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Autism and domestic space

Location choices of autistic people when in different moods

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ABSTRACT

This paper examines the choices made by autistic people in their domestic environment. The hypothesis to be tested is that an autistic person relates differently to his/her domestic environment depending on the state he/she is in. The methodology used combines the spatial analysis of the houses as well as questionnaires answered by the parents or home caretakers of the autistic persons in a sample of fifteen cases. The spatial analysis is carried out using the space syntax tools for the calculation of such measures as integration/segregation values, isovists, skewering of spaces and route choices. The questionnaires aim at recording the places chosen by the autistic person when he/she is relaxed, stressed or very happy. Due to the potential difficulty in acquiring this information from the autistic persons themselves, the questionnaire is filled by the person who has been taking care of the autistic person, hopefully for a long time, since, one of the questions to be addressed is whether the relationship of the autistic person and his/her domestic space changes through time. The analysis will also look at other basic factors that may influence the choice of space by the autistic persons such as an object or the presence of other people.

KEYWORDS

Autism, Domestic space, Space Syntax, Space choices

1 INTRODUCTION

The interaction between psychology and the built environment is complex since the latter's physical properties influence how the user feels while how the user feels in an environment may result in changing some of its aspects. The built environment affects the experience and behaviour of users through the perceived information it offers, causing various emotional reactions such as calmness, anxiety, happiness, and fear. The relationship between space and

human psychology gains more weight and urgency when the users are autistic. This group of users shows developmental and mental disorders in terms of their social, communication and sensory abilities. Autistic individuals are characterized by the special way they perceive the space around them due to their particularly structured sensory system, resulting in the emergence of extreme behaviours. Leo Kanner was the first to argue that autistic people are not schizophrenic but tend to have an aloneness “that whenever possible, disregards, ignores, shuts out anything that comes to the child from the outside¨ (Kanner,1943,p.242).

In recent years, research on autism has been increasing, with a number of studies focusing on the relationship between space and autism (Humpheys, 1989; Sanchez1, et all,2011; Kinner, et all, 2015; Pomana, 2017). Some focus specifically on educational centres for autistic people (Scott, 2009; Mullick, 2009). A number of studies propose a list of design guidelines for such centres. Magda Mostafa proposes what she refers to as Sensory Design Theory, with seven guidelines that deal with acoustics, spatial sequencing, escape, compartmentalization, transition, spaces, sensory zoning, and safety (Mostafa, 2014). Andrei Pomana on the other hand proposes the creation of more interactive spaces the purpose of which is to educate autistic people in interacting with non-educational, less sterile environments (Pomana, 2014), while Neeraj Choudhary focuses on such aspects as light, sound and colour (Choudhary, 2019).

And while educational spaces are clearly important, it is the house that is probably the most important cell of the built environment. It is thus no surprise that a lot of research has been carried out regarding the domestic environment and the psychology of its users. Sonit Bafna, Kinsuk Maitra, Yoonjeong Lim, Winifred E. Newmar and Manasi Shah, for example, use the space syntax methodology to investigate the relationship between the spatial qualities of the house and the behaviour of the elderly (Bafna et all,2019). Another research project which examines the relationship of autistic people and space is the work carried out by Shokrollahi Ardekani and Emin Salgamcioglu but, unlike the research presented here, it uses virtual rather than lived space. (Ardekani, Salgamcioglu, 2019). More specifically, our research examines the relationship between the home environment and the spatial preferences of an autistic person when calm, sad, or happy. In other words, our main objective is to examine the relationship between domestic space and the behaviour of the autistic person when in different moods.

2 DATASET METHODOLOGY

The methodology of the present research consists of three parts, and uses both quantitative as well as qualitative tools. The sample consists of fifteen cases. For each case, the data used is derived from the homes of people with autism and their caretakers. Because people with autism have communication difficulties, but also for ethical reasons, the information about the behaviour of the person in the domestic environment was collected from the testimonies of the caregivers of the individual. The cases were selected on the condition that the subjects, who belong to the

autism spectrum, reside for over a year in their dwelling. The participants in the resulting sample are 10 to 34 years old, and the sample consists of both twelve males and three females. Six of the homes are flats, four are duplex dwellings and five are detached houses. The spaces that the present study focuses on are: formal living room (FL), daily living room (DL), formal dining room (ET), corridor (C),Kitchen (K), autistic person's bedroom(AB), second bedroom (SB) and the terrace/garden (G), depending on the type of residence(Figures1,2 and 3).

The first part of the research uses the information collected through questionnaires to identify what space is preferred by the subject when sad, calm or very happy, what exact point in the space, whether the space preference is due to an object, a person or the space (Table1), whether the subject tends to be stationary or moving, and whether there is a preference between looking inside or outside .In the second part the syntactic characteristics of the dwellings are examined with the tools of Space Syntax (Hillier and Hanson, 1984) such as Convex Graph Analysis (integration (HH), connectivity) and VGA Analysis (Integration, Isovist Area). With the above tools, the study calculates the values of the integration of the individual spaces and the visual relationships between the spaces of each dwelling.(Tables 2,3,4,5,6 and 7). The results of the two parts described above are then used in the third and last part to search for any patterns in the relationship between spatial characteristics and spatial preferences of the autistic subjects when in different mood.

3 RESULTS

In this section, the data regarding each if the three moods of the autistic subjects is presented separately, with the first section looking at the data collected regarding the relationship of the subject and his domestic environment when in a calm mood, the second when in an angry mood and the third when in a happy mood.

3.1 When in a calm mood

According to Table 1.1 where the information from the questionnaires is collected, 12 out of 15 autistic people choose the daily living room, 1 chooses the second bedroom, 1 chooses the kitchen area and 1 chooses his own bedroom. According to the opinion of the caretaker 11 of the subjects select the specific space because of the space itself, 3 because of a person present there, and 1 because of an object found in the space.

The results of Convex Graph Analysis (integration (HH) (Table 2.1) show that 9 out of the 15 subjects choose a space with a high integration value , 5 choose a space of medium integration value, and only 1 subject chooses a space that has a low integration value. In terms of step Depth measurements , according to Table 2.2, 6 out of the 15 subjects choose a space to has a low depth value, 7 choose a space of medium depth value, and 2 choose a space with a high depth value.

The results of the Visual Graph Analysis (Table 2.3) show that 11 out of the 15 subjects choose spaces with high visual integration value, and 4 choose spaces of medium visual integration value.

The data collected from the isovist analysis (Table 3) show that : 3 out of the 15 subjects choose a space with 6 visual accesses, 4 choose a space with 5 visual accesses , 5 choose a space with 4 visual accesses , 2 choose a space with 3 visual accesses and only 1 subject chooses a space with 3 visual accesses when calm; in 13 cases, the visual accesses resulting from the specific point in which the autistic subject chooses, are distributed perimetrically, while in 2 cases the visual accesses are connected axially; 14 subjects tend to be stationary when in a calm mode while 1 tends to move around in a linear pattern; 12 subjects position themselves in the centre and 3 off-centre; 13 subjects choose to look only in the interior while only 2 choose to look outside.

The observations above suggest that when in a calm mood the majority of the autistic subjects of the sample tend to be stationary than move around and choose to spend time in the informal living room, a space which tends to be well integrated and with strong visual connections to spaces which are arranged perimetrically around it. The choice seems to be due to the space itself while the specific position within the space tends to be off-centre.

Table 1: Table showing the space chosen by the subject according to his/her mood and the reason that he/she chooses the space.

