

## **Landscape Perception and Landscape Change for the City of Irbid, Jordan**

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**Abstract:** This paper assesses the perception of Irbid city boundary by a group of university students and people over 40 years old; and by comparing this to Viewshed analysis which reflects the geographical setting. The methodology utilizes three assessment methods: digital computation (Viewshed), questionnaires and visual assessment. The aim is to illustrate subjective assessment as an indicator of change in the landscape character of city boundaries. The subjective assessment includes memory-based questionnaires targeting both age groups while the visual assessment targets urban planning students; the objective assessment is reflected by digital computations using GIS and Viewshed analysis. Although the city boundary as perceived by the older generation is closer to the Viewshed analysis results, in both the visual assessment and memory-based questionnaire the young generation perceived a tighter boundary than the older generation.

**Keywords:** Viewshed, landscape planning, landscape character, city boundary and cultural landscapes.

### **1. Introduction**

In his book *The Image of the City* (1960), Kevin Lynch characterised city identity as one important aspect by which we could distinguish one city from another not only from their urban fabric, but also their surrounding landscape. Academic awareness of landscape significance and identity has been growing since the 1960s due to the efforts of research groups in landscape ecology (McHarg, 1969; Forman and Gordon, 1986; Turner et al, 2001; Naveh et al, 1994).

In addition to cultural-spatial character, landscape identity broadly refers to aspects such as history, economy, philosophical understanding and ideology. The present research examines spatial identity or “landscape character,” combining physical and visual characteristics (Stobbelaar and Pedroli, 2011).

Landscape character is a construct concerned with visual characteristics usually referred to as scenic quality (Arthur et al, 1977; Brush & Palmer, 1979) which is a product of the landscape and the reactions of people who experienced the landscape in question (Zube and Pitt, 1981; Ulrich, 1981; Ulrich, 1983; Chenoweth and Gobster, 1990). The experience and the interaction are interrelated, complicated and layered (Zube et al, 1982; Gobster, 2008). The experience is sometimes referred to as emotional judgments (Litton, 1982), whereas scenery is referred to as the general appearance of a place (USDA Forest Service, 1995). The general appearance is embedded in the landscape features and the ability to view the features in a contextual framework (Zube et al., 1982; Daniel and Vining, 1983; Brown and Daniel, 1987; Amedeo et al., 1989; Van den Berg and Vlek, 1998). Therefore,

scenic quality, general appearance and emotional judgments are components of landscape character.

The general appearance of landscapes as plains, mountains, hills, canyons, or valleys constitutes our attempt to describe the physical qualities of the landscape, whereas city observers base general appearance on scenic qualities and emotional judgments, approaching a city from the outside. We perceive urban settlements as consistent with the natural landscape since they are sited with regard to the general landscape appearance and its amenities.

According to Dijkstra (1991) there are three approaches by which the observer analyses the appearance of the landscape: from observation points, from routes, and from areas. Such analyses can be conducted using Viewsheds; an important method analysing the physical appearance of spaces in their current state, while also making it possible to reflect the landscape character objectively from the perspective of a proposed hypothetical viewer (Lynch, 1976; Tandy, 1967). Although much of this assessment is concerned with maintaining the particular character of a city in its landscape setting by relying primarily on objective description as an aid to conservation and enhancement, it is nonetheless complemented by the subjective assessment of residents and visitors.

However objective the general appearance of the landscape might be, it is read variously by different people with diverse backgrounds and experiences (Meinig, 1979a, Jackson, 1979, Lewis, 1979, Lowenthal, 1979, Samuels, 1979, Sopher, 1979, Tuan, 1979). In *The Language of Landscape*, Sporn (1985) asserted that people are imprinted with the landscapes of their early childhood and that lasting memories present ways of framing the world, while Wynn (2005) states that permanent ideas regarding places are instilled in the early childhood years of rapidly expanding cognition.

Despite the advantages of a holistic approach to understanding contemporary landscape character using both objective and subjective data, few studies have used subjective data to identify changes in landscape character. Macro level planning studies, for example, have regarded cultural landscape and landscape character as an important driving factor in regional planning. Many studies focused on the characterization of urban and regional landscapes in order to identify unique natural, cultural, and historical landscapes; create Environmental Order Plans (EOP); and integrate landscape character assessment (LCA) in land use planning as well as regional and town planning policies (Atik et al, 2015; Guneroglu et al, 2015). LCA studies focusing on expert opinions were criticized for

neglecting public and stakeholders opinions (Butler and Akerskog, 2014). The later focused on awareness of landscape character among the public who in turn didn't seem to be able to define the landscapes properly according to their study. This made it difficult to appreciate and consider the results based on the public opinion of their landscape values (Butler and Akerskog, 2014). They concluded that developing an understanding of individually experienced landscapes required a democratic understanding of landscape.

Research into landscape perception increased during the 1960s and 1980s (Zube, et al., 1982) and although research on the implications of age in evaluating scenic quality of a particular landscape exists (Zube et al, 1975, 1983; Craik, 1972; Daniel & Boster, 1976; Kaplan and Kaplan, 1982; Ulrich, 1981; Miller & Rutz, 1980), none addresses the connection between age and the perception of landscape change. While theories are developing, the challenges facing researchers of achieving reliable results and the subjectivity of the analysis are possible reasons for the lack of research in this field (Palmer, 2000; Lothian, 1999).

According to Tilley (1994), people recognize significant qualities based on past social activities, taking into account gender, age and kinship; with age in particular, the contemporary experience of these features (geographic experience) may vary. In city scale environments such experience can highly impact a person's ability to comprehend spatial relationships and general appearance of the landscape (Evans, 1980; Hart, 1979). According to Stea (1970) geographic experience might be limited in children due to their limited home range, but gradually increases throughout adolescence. Therefore it is possible to identify change by comparing the perceptions of adolescence and mature age groups. Results of visual landscape assessments show that obvious differences exist at the experience level among groups as well. The expert and a lay man may be opting to focus on different landscape features assessing a varied character despite seeing the same content (Dupont et al, 2015).

