Daylight, Stimulator of Happiness and Psychological Health of the Inhabitants of Residential Compounds; Case Study: Districts 7, 8, 12 and 14 in the City of Isfahan

Zahra Javani\textsuperscript{a} - Ramin Madani\textsuperscript{b*} - Isa Hojjat\textsuperscript{c}

\textsuperscript{a} Ph.D. of Architecture, Faculty of Architecture and Urban Design, Art University of Isfahan, Isfahan, Iran.
\textsuperscript{b} Assistant Professor of Architecture, Faculty of Architecture and Urban Design, Art University of Isfahan, Isfahan, Iran (Corresponding Author).
\textsuperscript{c} Professor of Architecture, College of Fine Arts, University of Tehran, Tehran, Iran.

ABSTRACT

The relationship between manmade environment and spaces’ users is a mutual one in such a way that the same way that the environmental situations and conditions influence the building, the building’s conditions and properties, as well, intensively influence the space users. The improvement of the residential spaces inter alia the various kinds of artificial environments that have to support the physical and psychological health of the residents is of a great importance because the family members’ presence in this space can considerably contribute to the betterment of their physical and psychological health. The effects of the daylight as one of the primary indicators of the residential buildings on the humans’ life and liveliness can be assessed within the format of two subsystems, namely perceptual psychology and psychological biology. This is while the common lighting strategies are concentrated on the energy output and/or supply of the required light for performing the tasks and/or they have been devised in laboratory explorations and under artificial sky and with no presence of the human beings. Thus, the present study has been conducted with the objective of elaborating the relationship between daylight and psychological health and happiness of the inhabitants of the residential compounds and increasing of the individual happiness so as to figure out the quality of the relationship between the daylight and happiness of the inhabitants of the residential compounds in the city of Isfahan. The study has been carried out based on a causal-comparative plan and makes use of a survey method to describe the correlation between the variables through taking advantage of a cross-sectional method during the years from 2013 to 2014 in low-rise buildings (3-7 storeys) in Isfahan. To determine the happiness status, use has been made of Oxford and Fordyce’s happiness assessment instrument. Then, the obtained data were analyzed using SPSS via taking advantage of the descriptive statistics. The data analyses indicated that there is a significant difference between the happiness levels of the inhabitants of the residential complexes and the amount of light entering each unit meaning that the higher the light entering the residential units, the more the inhabitants are happy. It seems that the optimal and purposive designing of the daylight in the residence space somehow influences the improvement of the inhabitants’ psychological health and happiness.

Keywords: Daylight, Residential Compounds, Happiness, Psychological Health, Isfahan.

* E-mail: r.madani@aui.ac.ir
1. INTRODUCTION

As the border between the external environment and the human body, architecture has to be formed in such a way that the human body becomes capable of supplying its needs from the exterior environment. Although it is the architects who shape a building, it is eventually the buildings that influence the human beings. The quality of the environment designing can be disease generator or disease and physical damage inhibitor (Cummins & Jajcson, 2001) and, on the other hand, influence the emotions, feelings and performance of the human beings, as well (Srinivasan, Liam, & Allen, 2003). Additionally, as it is stated by a French Architect, Le Corbusier, in 1929, “the history of architectural expediencies … is an endless fight for light; and, in other words, it has been the history of the windows” (Aries, Aarts, & Van Hoof, 2015). Although the discussions on and dealing with daylight in various environments like educational-treatment and administrative spaces is indicative of its being the primary and important component of the daily life, the dwelling space is also deemed as the most original environment wherein the human beings spend a large part of their lives; it is the source and the destination of their daily lives because the human beings leave their houses to take part in work and social activities and return to it after working outside and acquiring experience. Thus, the residential environment needs specific precision and consideration, especially according to the fact that the residence is of a great importance as the regulator of the body’s circadian rhythm; the illumination level of light in a house during the day can be envisioned as a biological scale of health (Sharon & Gochenour, 2009).

