A study of the continuity of architectural identity through visibility analysis Houses in Erbil city as a case (1900-2020)

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Abstract

This study aims to study the continuity of architectural identity in the houses in Erbil city for the period (1900-2020) through the analysis of visibility, using (space syntax-depth map X 0.8) to conduct visibility analysis and identifying the 2D isovist polygon from the first point of the urban threshold between the street as a public domain space and the private spaces of the house which is referred to as a point (A). The research concludes that the change in architectural identity due to the change in private-public threshold in the houses of Erbil city has effect on the 2D isovist area, and the ratio of visibility of private spaces in the house from the observation point (A). The research contributes to studying the continuity of the tangible identity of architecture via the analysis of visibility of the interior spaces of the building from the first point of the public-private threshold.

Keywords: Architecture, continuity, identity, visibility, house

1. Introduction

Identity refers to the uniqueness, oneness and individuality features and characteristics of a thing that makes it different and unique (Salama, 2005). This notion refers to the physical representation of identity. In this occasion, architecture is considered as an important medium for reflecting the identity of societies and cultural groups in certain contexts and periods (Popescu, 2006). Architecture identity is considered as a process that is changeable through time.

Visibility is an important factor that effects on the spatial configuration and the distribution of spaces that represents the tangible identity of the building. There are two types of visibility path regarding the outdoor and indoor spaces. The first is the path of visibility from outside to inside spaces, and the second is the view of outside spaces from indoor spaces. This research

aims to study the visibility of indoor spaces from observation point (A), which represents the first point in the threshold between the street as a public domain and the spaces of the house as private domain.

Houses in Erbil city are selected as samples for analysis, for this purpose a total of 140 houses are chosen, they are stratified into four periods, (1900-1929), (1930-1959), (1960-1989), and (1990-2020). For the purpose of visibility analysis, the software of space syntax-depth map X 0.8 is used to draw the 2D isovist polygon of visibility from observation point (A) and finding the isovist area for each sample.

2. Literature review and the definition of research variables

In this section, the research will review previous studies regarding the concepts and variables of the research, also the methodologies used in these studies.

2.1 Architectural identity as a continuous process

Identity can be considered a continuous process (Kamel and Shok, 2022). As Hall (1998) argues, identity is a product and notion that never completes, it is continuously in process, and it always constitutes the representation of the thing. A new assessment of the built environment and its meaning is constantly carried out by societies. This process is rapidly being conducted.

According to Correa (1983), identity is considered to be a sequence of on-going processes rather than an established entity. Over time, it undergoes constant changes and becomes dynamic rather than a concrete object.

Continuities and discontinuities in architecture identity is bound to the factors of changes in typologies, changes of materials, sustainable design elements, social factors, and architecture morphological changes (Philokyprou, 2015).

Every building has a life cycle, and during this cycle changes happen in terms of facade and structure of the buildings, this influences on the spatial patterns and functional distribution of internal spaces, this process is crucial to meet the user's requirements (Youssef, 2018).

2.2 Visibility analysis

From a certain point in space, isovists are all points that can be seen. It can be considered as a polygon of two dimensions when viewed in the plan layout (Psarra and McElhinney, 2014). The research in this part aims to study the continuity of architectural identity through the analysis of the visibility of plan layouts for houses in Erbil city from the period (1900-2020).

2.3 Private and public spaces

The distinction between private and public space can be defined by several factors:

1. Ownership or Control: Private space is typically owned or controlled by individuals, corporations, or other entities. Examples include private residences, commercial buildings, and privately-owned land. Public space, on the other hand, is usually owned or managed by the government or designated public authorities, such as parks, sidewalks, and public squares. (Peter Jones, 2022).
2. Access: Private space is generally restricted to authorized individuals or groups, while public space is open and accessible to the general public. Private spaces may have controlled entry points, such as locked doors, gates, or security measures, while public spaces are designed to be open to all (Birch, 2007).
3. Purpose: Private space is often intended for specific purposes related to the owner's needs or activities. It can include homes, offices, businesses, or other establishments with restricted access. Public space, on the other hand, is typically intended for public use and may serve various purposes such as recreation, transportation, social interaction, or cultural events (Peter Jones, 2022).
4. Regulation: Private space is subject to the rules and regulations set by the owner or governing bodies, while public space is subject to public laws and regulations. Private property owners have more control over the activities and behavior within their space, while public spaces are governed by public policies, ordinances, and laws that aim to ensure the well-being and rights of the public (Birch, 2007).

2.4 House as a symbol for privacy

The house is considered as a place that human being spend most of their life inside its boundary. It is a spatial territory that provides privacy to its occupants. As Rapoport (2011) declares, the house is the most cultural oriented type of buildings. The threshold between the public space and the private space in the house differs in the various cultural contexts. The threshold represents the border where the strangers have to be allowed to enter the house.

In Erbil city, two types of houses are found, a courtyard house and a house with a transitional zone of garden and garage. In the first type, the house has a direct relationship with the public domain, in the second type the house has an indirect relationship with the public space.

Privacy is an important sociocultural factor that impacts on the change in house forms, therefore the change in the continuity of architectural identity of a house (Shabani et.al. 2011). Privacy is considered as a human and social need that is globally maintained by societies, but the response to the factor of privacy through architecture especially the house differs in various cultural contexts. The location of the threshold between public and private spaces of the house represents the response of different cultural groups to maintain privacy within the boundary of the house.

3. Research methodology

A certain methodology followed in this study to measure the visibility and the degree of visibility of spaces in the houses of Erbil City for the period 1900-2020 by using space syntax-depth map X 0.8, and a statistical analysis for the results has been conducted.

3.1 Erbil city as a case study

Erbil city is the oldest continuously inhabited city in the world. It dates back to 6000 years ago. It is located in the north of Iraq. Erbil is well known of its unique citadel, which is an entire city built on a mound of 33 meters high (Al Yaqoobi et. al., 2016). The citadel represents the urban core of the city. The expansion of the city outwards the citadel followed the shape of ring roads with intersecting roads that radiate from the citadel. The urban expansion of the city is correlated to its historical evolution through time. This means the spatial expansion from the citadel represents the chronology of building constructions. Erbil comprises of four ring roads and one under construction.

3.2 Sample selection

For the purpose of this study house samples have been selected in different areas, covering the period from 1900 to 2020, in 120 years houses in Erbil city witnessed changes in terms of its design and typo-morphologies. A total of 140 house plan layouts are chosen by using non-probability random sampling and dividing the period of the study to four strata in order to cover the entire period of the study, as following:

- The period between 1900-1929, 20 samples are selected in the area located between the citadel and the first ring road.
- The period between 1930-1959, 20 samples are selected in the area located between the first ring road and the second ring road.