Administrative boundaries for governorate, city and district created and maintained by spatial planning strategies and interventions (Kraemer, 2005) may not be sensed by local inhabitants or visitors. They perceive boundaries delineated by the nature and character of the landscape, geographical features, land use distribution and a sense of comprehensive combination of these features.

Municipal management strategies attempt to address the conservation of landscape character

by regulations based on objective data without considering the impact on residents and visitors. Municipal decision-makers must determine whether or not there is a perception consensus among interest groups and if no consensus exists, how it might impact their comprehensive planning strategy. The present research attempts to justify the perceived view as a valid indicator for character change, thus encouraging municipal managements to incorporate the community in decision-making.

In examining the similarities in the landscape character of the city boundary among people who view and use the landscape, the primary goal is to spatially delineate the city boundary as viewed by two different age groups: the young generation (university students) and older generation (above 40 years old). Objectively, however, the landscape character is drawn from the geographical appearance by employing the Viewshed tool. These methods insure the transparency of the data in comparing subjective and objective assessments.

The primary objectives in this study are: (1) to explore the differences of landscape perception among the two age groups as an indicator for landscape change in the city boundary, (2) to provide theoretical explanations for these differences and (3) to explore possible relationships between the objective and subjective assessments.

## 2. CONTEXT OF THE STUDY

Irbid, the second largest city in Jordan, is selected as the case study for a comparison of subjective and objective assessments of the landscape character of the city boundary. Located in the Horan Plains in north of Jordan, the landscape is one of rolling hills, plateaus and plains dissected by canyons descending to the Yarmouk and Jordan River valleys. Natural springs irrigating the lower land create a microclimate for figs and pomegranates, whereas the hillsides and hilltops are suitable for olives and grapes (Appendix A) and these have defined Irbid's landscape for at least the past two thousand years. Approaching Irbid from Amman, Jerash, Ajloun and Mafraq, roads cut across the plains passing through gentle hills to the Ajloun Mountains in the south west.

Irbid governorate encompasses 23 city districts comprising 75 towns and villages. For the purpose of this research, the boundaries of the towns and villages are used to identify the perceived city boundary, exceeding Irbid governorate boundary to partially include Ajloun, Jerash and Mafraq (Figure 1).

A large percentage of the land in the metropolitan area is flat and agricultural (Figure 2) but rapidly disappearing due to urban sprawl, with commensurate attenuation and fragmentation of agricultural land. Given these conditions, the perception of the city boundary is expected to change in the future.

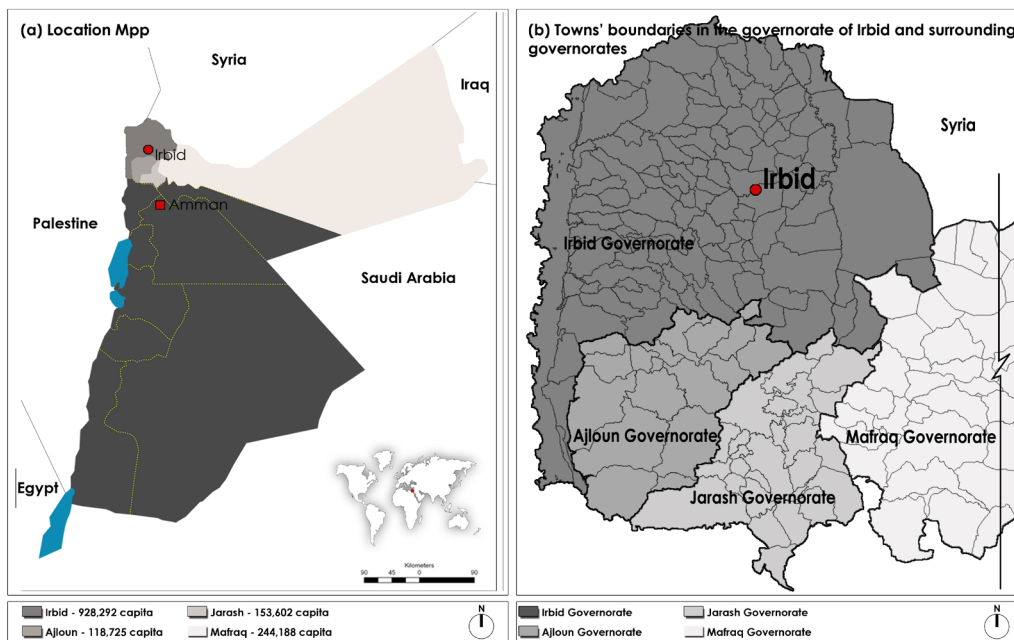


Figure 1: (a) Location Map, (b) Towns' boundaries in the governorate of Irbid and surrounding governorates which include: Mafraq, Jerash, and Ajloun. The Northern and western boundaries are international boundaries with neighboring countries.