The necessity for dealing with the health in residential space can be clarified by WHO’s definition wherein the house is given a meaning beyond the roof over the heads. In fact, the house is defined as a place that contributes to the health and physical and psychological welfare of the inhabitants and it is of a particular stance in this regard (Bonnefoy, 2007). Amongst the outcomes of designing residential environment, factors like the inhabitants’ psychological health, individual and social consistency and stability and solidarity between the family members can be pointed out (Bahrami, 2009). On the other hand, inappropriate house causes a weakening of psychological health such as through inducing psychological distress, psychological disorders and depression, behavioral disorders and nervous emotions (Tyson, 2002). Such disorders may come about due to the various properties of the houses (Evans Gary, 2003).

This is while the increase and prevalence of various psychological disorders like depression during recent years could have happened due to paying insufficient attention to the principles of house designing based on health-oriented approaches. As highlighted by WHO, depression would incur the healthcare with the heaviest burden worldwide till 2030 in contrast to all of the diseases. In between, Iran, as well, faced an increasing growth of the life in residential compounds in its keeping pace with the growing trends of urbanization in such a way that mass production of the house was intensified within the format of the mass production of residential compounds but, unfortunately, it was not consistent with the economic, political and social conditions governing the society and the housing sector and did not possess the scales for the creation of optimal residential environment (Azizi & Malekmohammadnejad, 2006). Iran’s being ranked in the low levels of happiness in the fourth wave of Inglehart’s survey (Iran is ranked 61st amongst the 69 countries in terms of the happiness level) is perhaps a reason for the paying of insufficient attention to the principles of psychological health therein. On the other hand, depression and dispositional disorders like seasonal affective disorder are considered as one of the most distinct effects resulting from the light on the physiology and circadian rhythm of the human body to the extent that light therapy is used as an effective antidepressive drug (only when the light is adequately bright) and there is a proportional relationship between the intensity of light and treatment effectiveness. The studies have shown that the effect of light therapy depends not only on the light intensity but also on the duration of exposure to the light and the spectral quality thereof (Wirz-Justice, Benedetti, Berger, Lam, Martiny, & Terman, 1998; Graw, Wirz-Justice, 1999). Furthermore, the various wavelengths of the light have different effects on the human body. This is while the majority of light sources lack the spectral distribution required for supplying all of the physiological activities of the body.

Based on what was mentioned before, the present study tries investigating the effective relationship between the daylight and the inhabitants’ psychological health and exploring its effects on the human beings’ psychological health through adopting a causal-comparative approach and based on a survey research; since the studies signify the increase in depression and seasonal affective and temperamental disorders due to the problems resulting from the inappropriate designing of the residential spaces, the current research paper endeavors to deal with the effective relationship between depression and daylight in the residential spaces of Isfahan. However, since paying attention to the positive aspects of health like happiness has a greater deal of effect on the enhancement of health from the perspective of the positivist psychology, the current article attempts, in lieu of focusing on the negative aspects like depression, to investigate the relationship between daylight and the happiness of the inhabitants of Isfahan’s residential compounds. To do so, the bilateral relationships between each of the study’s variables will be seminally explicated in details and, eventually, the correlation among three variables will be tested.
2. THE EFFECTIVE RELATIONSHIP BETWEEN DAYLIGHT, HOUSING AND PSYCHOLOGICAL HEALTH AS THE STUDY VARIABLES

The relationship between daylight and happiness (psychological health) and the residential environments as the study ground has to be seminally elucidated as presented in the following.

2.1. Housing and Psychological Health

It is now for a long time that the relationship between housing, in general, and health has been found out. Words like healthy housing, healthy housing and/or housing hygiene are the terms often used for explicating a safe and sound house. In regard of the healthy housing, there are numerous definitions offered. WHO’s definition of the healthy housing underlines that the individual’s residence place should be free of physical damages and accidents; it has to provide the inhabitants with adequate spaces for activity and support the physical and psychological health and it has to supply natural and artificial lighting in a safe manner and sufficiently in terms of quality and quantity (Ranson, 1991).

