SOCIAL INTERACTION IN THE DIGITAL ERA: TOWARDS FLEXIBLE DESIGN OF HOME LAYOUT

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Abstract - Recently, smart technology has been attracting more and more attention since it became an integral part of our life. This technological revolution had substantial impact on the dynamics of the family and on the inter-family interactions. Indeed, it has contributed to emergence of new lifestyles that depend on smart technology in daily routine, which negatively affected the intensity of social interaction. This study aimed to propose design guidelines which will enhance social interaction among family members. So, a mixed-method approach was adopted to understand the complexity of social interaction in digital era. This was achieved through the following: First, content analysis of written and visual documents and audio-visual material was performed to explore emergence of new types of social interaction within families. Second, quantitative statistical analysis was performed on data drawn from a structured questionnaire that was employed to collect data from 512 head of household who are living in apartment. Third, four online workshops were conducted with academics (23 master's students and 29 faculty members) and professionals (32 architects and 21 developers). Based on their feedback, several recommendations were proposed to enhance flexibility and vitality of interior home layout, and then promote social interaction within families in the digital era.

Keywords - Digital Era, Flexibility Design, Human Behavior, Information Communication Technology, and Social Interaction.

I. INTRODUCTION

Recently, it has been witnessed a growing interest in smart technology, which has become an integral part of individuals' daily routine. Many studies reported that high intensity of use associated for virtual social media in general and for youth in specific. For example, in Jordan (research setting), more than 85% of population considered as internet user and most of them use it on daily basis. nearly one third of the World population uses social media for different purposes (Duggan, 2015; Dary, 2019). Currently, it is viewed as a basic need that is reflected directly on having a mobile phone, phone charger, Wi-Fi connectivity, and other electronics (Chayko, 2019). The increased use of the smart technology has noticeable negative impacts on family ties. For instance, it causes coldness of the relation that leads to social isolation of its members (Carvalho, Francisco, & Relvas, 2015; Corcoran, 2012; Gora, 2009). This change in the patterns of social interaction is often accompanied by changes in the lifestyles and rituals of most families (Gora, 2009). However, while these changes were taking place, the interior layout of the housing unit remained the same, with no response to the new requirements of the family.

Several researchers highlighted the evolution of new scenarios of interaction between individuals/groups through the cyber space. Others argued that physical interaction (i.e., face-to-face interaction) can be replaced by digital (virtual) interaction (Christensen, 2018; Dwyer, Kushlev, & Dunn, 2018; Farrugia, 2013; George & Odgers, 2015). Such belief needs to be assessed comprehensively especially in conservative societies, which sanctify collective values of the family (Aldhafeeri, Palaiologou, & Folorunsho, 2016; Gjylbegaj, 2019; Mastur & Jamal, 2020).

"Architecture can't force people to connect; it can only plan the crossing points, remove barriers, and make the meeting places useful and attractive" (Cutieru, 2020, p.22). This means that architecture can participate through design in relieving the negative impact and highlighting the positive effect of Information and Communication Technology (ICT) on the family ties. On this account, this study aimed to understand the impact of ICT on social interaction among family members and, thereupon, suggesting design guidelines that keep pace with the changes in societies that are associated with the digital era and contribute to improve life quality.

A. Social Interaction in Digital Era

Social interaction has important role in improving the quality of life since it fosters integration and creates coherence among individuals. This is ensured through emphasizing sustenance of social relationship that starts "When one human being encounters another and engages in a conversation" (Nee & Khan, 2012, p. 199). So, it can be said that social interaction is a social process, which progresses in four consecutive processes: (i) distributed attention (the co-presence level of interaction), which refers to the presence of people with different foci and interests in one place; (i) shared focus (the co-attention level of interaction), which is evident when people see and notice the same things; (iii) dialogue (the co-exchange level of interaction), which usually occurs at the beginning of exchange of talks between people or when the actual interaction between people starts; and (iv) collective

action (the co-action level of interaction) that occurs when a group of people adopts the same goals and starts working on achieving them (Brynskov et al., 2009; Jansen & Bekker, 2009; Long, Jacob, Davis, & Magerko, 2017; Nee & Khan, 2012). These four processes can be categorized into two main types of interaction: (i) passive interaction, where no one actually interacts with others as is the case actually in the first two foregoing processes; and (ii) active interaction, where actual interaction takes place as is the case in the third and fourth aforementioned processes (Mamaghani, Asadollahi, & Mortezaei, 2015).