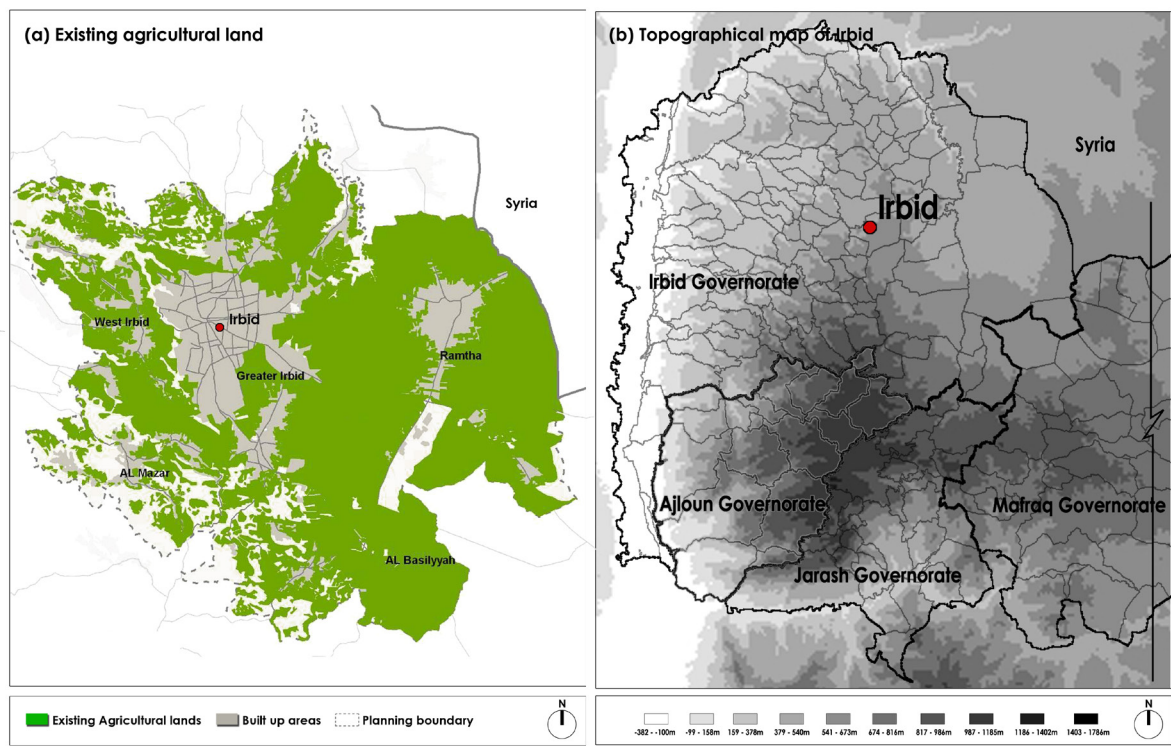


Figure 2: (a) Existing agricultural land (Comprehensive Plan, 2009), (b) Topographical map of Irbid.

### 3. METHODOLOGY

The primary research examines the perception of the landscape character of the city boundary, based on Tilley's remarks (1994) as discussed in the introduction, that age impacts the perception of the landscape. Young generations may be principally affected by the confines of their immediate surroundings because of their relatively short and limited experience during which changes have been minimal. The perceptions of older generations however, having witnessed change over a longer period of time, are more likely to be affected by their memory of the place and may be more resistant to changes in character.

Therefore, the methodology used two methods of comparison: First, results of the Viewshed analysis and urban sprawl as compared to the perceived views of an older generation survey group (n=102) (aged 40-75); Second, results of the comparison of the perceived views of a survey group of undergraduate university students, with the perceived views of a second older generation survey group (n=280) (aged 40-80). The second comparison focused on a specific seg-

ment of the city boundary, the two main access roads into the city: Petra and Hosn highways approaching the city from the East and South-East, respectively.

The 'out-in' approach was used to collect data on image and character perceptions of the various age groups regarding the landscape character of the city boundary, with the aim of identifying the physical signifiers defining the city boundary as perceived by visitors and inhabitants when entering the city. The objective analysis employed the Viewshed tool, which focused on the centre to boundary one-point view to characterize the natural landscape of the area.

Research on the perceived boundary utilized three types of data collection: digital computations of urban sprawl and Viewshed analysis; questionnaire data; and data from students' visual analysis survey (Figure 3).

#### 3.1 Comparison of Digital Computations with the Older Generations' Perception

This comparison identified the possible correlation between the existing geographical landscape character of the city boundary using Viewshed and urban sprawl analysis with the memory based views of the first older generation group (n=102), with corresponding overlays of resulting city boundary plots.

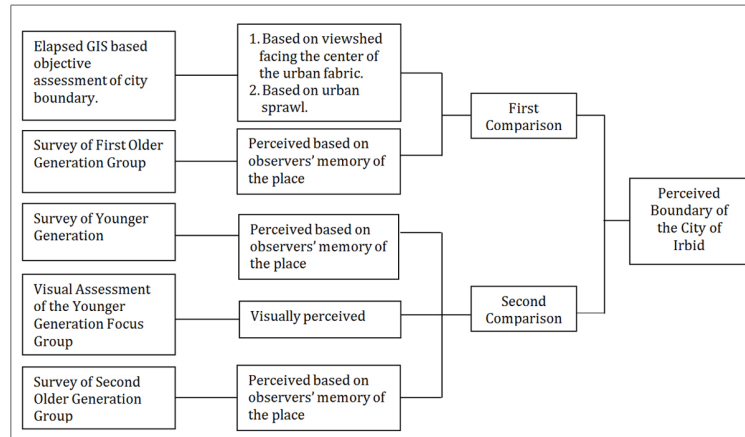


Figure 3: Methodological process.

### 3.1.1 Viewshed

“Viewshed” is a concept that supports visual surveying using a computed tool. This concept is used to survey the landforms of the entire area a person can view from a given point. The delineation is predicated on the concept of visual clarity between places based on the ground elevation as obstacles for straight vision (Figure 4). All land within the Viewshed are the areas that can be observed when connected with straight rays without being hindered by any topographic obstacles from land rising above eye level or any other physical obstacles. The revelation and concealment based concept is applied in a three-dimensional space as observed from the location of the viewer (Berry, 1996), straight rays being sometimes referred to as: “straight line-of-sight in three-dimensional space” (Berry and Mehta, 2009, p. 47). Topographic relief and objects in the landscape, such as trees or buildings, create barriers that hinder visual connectivity (Berry and Mehta, 2009). This tool is found useful for regional planners and landscape architects who are concerned with visual impressions and the identity and branding of places (Limp, 2001).