Table 1.1. Spaces chosen by the participants and the reason that he/she chooses the space when calm .

Question 1	Dwelling spaces	Autistic Participants														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
In which space is he calm?	Off. Living room															
	Daily Living room	●	●	●	●	●	●	●		●	●		●	●		●
	Off. Dinning room															
	Kitchen								●							
	Corridor															
	Courtyard															
	Autistic's Bedroom											●				
	Second Bedroom														●	
	Somewherelse															
	The reason that autistic participants choose the dwelling space was due to:	Autistic Participants														
	An object											●				
	The human presence										●			●	●	
	The space	●	●	●	●	●	●	●	●	●			●			●

Table 1.2. Spaces chosen by the participants and the reason that he/she chooses the space when upset/angry .

Question 2	Dwelling spaces	Autistic Participants														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Which space does he choose when he is upset/angry?	Off. Living room															
	Daily Living room			●				●				●				
	Off. Dinning room															
	Kitchen															
	Corridor		●							●						
	Courtyard														●	●
	Autistic's Bedroom	●				●	●		●		●		●			
	Second Bedroom															
	Somewherelse				●									●		
	The reason that autistic participants choose the dwelling space was due to:	Autistic Participants														
	An object							●								
	The human presence				●									●		
	The space	●	●	●		●	●		●	●	●	●	●		●	●

Table 1.3. Spaces chosen by the participants and the reason that he/she chooses the space when very happy.

Question 3	Dwelling spaces	Autistic Participants														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Which space does he choose when he is very happy?	Off. Living room				●											
	Daily Living room	●	●	●		●	●	●		●	●	●	●	●	●	●
	Off. Dinning room															
	Kitchen								●							
	Corridor															
	Courtyard															
	Autistic's Bedroom															
	Second Bedroom															
	Somewherelse															
	The reason that autistic participants choose the dwelling space was due to:	Autistic Participants														
	An object				●											
	The human presence													●		
	The space	●	●	●		●	●	●	●	●	●	●	●		●	●

Table 2: Table showing the results from syntactic analysis for each space according to integration value VGA integration value and step depth value of 15 dwellings when he/she is calm.

Table 2.1

Convex Analysis (Results of Integration Value (HH) for each space , red (comparatively high integration), green (comparatively medium integration) blue (comparatively low integration)

	High			Medium			Low	
Dwelling	Dwelling Spaces							
DW1	Corridor >	Kitchen >	**D.Living room: 1.07**	Subject's Bedroom >	Second Bedroom	F. Living room >	F. Dining room >	Garden
DW2	Corridor >	**D.Living room :1.38**	Kitchen >	F. Dining room >	Garden >	F. Living room >	Subject's Bedroom >	Second Bedroom
DW3	Corridor >	**D.Living room :0.97**	Subject's Bedroom >	F. Dining room >	F. Living room >	Garden >	Kitchen >	Second Bedroom
DW4	Corridor >	**D.Living room :1.17**	F. Living room >	F. Dining room >	Garden >	Somewherelse >	Kitchen >	Subject's Bedroom
DW5	Corridor >	**D.Living room :1.19**	Second Bedroom >	F. Living room >	Subject's Bedroom >	F. Dining room >	Kitchen >	Garden
DW6	Corridor >	**D.Living room :1.04**	Kitchen >	Second Bedroom >	F. Dining room >	Subject's Bedroom >	Garden >	F. Living room
DW7	Corridor >	Kitchen >	**D.Living room :1.08**	F. Dining room >	Somewherelse >	Garden >	Second Bedroom >	Subject's Bedroom
DW8	Corridor >	Second Bedroom >	F. Living room >	Daily Living room >	F. Dining room >	**Kitchen :1.05**	Garden >	Subject's Bedroom
DW9	Corridor >	**D.Living room :1.31**	Garden >	F. Dining room >	F. Living room >	Kitchen >	Second Bedroom >	Subject's Bedroom
DW10	Corridor >	F. Dining room >	F. Living room >	Subject's Bedroom >	Second Bedroom >	Kitchen >	**D. Living room: 0.45**	Garden
DW11	Corridor >	F. Dining room >	Second Bedroom >	Garden >	**Subject's Bed. : 1.21**	Daily Living room >	Kitchen >	F. Living room
DW12	Corridor >	F. Dining room >	Kitchen >	**D.Living room : 0.95**	Garden >	Subject's Bedroom >	Second Bedroom >	F. Living room
DW13	Corridor >	Kitchen >	**D. Living room :1.72**	F. Dining room >	Garden >	Second Bedroom >	Subject's Bedroom >	Somewherelse
DW14	Corridor >	Kitchen >	F. Dining room >	**Second Bed. : 1.11**	Garden >	Daily Living room >	Subject's Bedroom >	Somewherelse
DW15	Garden >	Corridor >	Subject's Bedroom >	**D.Living room: 0.68**	F. Dining room >	Second Bedroom >	Kitchen >	Somewherelse
Total	**9/15 High**	**5/15 Medium**	**1/15 Low**					

Table 2.2

Step Depth (Results of step number from the entrance of dwelling , red (comparatively high number) green (comparatively medium number) blue (comparatively low number)

	High			Medium			Low	
Dwelling	Dwelling Spaces							
DW1	Garden >	Kitchen >	Second Bed. >	Subject's Bed. >	Corridor >	F. Dining room >	F. Living room >	**D. Living room (1)**
DW2	Second Bed. >	Second Bed. >	Somewherelse >	F. Living room >	F. Dining room >	Kitchen >	**D. Living room (2)**	Garden
DW3	Kitchen >	D. Living room >	Subject's Bed. >	Garden >	Corridor >	**D. Living room (2)**	F. Dining room >	F. Living room
DW4	Second Bed. >	Subject's Bed. >	Corridor >	F. Dining room >	F. Living room >	Kitchen >	**D. Living room (3)**	Garden
DW5	Subject's Bed. >	Garden >	Second Bed. >	Kitchen >	F. Dining room >	Off. Living room >	**D. Living room (2)**	Corridor
DW6	Subject's Bed. >	Second Bed. >	Corridor >	Kitchen >	F. Dining room >	**D. Living room (3)**	Garden >	Somewherelse
DW7	Subject's Bed. >	Second Bed. >	Somewherelse >	Garden >	Kitchen >	F. Dining room >	**D. Living room (5)**	Corridor
DW8	Garden >	**Kitchen (4)**	D. Living room >	F. Dining room >	Second Bed. >	F. Dining room >	Subject's Bed. >	Corridor
DW9	Subject's Bed. >	Kitchen >	Second Bed. >	F. Dining room >	F. Living room >	**D. Living room (4)**	Corridor >	Garden
DW10	Garden >	D. Living room >	Kitchen >	**Subject's Bed. (9)**	Second Bed. >	Corridor >	F. Dining room >	F. Living room
DW11	Somewherelse	Second Bed. >	Subject's Bed. >	Garden >	Kitchen >	Corridor >	**D. Living room (3)**	F. Dining room
DW12	Subject's Bed. >	Second Bed. >	Garden >	Kitchen >	F. Dining room >	**D. Living room (2)**	Somewherelse >	Corridor
DW13	Subject's Bed. >	Second Bed. >	Corridor >	Kitchen >	F. Dining room >	**D. Living room (3)**	Somewherelse >	Garden
DW14	Subject's Bed. >	Kitchen >	Corridor >	F. Dining room >	**Second Bed. (2)**	Daily Living room >	Somewherelse >	Garden
DW15	Kitchen >	Second Bed. >	**D. Living room (5)**	F. Dining room >	Subject's Bed. >	Corridor >	Somewherelse >	Garden
Total	**1/15 (High)**	**3/15 (Medium)**	**11/15 (Low)**					

