

Quality of Space and Its Relation to the Social Behavior in Academic Open Space

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ABSTRACT Academic open spaces guide students through their movement and shape our universities' environment by their design and quality of space. They are so important in students' life. In the academic year 1991/1992 the Isra University was established with only 539 students and 5 colleges. The number of students since then increased dramatically and the total number for the academic year 2006/2007 has reached a little over 7300 students. There is, as a result, a large increase of pressure on the University's public utilities, facilities and the open public spaces, where the Main Square is among those utilities that have reached a saturation peak. In this study, the problem of capacity of the most popular space, so called square of the Main Square at the Isra University will be dealt with and an evaluation of the open space will be carried out focusing on social behavior. A questionnaire whose aim is to evaluate the open space of the Isra University through understanding students' behavioral mapping is carried out for two weeks during November 2006. This study will examine the effect of spatial environment upon the behavior of students at the Isra University, with respect to open space, and will concentrate on the design quality of the Main Square, the human behavior inside the Main Square, the landmarks within the Main Square and the wayfinding in it. A number of recommendations are suggested at the end to improve the spatial environment.

1. INTRODUCTION

Jordan's first university is the University of Jordan which was established in 1962 in the northern section of the capital Amman on a hilly area. The site area was 1.2 square kilometers with spacious amount of trees. Architect Alister Mac Donald designed the master plan in 1963. He designed several zones, such as the science zone, the humanities zone, the commercial and social zone, the sport's zone, the housing zone and others and proposed a ring road inside the campus to facilitate vehicle movement with some parking pockets to separate pedestrians from vehicles (Mac Donald 1963). Over the years, the University expanded rapidly, because it was the only university in Jordan at that time (1962-1976). The University of Jordan continued to expand rapidly and in 2007 the total built-up area reached 550,000 square meters and the number of students is more than 39,000. As a result of the expanding numbers of students several state and private universities were established since 1976 in Jordan and the total number now is 25.

The Isra University is one of the private

universities that were established in 1991 in the southern section of the capital Amman on the main road connecting the capital to the Queen Alia International Airport. In the academic year 1991/1992 the Isra University started with only 539 students and 5 colleges. The evening studies at the Isra University started in the academic year 2000/2001 that raised the number of students to 2439 students. The number of students since then increased dramatically and the total number for the academic year 2006/2007 has reached a little over 7300 students.

The campus of the Isra University is rectangular with two main entrances, one from the west that has a direct access to the Queen Alia International Airport Road and the other is from the north. The site area is 300,000 square meters (Fig. 1). The design concept of the campus is divided into three main zones. The first zone is located near the west entrance where the location of students' car parking is seen. The second zone is in the middle where the main five colleges in addition to the main library, the restaurant, and the president's building are located. The third zone is located to the eastern section of the university where the main playing field is located. Our case study, the Main Square, is located in the second zone between the colleges' buildings. A ring road is surrounding the second zone with some dead-

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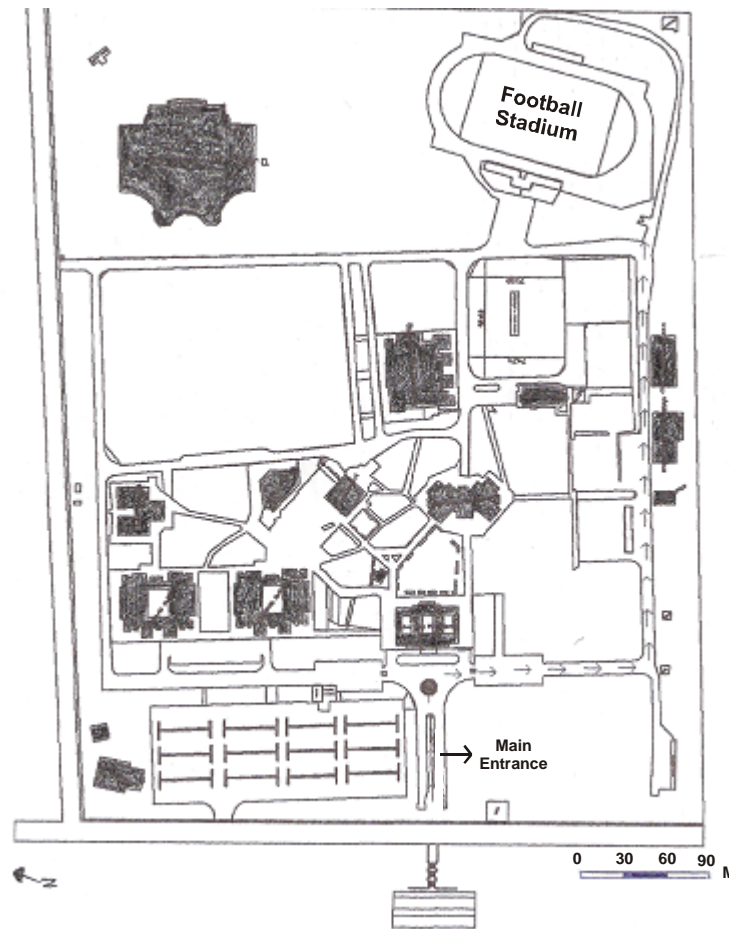