- The period between 1960-1989, 50 samples are selected in the area located between the second ring road and the third ring road.
- The period between 1990-2020, 50 samples are selected in the area located outside third ring road.

3.3 Data collection process

Data collection process included the following steps:

- Site survey for houses by taking photos and necessary dimensions and preparing sketches for house layouts.
- Visiting the municipality and High Commission for Erbil Citadel Revitalization (HCECR), in order to check the date of construction of houses.

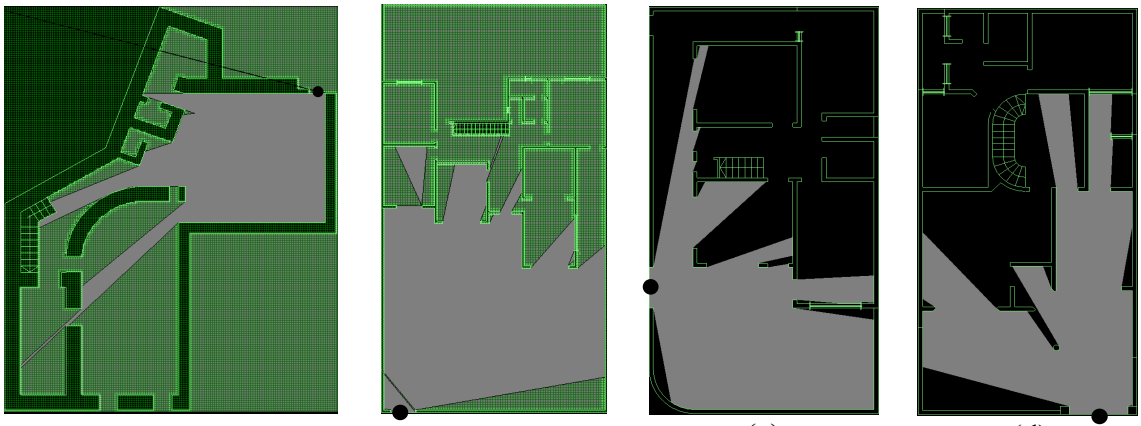
3.4 Measuring visibility

This paper utilized space syntax-depth map X 0.8 software to measure the visibility of spaces in the selected samples. The procedure of collecting data and visibility measurements included the following steps:

- Drawing all plan layouts by using AutoCAD software.
- While measuring and identifying 2D isovist polygon which deals with all open spaces without physical barriers, for this purpose all openings including windows and doors are removed in the drawings.
- Converting all (DWG) extension files to (DXF)
- Importing the (DXF) drawings to depth map X window
- Drawing 2D isovist polygon from observation point (A) for all samples (Fig. 1)
- Identifying the plot area for each sample in (m2) unit by using AutoCAD software.
- Finding the isovist area which is calculated in the software in (m2) unit for all samples
- Finding the ratio (%) of isovist area to plot area for all samples by using the following formula:

  Plot area (m2) / isovist area (m2) X 100
- Identifying the degree of visibility for each space of the house, by using five degree likert scale, by using the following formula:

  Space area (m2) / isovist area in the space (m2) X 100



(a) (b) (c) (d)

● Observation point A

Fig.1 2D isovist polygon from observation point A in houses in Erbil city for the periods (a) 1900-1929 (b) 1930-1959) (c) 1960-1989 (d) 1990-2020

To identify the ratio of visibility of each space from observation point (A), the research followed the following steps:

- Removing all openings including windows and doors, then taking the area of 2D isovist polygon from observation point (A), referred to as area 1
- Closing the openings and only removing the openings of the desired space to calculate its ratio of visibility from observation point (A), then taking the area of 2D isovist polygon referred to as area 2
- Using the following formula to calculate the 2D isovist area for a certain space:
  2D isovist area for a certain space = area 1 – area 2

The paper identified five scales for the ratio of visibility of the spaces from observation point (A):

- Space is non-visible from observation point (A)
- %1-%25 of the space is visible from observation point (A)
- %26-%50 of the space is visible from observation point (A)
- %51-%75 of the space is visible from observation point (A)

- %76-%100 of the space is visible from observation point (A)

The frequency percentage for the existence of the ratio of visibility of any space in the house from observation point (A), is categorized according to a five point Likert scale as follows:

- Zero means that none of the samples have a specific characteristic.
- (1), is dedicated to the ratio of the frequency of availability of a specific item of each period between (1%-%20)
- (2), is dedicated to the ratio of the frequency of availability of a specific item of each period between (21%-%40)
- (3), is dedicated to the ratio of the frequency of availability of a specific item of each period between (41%-%60)
- (4), is dedicated to the ratio of the frequency of availability of a specific item of each period between (61%-%80)
- (5), is dedicated to the ratio of the frequency of availability of a specific item of each period between (81%-%100)

4. Results and discussion

The research found that factors affecting on the isovist area observed from observation point (A) are:

- Area of land plot
- Relationship between house and public domain
- Ratio of mass to open spaces
- Size of openings
- Number of openings
- Space functions

Factors affecting on the level of visibility of spaces from observation point (A) are:

- Visual privacy
- Size of the opening
- Direction of the opening regarding the façade line

The analysis of results of the checklist that is prepared for the visibility analysis of examples was conducted by using SPSS software version 26 to find the mean value and frequency percentage value for analysis items for each period of the research.

Mean value of the area of house plots

- The mean value for the area of plots in all periods show that, the largest mean value of house plots is (451.70 m2) for the period (1930-1959), the period of (1960-1989) have a mean value of (291.12 m2), the mean value of the period (1900-1929) is (266.50 m2), and the smallest mean value is (203.20 m2) for the period (1990-2020). The difference in the mean of land area is related to the change in regulations of urban plot distributions, the demand for large area houses, the desire for large open spaces, and the economic situation (Fig. 2).

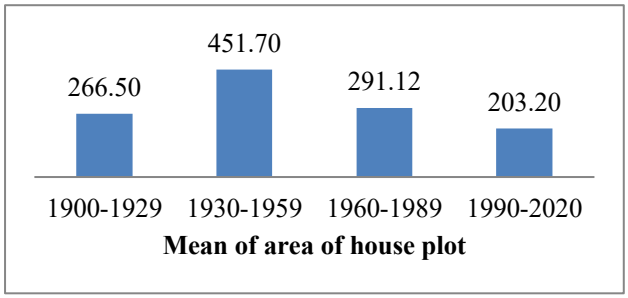


Fig. 2 Mean value of the area of the house plot

Mean value for the isovist area

- It is noticed that the mean value of isovist area for the periods (1930-1959) and (1960-1989) are the biggest due to the increase in plot areas in these periods. The mean value of isovist area for the period (1900-1929) is (48.88 m2) which is very low due to visual privacy and the strict of vision towards the interior spaces from observation point (A) (Fig. 3).