Table 2.3

VGA Analysis (Results of Visual Integration Value for each space , red (comparatively high visual integration) green (comparatively medium visual integration) blue (comparatively low visual integration)

	High		Medium				Low	
Dwelling	Dwelling Spaces							
DW1	Corridor >	**D.Living room: 6.212**	F. Living room >	Kitchen >	F. Dining room >	Subject's Bed. >	Second Bed. >	Garden
DW2	Garden >	**D.Living room:9.606**	F. Living room >	Corridor >	F. Dining room >	Kitchen >	Subject's Bed. >	Second Bed.
DW3	Corridor >	**D.Living room: 8.584**	Garden >	F. Living room >	F. Dining room >	Kitchen >	Second Bed. >	Subject's Bed.
DW4	Corridor >	Garden >	**D.Living room: 10.389**	F. Dining room >	Kitchen >	F. Living room >	Second Bed. >	Subject's Bed.
DW5	Corridor >	**D.Living room : 10.276**	F. Dining room >	F. Living room >	Subject's Bed. >	Garden >	Second Bed. >	Somewherelse
DW6	**D.Living room:14.238**	Corridor >	F. Dining room >	Subject's Bed. >	Second Bed. >	Kitchen >	Somewherelse	Garden
DW7	Corridor >	**D.Living room: 10.465**	F. Dining room >	Garden >	Kitchen >	Second Bed. >	Subject's Bed. >	Somewherelse
DW8	Corridor >	Garden >	D.Living room >	**Kitchen : 9.433**	F. Living room >	F. Dining room >	Second Bed. >	Subject's Bed.
DW9	Corridor >	Garden >	**D.Living room: 8.984**	F. Dining room >	F. Living room >	Kitchen >	Second Bed. >	Subject's Bed.
DW10	Corridor >	F. Dining room >	F. Living room >	**D.Living room:12.922**	Kitchen >	Garden >	Second Bed. >	Subject's Bed.
DW11	Garden >	Corridor >	D.Living room >	F. Dining room >	Second Bed. >	**Subject's Bed. 8.030**	Kitchen >	Somewherelse
DW12	Corridor >	**D.Living room 14.502**	F. Dining room >	Garden >	Kitchen >	Subject's Bedroom >	Second Bed. >	Somewherelse
DW13	Corridor >	**D.Living room 13.631**	F. Dining room >	Kitchen >	Garden >	Subject's Bedroom >	Second Bed. >	Somewherelse
DW14	Corridor >	Kitchen >	D.Living room >	F. Dining room >	Garden >	**Second Bed. 7.165**	Somewherelse	Subject's Bed.
DW15	Garden >	Subject's Bed. >	**D.Living room 13.588**	F. Dining room >	F. Living room >	Second Bed. >	Somewherelse >	Kitchen
TOTAL	**11/15 High**	**4/15 Medium**						

Table 3: Table showing the results from isovist analysis for each space chosen when the subject is calm.

Isovist Analysis : The characteristics of the specific point that subject chooses in the domestic space when calm.

Dwelling	Number of spaces with visual access from the specific point that autistic people choose in the house					The spaces are developed perimetrition or axially?		The actual point that autistic people choose in the space			Position of the subject in the space chosen			The spaces that subject chooses to focus on more			Isovist Vaue
	2	3	4	5	6	Axially	Perimetrition	Off-centre	Centre	Corner	Stationary	Motion (Linear)	Motion (Circular)	Interior	Exterior	Both	
DW 1					●		●	●			●			●			41.932
DW 2					●		●	●			●					●	54.485
DW 3			●				●	●			●			●			49.993
DW 4				●			●	●			●			●			65.826
DW 5			●			●		●			●			●			49.89
DW 6			●				●	●			●			●			48.754
DW7					●		●	●			●			●			72.864
DW8			●				●			●	●					●	60.816
DW9			●				●	●			●			●			51.896
DW10				●			●	●			●			●			41.151
DW11	●					●				●	●			●			17.501
DW12		●					●	●			●			●			61.967
DW13			●				●	●			●			●			46.543
DW14		●					●			●	●					●	23.954
DW15				●			●	●				●		●			54.474

3.2 When upset

According to Table 1.2 where the information from the questionnaires is collected, 6 out of 15 autistic people choose their bedroom, 4 choose the daily living room, 2 choose the courtyard, 2 choose another space such as the bathroom, and 1 chooses the corridor. According to the opinion of the caretaker 12 of the subjects select the specific space because of the space itself, 2 because of a person present there, and 1 because of an object found in the space.

The results of Convex Graph Analysis (integration (HH) (Table 4.1) show that 5 out of the 15 subjects choose a space with a high integration value , 8 choose a space of medium integration value, and 2 subjects choose a space that has a low integration value. In terms of step Depth measurements , according to Table 4.2, 8 out of the 15 subjects choose a space to has a low depth value, 3 choose a space of medium depth value, and 4 choose a space with a high depth value. The results of the Visual Graph Analysis (Table 4.3) show that 6 out of the 15 subjects choose spaces with high visual integration value, 5 choose spaces of medium visual integration value , and 4 choose spaces with low visual integration value. The data collected from the isovist analysis (Table 5) show that: 5 out of the 15 subjects choose a space with 2 visual accesses, 4 choose a space with 4 visual accesses , 2 choose a space with 5 visual accesses , 2 caretakers did not specify because the choice depends on the presence of a person in the space, 1 chooses a space with 8 visual accesses, and 1 a space with 3 visual accesses when upset; in 8 cases, the visual accesses resulting from the specific point in which the autistic subject chooses, are distributed perimetrically, 5 are axially arranged and 2 are not specified as mentioned above; 10 subjects tend to be stationary when in a calm mode, 2 tends to move around in a linear pattern, while 1 moves in circles; 7 subjects position themselves in a corner, 4 subjects position

themselves off-centre, 2 subjects position themselves in the centre while the position is not specified for the remaining 2; 8 subjects choose to look only in the interior, 4 choose to look outside while the remaining 2 tend to go outside. The observations above suggest that when upset, a third of them choose their own bedroom and slightly less than a third still choose the living room. The space is chosen for the space itself and not because of the presence of a person or an object. It also tends to be more moderately than highly integrated. Regarding the visual integration of the chosen space, the values tend to be scattered evenly while the isovist analysis suggests that the subjects tend to choose spaces with less spaces visually accessible. These spaces tend to be mostly perimetrically but in some cases also. axiallyarranged. The majority of the subjects tends to be stationary and position themselves in a corner or off-centre when upset. Most focus on the inside.

Table 4: Table showing the results from syntactic analysis for each space according to integration value VGA integration value and step depth value of 15 dwellings when he/she is upset/angry.