Fig. 1. Site plan of the Isra University
 Source: Isra University, 2006

end roads. As described in the abstract, the Isra University has been witnessing a large increase in student numbers, and this trend will continue through the next academic years due to the dramatic increase in the students' numbers. The present situation in both colleges and open spaces, in terms of capacity, is saturated and the increase pressure on its public utilities is tremendous. The Main Square space is among those utilities that have reached a saturation point. In this study, an evaluation of the present situation of Main Square will be carried out, taking into consideration the following literature on the quality of open space and the human behavior. Academic open spaces guide students through their movement and shape our universities'

environment by their design and quality of space. They are so important in students' life. In this study, the problem of capacity of the most popular space, so called square of the Main Square at the Isra University will be dealt with and an evaluation of the open space will be carried out focusing on social behavior. This study will examine the effect of spatial environment upon the behavior of students at the Isra University, with respect to open space, and will concentrate on the design quality of the Main Square, the human behavior inside the Main Square, the landmarks within the Main Square and the wayfinding in it by applying a questionnaire to evaluate the open space through understanding students' behavioral mapping.

2. CONCEPTUAL APPROACH, PROBLEM, AIM AND RESEARCH METHODOLOGY

The Isra University, which is witnessing a large increase in student numbers, is facing a major problem in its Main square open space. The present situation, in terms of capacity, is saturated and the students can hardly find their way to colleges due to poor signage system and the absence of landmarks as we will see later on. In this study, an evaluation of the present situation of open space at the Isra University will be carried out. The study will be divided into several components: first, the design quality of the open space will be analyzed. Second, a study of the human behavior inside the Main Square will be carried out taking into consideration different human activities, such as sitting, standing, studying, eating, socializing and others. Third, a study of the landmarks inside the Main Square will be examined side-by-side to the studies of navigation system and the experience of maneuvering. A visual study of the spatial ability of these open spaces will be studied with its three components, the spatial orientation, the spatial visualization and the spatial relations, and a number of photographs will be analyzed. Fourth, the wayfinding within the Main Square will be studied in detail.

The research methodology depends on integrating the social and physical variables through intensive observation of students' behavior inside the Main Square (Wohwill 1980). The observation period of students' behavior is the first kind of method used in this study. The behavior mapping is divided according to the students' academic schedule: the morning session between 8 a.m. and 1 p.m., the afternoon session between 2 p.m. and 4 p.m. and the evening session between 4 p.m. and 8 p.m. Between 1 p.m. and 2 p.m. a break to nearly all students exists. The long period of morning session of five hours has made it difficult to give precise results, so a division to this period into two phases is suggested as in table 1. The sample consisted of 100 Isra University students selected randomly, with a percentage of nearly 50% of the students' male and the others are female. They are from various university departments and faculties, and were asked if they would like to participate in the study. The total numbers of students observed are 500 daily for two weeks. Two trained researchers, in addition to the authors have helped in behavior mapping at the selected setting. The

observations that appear in table one are developed according to the student's behavior recorded by the researchers. They concluded nine subjects to review and record. The study is conducted in the first semester of the academic year 2006/2007 over 2 weeks. The second type of research method is a questionnaire tested through interviewing students by researchers. The participants are 100 students daily from each academic year selected randomly according to the aforementioned criteria over two weeks. Participants voluntarily agreed to make the interview and fill out the questionnaire that is presented in table two. The third type of research method is using the pictures of the Main Square to analyze its quality, form, shape and other urban design elements.

