Approach in Contemporary Interior Design Process Transforming Field Data into Diagrammatic Indexes: An Artistic Technological Approach in Contemporary Interior Design Process Transforming Field Data into Diagrammatic Indexes: An Artistic Technological Approach in Contemporary Interior Design Process Transforming Field Data into Diagrammatic Indexes: An Artistic Technological Approach in Contemporary Interior Design Process Transforming Field Data into Diagrammatic Indexes: An Artistic Technological Approach in Contemporary Interior Design Process Transforming Field Data into Diagrammatic Indexes: An Artistic Technological Approach in Contemporary Interior Design Process Transforming Field Data into Diagrammatic Indexes: An Artistic Technological Approach in Contemporary Interior Design Process Transforming Field Data into Diagrammatic Indexes: An Artistic Technological Approach in Contemporary Interior Design Process