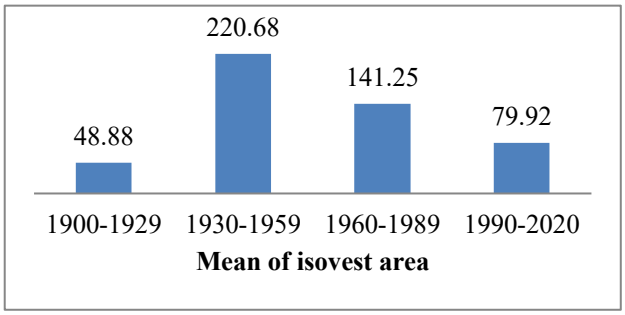


Fig. 3 Mean value of isovist area

The ratio of isovist area to house plot area

- The ratio of isovist area to plot area for the period (1930-1959) is (%50.65), while the lowest ratio is for the period (1900-1929) which is (%17.49) (Fig. 4).

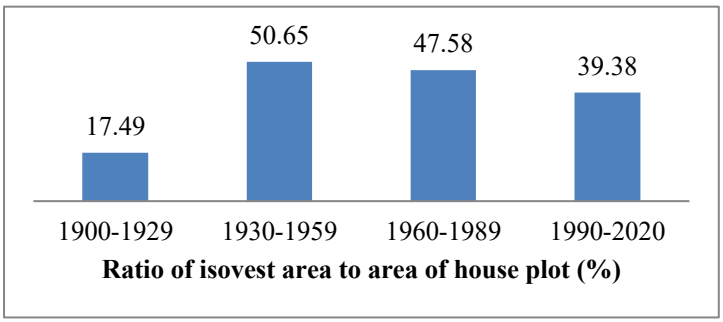
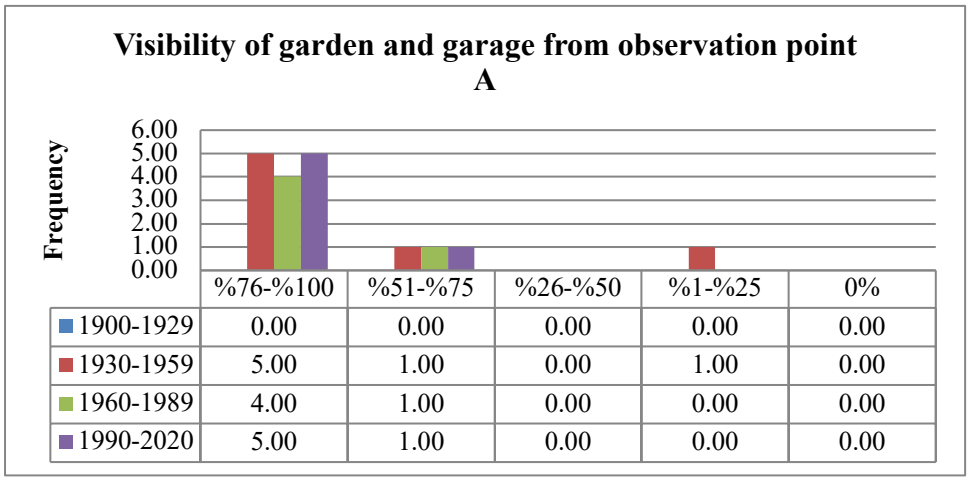


Fig. 4 Ratio of isovist area to area of house plot (%)

By examining the frequency percentage value for the visibility of the garden and garage from observation point (A), it is clear that the frequency percentage value for the period (1900-1929) is zero because in this period the samples are courtyard houses without gardens and garages. The creation of the garden and garage started in the period of (1930-1959) and was inherited in other periods. As it is seen the highest frequency percentage value is located in the periods (1930-1959), (1960-1989), and (1990-2020), in which (%76-%100) of the garden and garage space is visible from observation point (A) (Fig. 5).

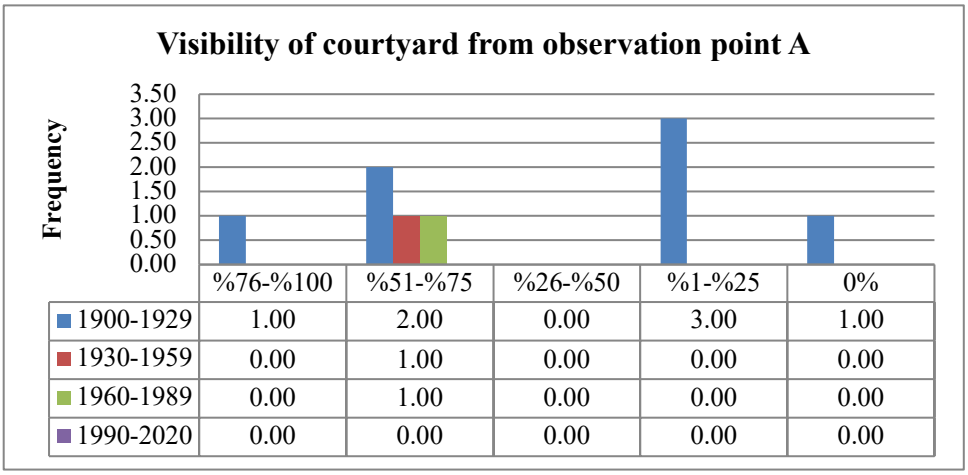


	%76-%100	%51-%75	%26-%50	%1-%25	0%
1900-1929	0.00	0.00	0.00	0.00	0.00
1930-1959	5.00	1.00	0.00	1.00	0.00
1960-1989	4.00	1.00	0.00	0.00	0.00
1990-2020	5.00	1.00	0.00	0.00	0.00

Fig. 5 Visibility of garden and garage from observation point A

The frequency percentage value for visibility of the courtyard from observation point (A) shows that the highest frequency percentage values are located in the period (1900-1929) because samples of this period are courtyard houses and it is noticed that in the majority of samples (%1-%25) of the courtyard is visible from point (A), this is due to privacy and the

partially blocked vision from observation point (A) towards the courtyard. In other samples (%51-%75) of the courtyard area is visible from observation point (A), and also in some samples, the courtyard is invisible from observation point (A). In a small number of samples (%76-%100), of the courtyard area is visible from observation point (A). We see that the