WHO’s definition of health has not undergone any changes since 1946 up to now: “health is a state of perfect physical, psychological and social wellbeing and it is not just the absence of disease and disability. Enjoyment of the highest accessible level of health is one of the essential rights of every human being without any superiority and privilege in terms of race, religion, political beliefs and position. As viewed by WHO, the perfect ability for the performance of the social, psychological and physical roles is called health (WHO, 1998).

In fact, the definition emphasizes both the physical and psychological dimensions of health. As a science, the environmental psychology has been able to be extremely advantageous in perceiving and soothing the separations and disintegrations between the human beings and the environment (Levi, Kocher, & Aboud, 2001) and this shows how the specifications of the places influence the human beings and contribute to the change of behaviors or lead to compliance with the place (Moore, 2001; Gifford, 2007).

There are recently found a lot of evidence indicating the physical and psychological problems like stress, depression, attention deficit, drug abuse, aggressive behaviors and asthma in connection with the artificial environment. This issue is particularly tangible in connection with weak urban designing and inappropriate housing. As an example, unsuitable housing can put the inhabitants under intensive physical and psychological stresses (Srinivasan, Liam, & Allen, 2003). It is not solely the old and depreciated houses that may cause health risks to the inhabitants rather many of the new and recently constructed buildings, as well, can expose the inhabitants to a lot of risks due to their lack of the required standards (Barrett, 2000).

Application of the environmental psychology principles in the area of the environmental designing (especially from the perspective of the environment’s curative features that are currently taken into account in holistic medicine) causes the psychological health and wellbeing of the human beings (Evans Gary, 2003). Having a view of the environment through the windows increases the inhabitants’ sense of wellbeing; in addition, the use of the components of nature in the environment brings about reduction in the environmental stress and inhabitants’ tranquility (Evans Gary, 2003), lowers depression and enhances the psychological adaptation (Davidson, 2001) and exerts positive effects on the happiness and quality of life (Perrnis-Margalis, Rugletic, Schepis, Stepanski, & Walsh, 2000); it is also a shield against the stressful events (Kuo, 2009) and it is influential in the improvement of the individual’s health (Pillow, 1999), increase in consistency, sense of security, positive affection as well as decrease in anger and augmentation of toleration and forbearance of the individuals (Velarde, Fry, & Tveit, 2007). There are numerous reports regarding the improvement of the house inhabitants’ psychological health as a result of the improvement of the housing status. In fact, psychological health is directly associated with the improvement of the housing status (WHO, 2005) in such a way that the weak psychological health such as psychological distress, psychological disorders and depression may happen due to such characteristics as the housing type (for instance, the single household houses in contrast to the numerous residential units and low-rise buildings in comparison to the high-rise buildings), number of floors in a building, quality of the building, general quality of the building (structure’s quality and the quality of repair and maintenance), security and others as factors that can intensively influence the psychological health of the inhabitants (Evans Gary, 2003).

<table>
<thead>
<tr>
<th>Housing properties</th>
<th>Housing type</th>
<th>Lower depression in the inhabitants of the houses in contrast to the residents of the apartments (Richman, 1978)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The individuals residing the single-household houses are in better status in terms of the psychological health than those residing the other types of the houses (Edwards &amp; Torcellini, 2002)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The effect of the interior design and greenness of the residential villa and appartment environments on the health and happiness of the young girls (Safarinia, 2010)</td>
<td></td>
</tr>
</tbody>
</table>
In a report, Brown et al investigated the relationship between the personal reports about the insufficient daylight and the likelihood of infection with depression and fall in the individuals above 18. They dealt with the general calculation and estimation of the likelihood of depression and suicide through jumping down from the high levels by the assistance of the data presented by WHO; they also examined the researches by European Organization of Housing and Health and the results of the cross-sectional housing and healthcare studies in eight cities in Europe. The participants’ reports signified the increase by 1.4 times in the inhabitants’ depression likelihood in the houses with insufficient lighting. Brown et al announced that the insufficient lighting in the residence space is directly associated with the depression and fall (Brown & Jacobs, 2011).