3. WAYFINDING CONCEPT AND SPATIAL ENVIRONMENT

Wayfinding is a very important issue. It is an integral part of our everyday life. We usually rely on our memory to find our way in which meaningful and recognizable patterns of visual information are stored (Lam 1977). Wayfinding is a spatial problem that involves identifying a current location, then maneuvering through a route to reach the desired place or building. It consists of a behavioral attitude to find a destination. If the desired location is not reached, this means there is a problem in the design of the scheme and the environmental stress is increased on the user. The difficulties may be due to several factors, among them the inaccessibility to the location, or to the complexity of the circulation pattern or to the inefficiency in the design of layout, or due to safety problems and security (Gluck 1991). We usually pick out a particular pattern which enables us to find our way, as the built environment contains so much visual information that we cannot remember it all. This is called the spatial cognition, which depends on the knowledge representation people learn in childhood and through time. People navigate from one place to another using their knowledge, mediated by categories of understanding their experience (Johnson 1987). People develop a cognition map in their heads to navigate through space. As they use the space more frequently a better image is developed in their minds, and an easier way to find their desired location is achieved (Kuipers 1982).

Gluck defines wayfinding as "the process of

orientation and navigation. The overall goal of wayfinding is to accurately relocate from one place to another in a large scale space" (Gluck 1991). Wayfinding requires several procedures, such as taking into account the previous experience, trying to understand the spatial characteristics of the built environment, and the assessment of different objects and landmarks (Arthur and Passini 1992). The place or space should be first recognized before a decision can be transformed into behavior or movement. (Peponis et al. 1990). Cognitive map, which as a map is constructed in our mind so that we are able to look at to answer questions about the required task, is essential in wayfinding (Passini 1984). The spatial relationship in an area is based on the cognitive map. A well-developed mental representation or cognitive map is essential if we want our open space to be successful, and in order to achieve that, students or people need clues within their environment (Moore 1973). Human behavior in wayfinding depends on the spatial perception of the environment, which depends on vision, hearing and touching (Stokols 1981). Human spatial knowledge of space consists of three levels: landmark knowledge, which is a point of reference in the built environment; path knowledge, which organizes the sequence of landmarks; and the survey of configurationally knowledge, which permits the location of landmarks and paths (Siegel and White 1975). Humans use other senses than eyes to navigate space, and as they age, they become much more experienced to maneuver their bodies under control of automatic processing (Kitchin 1996). Psychologists studied the human behavior and the wayfinding in housing schemes for several decades in order to design a better space and place for humans (Golledge 1992).

Twentieth century spatial environment in the Middle East and nearly all over the World are characterized by designing open spaces in front of their buildings as a left over space without paying much attention to their quality or character (Jensen 1981). Open spaces are perceived as areas for recreation and interaction in universities, as well as around other types of building (Unger and Wandersman 1985). The volume of the space determines the characteristics of open space. The physical features inside the open space are also as important as the space itself. Some spaces are famous because of special features, or because they are adjacent to an appealing scene, such as

water front or green area that overlooks a beautiful landscape (Wiseman 1981). Barriers inside the open space control people's movement and direct wayfinding. Barriers can be symbolic or real. Symbolic barriers include plants, steps and signs, while real barriers include walls of buildings and free-standing wall (Rapoport 1982). The distance of the observer and the surrounding architecture height influence how these open spaces are perceived (Kornblum 1981). In public open space the absence of landmarks disorient the user and gives no identity to the space, and they even make it more difficult to reuse the open space and to remember it (Mac Minner 1997). Landmarks are an important element in city and urban design. They give a meaning to the open space and people only remember those landmarks inside the open space (Lynch 1981).

4. DESCRIPTION OF THE MAIN SQUARE

The case study that will be studied in this research is similar in a way to many other modern open spaces, whether in Jordan, the Middle East, Europe, the United States or any other country. As described before, we can find similar cases in modern cities because modern open space is a left over space in front or among buildings. This research is going to assess the quality of open space in the campus of the Isra University in 2006 in general.