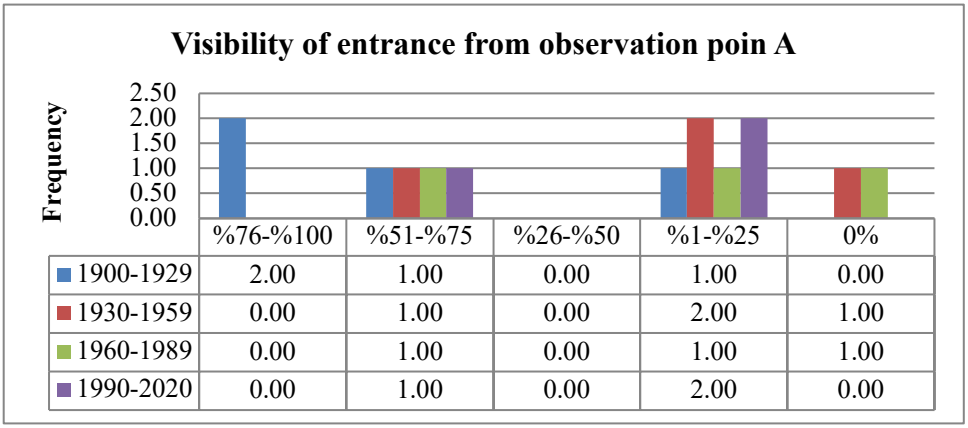


	%76-%100	%51-%75	%26-%50	%1-%25	0%
1900-1929	1.00	2.00	0.00	3.00	1.00
1930-1959	0.00	1.00	0.00	0.00	0.00
1960-1989	0.00	1.00	0.00	0.00	0.00
1990-2020	0.00	0.00	0.00	0.00	0.00

existence of courtyard houses is inherited from the period (1900-1929) to the periods of (1930-1959) and (1960-1989) (Fig. 6)

Fig. 6 Visibility of courtyard from observation point A

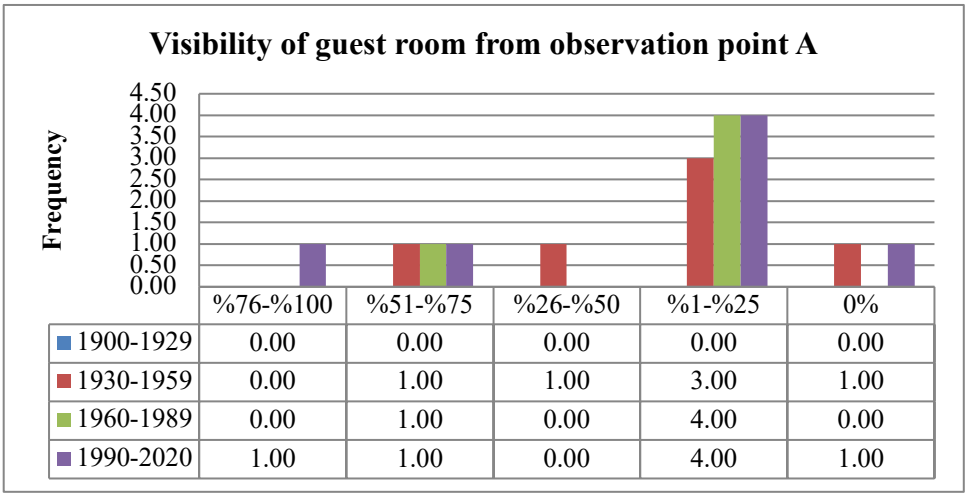
The frequency percentage value for the visibility of the main entrance of the house from observation point (A), shows that (%1-%25) of the entrance is visible from observation point (A), this is related to the direction of the entrance regarding the main façade line and its location regarding the observation point (A). It is noticed that (%76-%100) of the entrance were visible in the courtyard houses in the period (1900-1929), due to the direct relationship of the houses with the public domain (street), and also in a big range of samples, (%1-%25) of the entrance is visible from the observation point (A). It is clear that the existence of the main entrance of the house is inherited for all periods, with the change of the ratio of visibility (Fig. 7)



	%76-%100	%51-%75	%26-%50	%1-%25	0%
1900-1929	2.00	1.00	0.00	1.00	0.00
1930-1959	0.00	1.00	0.00	2.00	1.00
1960-1989	0.00	1.00	0.00	1.00	1.00
1990-2020	0.00	1.00	0.00	2.00	0.00

Fig. 7 Visibility of entrance from observation point A

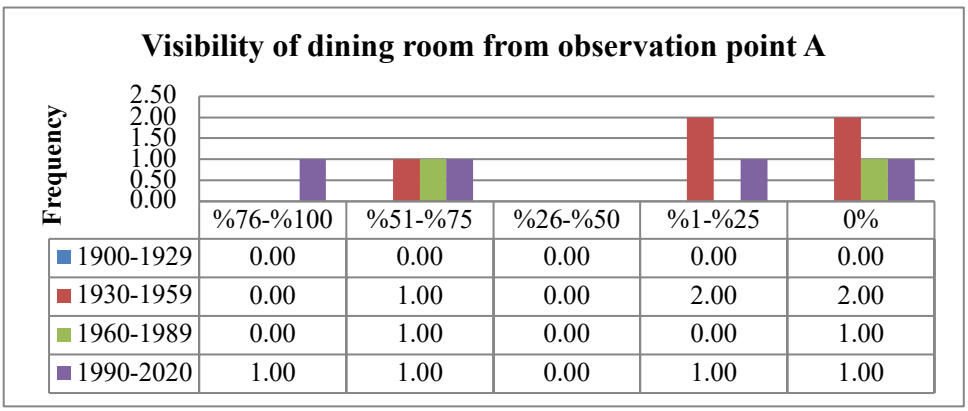
The frequency percentage value for the visibility of guest room from observation point (A) indicates that this space did not exist in the period of (1900-1929). The majority of samples for the periods (1930-1959), (1960-1989) and (1990-2020) show that (%1-%25) of the guest room is visible from observation point (A), other samples have different ranges of visibility from the observation point (A). The existence and visibility of the guest room from observation point (A) is inherited for all periods except the period of (1900-1929) (Fig. 8).



