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## **IR 4.0: Things that graphic designer should know**

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### **ABSTRACT**

They key element of Industrial Revolution 4.0 (IR 4.0) is connected to modern Information Technology (IT). Thus, it relatively close to Internet of Things (IoT) that allows the communication between people and machines through devices or sensors. This interoperability process embarks the intermediary element such as the design for enhancing the communication process. Since the design for IR 4.0 involves the complex systems and environments that engross people to live, work, play and learn, therefore, this paper will focus on graphic design field throughout the content analysis related to the fourth order of design. This paper has suggested two design concepts i.e. human-centred design and emotional design that would help graphic designers, hence to survive in this new industrial revolution era.

**Key Words:** IR 4.0, fourth order of design, graphic design

## 1. INTRODUCTION

In a nut shell, Industrial Revolution 4.0 (IR 4.0) is about the transformation of manufacturing industry in organising and managing the entire value chain process. IR 4.0 is regarded as a continuance development of Industrial Revolution 3.0, in which not only focusing on the initiation of computers for automation but embraced modern Information technology (IT) as a prominent constituent embedded in the process.

Deloitte (2015) conferred that IR 4.0 ought to adopt modern IT in manufacturing process for the purpose of optimizing product life cycle and value chain throughout the smart networks system. Therefore, Cyber-Physical Production System (CPPS) is created by means of IT influence for merging the boundaries between the real world and the virtual world. Cyber-Physical system is linked to Internet of Things (IoT) which drives from a digital platform to facilitate physical process of factory. Besides, it embarks decentralized communication not only between the machines but also human through the wireless web at the actual time (Marr, 2016).

IR 4.0 is formed from the smart technologies that blurring the boundaries of physical, digital and biological spheres (Schwab, 2016). Nevertheless, these three mechanisms should be working by human participation. The human participation is needed in order to communicate and interact with the machines, electronic devices even the application systems. In this context, the solution from the graphic design perspective is significant for making the communication and interaction process are more effective.

In consequence, the roles of graphic designer is becomes more challenging for revitalizing communication and interaction process. Throughout the complex systems and environments, graphic designer is supposed to embrace the design that allows people to live, work, play and learn (Buchanan, 2001). For that reason, this paper will discuss the notion of fourth order of design in relation to IR 4.0 which reflecting to graphic design field. Besides, this paper also intends to propose the design concepts that would help graphic designers to survive in IR 4.0 realm.

## 2. The four orders of design related to Industrial revolutions.

The four orders of design is a notion coined by Richard Buchanan in 2001. He is a professor of design, management, and information systems that wrote about a design characterization structure of four orders. According to Buchanan (2001), the first and second order of design "were central in the establishment of the professions of graphic and industrial design", in which the design characterization is concerned about *symbols* and *things*. The *symbols* are related to graphic design field that produced visual symbols, words and images, while for *things* involved industrial design field that produced tangible products, physical artefacts, and material things.

The third order of design is concerned about interaction and experience, in which the design could influence people to interact with each other, hence integrated with their experiences. For the fourth order of design, the design characterization is about environments and systems. In this sense, the design is more focusing on human systems encompass the integration of information, physical artefacts, and interactions in environments of living, working, playing, and learning (Buchanan, 2001).

García Ferrari (2017) has associated the Buchanan's four orders of design with the different phases of industrial revolution. According to him, the clear discernment of the first and second order of design can be associated to industrial revolution 2.0, in which the design realm is related to mass production of the products and services. The design activities and practices involved the domain of industrial design for study materials and manufacturing process, while the domain of graphic design comprehend materials and printing purposes.

García Ferrari (2017) also added that since the industrial revolution 3.0 predominantly interconnected to electronics and IT for post- industrial and societal services, the notion of third order of design acquired the designers to endeavour several new design concepts i.e. interaction design, experience design, service design as well as design thinking. Furthermore, the fourth order of design is referred to industrial revolution 4.0 in the sense that the design practise is supposed to cater the complex interrelations of systems comprising the intersection between design and cybernetics environment. This is in line with Buchanan's (2001) idea that the fourth order of design characterization is supposed to emphasize on systems and environments. Besides, Buchanan (2001) also highlighted that the third and the fourth order of design are reconciling strongly which required the designers to contemplate both design concepts of interaction and environment.

### **3. DESIGN thinking in the four orders of design**

Buchanan (2015) has listed several meanings of design thinking that represents the four orders of design. The design thinking is ranging from the design theory, design practice to design management. In term of design thinking related to art and design practise, Buchanan (2015) has came out with four dialectical moments in the sequence of thought and action for the design progresses as shown in Figure 1.