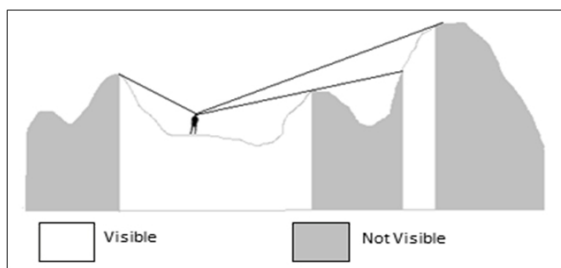


Figure 4: The concept of viewshed explained.

Viewshed analysis is commonly a function of GIS software, since GIS uses elevation data (with possible additional layers, such as vegetation and structures) to compute Line-Of-Sight (LOS) (Limp, 2001). The analysis utilizes the Digital Elevation Model (DEM), where each cell of the DEM is assigned a value reflecting its elevation above sea level. With reference to a certain viewpoint on a particular cell, the software determines the visibility to all other points in the specified radius of the study.

To conduct a Viewshed analysis, many GIS programs may be applied such as ArcMap, Global Mapper and ERDAS IMAGIN. In all programs, an algorithm calculates the difference of elevation from the viewpoint cell to the target cells. All cells within the radius of vision are examined for visibility. If the LOS is blocked by topography or objects in the landscape, then the target cell is excluded from the Viewshed, but if it is visible from the viewpoint cell then it is included in the Viewshed (Kim et al., 2004).

### 3.1.2 Urban Sprawl

During the past four decades urban areas have expanded from the historical city centre into the surrounding agricultural lands. Using GIS, an elapsed urban sprawl map was created. Aerial photographs of the city from four different years (1972, 1987, 2003 and 2010) were digitized to reflect the urban footprint. Finally the expansion of urban areas was overlaid on one map, each year indicated by a different colour (Figure 5).

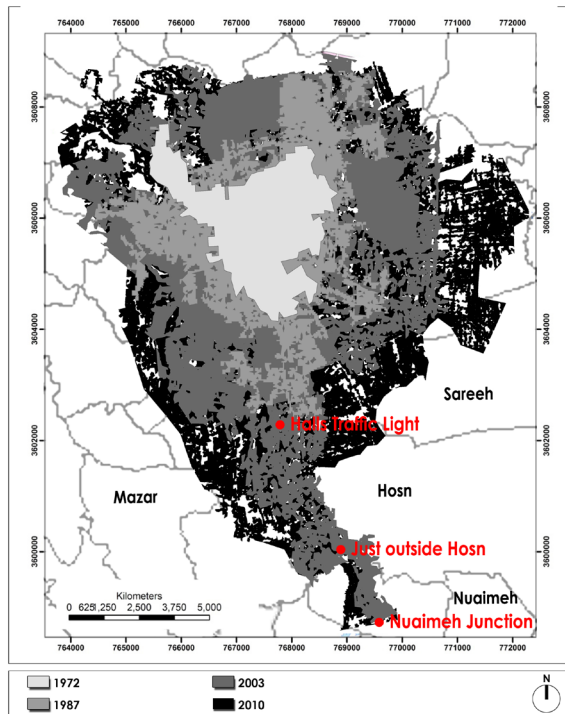


Figure 5: Elapsed urban sprawl of the core area of the City of Irbid. 1972 (5.4 km<sup>2</sup>), 1987 (13.1 km<sup>2</sup>), 2003 (29.4 km<sup>2</sup>) and 2010 (39.1 km<sup>2</sup>). In addition to location of boundary indicators.

### 3.1.3 Survey of the First Older Generation Group

A questionnaire was administered to a group of older adult residents of Irbid (61%) and its outskirts (39%), comprised of 102 people ranging in age between 40-75, averaging 46.7 years, with the aim of exploring the perception based on their memories. Participants were asked to identify the city boundary by the boundary-signifier towns on each main road entering the city, to identify the towns they feel form a city boundary, and name the boundary-signifier towns from memory. Additional questions concerned the geography of the area, percentage of landscape character change and percentage of unchanged landscapes.

### 3.2 Comparison of the of the Young and Older Generations' Perceptions

The second comparison aims to illustrate the impact of age in landscape character perception, focusing on a particular segment of the areas surrounding the city familiar to both survey groups. A pilot questionnaire study concluded that university students were less able to name possible boundary-signifier towns than the older generation. Therefore, landmarks and distinctive physical characteristics within those towns were cho-

sen by students as boundary indicators, such as gas stations, junctions, university sites, prison site and silos.

Questionnaires focussed on two primary incoming highways: Amman-Hosn-Irbid (Hosn Highway) and Amman-JUST-Irbid (Petra Highway) (Figure 6). Hosn highway was studied through questionnaires whereas Petra highway was addressed through visual analysis by a focus group; both highways were addressed by the second older generation survey.

### 3.2.1 Survey of the Young Generation Group

Over a period of nine years, 310 male and female college-age participants undertook the prepared out-in view questionnaire, asking them to choose their perceived first encounter of the city boundary from several significant locations. To ensure a holistic survey the group included residents and daily commuters who were asked about their memory-based views.