	%76-%100	%51-%75	%26-%50	%1-%25	0%
1900-1929	0.00	0.00	0.00	0.00	0.00
1930-1959	0.00	1.00	1.00	3.00	1.00
1960-1989	0.00	1.00	0.00	4.00	0.00
1990-2020	1.00	1.00	0.00	4.00	1.00

Fig. 8 Visibility of guest room from observation point A

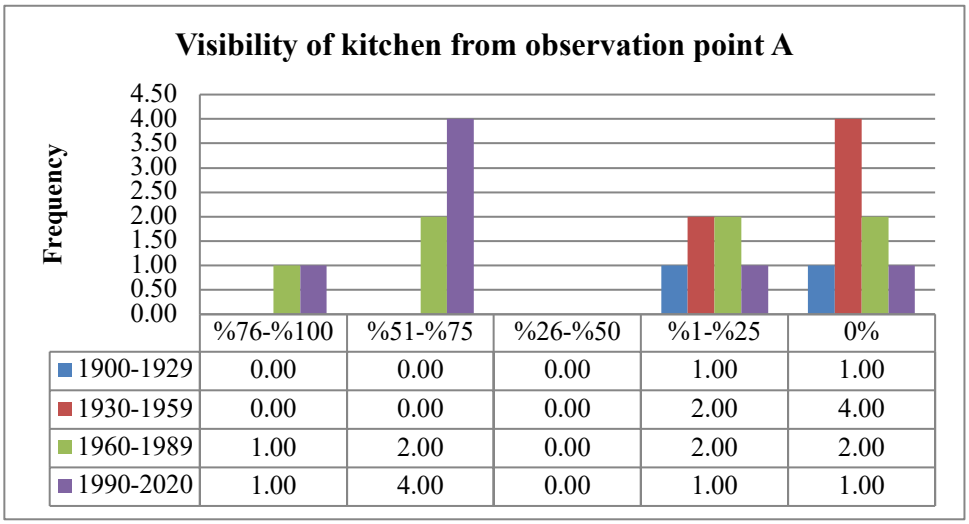
The frequency percentage value for the visibility of the dining room from observation point (A), shows that this space did not exist in the period of (1900-1929), but it was created in the other periods. The majority of samples in the period (1930-1959) have no visibility from observation point (A) towards the dining room. In other samples (%1-%25) of the dining room area is visible from observation point (A). This is due to the location of this space regarding the observation point (A) (Fig. 9)



	%76-%100	%51-%75	%26-%50	%1-%25	0%
1900-1929	0.00	0.00	0.00	0.00	0.00
1930-1959	0.00	1.00	0.00	2.00	2.00
1960-1989	0.00	1.00	0.00	0.00	1.00
1990-2020	1.00	1.00	0.00	1.00	1.00

Fig. 9 Visibility of dining room from observation point A

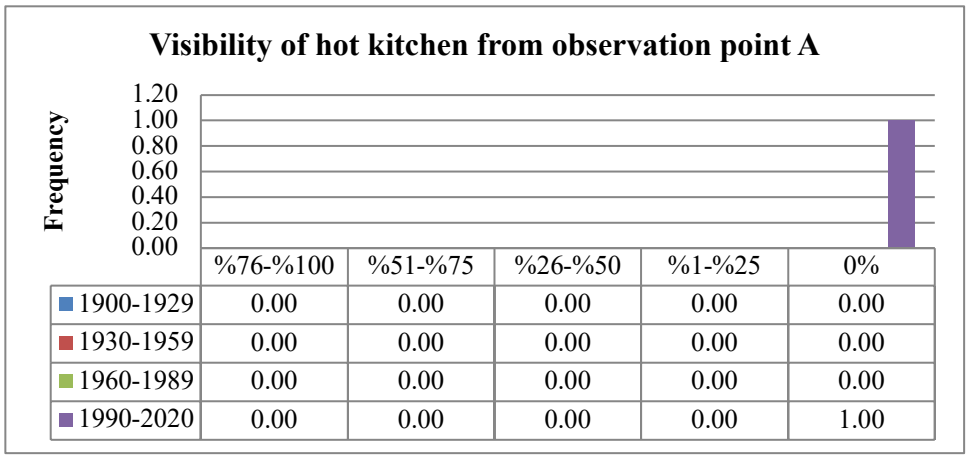
The frequency percentage value for the visibility of the kitchen from observation point (A), shows that this space is existed in all periods. In the majority of samples in the period (1930-1959), the kitchen is not visible from observation point (A), because it is located in the back of the house, while in the period (1990-2020) the kitchen is (%51-%75) visible from observation point (A), due to its location in the front of the house and the large area of the windows (Fig. 10).



	%76-%100	%51-%75	%26-%50	%1-%25	0%
1900-1929	0.00	0.00	0.00	1.00	1.00
1930-1959	0.00	0.00	0.00	2.00	4.00
1960-1989	1.00	2.00	0.00	2.00	2.00
1990-2020	1.00	4.00	0.00	1.00	1.00

Fig. 10 Visibility of kitchen from observation point A

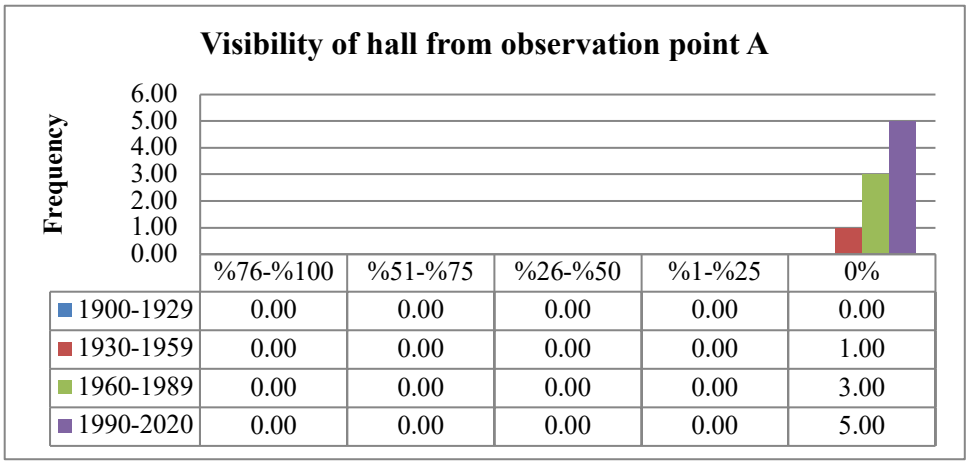
A hot kitchen or working kitchen is a space that was created in the period (1990-2020). This space is used for cooking only, It is usually located on the back of the main kitchen, and it is well ventilated to eliminate odors. This space is not visible from observation point (A) (Fig. 11).