Digital era has substantially affected interaction between individuals as it affected the nature of social relations and created new ways of interaction. The warmth and intimacy of the physical (face to face) interaction have been replaced by the virtual interaction. Numerous studies have shown that the immersion of people and their total dependence on smart technology for social communication influenced the bonds and strength of social relationships since the intimate relationships among humans and their interactions were replaced by cold interactions between humans and machines (Christensen, 2018; Dwyer et al., 2018). This new style of interaction appeared more evidently during the Corona crisis because family members increased their dependence on the smart technology, whether for working, studying, or entertainment. As a result of staying at home and using electronic devices for long time and consecutive hours, family members became spending most of their time in their own rooms. This resulted in over-attachment to the smart technology that had detrimental impacts on family time and relationships and on the intensity of social interaction (Bettaieb & Alsabban, 2020; Laura Alfaro, 2020).

Various studies have confirmed the negative impact of smart technology on the individual's behavior within the family. As each family member has her/his own social life in the virtual world in which she/he spends most of her/his time, most of the family members are actually in a state of constant isolation. This results in limited family activities and fragile family relations that lack interaction and dialogue (Christensen, 2018; George & Odgers, 2015). Before advent of the smart technology, social interaction among family members used to take place spontaneously through the daily routine that includes interactive games, family sessions, participation in household chores, preparing food, and gathering at a fixed time. By advent of the smart technology, new rituals appeared and replaced the interactive participatory activities with virtual activities such as playing electronic games and interacting with others through social media platforms (Carvalho et al., 2015).

However, the new forms of interaction have negative impacts on the inter-family relationships, particularly in the conservative and collective societies. The societies that sanctify family values and collective standards started facing many challenges and difficulties because the technological revolution affected the values, morals, behaviors, and lifestyles of the families and created a new cultural revolution that contributed to loss of cultural heritage of family and created a generational gap that affected family interaction (Aldhafeeri et al., 2016; Gjylbegaj, 2019; Gunuc & Dogan, 2013; Mastur & Jamal, 2020). In light of this, home design needs to be improved to preserve the warmth and collective values of the family.

B. Design for Social Interaction

Several studies have discussed the relation between human behavior and the built environment, where the behavior can be determined and adjusted through the perceptual capacity of the space. Hence, it is important to discuss the role of designers in creating a suitable environment for social interaction, especially in the housing units. This is associated with the opportunity to enrich the perceptual inputs of human senses, whether visual, auditory, kinesthetic, or even olfactory. This is also connected with design of cognitive environments that stimulate interactive activities of individuals, taking into account their different personalities and cultures (Cervone, 2004). Based on that, more attention for environment to stimulate human physiological senses.

Many studies highlighted the significance of the design elements (e.g., materials, lighting, colors, details of space, and decoration) that greatly influence human perception by creating a visually-appealing space that prompts people to enter it. This approach achieves integration of people in the same space and generates passive interaction, which can be developed to active one. Furthermore, incorporation of an appropriate space program that accommodates diverse activities can encourage individuals to stay longer and, thus, increase the opportunities for social interaction, either passively or actively. Regular interaction may create a space with a collective spirit that enhances belonging and attachment to place (Hashemnezhad, Heidari, & Hoseini, 2013).In general, most of the previous studies have dealt with the impact of smart technology on social interaction on public space such as neighborhoods and investigated the role of built environment in improving social interaction between people. In contrast, few studies researched into the effect of smart technology on social interaction at the private zone (home). However, these studies did not discuss the role of interior layout of housing unit in raising opportunities of social interaction. Bearing in mind that the home is basic nucleus, which shapes personality of individuals and enhance their life quality. So, it is necessary to propose design guidelines for layout of housing unit to meet users' demands and aspirations for improving interactions among family members.