### 3.2.2 Visual Analysis of the Young Generation Focus Group

To validate the outcome of the student questionnaire, a visual analysis of the main street corridors into Irbid was conducted by a focus group of (28) 4th and 5th year urban planning studio students, using slides to evaluate landscape changes. Having partici-

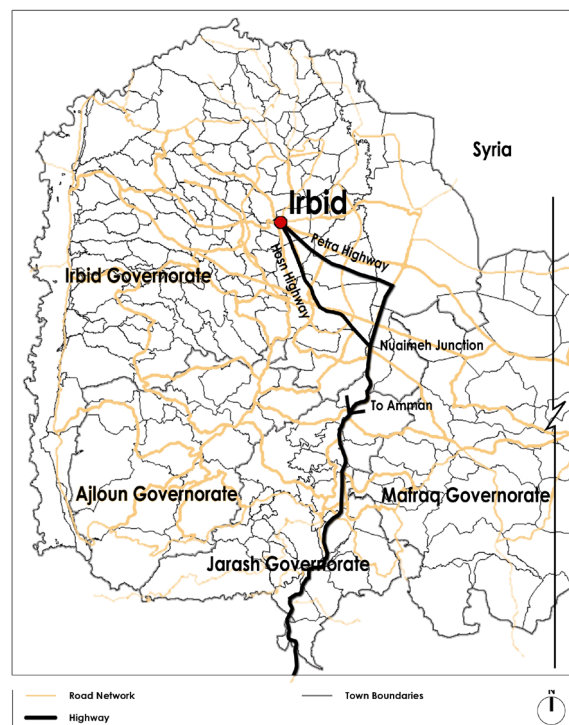


Figure 6: Location of the specific highway segments included in the students and second older generation survey.



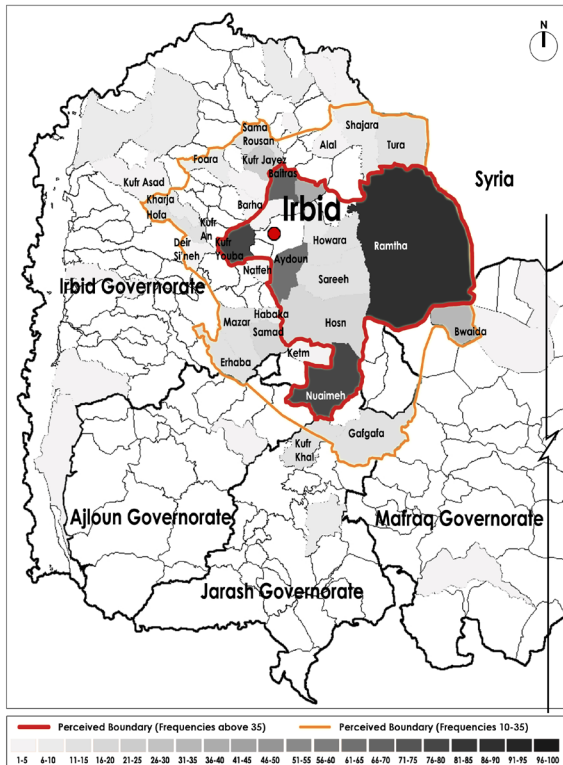


Figure 9: Frequency of towns as periphery signifier.

Additional information from the questionnaire revealed a total of 91/102 (89%) of respondents described the landscape character of the Irbid city boundary as plains. A total of 85/102 (83%) declared that the landscape has changed in the past 30 years an average of 67%, and unchanged landscape an average of 31%. 72/102 (71%) specified the reason for change as urban sprawl, and 75/102 (74%) declared that the landscape character of the city boundary had completely changed.

#### 4.2 Results of the Comparison of the Young and Older Generations' Perceptions

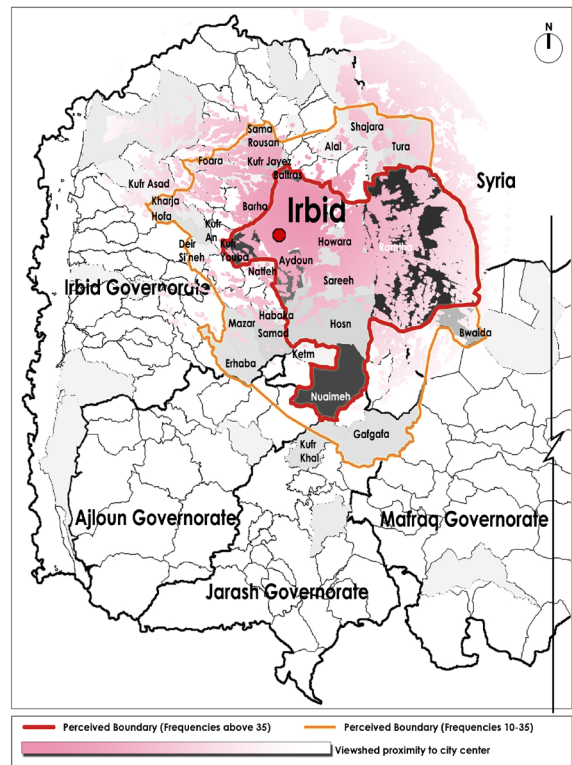


Figure 10: Overlapping the viewshed results and the older generation identified periphery.

#### 4.2.1 Results of the Young Generation Questionnaire

Architecture students resident in Irbid (and enrolled for a requisite class in landscape architecture at Jordan University of Science and Technology) were asked:

“When you go to Amman for any type of visit and take the bus back home to Irbid, when do you start feeling relaxed that you are home now or that you have reached the familiar landscape in which you reside?”  
 48.3% responded “just outside Hosn” and 39.3% “just about when I reached the Nuaimah road junction” (Table 1).