	%76-%100	%51-%75	%26-%50	%1-%25	0%
1900-1929	0.00	0.00	0.00	0.00	0.00
1930-1959	0.00	0.00	0.00	0.00	0.00
1960-1989	0.00	0.00	0.00	0.00	0.00
1990-2020	0.00	0.00	0.00	0.00	1.00

Fig. 11 Visibility of hot kitchen from observation point A

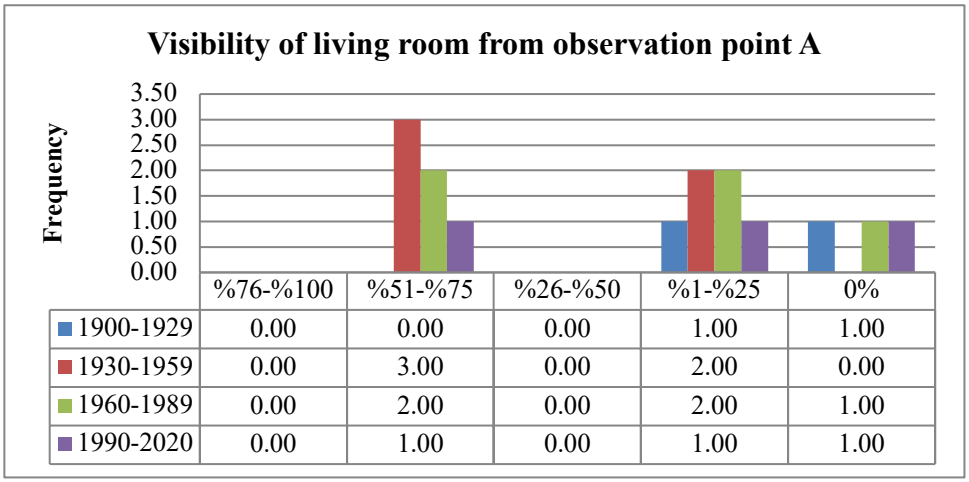
A hall or interior hall is a space that is usually located in the middle of the house. It is used for family gatherings, other spaces of the house have access to this space. In many examples, the staircase is located in this space. This space was created in the period (1930-1959), and it is inherited in other periods. The maximum usage of this space is observed in the period (1990-2020). This space is not visible from observation point (A) (Fig. 12).



	%76-%100	%51-%75	%26-%50	%1-%25	0%
1900-1929	0.00	0.00	0.00	0.00	0.00
1930-1959	0.00	0.00	0.00	0.00	1.00
1960-1989	0.00	0.00	0.00	0.00	3.00
1990-2020	0.00	0.00	0.00	0.00	5.00

Fig. 12 Visibility of hall from observation point A

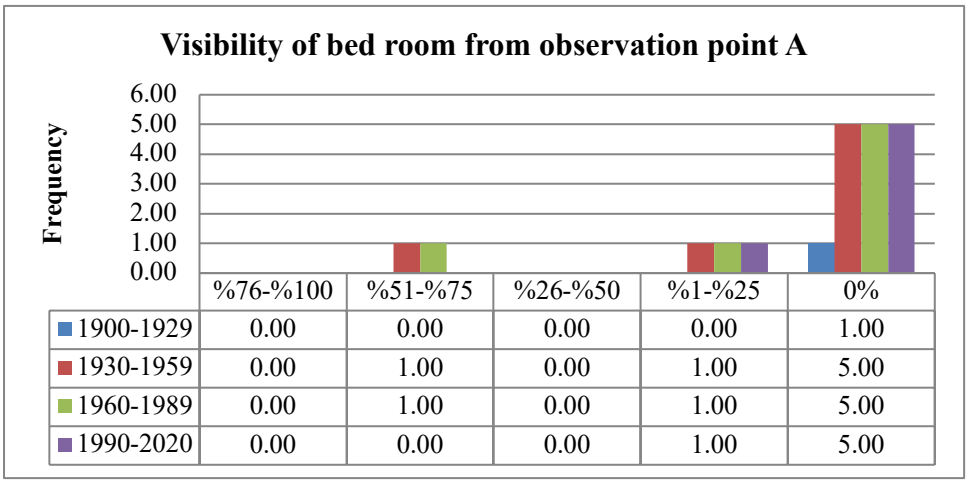
The living room is a space that is usually utilized for the daily family gathering. This space can be noticed in all periods. It has been highly used in the period (1930-1959). This space has a different visibility rate from observation point (A). For example, the invisibility of this space from observation point (A) in the periods (1900-1929), (1960-1989) and (1990-2020) has a low frequency percentage value of 1. The maximum visibility of this space is (%51-%75) from observation point (A) is noticed in the period (1930-1959) (Fig. 13)



	%76-%100	%51-%75	%26-%50	%1-%25	0%
1900-1929	0.00	0.00	0.00	1.00	1.00
1930-1959	0.00	3.00	0.00	2.00	0.00
1960-1989	0.00	2.00	0.00	2.00	1.00
1990-2020	0.00	1.00	0.00	1.00	1.00

Fig. 13 Visibility of living room from observation point A

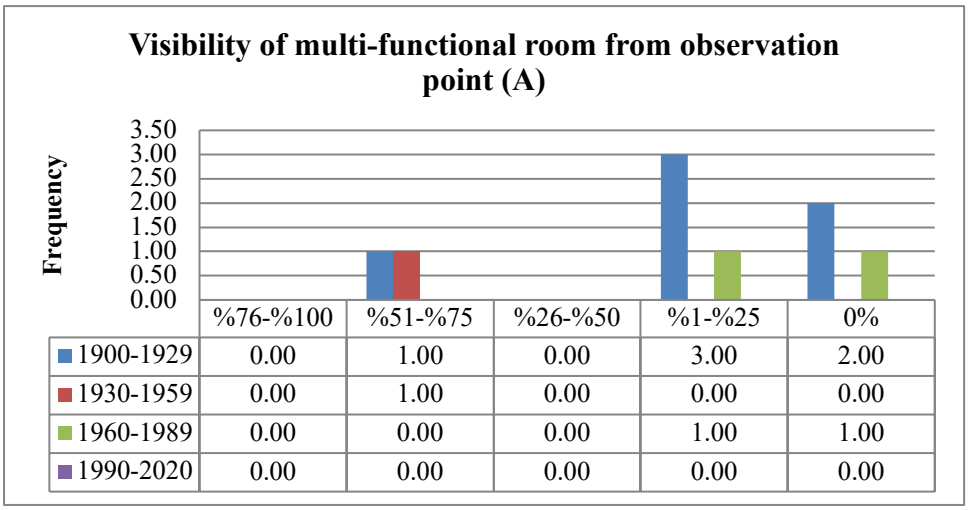
Bedroom is existed in all periods. In most samples in the periods (1930-1959), (1960-1989), and (1990-2020) the space of bedroom is not visible from observation point (A). This space is usually located in the back of the house for privacy (Fig. 14)