II. METHODOLOGY

This research aimed to understand the impact of ICT on social interaction among family members. This was achieved by investigating the effect of using intensively smart technology devices (high level of dependence, and attachment) on social interaction. A mixed-method approach was adopted to consider both perspectives and viewpoints of users and designers as illustrated in research framework (Figure 1).

1. Behavioral analysist, which was performed for the social relationships amongst members of the Jordanian family in terms of type and intensity. This analysis was conducted via content analysis and an on-line survey. The analysis aimed to explore lifestyles of Jordanian families by analyzing written and visual documents, including proceedings of interviews (oral material), and audio-visual recordings. The data were collected from various sources (local newspapers, magazines, websites, and social media). The 'oral material' was obtained from feedback on the social lifestyles of 25 Jordanian families that was compiled through a series of interviews that investigated how the smart technologies affect family relationships. Similar issues were explored in visual (pictures) and audio-visual materials (video recordings), comprising dramatic shows and videos that highlighted social phenomena and impact of smart technology on the Jordanian families. Also, quantitative analysis for data collected from the heads of households living in apartments to assess the impact of ICT on social interaction among family members. The questionnaire consisted of four sections: (i) socio-economic characteristics of the participants, including family structure, occupation, and education; (ii) characteristics of the apartment, including ownership, prototype, and internal layout; (iii) attachment to smart technology, which is measured through number of smart technology devices, intensity of using and dependence on technology; and (iv) impact of smart technology on the social life of family in terms of activities, intensity of relations, and individuals' behaviors.

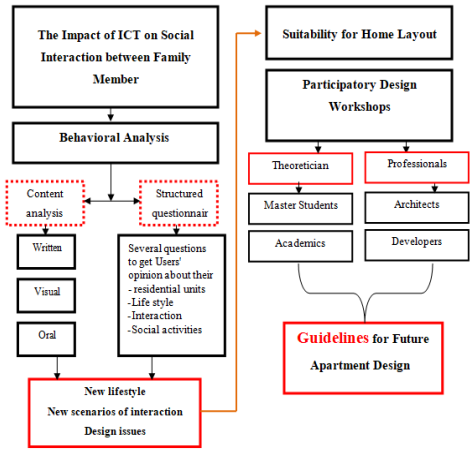


Figure 1: Research Framework

2. Participatory design workshops (focus groups) were organized to observe suitability of interior layouts for apartments and, then suggest recommendations and design guidelines to improve social interaction among family members. The workshops helped to have feedback from experts through four online meeting involving personnel with noteworthy theoretical and professional architecture backgrounds. Each workshop was held in the Zoom platform for two hours and a half. It was started by a number of introductory engagement questions, and a general prelude to the topic, then illustration of the research objectives, and framework. At the end of the meeting, a set of exploratory questions were asked to stimulate the discussion.

A. Research sample

A total of 512 heads of household living in apartments participated in the study. Most of them (95%) were married and having two to four children. Moreover, about 70.0% of the sample members were educated, where both (husband and wife) have bachelor's degree. This may explain why nearly two thirds of the sample families are working families, where both parents have full-time jobs. This is associated with time limitation for family's activities and social interaction. In addition, most of the participants (69.7%) own their apartment units, which ranged in their areas from 120 m2 to 150 m2 and which consisted of three bedrooms. In other respects, about half of the sample families (43.4%) were residing in the same apartment for 5 to 10 years. Furthermore, nearly half of the sample members (53.0%) were having a fixed Internet connection. Additionally, 60.7% of the participants were having one smart phone per person in the family and 55.0% of their kids were using the smart technology constantly.