		Communication Symbols	Construction Things	Interaction Action	Integration Thought
<b>First Order</b>	Inventing Symbols	Symbols: Words & Images			
<b>Second Order</b>	Judging Things		Physical Objects		
<b>Third Order</b>	Connecting Action			Activities, Services, Processes	
<b>Fourth Order</b>	Integrating Thought				Systems, Organizations, Environments

Figure 1: Design thinking related to Art and Design. Adapted from Buchanan (2015)

The moment in the first order of design is about invention, in which the designers involved in the creation of new ideas to communicate with the people. Invention activities resolve the problematic situation by thought and action. The second moment related to the second order of design, the construction of the physical objects or products required the design for desirability, feasibility and viability. Therefore, the designers must have a good judgment in the design process that gives benefits to the people.

The third moment related to the third order of design is about the central task of design that needs to be followed by the people. Consequently, the designers' task is to connect and develop the central themes of design linked to the features of product by considering the usability and desirability aspects. The fourth moment that connected to the fourth order of design is about integration. The designers should have thought to integrate the design with the systems, organizations and environments since people is strongly influenced by those three elements. Besides, the designers should concern to evaluate their design based on the interests and vision of the organization, thus the needs and desires of individual and society.

#### 4. Graphic design theory and practice in the fourth order of design

The fourth order of design is not only about designing forms, but evolving to the significance values and processes related to the people. According to Golsby-Smith (1996), the fourth order designers should "move through a field of less tangible factors such as values, beliefs and the wider context of other contingent processes". In fact, the designers should recognize the people's desires with the specific reason and purposes. Therefore, the main reason to be

concerned by the fourth order designers is about what values that needed by the people, thus their perceptions and worldviews (Golsby-Smith, 1996).

As the fourth order of design is about the systemic integration, the management theory and business practice should be implemented. Zyl & Sauthoff (2001) has expended the fourth order of design concept to three aspects; underlying assumptions; organizational structures and processes; and value determinants. The underlying assumption should focus on humanistic by knowing the market needs. For organizational structures and processes, people should be seen as individual that need to be learned rather than expecting them as merely consumers. Therefore, the media should be customized and integrated accordingly based on people needs and desires. Meanwhile, to determine the value, the intangibles aspect such as people emotion should be emphasized and followed by the contextual guided evaluation (Zyl & Sauthoff, 2001).

Certainly, the theory and practice of graphic design should be transformed to a new level which not only producing aesthetics artefacts based on intuition but extending to recognize what exactly the audiences want. For that reason, Bennett (2006) has suggested the graphic designer should involve the audiences while in the design process. Therefore, the design process should include the adaptation of human-centred design approach that focusing on human behaviour and experience throughout the process of research, prototyping, designing, testing and redesigning (Harte et al., 2017). In this sense, the typical graphic design process that focusing on the intuition of graphic designer itself is no longer relevant without involving the audiences' interest. In addition, the audiences' interest must be evaluated and tested for better design execution.

Another fraction that graphic designer should take into account is to determine the value for intangible aspect such as people emotion. Therefore, the proposition for emotional design approach is suitable to be adapted by graphic designer. Emotional design is not a new concept. It was coined by Norman (2004), a cognitive science and computer science expert. According to his theory, human cognition and emotion are interwoven and inseparable, besides integrated in human life through different brain processing; in which cognitive processing is set to assign meaning, whereas emotional processing is meant to assign value. The integration of cognitive and emotional processing is important to reflect the results of human behavior and experience.

Norman (2004) also depicted that emotional design is strongly connected to the notion of "attractive things work better". According to him, the attractive design will trigger human creativity and an expansion of mental processes which lead human to become more tolerant for minor difficulties. Besides, attractive design could influence human decision-making with ease which could make their life better.

Nevertheless, graphic designer should know how to grip people emotion in their creative works. Indeed, the emotional design approach would be a practical implementation since it involves the brain processing which related to biological activity of people. Hence, evoking people emotion is important for them to live, work, play and learn in complex system and environment of IR 4.0.

## 5. Conclusion and future works.

The success of graphic design field in IR 4.0 is depends to the competency of graphic designers to adapt the new theory and practice. The typical graphic design process which merely based on graphic designers' intuition is incomplete without involving the people in the design process. Therefore, the adaptation of human-centred design would be the best solution for graphic designers. On the other hand, in order to determine the value for the intangibles aspects of the people, the design for their emotion is imperative to be considered. For that reason, the notion of emotional design is significant to be exploited by graphic designers for enriching people to live in complex systems and environment.

In the future works, researchers are planning to examine the human-centred design approach in graphic design process. This should involve several design issues to be discussed. In addition, the new conceptual model would be developed for better understanding, hence provides the opportunities for the future research.

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