	%76-%100	%51-%75	%26-%50	%1-%25	0%
1900-1929	0.00	0.00	0.00	0.00	1.00
1930-1959	0.00	1.00	0.00	1.00	5.00
1960-1989	0.00	1.00	0.00	1.00	5.00
1990-2020	0.00	0.00	0.00	1.00	5.00

Fig. 14 Visibility of bedroom from observation point A

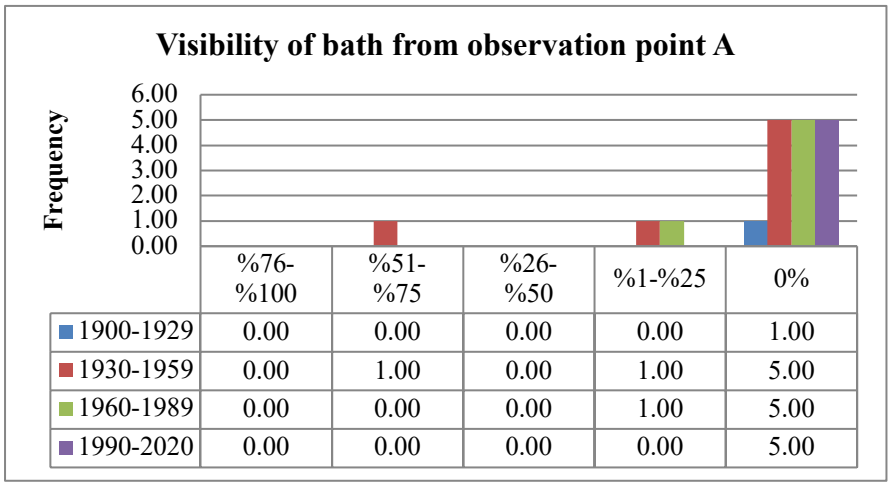
In the period (1900-1929), most spaces had no specific function, for example, a space that is used as a living room during the day time, same place will turn into a bedroom at night, and this can be called a multifunctional room. In some samples, the multifunctional rooms are not visible from observation point (A). In other examples, (%1-%25) of the multifunctional room space is visible from observation point (A) (Fig. 15).



	%76-%100	%51-%75	%26-%50	%1-%25	0%
1900-1929	0.00	1.00	0.00	3.00	2.00
1930-1959	0.00	1.00	0.00	0.00	0.00
1960-1989	0.00	0.00	0.00	1.00	1.00
1990-2020	0.00	0.00	0.00	0.00	0.00

Fig. 15 Visibility of multi-functional room from observation point A

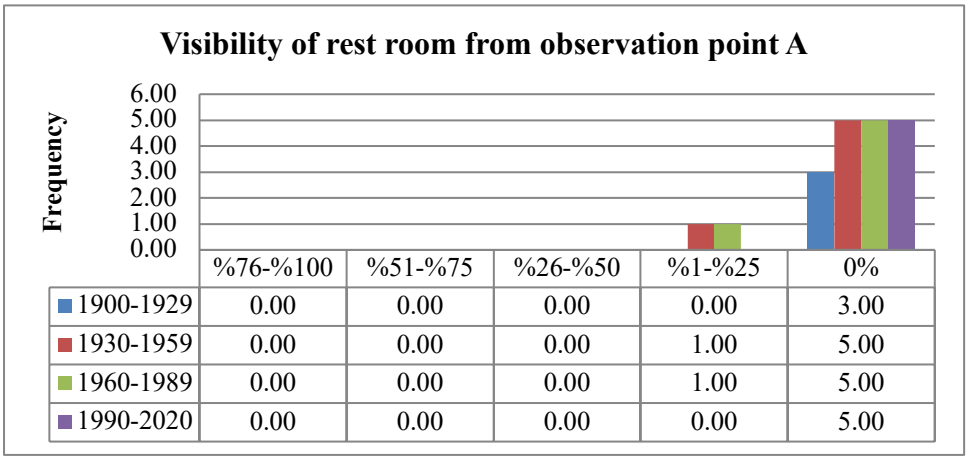
Bath space can be observed in all periods. It is noticed that the bath is not visible from observation point (A) in the majority of samples in all periods, due to the location of the bath at the back of the house, the size of the window is small, and in most cases, the window level is above human sight level, for privacy purposes (Fig. 16).



	%76-%100	%51-%75	%26-%50	%1-%25	0%
1900-1929	0.00	0.00	0.00	0.00	1.00
1930-1959	0.00	1.00	0.00	1.00	5.00
1960-1989	0.00	0.00	0.00	1.00	5.00
1990-2020	0.00	0.00	0.00	0.00	5.00

Fig. 16 Visibility of bath from observation point A

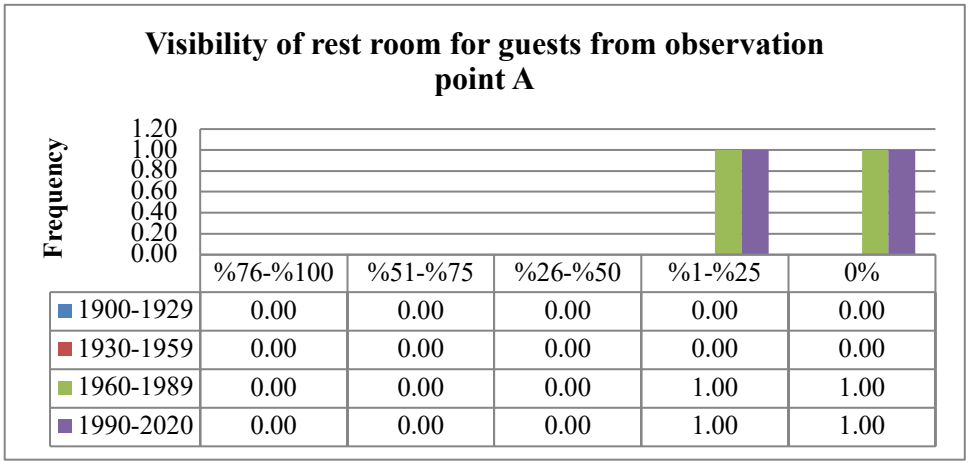
Rest room is a relatively small space separated from the bath. This space exists in all periods. It is noticed that in majority of samples, rest room is not visible from observation point (A) in all periods, because this space is mostly located at the back of the house with small-sized windows, and the level of the window is above the human sight level, for privacy (Fig. 17)