The Main Square open space is simply an irregular space surrounded by four main buildings, several pedestrian routes and a garden as in figure 2. It is used as a gathering point that is approached by several ways (Fig. 3, 4). The space contains a large amount of trees, several chairs, canopies, small fountain, and lighting features. It is almost flat with some steps. The physical features inside the open space are important as the space itself. Some spaces in the World are famous because of special features, or because they are adjacent to a nice scene such as water front or green area that overlooks a beautiful landscape as discussed before. Despite there are several physical features inside the Main Square but their design and setting is poor and need relocating and rearranging to facilitate movement and ease wayfinding. As seen from question number 5 students are satisfied with the chairs and canopies availability where the percentages varies from 85% for the first year students to 77% for the fourth year students, but



Fig. 2. View of the Main Square open space.
Source: Authors, 2006



Fig. 3. Approach of the Main Square.
Source: Authors, 2006.

a rearranging and relocating will increase those percentages and will solve other problems of wayfinding and orientation.

To assess the hypotheses of the study, Chi-Square Test is conducted and the equation of: $\chi^2: \Sigma(Fo-Fe)^2 / Fe$ is applied.

Where χ^2 : is the calculated critical value of Chi-Square.

Fo: observed counts.

Fe: expected counts

X': Tabled critical value of Chi-Square.

From Table 1 it appears that there are several



Fig. 4. Different approach to the Main Square.

Source: Authors, 2006.

Table 1: Activities of students during the day from 8 A.M. until 8 P.M., where the total for each cell is 100 participants.

Subject	Main square open space									
	8-11 A.M		11-1 A.M		1-2 P.M		2-4 P.M		4-8 P.M	
	Y	N	Y	N	Y	N	Y	N	Y	N
1. Penetrating	81	19	62	38	28	72	45	55	41	59
2. Sitting	54	46	72	28	88	12	63	37	52	48
3. Standing	55	45	65	35	78	22	62	38	52	48
4. Talking	75	25	78	22	91	09	73	27	64	36
5. Walking	54	46	58	42	36	74	63	37	61	39
6. Studying	47	53	53	47	15	85	36	64	28	72
7. Eating	28	72	45	55	78	22	32	68	22	78
8. Drinking	19	81	36	64	92	08	75	25	64	36
9. Resting	21	79	45	55	98	02	77	23	56	46

Table 2: Evaluation of the objects within the Main Square and examination of the human behavior in relation to the age of the students, where the total for each cell is 100 participants.

Object	First year student		Second year student		Third year student		Fourth year and above student	
	Yes	No	Yes	No	Yes	No	Yes	No
	1. Do you like the design layout of the Main Square?	75	25	72	28	68	32	64
2. Do you like the different approaches to the Main Square?	84	16	80	20	78	22	75	25
3. Do you see the height of the surrounding buildings appropriate?	65	35	68	32	74	26	78	22
4. Do you like the design of the surrounding colleges?	52	48	45	55	42	58	35	65
5. Do you feel the chairs comfortable	85	15	82	18	80	20	77	23
6. Do you see the plantation enough?	88	12	90	10	92	08	92	08
7. Do you see definite and appropriate boundaries to the main space?	35	65	28	78	25	75	19	81
8. Do you see a landmark in the Main Square?	08	92	05	95	03	97	01	99
9. Do you find your way to your college or lecture hall easily?	51	49	58	42	69	31	95	05
10. Do you see the signage system enough and efficient?	02	98	12	88	18	82	22	78
11. Can you plan your way mentally before entering the space?	11	89	15	85	36	64	51	49
12. Do you recognize the open space easily?	10	90	22	78	38	62	52	48

activities taking place in the Main Square. The most important is penetrating through the space to reach a building or a lecture hall especially in the morning between 8 a.m. and 11 a.m. Between 11 a.m. and 1 p.m. the activity shifts to talking and between 1 p.m. and 2 p.m. the activity shifts to resting and eating where there is an hour break to nearly all students. In the afternoon session, the activities revolve around resting, drinking and talking. To test the results of counts in table one,

Chi-Square Test is applied. The test shows that χ^2 (calculated) is $> X'$ (tabled) and there is significant difference between variables or so called subjects in each square.