Large analysis and review of European housing and health status (LARES) investigated various factors with respect to the relationship between psychological health and housing and depression, anxiety and solitude were inter alia the most general considerable symptoms. In between, depression needs more contemplation as the psychological wellbeing index in contrast to the other factors. There are various factors considered in relation to depression in the residence space amongst which the absence of sufficient daylight (the chance of increase in the depression up to 60%), unfavorable landscape view through the window (increase by 40%), interfering noise (increase by 40%) and sleep disorders due to the noise (doubling the depression likelihood), absence of privacy for being alone (increase up to 50%) and being exposed to the humidity and fungi (increase by 60%) can be pointed out (Lares, 2007).

### 2.2. Daylight and Mental Health

Essentially, lighting influences the individuals either directly or indirectly: “the direct effect stems from the creation of the changes in the quality of the vision due to lighting and through changing the stimulators of the visual system or the changes in the conditions and functions thereof whereas the indirect effect is the product of the light’s ability in drawing attention, change of attitudes, state, behavior and correction of the human body’s hormonal equilibrium. Lighting can influence the physiological reactions of the human body like visual perception” (Pourdeihimi & Haji Seied Javadi, 2010).

Considering the extensive relationship between the things perceived by the eyes and the nervous system, it seems that lighting has great effect on the regulation of the vital rhythms of the human beings. These rhythms depend on the day-night cycles, moon’s movement cycle and seasonal cycle, i.e. the three primary geophysical rhythms existent in the nature. These cycles can influence the physiology, temperaments and capabilities of the human beings. In this regard, the circadian (24-hour) rhythm has been more carefully taken into consideration because this rhythm is directly the primary factor in relation to the circadian cycle or darkness/light cycle (United States Congress, Office of Technology Assessment, 1991). The Ransler research institution showed that light plays an important role in the preservation and improvement of the human beings’ life cycle and it simultaneously has particular therapeutical effects on some of the physical and psychological diseases and it can largely influence the treatment of such patients. On the other hand, whenever lighting is used in consideration of the intensity of light reaching the retina as well as the irradiation duration and timing, it will not only prevent depression but it is also effective on the entire aspects of psychological health.

Architectural designing is posited in this discussion as an important factor to the extent that the entire quantitative components of daylight, including intensity, time and spectrum, can be changed by the form of the adjacent structures. On the other hand, the quality of the transferred light depends on the openings’ types, the presence and amount of shade, size and form of the illuminated space, the building’s climatic placement and general location as well as the depth and direction of the light receivers like eyes and/or luximeter. Timing of the daylight reception is adjustable by the direction of the building and the form.
2.3. Mental Health and Happiness

There are many reasons for paying attention to and investigating the prevalence and etiology of mental disorders. Based on the report by WHO, depression will be the largest difficulty of global hygiene during the next two decades. According to the prediction by the same organization, the people would be afflicted with mental disorders more than any other disease during the upcoming 20 years (WHO, 2005). For example, many people have been repeatedly diagnosed with unipolar depression on a daily basis. More than half of the adults have experienced a serious period of mental disease during their lives and 10% to 14% of the adults experience an essential depression period during a year. It is evident that two mental disorders, namely anxiety and depression, have been widely prevalent and extensively spread during the two recent decades worldwide, including in Iran (Abedi & Jafari, 2006).