Table 4.1

Convex Analysis (Results of Integration Value (HH) for each space , red (comparatively high integration), green (comparatively medium integration) blue (comparatively low integration)

	High			Medium			Low	
Dwelling	Dwelling Spaces							
DW1	Corridor >	Kitchen >	D. Living room >	**Subject's Bed. :0.98**	Second Bed. >	F. Living room >	F. Dining room >	Garden
DW2	**Corridor:1.78**	D. Living room >	Kitchen >	F. Dining room >	Garden >	F. Living room >	Subject's Bed. >	Second Bed.
DW3	Corridor >	**D. Living room:0.97**	Second Bed. >	F. Dining room >	F. Living room >	Garden >	Kitchen >	Second Bed.
DW4	Corridor >	D. Living room >	F. Living room >	F. Dining room >	Garden >	**Somewhere else -**	Kitchen >	Subject's Bed.
DW5	Corridor >	D. Living room >	Second Bed. >	F. Living room >	**Subject's Bed. :0.97**	F. Dining room >	Kitchen >	Garden
DW6	Corridor >	D. Living room >	Kitchen >	Second Bed. >	F. Dining room >	**Subject's Bed. : 0.63**	Garden >	F. Living room
DW7	Corridor >	Kitchen >	**D. Living room: 1.03**	F. Dining room >	Somewhereelse >	Garden >	Second Bed. >	Subject's Bed.
DW8	Corridor >	Second Bed. >	F. Living room >	D. Living room >	F. Dining room >	Kitchen >	Garden >	**Subject's Bed. : 0.77**
DW9	**Corridor : 0.98**	D. Living room >	Garden >	F. Dining room >	F. Living room >	Kitchen >	Second Bed. >	Subject's Bed.
DW10	Corridor >	F. Dining room >	F. Living room >	**Subject's Bed. :0.54**	Second Bed. >	Kitchen >	D. Living room >	Garden
DW11	Corridor >	F. Dining room >	Second Bed. >	Garden >	Subject's Bed. >	**D. Living room : 1.13**	Kitchen >	F. Living room
DW12	Corridor >	F. Dining room >	Kitchen >	D. Living room >	Garden >	**Subject's Bed. : 0.86**	Second Bed. >	F. Living room
DW13	Corridor >	Kitchen >	D. Living room >	F. Dining room >	Garden >	Second Bed. >	Subject's Bed.>	**Somewhere else -**
DW14	Corridor >	Kitchen >	F. Dining room >	Second Bed. >	**Garden : 0.97**	D. Living room >	Subject's Bed.>	Somewhere else
DW15	**Garden : 1.83**	Corridor >	Subject's Bed. >	D. Living room >	F. Dining room >	Second Bed. >	Kitchen >	Somewhere else
Total	**5/15 High**	**8/15 Medium**	**2/15 Low**					

Table 4.2

Step Depth (Results of step number from the entrance of dwelling , red (comparatively high number) green (comparatively medium number) blue (comparatively low number)

	High			Medium			Low	
Dwelling	Dwelling Spaces							
DW1	Garden >	Kitchen >	Second Bed. >	**Subject's Bed. (3)**	Corridor >	F. Dining room >	F. Living room >	D.Living room
DW2	Second Bed. >	Subject's Bed. >	F. Living room >	F. Dining room >	D. Living room >	**Corridor (3)**	Kitchen >	Garden
DW3	Kitchen >	D.Living room >	Subject's Bed.>	Garden >	Corridor >	**D.Living room (3)**	F. Dining room >	Off. Living room
DW4	**Somewhereelse**	Subject's Bed. >	Corridor >	F. Dining room >	F. Living room >	Kitchen >	D. Living room >	Garden
DW5	**Subject's Bed. (4)**	Garden >	Second Bed. >	Kitchen >	F. Dining room >	F. Living room >	D.Living room >	Corridor
DW6	**Subject's Bed. (8)**	Second Bed. >	Corridor >	Kitchen >	F. Dining room >	D.Living room >	Garden >	Somewhereelse
DW7	Subject's Bed.>	Second Bed. >	Somewhereelse >	Garden >	Kitchen >	F. Dining room >	**D.Living room (5)**	Corridor
DW8	Garden >	Kitchen >	D. Living room >	F. Dining room >	Second Bed. >	Off. Living room >	**Subject's Bed. (2)**	Corridor
DW9	Subject's Bed.>	Kitchen >	Second Bed. >	F. Dining room >	F. Living room >	D.Living room >	**Corridor (2)**	Garden
DW10	Garden >	D.Living room >	Kitchen >	**Subject's Bed. (6)**	Second Bed. >	Corridor >	F. Dining room >	F. Living room
DW11	Somewhereelse	Second Bed. >	Subject's Bed.>	Garden >	Kitchen >	Corridor >	**D.Living room (2)**	F. Dining room
DW12	**Subject's Bed. (4)**	Second Bed. >	Garden >	Kitchen >	F. Dining room >	D.Living room >	Somewhereelse >	Corridor
DW13	Subject's Bed.>	Second Bed. >	Corridor >	Kitchen >	F. Dining room >	D.Living room >	**Somewhereelse**	Garden
DW14	Subject's Bed.>	Kitchen >	Corridor >	F. Dining room >	Second Bed. >	D.Living room >	Somewhereelse >	**Garden (1)**
DW15	Kitchen >	Second Bed. >	D.Living room >	F. Dining room >	Subject's Bed.>	Corridor >	Somewhereelse >	**Garden (2)**
Total	**4/15 (High)**	**2/15 (Medium)**	**9/15 (Low)**					

Table 4.3

VGA Analysis (Results of Visual Integration Value for each space , red (comparatively high visual integration) green (comparatively medium visual integration) blue (comparatively low visual integration)

	High			Medium			Low	
Dwelling	Dwelling Spaces							
DW1	Corridor >	D.Living room >	F. Living room >	Kitchen >	F. Dining room >	**Subject's Bed. :4.704**	Second Bed. >	Garden
DW2	Garden >	D.Living room >	F. Living room >	**Corridor :5.918**	F. Dining room >	Kitchen >	Subject's Bed. >	Second Bed.
DW3	Corridor >	**D.Living room :8.213**	Garden >	F. Living room >	F. Dining room >	Kitchen >	Second Bed.>	Subject's Bed.
DW4	Corridor >	Garden >	D.Living room >	F. Dining room >	Kitchen >	F. Living room >	**Somewherelse**	Subject's Bed.
DW5	Corridor >	D.Living room >	F. Dining room >	F. Living room >	**Subject's Bed. :8.956**	Garden >	Second Bed.>	Somewherelse
DW6	D.Living room >	Coridor >	F. Dining room >	**Subject's Bed. :7.334**	Second Bed. >	Kitchen >	Somewherelse	Garden
DW7	Corridor >	**D.Living room :8.173**	F. Dining room >	Garden >	Kitchen >	Second Bed.>	Subject's Bed.>	Somewherelse
DW8	Corridor >	Garden >	D.Living room >	Kitchen >	F. Living room >	F. Dining room >	Second Bed.>	**Subject's Bed. :6.067**
DW9	**Corridor :9.834**	Garden >	D.Living room >	F. Dining room >	F. Living room >	Kitchen >	Second Bed.>	Subject's Bed.
DW10	Corridor >	F. Dining room >	F. Living room >	D.Living room >	Kitchen >	Garden >	Second Bed.>	**Subject's Bed. :9.822**
DW11	Garden >	Corridor >	**D.Living room: 9.540**	F. Dining room >	Second Bed.>	Subject's Bed. >	Kitchen >	Somewherelse
DW12	Corridor >	D.Living room >	F. Dining room >	Garden >	Kitchen >	**Subject's Bed. :9.356**	Second Bed.>	Somewherelse
DW13	Corridor >	D.Living room >	F. Dining room >	Kitchen >	Garden >	Subject's Bed. >	Second Bed.>	**Somewherelse**
DW14	Corridor >	Kitchen >	D.Living room >	F. Dining room >	**Garden :7.048**	Second Bed.>	Somewherelse	Subject's Bed.
DW15	**Garden :33.247**	Subject's Bed. >	D.Living room >	F. Dining room >	F. Living room >	Second Bed. >	Somewherelse >	Kitchen
Total	5/15 High		6/15 Medium		4/15 Low			

Table 5: Table showing the results from isovist analysis for each space chosen when the subject is upset/angry.