Table 2 assesses the open space in terms of its design. The question number 1 deals with the quality of the open space where most of the first year students, 75% of the participants, do like the design of the open space due mainly to the human scale of the space, as evident in question



Fig.5. Barriers of the Main Square.
Source: Authors, 2006



Fig. 6. Different barrier of the Main Square.
Source: Authors, 2006.

number 3, where 65% from the first student sample see the height of the surrounding buildings appropriate to reach 78% for the fourth year students. The second reason for admiring the Main Square space may be due to the extensive plantation inside it where question number 6 supports this and shows a percentage variation from 88% to 92% from first year students' sample to fourth year students' sample. As students get older, the percentage of admiring this Main Square decreases until it reaches 64% for fourth year students. The Square has different approaches from different sides because simply there are no definite boundaries. Question number 7 in the same table, which is about the quality of boundaries of the Main Square, supports this, where the percentages seeing definite and appropriate boundaries decreases from 35% for the first year student sample to 19% for the fourth year students sample. This is due to the absence of identity and the spatial quality of open space characteristics. Barriers inside the open space, which control people's movement, and direct wayfinding, can be symbolic or real as mentioned before. Trees, which are symbolic barriers, are randomly planted inside the Main Square that can not form any barrier. Steps are found inside the Main Square and not at the edges to form a barrier. No obvious signs are found. Only the wall of the presidency building is forming a real barrier to the west of the Main Square. No free-standing walls exist. Both symbolic and real barriers are neglected in the Main Square as evident in figures 5 and 6.

The spatial orientation, where the ability to move and mentally manipulate an object, that was discussed before is seen accepted from tables 1 and 2. This spatial orientation will of course be decreased if more students and users are allowed to use the space. Question number 9 explains this where 51% of the first year student find your way to their college or lecture hall easily. As they get older the percentage increases to reach as much high as 95% for the fourth year students. There is no obvious signage system to direct the students and users within and through the Main Square. Students find their way difficultly. Question number 10 supports this where the percentage varies from 2% to 22%, according to the level of the student, for those who see a good signage system within the Main Square. We can conclude that the more senior the student has been at the University, the more experienced in

finding his or her way and in recognizing the space he or she uses. If we compare a fourth-year student with a first-year student, as in question number 9; we see a large difference between them. This is in line with Kitchin (1996) arguments when he discussed the human navigation and age. He concluded that the older people are in using the activity, they become much experienced in maneuvering their bodies under control of automation process.

The spatial visualization, which goes further beyond the spatial orientation, where the person can manipulate the relationships within an object, is less in the Main Square. Question number 11, which is about the ability of the students to plan their way mentally before entering the space, is in support of this argument. Only 11% of the first year students' sample can plan their way easily before entering the Main Square. This percentages increase to 51% for the fourth year students' sample. This is due mainly to the absence of landmarks inside the Main Square as evident from question number 8 where only 8% from the first year students' sample see a landmark in the Main Square and 1% from the fourth year students' share the same opinion. Only 10% from the first year student recognize the open space from other squares easily as seen from question number 12. If we compare a fourth-year student percentage of 52% with a first-year student, we see a large difference between them. After applying Chi-Square Test for table two the results show that the table is dependent, which means that χ^2 (calculated) is $> \chi^2$ (tabled) and there is significant difference between variables. In other words the Main Square users are not similar to each other in answering the questionnaire, and there is significant difference between the first year, the second year, the third year and the fourth year students.

5. RESULTS AND DISCUSSION

Wayfinding, which is the dynamic process of using the spatial ability and navigational awareness to reach the required place can be improved in the Main Square if the spatial quality of the open space is adjusted and improved. This can be achieved by using an effective signage system, by erecting new landmarks and by redesigning of the boundaries and heights of the surroundings of the Main Square. As discussed before, the boundaries of the Main Square are