Psychological abstracts from 1887 until now are indicative of the idea that psychology has mostly dealt with the negative emotions in the course of its history. However, in recent years, the researchers have become interested in the mental health and hygiene more and more (Myers, 2004). During the late 20th century, the psychologists started paying attention to the positive emotions and happiness was since posited as one of the subjects investigated by the psychologists and sociologists and this also found its way into the area of the medical sciences (Abedi & Jafari, 2006). The researches performed regarding happiness are indicative of the idea that the happy individuals’ thoughts and behaviors are more consistent and contributive. These individuals adopt clear perspectives towards the affairs, say prayers, directly take measures for resolving their problems and ask help from others in a timely manner. On the other hand, the unhappy individuals think and act pessimistically, sink in their imaginations and reapproach their own selves and others and avoid doing something for overcoming the problems. Thus, mental health incorporates important regulations that are recognizable through the effects of emotions on all aspects of human behavior and progress (including physical and psychological health, skill and educational progress, social competency and creation of positive social relations) (Bridges, Margie, & Zaff, 2002).

As the common goal of all individuals for the achievement of which everybody is making efforts, happiness includes individuals' appraisal of their own selves and their own lives (Buss, 2000). From the very beginning of the human civilization, the thinkers have discussed and conversed about the human life and “optimal life”. Some of the individuals see their ideal in accumulation of wealth and some others in having meaningful and group relationships and helping the needy persons. All of these individuals differ from one another in terms of the external conditions and appearances but they enjoy a common sense of “subjective wellbeing” (Jafari, Abedi, & Moradi, 2004). The term “subjective wellbeing” is a psychological expression equivalent to happiness but it is preferred to it for the many of the concepts that are latent therein. Subjective wellbeing refers to the individuals’ appraisals of their lives. These evaluations might have cognitive aspects (such as judgements that take place regarding consent of life) and/or affective aspects that include the dispositions and emotions that appear in reaction to the life incidents (Jafari et al., 2004).

Happiness is one of the scales of psychological health and it literally means being glad, pleased and griefless as well as living a cheerful and fortunate life (Omidian, 2010). Happiness is one of the six essential emotions of the human beings, i.e. anger, fear, sadness, hatred, wonder and happiness. This positive emotion is a personality characteristic and a stable and pleasant mental-internal and emotional phenomenon comprised of three essential components, named positive emotion, life satisfaction and absence of negative emotions like depression and anxiety (Abedi & Jafari, 2006).

Researches performed on happiness demonstrate that the happy individuals are those who are biased in their processing of information and interpret and process the events in such a way that they can lead to happiness and satisfaction of them (Omidian, 2010). Being satisfied with life, an individual would constantly experience positive affections and s/he would have lower negative affections and it is stated that s/he enjoys higher healthiness (Abedi, 2005).

According to Vinhoven, happiness points to an individual’s judgment of the optimality rate of his or her entire life. In other words, happiness is the extent to which an individual loves his or her life. The variables influencing happiness are diverse and numerous. In fact, a vast spectrum of the inherent and vital streaks and properties influence happiness. Lyubomirsky et al. (2005) offered the combined or eclectic genetic-personality model or the anthropological-environmental factors’ model for happiness and wellbeing that encompasses genetic factors and environmental factors and conditions as well as the voluntary and optional activities and exercises that have been codified according to the following formula: Voluntary behaviors+environmental factors+genetic factors=wellbeing and happiness (Hadinejad & Zarieie, 2010). Based on the researches by Lyubomirsky, the genetic determinants cause temperamental properties of personality like introversion, extroversion, negative dispositions and so forth that are rooted in neurobiology. The other one is the environmental statuses and conditions that embrace factors like geographical conditions, culture and anthropological factors like age, gender and education, race and marital status and so forth. The most important point
regarding the environmental factors is their stability and repetitiveness. In fact, various adaptations like sensory adaptations to the stinky smells or physiological adaptations to high or low temperatures and so on, each causes the creation of a response to their corresponding stimulant which is stable and repetitive. The third factor influencing happiness and wellbeing is the optional activities as well as voluntary and intentional behaviors meaning that the things individuals perform originate from their attitudes and cognitions such as in the expansion of the friendships and cordial relationships or spending more time in nature and so forth. Since many variables cause an increase in the individual happiness, some of them pertain to the environmental statuses and conditions; on the other hand, the relationship between the daylight, as one of the environmental variables, and depression is a clearly visible one. It has to be investigated as to whether an effective relationship can be found between daylight and happiness as the opposite point of depression in such a way that, in lieu of concentrating on the diseases and the unfavorable results stemming from the insufficient daylight in the residential spaces which is the urban problem in the contemporary era, happiness and the solutions to its augmentation can be freshly and newly approached from the perspective of architectural designing of landscape? (Lyubomirsky, Shelden, & Schkade, 2005).