**Table 2: Memory-based response of Landscape Architecture class students (who dwell in other cities during the study time) to the question of landscape character as remembered by them.**

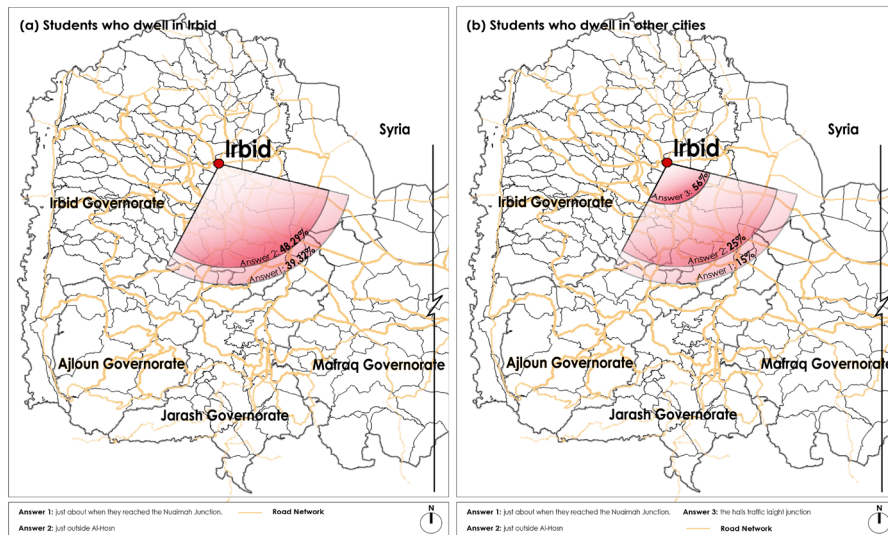
Year	No. of registered Students	No. of Irbid dwellers	No. of Irbid dwellers with answer 1*	No. of Irbid dwellers with answer 2**	No. of Irbid dwellers with other answers
2002	25	20	7	9	4
2003	30	22	9	11	2
2004	28	18	7	7	4
2005	25	19	7	11	1
2006	23	24	10	13	1
2007	30	21	8	8	5
2008	28	23	8	12	3
2009	31	25	10	14	1
2010	90	62	26	28	8
<b>Sum</b>	<b>310</b>	<b>234</b>	<b>92</b>	<b>113</b>	<b>29</b>
<b>percentage</b>	<b>100%</b>	<b>75.5%</b>	<b>39.32%</b>	<b>48.29%</b>	<b>12.39%</b>

\* Answer 1: just about when they reached the Nuaimah Junction.

\*\* Answer 2: just outside Al-Hosn.

Conversely, the question directed to students who commute daily was the following: “Coming back from Amman, when do you feel that you have reached Irbid?” Approximately 80 students responded, with

56.25% selecting the last traffic light (the Halls traffic light) located at the boundary between Hosn and Irbid while the remainder specified locations farther from the city than Hosn (Table 2). All the respondents indicated that the significance of the city landscape is its extensive panorama and the urban sprawl. Figure (11) illustrates the location of the answers within the governorates boundaries.



**Figure 11: (a) Results of questionnaires answered by students who dwell in Irbid, (b) Results of questionnaires answered by students who dwell in other cities.**

**Table 2: Memory-based response of Landscape Architecture class students (who dwell in other cities during the study time) to the question of landscape character as remembered by them.**

Year	No. of registered Students	No. of dwellers of other cities	No. of dwellers of other cities with answer 1*	No. of dwellers of other cities with answer 2**	No. of dwellers of other cities with answer 3***	No. of students with other answers
2002	25	5	0	2	2	1
2003	30	8	1	1	5	1
2004	28	10	3	5	2	0
2005	25	6	0	0	4	2
2006	23	1	0	0	1	0
2007	30	9	2	3	4	0
2008	28	7	0	0	6	1
2009	31	6	0	2	2	2
2010	90	28	4	8	14	2
<b>Sum</b>	<b>310</b>	<b>80</b>	<b>12</b>	<b>20</b>	<b>45</b>	<b>3</b>
<b>percentage</b>	<b>100%</b>	<b>25.81%</b>	<b>15.00%</b>	<b>25.00%</b>	<b>56.25%</b>	<b>3.75%</b>

\* Answer 1: just about when they reached the Nuaimah Junction.

\*\* Answer 2: just outside Al-Hosn.

\*\*\* Answer 3: at the traffic light where the bus departs the main highway in its way to the station to drop off passengers. Junction is referred to by the students and bus drivers as (The Halls traffic light).

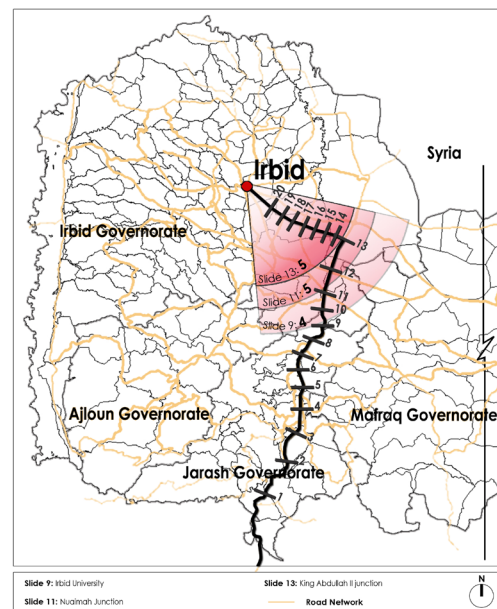
#### 4.2.2 Visual Analysis of the Young Generation Focus Group

To explore their view of the city boundaries, the student focus group was exposed to a sequence of 20 slides (visual impact images) taken at two-mile intervals along Petra Highway approaching Irbid (Figure 12). Having viewed the 20-slide sequence approaching the city at a steady speed of 1 slide per second, the students were asked the following question:

“When you go to Amman for any reason and come back to Irbid taking the Petra Highway into the city, when do you start feeling relaxed that you have more or less reached Irbid?”

The participants were shown the slides again at the same speed and asked to indicate the number of the slide that best answered the question (Table 3).

Four students answered the city boundary started at Irbid University, five students answered Nuaimah Junction, and another five students chose King Abdullah junction. The rest of the students specified a wider boundary (Thaghret Asfour) or tighter boundary (Howara Junction).