Iovist Analysis: The characteristics of the specific point that subject chooces in the domestic space when upset/angry.

Dwelling	Number of spaces with visual access from the specific point that autistic people choose in the house					The spaces are developed perimetrition or axially?		The actual point that autistic people choose in the space			Position of the subject in the space chosen			The spaces that subject chooses to focus on more			Isovist Vaue
	2	3	4	5	8	Axially	Perimetrition	Off-centre	Centre	Corner	Stationary	Motion (Linear)	Motion (Circular)	Interior	Exterior	Both	
DW 1	●					●		●			●			●			19.986
DW 2					●		●		●			●				●	63.142
DW 3			●				●	●					●	●			37.158
DW 4																	
DW 5	●						●			●	●			●			23.858
DW6			●				●			●	●			●			19.272
DW7	●					●				●	●			●			23.586
DW 8			●			●				●	●			●			15.958
DW 9			●				●			●	●					●	22.174
DW10				●		●				●	●			●			11.01
DW11				●			●	●				●				●	37.658
DW12	●					●				●	●			●			11.961
DW13																	
DW14	●						●	●			●					●	42.239
DW15		●					●		●		●						121.21

3.3 When happy

According to Table 1.3 where the information from the questionnaires is collected, 14 out of 15 autistic people choose the daily living room, 1 chooses the kitchen area. According to the opinion of the caretaker 13 of the subjects select the specific space because of the space itself, 1 because of a person present there, and 1 because of an object found in the space.

The results of Convex Graph Analysis (integration (HH) (Table 6.1) show that 9 out of the 15 subjects choose a space with a high integration value , 5 choose a space of medium integration value, and only 1 subject chooses a space that has a low integration value. In terms of step Depth measurements, according to Table 6.2, 8 out of the 15 subjects choose a space to has a low depth value, 3 choose a space of medium depth value, and 4 choose a space with a high depth value. The results of the Visual Graph Analysis (Table 6.3) show that 12 out of the 15 subjects choose spaces with high visual integration value, and 3 choose spaces of medium visual integration value.

The data collected from the isovist analysis (Table 7) show that : 8 out of the 15 subjects choose a space with 4 visual accesses, 3 choose a space with 6 visual accesses , 2 choose a space with 1 visual access , 1 chooses a space with 7 visual accesses and only 1 subject chooses a space with 2 visual accesses when calm; in 12 cases, the visual accesses resulting from the specific point in which the autistic subject chooses, are distributed perimetrically, while in 3 cases the visual accesses are connected axially; 9 subjects tend to be stationary when in a calm mode, 4 move cyclically, and 2 linearly; 13 subjects position themselves off-centre, 1 in the centre and 1 in a corner; 10 subjects choose to look only in the interior while 5 choose to look outside.

The observations above suggest that when in a happy mood the majority of the autistic subjects of the sample tend to be stationary than move around and choose to spend time in the informal living room, a space which tends to be well integrated and with strong visual connections to spaces which are arranged perimetrically around it. The choice seems to be due to the space itself while the specific position within the space tends to be off-centre. While most choose to look only in the interior some look on the outside as well.

Table 6: Table showing the results from syntactic analysis for each space according to integration value VGA integration value and step depth value of 15 dwellings when he/she is very happy.

Table 6.1

Convex Analysis (Results of Integration Value (HH) for each space , red (comparatively high integration), green (comparatively medium integration) blue (comparatively low integration)

	High			Medium			Low	
Dwelling	Dwelling Spaces							
DW1	Corridor >	Kitchen >	**D. Living room :1.07**	Subject's Bed.>	Second Bedroom	F. Living room >	F. Dining room >	Garden
DW2	Corridor >	**D. Living room :1.38**	Kitchen >	F. Dining room >	Garden >	F. Living room >	Subject's Bed.>	Second Bed.
DW3	Corridor >	**D. Living room :1.39**	Subject's Bedroom >	F. Dining room >	F. Living room >	Garden >	Kitchen >	Second Bed.
DW4	Corridor >	D. Living room >	**F. Living room :1.08**	F. Dining room >	Garden >	Somewherelse >	Kitchen >	Subject's Bed.
DW5	Corridor >	**D. Living room :1.19**	Second Bed. >	F. Living room >	Subject's Bed.>	F. Dining room >	Kitchen >	Garden
DW6	Corridor >	**D. Living room :1.04**	Kitchen >	Second Bed. >	F. Dining room >	Subject's Bed.>	Garden >	F. Living room
DW7	Corridor >	Kitchen >	**D. Living room :1.08**	F. Dining room >	Somewherelse >	Garden >	Second Bed.>	Subject's Bed.
DW8	Corridor >	Second Bed. >	F. Living room >	Daily Living room >	F. Dining room >	**Kitchen :1.05**	Garden >	Subject's Bed.
DW9	Corridor >	**D. Living room :1.14**	Garden >	F. Dining room >	F. Living room >	Kitchen >	Second Bed. >	Subject's Bed.
DW10	Corridor >	F. Dining room >	F. Living room >	Subject's Bed.>	Second Bed. >	Kitchen >	**D. Living room :0.45**	Garden
DW11	Corridor >	F. Dining room >	Second Bed. >	Garden >	Subject's Bed.>	**D. Living room :1.13**	Kitchen >	F. Living room
DW12	Corridor >	F. Dining room >	Kitchen >	**D. Living room :0.95**	Garden >	Subject's Bed.>	Second Bed.>	F. Living room
DW13	Corridor >	Kitchen >	**D. Living room :1.72**	F. Dining room >	Garden >	Second Bed. >	Subject's Bed.>	Somewherelse
DW14	Corridor >	Kitchen >	F. Dining room >	Second Bed. >	Garden >	**D. Living room :1.07**	Subject's Bed.>	Somewherelse
DW15	Garden >	Corridor >	Subject's Bed. >	**D. Living room :0.68**	F. Dining room >	Second Bed. >	Kitchen >	Somewherelse

Total	9/15 High	5/15 Medium	1/15 Low

Table 6.2

Step Depth (Results of step number from the entrance of dwelling , red (comparatively high number) green (comparatively medium number) blue (comparatively low number)