3. STUDY METHODOLOGY

3.1. Objectives
The present study aims at the elaboration of the extent to which the amount of daylight is associated with mental health and happiness in the inhabitants of the residential compounds. The present article has been drawn on the contextual investigations as well as based on the above-cited researches and according to the vivid effects of light on the psychological health and happiness; the necessity for dealing with mental health in the residential spaces lies in the determination of the way the inhabitants of the residential compounds are supplied with daylight as one of the indicators influencing it.

3.2. Study Questions and Assumptions
The following questions guide the present study:
1. How are the happiness of the inhabitants and the daylight associated with the residential compounds in Isfahan?
2. How can the relationship between the daylight in the residential units and the happiness of the residents be elaborated?
The following assumptions can be made in this regard:
1. Despite the numerosity and diversity of the indicators influencing happiness, the effect of daylight on the happiness is significant.
2. The units with optimal and favorable amount of daylight have happier inhabitants in contrast to the units with nonoptimal daylight.

3.3. Study Method
The present study is causal-comparative research that adopts a fundamental approach to investigate the intervariable correlations based on a descriptive method; the study has been carried out in the form of a survey of the inhabitants of medium-rise (3-7 storey) residential compounds in Isfahan during the time cross-section from 2013 to 2014.

3.4. Study Sample Volume and Sampling Method
Out of the aforementioned study population, the districts 7, 8, 12 and 14 were selected as the study sample volume based on the two-stage random clustering method.

3.5. Data Collection Instruments
In the course of sampling and after acquiring the residents’ consents in the present study, two questionnaires were administered to 30 residential units. For gathering the information in this study, two tests were utilized: Oxford’s happiness test and Fordyce’s Happiness test. The following parts are a brief introduction of each of these tests.

3.5.1. Oxford’s Test of Happiness
Oxford’s happiness inventory is amongst the psychological tests and contains 29 items. The questionnaire has been drawn on the happiness definitions proposed by Argyle and Crosland who realized it based on an operational definition as a construct made of three important parts:
1. Frequency and degree of positive affection
2. The mean level of satisfaction during a period
3. Having no negative emotions
Argyle et al obtained Oxford’s happiness list based on a factor analysis. Positive cognition, social commitment, positive mood, feelings’ control, physical health, self-satisfaction and mental consciousness with Cronbach’s alpha coefficients of them being found 64% and 84% (Haris & Aipour, 2006). To measure the happiness, various methods have been applied. These methods fall on a vast spectrum on one side of which lies the friends and teachers’ judgments and friends and teachers’ judgment takes the other end. Amongst the questionnaires that have been used for the assessment of happiness, Oxford’s happiness questionnaire enjoys a particular position (Abedi, 2005). The aforementioned instrument was prepared by Argyle and Loo in 1989. Since Beck’s test has been one of the most successful depression scales, Argyle decided following his conversations with Beck to reverse the statements in Beck’s questionnaire. The final form of
the questionnaire contains 29 items out of which 21 have been excerpted from Beck’s test and the rest have been added by Argyle et al. The test’s reliability has been reported based on Cronbach’s alpha method by Argyle et al to be equal to 0.9 (Alipour, Nour Bala, & Motieian, 2000). The reliability of the instrument was calculated 0.83 by Valliant (1993) after three weeks based on the retest method. He concluded that the reliability of Oxford’s questionnaire is higher than the reliability of the general health questionnaire and also Beck’s depression scale (Argyle, 2001).