inconvenient as seen from figures 5 and 6 and from table 2. The sense of enclosure is missing and this affects the spatial quality of the Main Square. The using of symbolic and real barriers inside the open space to control people's movement, and direct wayfinding can help in minimizing this problem. A relocating to some trees or even planting new ones, incorporating new steps and mainly introducing new signage system will ease wayfinding. A place has to be first recognized before a decision can be transformed into behavior. The distinctiveness of a place gives its identity and eases for wayfinding. The visual system, the hearing system and the touching system are the most important senses used in wayfinding. The acoustic sense allows us to identify certain characteristics of the setting and to perceive some distance cues. The water features, such as fountains, clock towers and the sound and noise of gathering people are all samples that can make the students distinguish the open space they are using (Hirtle 1991). The incorporation of water features, clock towers or other acoustical elements will improve both the wayfinding and the quality of space in the campus of the Isra University. Human behavior depends on spatial perception, which relies on vision, hearing and touching (Theil et al. 1986). The identity of open space is stressed by using landmarks whose are missing in the Main Square. If people can remember a landmark, only then can they remember the space (Garling and Lindberg 1986). The absence of landmarks (as shown in the photographs presented in figures numbers from 2 to 6) in our case study disorients the students and gives no clear identity to the open space. The space should first be recognized either by its landmarks or by other means before a decision can be transformed into behavior or movement into the space (Mac-Minner 1997). The distinctiveness of open space gives its identity, which is considered a major requirement in wayfinding (Peponis et al. 1990). Boundaries, which are missing in our case study, play a major role in public open spaces. They help us in wayfinding and in recognizing spaces, thus defining a territory. Territoriality serves both socially and physically, and is considered an important organizer of human life. It facilitates social activity and permits performance of certain functions. Territory can be made of real barriers such as walls or fences, or from symbolic barriers such as levels, steps, lights or landscaping (Bower 1988). No real or symbolic barriers exist in the Main Square.

The space perception is dependent on the distance between users and objects, the orientation and the movement of users in the space. Ittelson (1973) added the environmental space, which is based on the relationship between scale, space and people's experience. Scale plays a central role in the distinction between objects and environments. Our case study open space has a human scale; thus, there is no problem in the quality of approach to the Main Square as evident in tables 1 and 2. Question number two in table two shows an acceptable approach for students of a percentage of 84% for the first year student and 75% for the fourth year student. While observation number one in table one shows an acceptable penetrating of students to the Main Square of percentages from 41% to 81%. The percentage varies widely according to the time of survey. The worst and lowest percentage is during the lunch hour between 1 and 2 o'clock, which is considered a rush hour where almost all the students try to take their break or lunch at that time.

Human behavior is dependent on the people's mental representation of spatial environment. The mental representation is used to direct movement and the experience is used to modify the representation (Sadalla and Montello 1989). Human spatial perception is different from other perceptions because it is always possible to verify through several senses of vision, hearing and touching. This is related closely to the signage system which people or students depend on greatly in finding their way through open space (O'Neill 1991). As evident in table 2, the signage system in the aforementioned square is weak and needs design. Although the fourth- year student users of the Main Square at the Isra University see fewer problems in signage system, still the percentage is 78% for those who see a problem in it. The appropriate location of signs helps a lot in distinguishing them and therefore reflects the open space in a better form. When moving through a space the eyes of the students scan the visual field to identify objects and signs. Visual scanning is usually fast and efficient and it is considered as a primary sense in wayfinding (Devlin 1995).

Cognitive map is poor in our case study, taken from the Isra University as seen from table 2. This cognitive map usually develops from mental landmark, which does not exist in our case study, to a mental route map and should eventually result in a mental survey map, which is related to the

students' movement in the open space. Remembering what has been seen when walking or moving through the open space creates this movement. Landmarks, which are missing in our case study, are a basic component in spatial knowledge. Landmarks, which are memorable locations that help to orient navigator, are stored in declarative knowledge structures (Passini 1984). They are very important in wayfinding, not only for the first time, but also as our experience in the open space increases, we may learn how to identify them from new perspectives. Landmark knowledge becomes more valuable as we learn to relate spatially individual landmarks to others in the environment. A construction of distance and orientation relationship will result. This means that if we erect a series of landmarks in the campus of the Isra University a better route knowledge will result.

One final remark should be mentioned here which is the urgent need to justify the design of our case study, the Main Square, before the problem even become much worse due to the continuing increasing of students in the next academic years.

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