	High			Medium			Low	
Dwelling	Dwelling Spaces							
DW1	Garden >	Kitchen >	Second Bed. >	Subject's Bed. >	Corridor >	F. Dining room >	**Off. Living room (1)**	D.Living room
DW2	Second Bed. >	Subject's Bed. >	F. Living room >	F. Dining room >	**D. Living room (2)**	Corridor >	Kitchen >	Garden
DW3	Kitchen >	D. Living room >	Subject's Bed. >	Garden >	Corridor >	**D.Living room (3)**	F. Dining room >	F. Living room
DW4	Second Bed. >	Subject's Bed. >	Corridor >	F. Dining room >	F. Living room >	Kitchen >	**D.Living room (4)**	Garden
DW5	Subject's Bed. >	Garden >	Second Bed. >	Kitchen >	F. Dining room >	F. Living room >	**D.Living room (2)**	Corridor
DW6	Subject's Bed. >	Second Bed. >	Corridor >	Kitchen >	F. Dining room >	**D.Living room (3)**	Garden >	Somewherelse
DW7	Subject's Bed. >	Second Bed. >	Somewherelse >	Garden >	Kitchen >	F. Dining room >	**D.Living room (5)**	Corridor
DW8	Garden >	Kitchen >	**D. Living room (4)**	F. Dining room >	Second Bed. >	F. Living room >	Subject's Bed. >	Corridor
DW9	Subject's Bed. >	Kitchen >	Second Bed. >	F. Dining room >	F. Living room >	**D.Living room (4)**	Corridor >	Garden
DW10	Garden >	**D.Living room (8)**	Kitchen >	Subject's Bed. >	Second Bed. >	Corridor >	F. Dining room >	F. Living room
DW11	Somewherelse	Second Bed. >	Subject's Bed. >	Garden >	Kitchen >	Corridor >	**D.Living room (2)**	F. Dining room
DW12	Subject's Bed. >	Second Bed. >	Garden >	Kitchen >	F. Dining room >	**D.Living room (2)**	Somewherelse >	Corridor
DW13	Subject's Bed. >	Second Bed. >	Corridor >	Kitchen >	F. Dining room >	**D.Living room (3)**	Somewherelse >	Garden
DW14	Subject's Bed. >	Kitchen >	Corridor >	F. Dining room >	Second Bed. >	**D.Living room (2)**	Somewherelse >	Garden
DW15	Kitchen >	Second Bed. >	**D. Living room (5)**	F. Dining room >	Subject's Bed. >	Corridor >	Somewherelse >	Garden

Total	1/15 (High)	3/15(Medium)	11/15(Low)

Table 6.3

VGA Analysis (Results of Visual Integration Value for each space , red (comparatively high visual integration) green (comparatively medium visual integration) blue (comparatively low visual integration)

	High			Medium			Low	
Dwelling	Dwelling Spaces							
DW1	Corridor >	**D.Living room:7.462**	F. Living room >	Kitchen >	F. Dining room >	Subject's Bed.>	Second Bed. >	Garden
DW2	Garden >	**D.Living room:9.606**	F. Living room >	Corridor >	F. Dining room >	Kitchen >	Subject's Bed.>	Second Bed.
DW3	Corridor >	**D.Living room :7.706**	Garden >	F. Living room >	F. Dining room >	Kitchen >	Second Bed. >	Subject's Bed.
DW4	Corridor >	Garden >	D.Living room >	F. Dining room >	Kitchen >	**F. Living room 8.990**	Second Bed. >	Subject's Bed.
DW5	Corridor >	**D.Living room 10.276**	F. Dining room >	F. Living room >	Subject's Bed. >	Garden >	Second Bed. >	Somewherelse
DW6	**D.Living room 14.238**	Corridor >	F. Dining room >	Subject's Bed. >	Second Bed. >	Kitchen >	Somewherelse	Garden
DW7	Corridor >	**D.Living room: 10.601**	F. Dining room >	Garden >	Kitchen >	Second Bed.>	Subject's Bed. >	Somewherelse
DW8	Corridor >	Garden >	D.Living room >	**Kitchen : 6.965**	F. Living room >	F. Dining room >	Second Bed. >	Subject's Bed.
DW9	Corridor >	Garden >	**D.Living room :8.947**	F. Dining room >	F. Living room >	Kitchen >	Second Bed. >	Subject's Bed.
DW10	Corridor >	F. Dining room >	F. Living room >	**D.Living room :11.896**	Kitchen >	Garden >	Second Bed. >	Subject's Bed.
DW11	Garden >	Corridor >	**D.Living room :11.240**	F. Dining room >	Second Bed. >	Subject's Bed. >	Kitchen >	Somewherelse
DW12	Corridor >	**D.Living room :14.502**	F. Dining room >	Garden >	Kitchen >	Subject's Bed.>	Second Bed. >	Somewherelse
DW13	Corridor >	**D.Living room :13.631**	F. Dining room >	Kitchen >	Garden >	Subject's Bed. >	Second Bed. >	Somewherelse
DW14	Corridor >	Kitchen >	**D.Living room :7.453**	F. Dining room >	Garden >	Second Bed.>	Somewherelse	Subject's Bed.
DW15	Garden >	Subject's Bed. >	**D.Living room :13.588**	F. Dining room >	F. Living room >	Second Bed.>	Somewherelse >	Kitchen

Total	12/15 High	3/15 Medium

Table 7: Table showing the results from isovist analysis for each space chosen when the subject is very happy.

Isovist Analysis: The characteristics of the specific point that subject chooses in the domestic space when very happy.

Dwelling	Number of spaces with visual access from the specific point that autistic people choose in the house					The spaces are developed perimetrition or axially?		The actual point that autistic people choose in the space			Movement of the subject in the space chosen			The spaces that the subject chooses to focus on more			Isovist Vaue
	2	4	5	6	7	Axially	Perimetrition	Off-centre	Centre	Corner	Stationary	Motion (Linear)	Motion (Circular)	Interior	Exterior	Both	
DW 1				●			●	●				●		●			41.932
DW 2				●			●	●					●			●	54.485
DW 3		●				●		●					●	●			49.993
DW 4		●					●	●			●			●			65.826
DW 5		●				●		●			●			●			49.89
DW6					●		●	●			●			●			48.754
DW7		●					●		●			●		●			72.864
DW 8		●					●	●					●	●			60.816
DW 9		●					●	●			●					●	51.896
DW10			●			●		●			●			●			41.151
DW11		●					●	●			●					●	17.501
DW12	●					●		●			●					●	61.967
DW13		●					●	●			●			●			46.543
DW14				●			●	●			●					●	23.954
DW15			●				●	●				●		●			54.474