In Iran, the Oxford test has been translated by Alipour and Noor Bala (1999) and the accuracy of its translation has been confirmed by eight specialists. The face validity of the questionnaire has also been affirmed by ten experts. To investigate the reliability and validity of the questionnaire, Alipour and Noor Bala (1999) studied 101 BA students from Allameh Tabataba’ei and Shahed Universities. The results were reflective of the idea that all of the 29 items of the questionnaire are highly correlated with the total score; Cronbach’s alpha was 0.98 and the guaranteed reliability was 0.92 and the retest’s reliability was found 0.79 after three weeks (Alipour et al., 2000).

### 3.5.2. Fordyce’s Scale of Happiness

It includes 45 questions in which, three questions deals with a cognitive or behavioral variable. In fact, the aforementioned questionnaire evaluates 14 cognitive and behavioral variables. Three of the study questions evaluate general happiness. The questionnaire has been used in the present study for the assessment of the cognitive and behavioral variables related to happiness. One variable, named “expression of emotions”, has been added thereto. This variable was highly correlated in a study by Abedi (2002) with the happiness rate and, subsequently, 15 cognitive-behavioral variables were investigated using the questionnaire. The cognitive and behavioral variables that were investigated through using the aforesaid questionnaire, were activity, social relations, elimination of negative emotions, optimism, expression of emotions, low level of expectations, being one’s own self, sincerity, planning, paying attention to the present time, giving superiority to happiness, creativity, avoidance of the worries, fostering of healthy personality and fostering of social personality.

### 3.6. Study Implementation Method

In implementing the present study, the resources were seminally reviewed, interviews were studied, the data gathering form was prepared, the study population was classified and the study sample volume was selected. Then, based on the type of the study and according to the goals and the need for comparing both of the variables, i.e. happiness and daylight, the proper instrument was selected for measuring the happiness and the researcher expressed the study goals and acquired consent letters from the study participants and units and explained to them how to fill in the questionnaires and gathered the data. In order to perform the comparison with the daylight in separate in each of the residential units, three scores, namely Oxford Happiness Inventory (OHI), Fordyce Happiness Inventory (FHI) and Daylight (DL), were attained for each testee after delineating the transversal diagrams (plans and cross-sections) related to the daylight and determination of the light value and rank in each unit. Next, the obtained data were analyzed in SPSS Software and subjected to analysis using descriptive statistics.

### 3.7. Instrument Scoring Method

#### 3.7.1. Oxford Questionnaire

There are 29 items in the Oxford test and each item includes four items that are scored in a range from 0 to 3. This way, the respondent can acquire a maximum score of 78 and a minimum score of 0.

#### 3.7.2. Fordyce Questionnaire

This test includes 48 items scored from 0 to 10. This way, each respondent can acquire a maximum score of 480 and a minimum score of 0.

#### 3.7.3. Daylight

To compare the amount of light, each residential unit was considered as an independent variable in association with happiness. According to the fact that the southern front’s openings are envisioned more superior in terms of the light amount and quality, the northern side should be consequently envisaged as the next highly superior front. On the other hand, since the lateral lighting from the eastern and western side can cause glaring effect and absorption of extreme heat in the majority of the cases considering the sun’s route of movement in the sky, the eastern and then the western openings are the third and the fourth designing priorities. Based thereon, considering a rank value for each aspects of the building in an order of priority, a number was considered for each residential unit in regard of their lighting amount. Then, according to the primary factors influencing the daylight that includes building’s orientation, building’s depth, adjacent shading and interfering views, these numbers were optimized and, eventually, a rank value indicating the amount of light in each unit, was specified.