**Figure 12: Location reference of the presented visual assessment.**

#### 4.2.3 Results of the Second Older Generation Questionnaire

The same questions that were included in the students’ questionnaires were again asked in a new questionnaire targeting an older generation group. The target group included (280) people, of which 85 were female and 195 were male. A total of 218/280 (78%) subjects described the landscape character of the city boundary as plains.

The survey asked the participants to identify

Table 3 : Visually-based response of the Urban Design Studio students at the department of Architecture.

Slide number	Number of students	Slide description along the street corridor coming into the city of Irbid.
1	0	Winding road
2	0	Winding road
3	0	Thaghret Asfour peek
4	2	slope of Thaghret Asfour
5	0	Winding road
6	0	Junction to Jerash
7	0	Olive press
8	2	Mosque
9	4	Irbid University
10	1	Jadara University
11	5	Nuaimah Junction
12	3	The beginning of JUST site
13	5	King Abdullah II junction
14	2	The beginning of Petra Street
15	0	Petra Street
16	0	Petra Street
17	1	Petra street Gas Station
18	0	Petra Street
19	2	Howarah Junction
20	1	Cultural Circle
Total students	28	

the location that they felt reflected the landscape character of Irbid city boundary if travelling to Irbid through the two highways previously identified. When travelling through the Hosn Highway, the results indicated that 14% chose Gafgafa Prison, 40% chose Nuaimah Junction and 14% chose first Hosn traffic light. However, when travelling through the Petra Highway, 25% chose Nuaimah Junction, 14% chose the Wheat Silos and 25% chose Jordan University of Science and Technology. Figure (13; b and c) represents the percentage of all answers.

When examining the survey results of the two gender groups separately, we can notice there are similarities within the perceived views of the two highways. The Hosn Highway survey of male participants resulted in 16% for Gafgafa, 43% for Nuaimah Junction and 14% for the first Hosn traffic lights as a city boundary, while the survey of female participants resulted in 13% for Irbid National University, 32% for Nuaimah Junction, 15% for the first Hosn traffic lights and 13% for the Amman bus station.

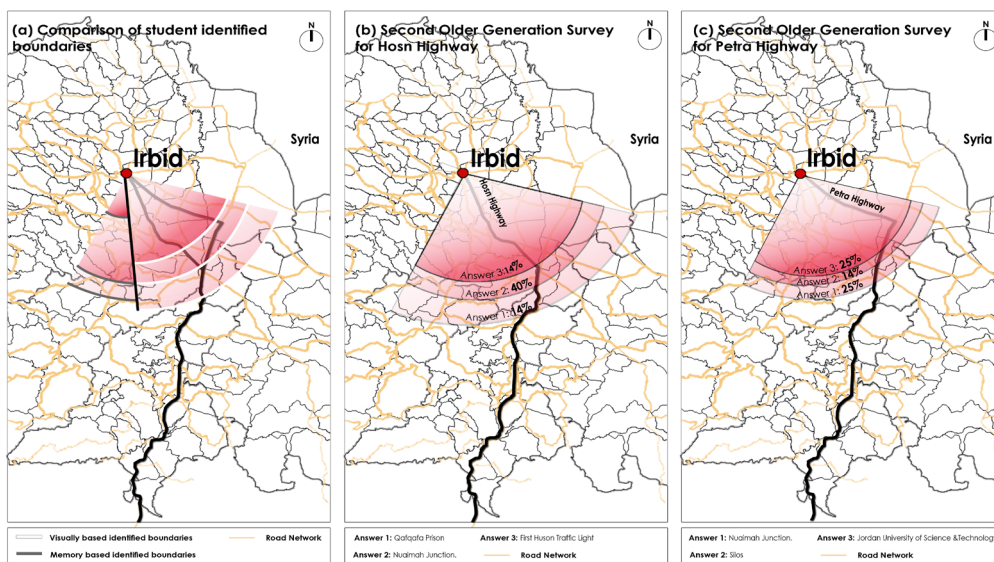


Figure 13: (a) Comparison of student identified boundaries based on visual assessment and questionnaire results, (b) Results of questionnaires answered by the second older generation for the Hosn Highway segment, (c) Results of questionnaires answered by the second older generation for the Petra Highway segment.

As for the Petra Highway survey, responses of male participants resulted in 49% for Nuaimah Junction, 17% for the wheat silos and 22% for Jordan University of Science and Technology. However the female participants resulted in 25% for Nuaimah Junction, 34% for Jordan University of Science and Technology and 15% for Howara traffic lights as city boundaries.

## 5. CONCLUSIONS

The Viewshed (as objective data) delineated the actual nature of the landscape prior to drawing the international borders between Jordan and its neighbouring countries. The most significant feature of the landscape is clearly the Horan Plains, which extends north to Syria and covers a much larger diameter, sometimes reaching 25 kilometres. Thirty years ago, the plains were easily observed from hilltops and as far as the naked eye could see. At present, due to urban sprawl, the view has become limited.

With such rapid urban sprawl, it is hard to sustain the landscape character of the surroundings. There is an urgent need to withstand the increased vulnerability to advent changes and to seek stability of the general appearance, scenic quality and character of the landscapes surrounding urban areas.

If we examine the result of the first comparison, the perception of the city boundary identified by the older generation was closely linked to the Viewshed. These people also identified the landscape character as "plains" however, because they are older and have longer experience and memories they identified the city boundary from all four directions, reflecting the generally holistic perception of this generation, incorporating geographical diversity (Figure 10). Their perception is closer to the original state of the landscape and the area.

If we examine the geographical map of these areas, we notice that the Eastern perceived boundary practically matches the Viewshed boundary. If we also take a look at the Eastern municipal boundary which is also the border between Syria and Jordan, it corresponds with the Viewshed and the perceived boundary denoted by the older generation, the topography characterized as plains edged by mountain ridges (Figure 10).