Four design workshops were held with academics and professionals. The sample included (i) twenty-three master's students enrolled in Jordan University of Science and Technology; (ii) twenty-nine academics specialized in architectural design, housing, and human behavior and working in several architectural colleges in Jordan; (iii) thirty-two designers/architects working in several architectural firms and having more than 10 years of experience in designing multi-family housing; and (iv) twenty-one developers working in the housing development industry for more than 10 years and registered in the Jordanian Housing Developers Association.

III. RESULTS AND DISCUSSION

This study investigated behavioral changes that were brought to family through using smart technology. Then, suggest design guidelines to improve the opportunities for social interaction and eliminate negative impact of ICT.

A. Smart Technology and Social interaction

Content analysis identified several themes, which are associated with ICT (see Table 1). Content analysis was done for written and visual local documents included newspapers, magazines, websites, and social media, along with interviews with twenty- five families.

The results indicate that the smart technology has introduced new habits to Jordanian families such as the bedroom culture, where the family members spend most of their times in their rooms. This habit affects communication among the family members negatively and reduces opportunities to find the common interest among them, and then reduces their willingness to interact. This phenomenon is more evident among the teenagers who started to prefer to do their activities in their own rooms. Thus, the smart technology led to intermittent communication among family members, where children, for instance, send text messages to their parents in the next rooms rather than making face-to-face interaction. This indicates emergence of virtual interaction that encourages isolation, which affected negatively on family cohesion and reduced dialogue among family members to create "bedroom culture". This isolation is further aggravated by the desire and tendency for loneliness and isolation of the adolescents and youth, which eliminate opportunities for interaction.

Themes	Keywords
1. Family's Activities	− Loss of skill in social participation − Preference for electronic games over collective games − Isolated lifestyle − Spending most of the time in the bedroom
2. Kid's behavior	− Kids became lazier and less patient than before − Tendency for loneliness − Sleep disturbances − Studying disturbances − Becoming stubborn, nervous, aggressive, and selfish − Eating disturbances − Brothers' conflicts
3. Family's relation	− Gap between family members − Absence of feelings of family warmth − Dismantling of family relationships − Reduction in dialogues among family members − New patterns of social interaction

Table 1: Themes Extracted Based on Content Analysis

Such results confirmed with feedback from questionnaire which investigated the family's social interaction at three levels as shown in Table 2 and 3. 1) Family's activities: there is a neutral attitude towards family activities as the mean (M) attitude score on a scale of 5 was 2.9, where 5 represents positive attitude and 1 denotes negative one. However, the results indicate that there are significant negative correlations ($p \leq 0.05$) among family activity and different dimensions of technological revolution under consideration (dependence on the smart technology, use of smart technology, and attachment to smart technology). This indicates that the smart technology has destabilized family bonding and affected family ties passively. This finding agrees with findings of a number of previous studies, e.g., Church, Weight, Berry, and Macdonald (2010) and Dwyer et al. (2018).

Level	Statement	Mean
Family activities M = 2.9	My family members rarely watch the same TV shows and have discussions about them	3
	When we gather, we are rarely socializing, not surfing the Internet	2.4
	My family rarely has a fixed time for having lunch	3.3
Interaction among siblings M = 3.67	During food time, my kids spend their time surfing the Internet	3.7
	My kids prefer surfing the Internet or playing games in their bedrooms	3.7
	My kids prefer to play electronic games over group interactive games	3.6
	My kids rarely spend time in the living room	3.6
	My kids often argue with each other because of their over-attachment to smart devices	3.7
	My kids prefer to meet with friends in their own bedrooms	3.1
Parent-child interaction M = 4.0	I always have an argument with my kids about time issues and the smart device	4
	I am always anxious when my kids stay alone in their rooms	4.2
	I noticed that my kids became more selfish and stubborn	3.8
Range of scale measurement (calculated according to the following equation (n-1)/n = 0.8 **1-1.8 Strongly Disagree 1.9-2.6 Disagree** **2.7-3.4 Neutral 3.5-4.2 Agree** **4.3-5.0 Strongly Agree**		