### 3.8. Study Findings

In the present study, two questions and two assumptions have been proposed. The findings obtained for the study questions and findings have been explicated below:
1. First Hypothesis: despite the numerosity and diversity of the indicators influencing happiness, the effect of daylight on the happiness is clearly visible. Table 2 summarizes the findings related to the comparison of the psychological health index and happiness of the inhabitants of the residential compounds and the compounds’ daylight.

<table>
<thead>
<tr>
<th>Table 2. The Mean, Standard Deviation, Significance Level of the Happiness Scores Obtained for the Housewives Residing the Residential Compounds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Oxford Happiness Inventory</td>
</tr>
<tr>
<td>Fordyce Happiness Inventory</td>
</tr>
<tr>
<td>Daylight</td>
</tr>
</tbody>
</table>

As it is shown in Table 2, there is a significant difference between happiness and daylight amounts in the low-lighted and high-lighted buildings. In a significance level of $P<0.1$, the happiness of the inhabitants of the units with optimal lighting was found more significant than that of the inhabitants living in units with nonoptimal lighting for an $r=0.009$ when assessed by the Oxford Happiness Inventory and $r=0.007$ when assessed by Fordyce’s Happiness Inventory.

2. The units with optimal and favorable daylight have happier inhabitants in comparison to the units with nonoptimal and unfavorable daylight.

<table>
<thead>
<tr>
<th>Table 3. Simple (Spearman) Correlation Coefficient of the Happiness and Daylight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxford Happiness Test</td>
</tr>
<tr>
<td>Fordyce Happiness Test</td>
</tr>
</tbody>
</table>

The second hypothesis can be explained in the following words: there is a high correlation between the happiness of the inhabitants and the amount of daylight received by the residential compounds. As is observed in Table 3 and based on the findings of Spearman correlation test, there is a significant correlation between these two parameters, i.e. daylight and inhabitants’ happiness; because the increase in the daylight is highly effective in improving the individuals’ psychological health and happiness.

4. DISCUSSION AND CONCLUSION

By creating extensive biological changes, the daylight causes alteration in the functioning conditions of the visual system, change of mood and behavior as well as the correction and balancing the hormonal levels and its absence is accompanied by various kinds of depression (unipolar, seasonal affective disorder and so forth); so, it is clearly seen that it is very effective in the creation of emotions and exhibition of happy behaviors in the space inhabitants in such a way that the high rate of the daylight presence in the buildings is closely associated with higher rate of the inhabitants’ psychological health and relatively higher levels of happiness. In fact, although various indicators like demographic and genetic and anthropological and other properties have been found influencing happiness, the study results are indicative of the favorable and, of course, vivid effects of light on the happiness of the residential compounds’ inhabitants to the extent that a significant difference was evidenced between the residential units with varying light values in terms of happiness. The results of the present study showed it with a high correlation, i.e. 0.66 in Oxford test and 0.64 in Fordyce test, that the inhabitants of the residential compounds that receive an optimal amount of daylight are happier than the inhabitants living in the units with lower lighting and receiving nonoptimal daylight. Additionally, although the inhabitants try in many of the cases to carve other excuses out for the increased happiness in the aforementioned houses, the optimal use of light in the residential space due to its unconscious effects on the circadian rhythm, hormone secretion system and sleep-wake cycle can indirectly influence the enhancement of the psychological health and happiness in the residents. It is suggested to the future studies that they can investigate and elaborate the solutions of optimal daylight-based designing in the residential spaces in line with the enhancement of the inhabitants’ health through paying attention to the optimization of energy consumption and/or supply of the optimal conditions for performing of the tasks.
REFERENCES


- Pourdeihimi, SH., & Haji Seied Javadi, F. (2010). Daylight Effects on Human, Mental Perception and Biology Processess of Daylight Illuminance, Sofeh, 46-68