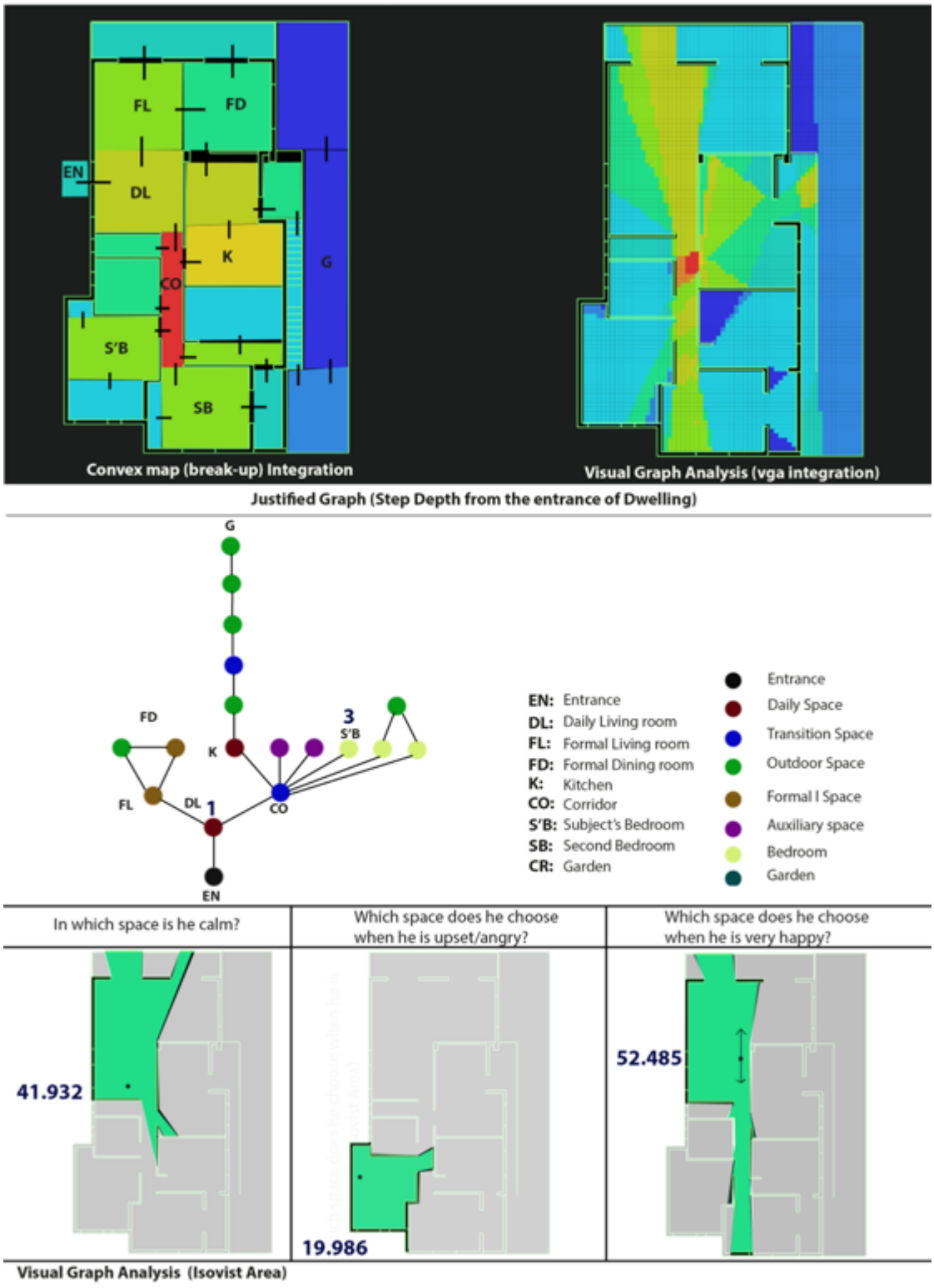

Figure 1: Syntactic Analysis -Dwelling 1(Flat)

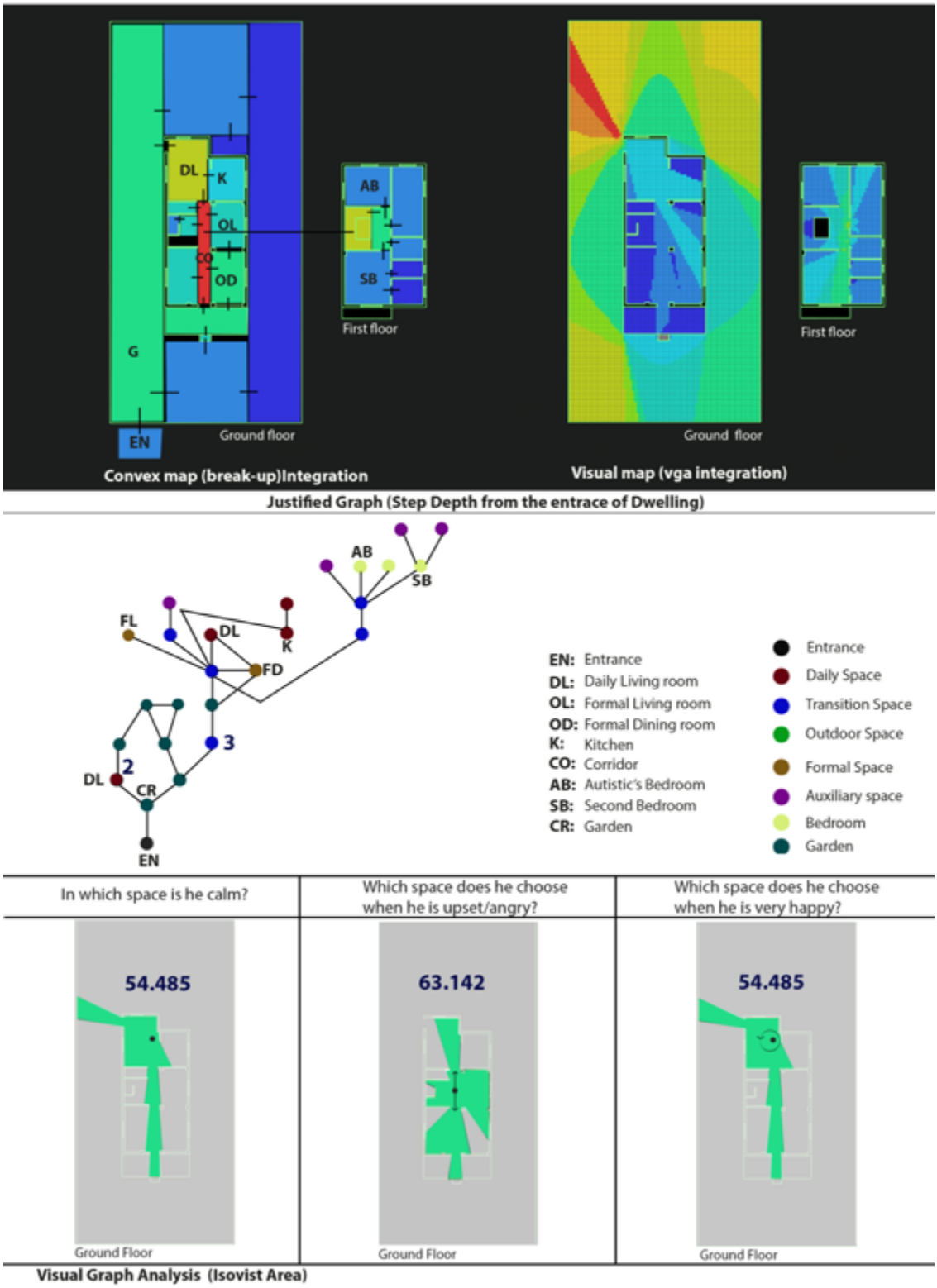

Figure 2: Syntactic Analysis -Dwelling 2(Duplex House)