The southern boundary partially matches the perceived boundary by the older generation. This can be explained if we examine the landscape character of

that area which is rugged, alternating between hilltops and shallow valleys, rising to higher altitudes further south.

The western and northern topography is characterized by canyons and plains, allowing a clear view from far areas, the unseen parts in the Viewshed are canyons dissecting the plains. The perceived boundaries denoted by the older generation correspond with the Viewshed due to these reasons. However, figure 10 shows that the Viewshed boundary extends further north beyond the Jordanian borders, while the older generation's perceived boundary did not exceed that far, possibly due to inhabitants' awareness of the Syrian-Jordanian border to the north.

The justification of the relationship between the Viewshed results and the perceived older generation boundary lies in the change witnessed over time. Regardless of landscape changes brought by factors such as urban sprawl and increasing development, the older generation still perceived things as they were 30 years ago (Figure 5). They are able to sustain cognition of the surroundings and the city boundary regardless of change, possibly because the landscape was imprinted in their early childhood years before change occurred.

In the second comparison, the students' questionnaire and the visual analysis results indicated that there were similarities in the perceived boundaries. Both of the young student groups' results—the perceived and the visually analysed—evaluated the boundary from two access roads into the city. They showed the Nuaimah junction, the area just outside Al Hosn, the Halls traffic light, Irbid University, and King Abdullah University Hospital as indicators for the boundary. Almost all of these indicators are located within the plains area and are included inside the Viewshed. However, the plot of both have a tighter boundary than that identified by the second older generation group who also assessed the boundary as accessed from those directions (Figure 13).

Nevertheless, even when a segment of the city consisting of two access roads was studied, the second older generation results were also closely related to the Viewshed results. However, in the case of the Petra Highway, the existence of massive building structures slightly impacted the results. Structures along the highway, such as the wheat silos and the Jordan University of Science and Technology campus, created an easy-to-spot visual contrast with the surrounding plains, altering the way the older generation perceived the boundary, making it tighter (Figure 13; b and c).

If we examine the urban sprawl map we notice that the indicators with the highest percentage identified by the students are located within the footprint of the urban sprawl. This shows the strong impact the urban sprawl has on the perception of the young generations (Figure 5).

Ultimately, the perception variation between university students and older generations concerning the city boundary and the correlation between the older generations' opinions and the Viewshed results can be explained in a variety of ways.

Generally the young generation led a more family centred and limited life compared to the older generation. When the old generation were young their lifestyle was very different, more relaxed and integrated with the natural landscape. The population was smaller and the security of family and neighbourhood encouraged freedom and mobility to roam and explore the environment, with more time to spend on contemplation and perception of the surroundings.

Despite all the modern advances, the complications and stresses of contemporary life impose restrictions on the young generations' freedom to play and explore due to security concerns. The nuclear rather than the extended family is now the norm, living in an apartment in a large city and although amenities are close by, relatives are scattered world-wide and visits take place on Skype. Our young generations are more likely to be familiar with the layout of the city mall than to be aware and appreciative of the local landscape.

Perhaps due to the vast and rapid changes witnessed in Jordan in the space of one generation, we see that the view or concept of a small city such as Irbid as a complete entity, located in the plains and surrounded by mountains at a distance, is not grasped equally by the young and the elderly. However, it is most likely that urban sprawl and age variations also impacted noticeably on the perception of the city boundary.

Various objective methods have been used previously to assess change in the landscape character and city boundaries; however this study focused on the city boundary as perceived by the older and young generations as an indicator of change. Thus it is crucial to consider the perception of inhabitants as a valuable national as well as local resource to aid the planning process. As a result, municipal guidelines may be developed to account for control over certain areas, directing and managing change with minimal negative impacts. Therefore it is foreseen that sustaining the boundaries and controlling urban sprawl should be

among the priorities of any municipal and governmental bodies.

Apart from the apparent need for a democratic understanding of landscape and for creating awareness of the local landscapes among the new generations in order to be able to assess change, it appears that the sense of belonging has become a requirement for understanding, perceiving, and expressing landscape character.

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## إدراك تنسيق المواقع وتغيرها في مدينة إربد، الأردن

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ملخص البحث. يدرس هذا البحث الانطباع والإدراك الخاصين بحدود مدينة إربد من قبل مجموعة من طلاب الجامعة ومجموعة أخرى من الناس الذين أعمارهم أكثر من ٤٠ سنة. يقارن البحث بين الإدراك الإنساني وتحليل Viewshed الذي يعكس الإعداد الجغرافي الطبيعي للمكان وحدوده. يستخدم البحث منهجية تعتمد ثلاثة طرق للتقييم: الحساب الرقمي (Viewshed) والاستبيانات والتقييم البصري. والهدف من ذلك هو توضيح كيف أن التقييم الشخصي هو مؤثر على التغيير في طبيعة المشهد والانطباع عن خصائص حدود المدينة التي تغيرت مع الزمن. ويتضمن التقييم الشخصي استبيانات تعتمد على الذاكرة وتستهدف كل من المجموعتين العمريتين في حين أن التقييم البصري يستهدف طلاب التخطيط العمراني. يعتمد التقييم الموضوعي على حسابات رقمية باستخدام نظم المعلومات الجغرافية GIS وتحليل Viewshed. على الرغم من أن حدود المدينة كما يراها الجيل الأكبر سنا كانت أقرب إلى نتائج التحليل Viewshed فإن جيل الشباب (سواء في التقييم البصري أو التقييم المعتمد على الذاكرة في الاستبيان) ينظر إلى حدود أكثر إحكاما من الجيل الأكبر سنا.

الكلمات المفتاحية: Viewshed، وتخطيط تنسيق المواقع، الخصائص الطبيعية للمواقع، وحدود المدينة، تنسيق المواقع ثقافيا.