Table 2: Responses Related to Impact of ICT on Social Interaction

2) Interaction with siblings: the respondents agreed that there is a negative impact for smart technology on interaction between siblings, where the mean attitude score was M = 3.67 (see Table 3). This may reflect weakness in siblings' relations as the kids become stubborn and aggressive due to excessive attachment to smart technology, in addition to their desire to spend time alone, which makes them in conflict with their siblings. In this regard, George and Odgers (2015) stressed the negative impact of smart technology on kids' behaviors. As Table 3 shows, there are

significant negative correlations among the technological revolution and interaction between siblings ($p = 0.00$).

Pearson's correlation			Relation to smart technology		
			Dependence	Use	Attachment
Social interaction		Pearson Correlation	-0.56	-0.45	-0.60
		Sig. (2-tailed)	0.03	0.02	0.00
		N	512	512	512
Levels of Social Interaction	1. Family activity	Pearson Correlation	-0.55	-0.45	-0.60
		Sig. (2-tailed)	0.00	0.01	0.00
		N	512	512	512
	2. Interactions among siblings	Pearson Correlation	-0.60	-0.50	-0.55
		Sig. (2-tailed)	0.01	0.00	0.00
		N	512	512	512
	3. Parent-child interaction	Pearson Correlation	-0.55	-.50	-0.65
		Sig. (2-tailed)	0.02	0.00	0.01
		N	512	512	512

Table 3: Results of Analysis of Correlation between Technological Revolution and Social Interaction

3) Parent-child interaction: the respondents have a negative attitude to interaction with their kids (M = 4). These changes in kids' behaviors make parents in constant argument with them, which makes the parental relationship in a state of tension and anxiety. The results of this study point out that about 60% of the sample members always had arguments with their kids about time issues and the smart device. This finding is consistent with findings of Carvalho et al. (2015) and Mesch (2006). Table 3 highlights that technological revolution, in terms of dependence, use, and attachment, correlates negatively with the parent-kid interaction status ($p \leq 0.05$).

So, there is a consensus among the research sample on a real shift in the family's lifestyle and a change in its social habits. Moreover, the results point out that most families are facing problems associated with virtual communication because it has changed people's behaviors and characters and created new lifestyles characterized by reduced face-to-face interaction. Thus, there is an urgent need for improving apartment layout to enhance social interaction between family members through design guidelines.

B. Design Guidelines

Based on a series of online workshops, various innovative design ideas, themes, and suggestions were proposed to enhance social interaction between family members. These suggestions were coded and classified into two main categories:

1. Spatial organization (Zoning): Studies have emphasized the importance of the spatial experience for raising levels of social interaction where the spatial experience helps in creating bonds and perceptual relationship with the user (Mamaghani et al., 2015). This can be achieved by increasing the proportion of living room to be more spacious and then increasing level of comfort to encourage family members stay for longer time (passive interaction). This can be achieved by increasing the area of living space and reducing the proportion that is allotted for less used spaces like the guest room and hallways. This proposal contradicts with the opinion of developers who they all agreed on that hospitality value in the Middle East makes residents having spacious guestroom with luxurious decorations, even if it is not used (Sobh, Belk, & Wilson, 2013). Moreover, it had been suggested to improve level of interaction by promoting vitality and diversity of activities through creating technology corner. This required specifying a zone for smart technology especially it is irreplaceable part of daily practices. This can contribute gathering family members in one place and, then, achieving visual contact in spite of their preoccupation with technological practices. In general, this corner may encourage family members to move from visual contact (passive interaction) to engage with others or even develop a desire for participation (active interaction) as supported by Church et al. (2010), who highlighted the importance of keeping pace with technological development and encouraging collective activities based on modern technology. In addition, Brynskov et al. (2009) emphasized that technological media have pronounced contribution to heightening levels of social interaction and achieving active interaction.