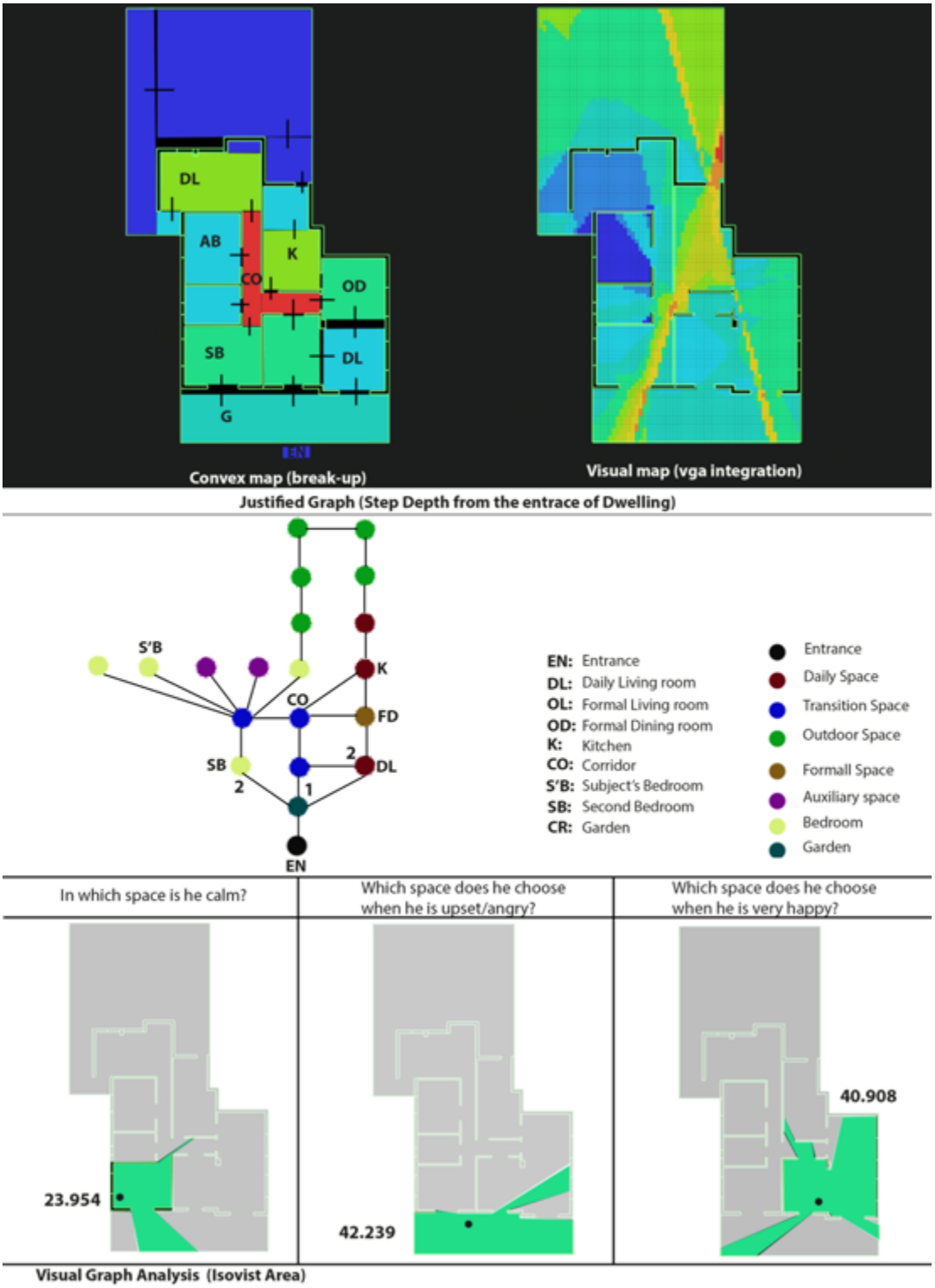

Figure 3: Syntactic Analysis -Dwelling 14(Detached House

4 CONCLUSIONS

Clearly, due to the small sample, any observation can only be tentative until a larger number of subjects is included. What can also be attempted is a fine-tuning of the questionnaires in order to allow for more nuanced information to be collected. A potential weakness of the present attempt to investigate the spatial choices in the home by an autistic person is the focus on the visual, disregarding what impact stimuli from the other senses may have. A more strict critique would also mention that it is only some aspects of the visual that have been looked at leaving out such important ingredients in spatial visual perception as colour or movement or light qualities.

Still, some observations can be made. Perhaps the most general observation when comparing the findings for each of the three moods of the autistic subject is that there are more similarities between the calm and happy moods, especially when compared to the upset mood. When calm or happy rather than upset, the space chosen is more integrated with regard to accessibility as well as visibility and tends to have less depth. What seems to remain unchanged in all three moods is the concentration of the subject in the interior rather than the exterior of the home, that the choice of space is based on the space itself rather than the presence there of a person or an object, and the fact that the subject remains mostly stationary.

In conclusion, it could be said that this first attempt does suggest that space is a parameter that a person with autism manipulates in order to cope with different mood conditions. If that is indeed the case, then the design of his/her environment cannot but play a role in how he/she feels, rendering such research attempts as the one presented here necessary for a better understanding of the relationship between autism and space.

REFERENCES

Benedikt, M. (1979), '*To take hold of space: Isovist and isovist fields'. In : Environment and Planning B*, Vol. 6, p.47-65.

Bafna,S.,Maitra,K.,Lim,Y.,Newmar,E.W, and Shah,M.,(2019),'The home as a therapeutic environment:*Investigating the association between home spatial morphology and the neuropsychological functioning of older adult* ', In: Proccedings of the 12 the International Space Syntax Symposium, Beijing, 8-13 July 2019. at Beijing Jiaotong University.

Choudhary,N.,(2019),' *Architecture for autism: A dissertation project*',National Institute of technology Hamirpur,NIT Harmipur(HP),p.3-41India, May 2019.

Firth,U.,(2003),*'Autism:Explaining the Enigma 2nd Edition'*,Oxford 2003.

Hadjichristos, C. and Kranos, E., (2015), '*Visual layering as a spatial quality in contemporary Cypriot Houses'*, In: Proceedings of the 10th International Space Syntax Symposium,London,13-17 July 2015.

Hadjichristos, C. (2003), 'The Would, the Could, the Should and the Is: *The role of the architect and client in the production of the spatial characteristics of the contemporary Greek-Cypriot House'*, In: Proceedings of the First International Space Syntax Symposium, London.

Hanson, J., (2003), *Decoding homes and houses.* Cambridge:Cambridge University Press.

Hillier, B. and Hanson, J., (1984) '*The social logic of space'*, Cambridge: Press syndicate of the University of Cambridge.

Hillier, B., (2007), 'Space is the machine: *a configurational theory of architecture*, London: Space Syntax 4 Huguenot Place, Heneage Street London E1 5LN United Kingdom.

Humphreys,S.,(1989),'Autism and Architecture',in: The national event for autism(including Asperger syndrome),Part1.at:www.simonhumphreys.co.uk.

Kanner,L.,(1943),*'Autistic Disturbances of affective contact,Pathology*:Nervous child 2(2):2017-230.

Khare,R., and Mullick,A., (2009),'*Incorporating the behavioural dimension in designing inclusive learning environment for autism*',In: International Journal of Architectural Research, Archnet IJAR,V.3, p.45-64 November 2009.

Kinnaer,M.,Baumers,S., and Heylighen,A.,(2015),*'Autism-friendly architecture from the outside in and the inside out: An explorative study based on autobiographies of autistic people'*,Journal of housing and the built environment,p.1-29, 2015.

Mostafa,M., (2014),' *Architecture for Autism: Autism Aspects in school design'*,In:International Journal of Architectural Research, Archnet IJAR V.8, p.143-158 March 2014.

Pomana,A.,(2014),' *Architecture for Autism:Improving designs for autistic integration'*,Graduation Dissertation,Uauim,Bucharest,April 2014.

Pomana,A.,(2017),*' Inclusion and wellbeing for people with autism and the role of built environment*',Epic Series in Education Science,V.1,p.187-195 AUBEA 2017.

Sanchez,A.P,Vazquez,S.F,and Serrano,A.L, (2001),*'Autism and the built environment'*, s19,p.364-378,Spain 2011.Available at www.intechopen.com.

Scott,I.,(2009),*'Designing learning spaces for children on the autism spectrum'*,Good Autism Practice 10(1):p.36-51 August 2009.

Shokrollahi,M. and Salgamcioglu,M.,(2019),'Assessing Autistic cognitive map through syntactic analysis :*Examining the expectations of weak central coherence theory in architectural domain* ' In: Proccedings of the 12 th International Space Syntax Symposium, Beijing, 8-13 July 2019. at Beijing Jiaotong University.

Varoudis, T. (2012), depthmapX-Multi-platform Spatial Network Analyses Software. Available at: https://github.com/varoudis/depthmapX.