	%76-%100	%51-%75	%26-%50	%1-%25	0%
1900-1929	0.00	0.00	0.00	0.00	3.00
1930-1959	0.00	0.00	0.00	1.00	5.00
1960-1989	0.00	0.00	0.00	1.00	5.00
1990-2020	0.00	0.00	0.00	0.00	5.00

Fig. 17 Visibility of rest room from observation point A

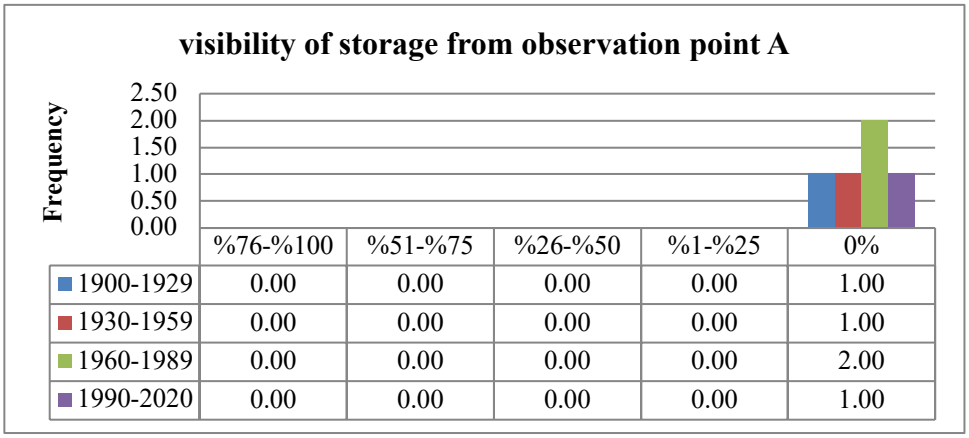
Rest room for guest is a space that is usually located at the main entrance of the house; it has a connection with the guest room. This space is usually used by guests to avoid the mix between guests and the other spaces of the house. This space was created in the period (1960-1989) and inherited in the period (1990-2020). In the majority of samples, the guest WC is not visible from observation point (A), in other samples (%1-%25) of the space is visible from observation point (A) (Fig. 18).



	%76-%100	%51-%75	%26-%50	%1-%25	0%
1900-1929	0.00	0.00	0.00	0.00	0.00
1930-1959	0.00	0.00	0.00	0.00	0.00
1960-1989	0.00	0.00	0.00	1.00	1.00
1990-2020	0.00	0.00	0.00	1.00	1.00

Fig. 18 Visibility of rest room for guests from observation point A

A storage room is a space that is usually linked with the kitchen, it is used for storing dry foods and some house stuff. This space can be found in all periods, but the maximum usage of this space can be noticed in the period (1960-1989). This space is not visible from observation point (A) for all periods, due to its location regarding observation point (A) (Fig. 19).



	%76-%100	%51-%75	%26-%50	%1-%25	0%
1900-1929	0.00	0.00	0.00	0.00	1.00
1930-1959	0.00	0.00	0.00	0.00	1.00
1960-1989	0.00	0.00	0.00	0.00	2.00
1990-2020	0.00	0.00	0.00	0.00	1.00

Fig. 19 Visibility of storage from observation point A

Table 1 shows a summary of the highest frequency percentage value for the samples in each period regarding the ratio of visibility from observation point (A) in different spaces, The sign (X) means that this space does not exist in the samples in the specific period.

Table 1 Degree of visibility from observation point A

Space	**Degree of visibility from observation point (A)**			
	(1900-1929)	**(1930-1959)**	**(1960-1989)**	**(1990-2020)**
Garden and garage	X	(%76-%100)	(%76-%100)	(%76-%100)
Courtyard	(%1-%25)	(%51-%75)	(%51-%75)	X
Main entrance	(%76-%100)	(%1-%25)	(%1-%25)	(%1-%25)
Guest room	X	(%1-%25)	(%1-%25)	(%1-%25)
Dining room	X	%0	%0	%0
Kitchen	%0	%0	(%51-%75)	(%51-%75)
Hot kitchen	X	X	X	%0
Hall	X	%0	%0	%0
Living room	%0	(%51-%75)	(%51-%75)	(%1-%25)
Bed room	%0	%0	%0	%0
Multifunctional room	(%1-%25)	X	%0	X
Bath	%0	%0	%0	%0
Rest room	%0	%0	%0	%0
Rest room for guests	X	X	%0	%0
Storage	%0	%0	%0	%0

This table provides two types of information, the existence of the space in the specific period and the ratio of visibility of the space from observation point (A) that is mostly found in the samples for each period.

It is noticed that 6 spaces out of 15 are not existed in the period (1900-1929), including garden and garage, guest room, dining room, hot kitchen, hall and rest room for guests. Some of those spaces are created in the following periods. This gives an indication that the period (1900-1929) has less diversity in the existing types of functions. In this period unless the

main entrance which is highly visible from observation point (A), other spaces have less visibility or no visibility from observation point (A).

In the period (1930-1959), 3 out of 15 spaces are not found in this period, and they are created in other periods. The most visible space is garden and garage from observation point (A). Then the courtyard and living room, other spaces are less visible or not visible from observation point (A).

In the period (1960-1989), only one space is not existed, which is hot kitchen, this period shows most diversity in spaces in the house samples. The most visible space is garden and garage from observation point (A). The visibility of kitchen increased in this period.

In the period (1990-2020), spaces of courtyard and multifunctional room are not existed in the selected samples. Garden and garage is the most visible space from observation point (A).

5. Conclusion

The factor of visibility is an important factor that effects on the house formation in different cultures and societies. It is this factor that shapes the house spaces and locate them within the spatial system of space distribution. The continuity of physical architectural identity of house is observed to be highly affected by the factor of visibility. In the case of Houses in Erbil City, it is noticed that the visibility of spaces from the observation point (A) differs in the research period from 1900 to 2020, This differentiation is affected by the factors of visual privacy, size of the opening, and the direction of the opening regarding the facade line. Another factor is the location of the space within the 2D isovist polygon drawn from observation point (A).

The isovist area and the visibility of the house spaces from observation point (A) differs in each period due to the change in architectural identity in each period. Also the ratio of visibility of house spaces from observation point (A) differs. The main reason of this diversity relates to the change in building and planning regulations and legislations, especially in the period (1930-1959) and other followed periods, where the house typology changed from courtyard houses to modern design houses with the spaces of garden and garage.

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