Several studies addressed the importance of 'shared activities' on social interaction among family members; Mesch (2006) described them as "forces that contribute to the perception of the identity and

uniqueness of one's family". Shared activities can be encouraged by open plan layout as recommended by professionals and academics in the present study; for example, establishing connectivity between the kitchen and living room. This can contribute to achieve passive level of social interaction since it guarantees visual contact between mother in the kitchen and others in the living room. This is supported by De Valk, Bekker, and Eggen (2015) who emphasized the importance of open space and its role in stimulating social interaction at different levels, whether passive or active interaction. So, social zone needs to be the core that works as a central point of attraction to encourage family members joining and interacting. This was highlighted by previous studies that discussed the significance of stimulating environment that drags people to space and makes them join others activities (Nee & Khan, 2012). In addition to this, connecting social space with outdoor/balcony will be beneficial and it will improve the quality of the space by creating opportunities for outdoor activities. It allows the outside environment to become part of the interior space, therefore making it more attractive and suitable for family gatherings. Such environment may improve certain psychological aspects for the apartment residents that directly affect their behavior and willingness to be involved in activities.

2. Interior details: Flexible design is significant aspect to improve vitality of space. Therefore, both academics and professionals suggested using flexible structural elements instead of traditional fixed partitions extending from floor to ceiling. Various flexible structural elements have been proposed such as switchable glass walls (smart glass technology) that can create transitional and multi-functional spaces with an ability to provide privacy upon request. Another proposed element is movable walls (sliding walls) that can be moved and relocated in different spaces according to family needs and future changes of space. These new types of walls provide visual contact between family members and may encourage them to join the collective activities, thus enhancing social interaction at different levels. In this context, Raviz, Eteghad, Guardiola, and Aira (2015) stressed the importance of using flexible structural elements like doors, walls, etc., and highlighted their role in connecting spaces and creating a flexible environment that fits with the new family lifestyle and achieves better levels of social interaction.

Such level of flexibility needs to be connected with efficiency and creativity that can be achieved by using flexible, multiple-use furniture especially in the limited spaces. As well, the orientation of furniture plays a critical role in enhancing social interaction. For example, directing the sofa and the TV screen towards the kitchen allows for visual contact between the mother when she is in the kitchen with those are in living room, which ensures achievement of the second level of social interaction. Such decision can be made based on family's needs since it entails the lowest level of intervention as discussed by participants in the workshops.

In general, designers cannot force people to interact, but they can help in creating attraction to spaces through different design plans and scenarios that may stimulate meeting of family members in one space and then develop the senses of warmth in the relations among them, which foster social interaction.

IV. CONCLUSION

Over the past two decades or so, the smart technology has become an integral and essential component of people's daily routine (Corcoran, 2012). However, this technology had a profound negative impact on interaction between family members and created new interaction patterns based on virtual spaces, which had negative bearings on the strength of family ties and relationships. Indeed, proliferation of the smart technology brought about changes in the family lifestyle and resulted in emergence of new rituals and habits. Despite the changes, the interior layout and design of the apartments remained the same; without any modification made to meet the new requirements of the Digital Era, which negatively affected the residents' comfort and satisfaction and the intensity of their social interaction. In view of this, there is a need to adjustment and changes of built environment to suit new lifestyle.

Several guidelines were proposed by both academics and professionals to improve social interaction. These recommendations were categorized into two facets of architectural design: spatial organization (zoning), and interior details. These guidelines stress the importance of architecture in bringing people together in a specific space by programming the space and finding points of intersection that comply with the nature of group activities. So, building relationships should be the strategy for designing space program, which is associated with the application of interactive and flexible architecture. Hoping this will be a good corrective method for human behavior by setting up basis for collective human activities to improve user's social interaction. Finally, architecture cannot force people to practice social interaction, but it plays an important role in laying grounds for social interaction. That can be achieved by paving the way for opportunities and coincidences that stimulate social interaction.

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