

# The Absent Presence of the Spatial Cognition of Cities in Hybrid Space

## Are People Still Aware of their Spatial Surroundings?

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**Abstract**— Despite the critics who argue that Information Communication Technologies (ICTs) will lead to a dramatical effect on cities, a growing body of research elicit empirical data suggests that ICT s can improve people’s awareness and connection to their urban surroundings. Navigation programs when embedded in smart phones and portable devices made wayfinding easier for users, but to what extent such tools will/is affecting peoples’ awareness of their spatial surroundings? Users are now more smarter and more efficient in using navigation programs but is this robotizing them, thus dehumanizing cities? The paper briefly reviews literature on both spatial awareness and location aware technologies. It then investigates the changes resulting from the digital revolution on peoples’ awareness and cognition of their spatial surroundings through an empirical study.

**Index Terms**— Cognitive map, Digital space, Hybrid space, Location Aware Technologies (LAT), Navigation programs, Physical space, Spatial awareness, Spatial surroundings, Wayfinding.

### 1 INTRODUCTION

Once upon a time, in the pre-industrial era, people depended on their urban surroundings as buildings’ types, street numbers, route signs and verbal direction for their wayfinding. Using such tools, people figured their location and destinations through spatial imagery and metaphors [1]. With the emergence of the industrial revolution, end of 17th century beginning of 18th century, reaching faraway destination was achieved by the direct experience of the physical environment with the help of special navigation gadgets (portable compass and cartographic maps). By the end of the twentieth century, and due to the third wave of industrial era generated by Information Technology (IT), people were introduced to the digital space. A new dimension was added to users’ cognitive map through their experience of the digital space via computers. Meyrowitz (1986), claimed that technology has led to placelessness and that the physical and social space is heading to total dissociation, disconnection and even total space separation, while others debated around the Internet’s anti-spatial nature [2], [3]. Later and on the threshold of the twenty first century, a remarkable evolution of technology emerged where Information Communication Technology (ICT) thrived. Further acceleration took place when Global Positioning System (GPS) was released and was allowed to be used for civilian purposes. Navigation gadgets became digital and became embedded in most portable/mobile devices, which affected most, if not all, aspects of life. With the embedment of navigation programs in mobile devices, mapping grew into the center of everyday life. From that moment, physical and digital spaces can no longer be analyzed as independent from each

other. Consequently, the Information Communication Technological (ICT) revolution raised concerns towards people spatial awareness.

### 2 PROBLEM

The significance attached to place identity as the interrelation of cognitive processes, experienced by the use of navigation facilities is the major force driving this research. Most theories of place and wayfinding were formed when the impact of the digital technology was not extensive [4], [5], [6], [7], [8]. Postulating theory in the field have argued that people’s relation with their physical surroundings is affected as they use digital technology to perceive space [9], [10], [11]. The incorporation of ICT into everyday life has raised debates about peoples’ spatial awareness. ICTs are tools that save time and defeat space restraints, [12]. Some critics argued that when users are digitally connected in public, it weakens their connection to the urban space and removes them from the context of public places, which represent a threat to the urban space and might lead to no sense of place [3], [13], [14], [15]. Scholars like Gergen (2002) [16] argued that technology is mentally blocking people from their surroundings, others predicted the “death of cities”, and that, “physical network will be substituted for by cyber/virtual”, and that mobility will be reduced and being online will take over, [17], [18], [19], [20], [21], [22], [23].

The above predictions are counter to the early declaration of

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Webber (1964), who noted that the growth of long-distance-connection is expected to produce a “non-place urban realm” which can improve place-based communities in traditional urban localities and not destroy it [24]. Later, more researchers argue that ICT connects users to their physical environment, and that mobile interfaces in the urban environment offer new ways to consider public space, [25], [26], [27]. Moreover, empirical work proved that interactions between people will be stronger and that the role of cities as centers of various activities will increase [28], [29].

The above debates threw up many essential and interrelating questions which go to the heart of the current arguments about people’s cognition of their spatial awareness in the shadow of the use of location awareness devices.

### 3 AIM

“When spaces are both physical and digital, and when interactions between people are mediated, this does not spell the end of good urban spaces; but it does spell a change” [30]. The paper aims to discourse such change. It aims to explore the impact of technological software on people’s spatial awareness and how people’s cognitive map is affected through the use of location aware technologies. In other words, it will explore what the psychologist Kenneth Gergen (2002) named as “absent presence”, when “one is physically absorbed by a technologically mediated world of elsewhere” [16]. Are spatial surroundings in an absent presence state in people’s cognitive map due to their dependence on navigation programs? Are people becoming more dependent on technology in their orientation in the physical space? And to what extent? Are spatial surroundings becoming of less importance due to the use of digital navigation programs? The answer to the above raised questions will be explored through the study.

## 4 DEFINITIONS AND STIPULATIONS:

### 4.1 Wayfinding, Orientation and Cognitive Map

Wayfinding is a self-motivated process through which people acquire procedural knowledge of the spatial surroundings in its geo-context (maps). Although the act of wayfinding is as old as human behavior, as a term it has been widely used by urban planners and environmental psychologists by the end of the twentieth century [4], [31], [32], [33]. When addressing the importance of a clear wayfinding in the city, Lynch (1960) claims that being lost may disturb “our sense of stability and wellbeing” [4]. So, to prevent spatial confusion and loss of orientation, a clear image of the city should be supported. Orientation is a fundamental function of the body and maintaining an image of one’s environment. It is important to be in direct contact and full awareness of the urban surroundings to restore the visual qualities of cities in the mental image of users. Uncertainty and feeling lost in the physical environment negatively affect both individuals and community.

Focusing on problems of orientation, Lynch (1960) [4] generated the idea of cognitive mapping to produce a relation between formal physical characteristics of cities and problems of wayfinding. He investigated five elements that compose people’s cognitive maps; paths, nodes, landmarks, edges and districts. It is claimed by researchers that the physical elements of the cognitive map addressed by Lynch supports cognition of the image of the city. Following Lynch, many researchers defined cognitive map. Downs and Stea (1977) defined it as “a person organized representation of some part of the spatial environment” [1]. It involves the collecting, organizing, storing and recalling and manipulating of spatial information [1]. According to them, “it is a coping mechanism through which the individual answers two basic questions quickly and efficiently: where certain valued things are, and how to get to where they are from where he is” [1]. Cognitive mental mapping refers to the capability to collect, store, recall, and manipulate information about spatial surroundings [34], [35]. It is defined by Kitchin and Blades (2002), as “an individual’s knowledge of spatial and environmental relations, and the cognitive process associated with the encoding and retrieval of the information from which it is composed”. The latter definition highlights the physical surroundings and ignore related emotions and memories [36].

### 4.2 Cartographic and cognitive maps

Physical objects, such as landmarks and other spatial features, support users through their process of wayfinding and provide them with sense of direction [37]. In addition to spatial features and landmarks, cartographic maps are considered a forefront aid. Cognitive maps differ from cartographic maps, the former is a mental image of the spatial location and its surroundings, while the latter represents a tool which facilitates direction and distance. Cognitive maps are partially subjective when compared to cartographic mapping. They are the mental response of the spatial context. Both aid users to orient themselves and have an approximate idea about the space and place surroundings. In the absence of wayfinding aids, humans must rely on their cognitive map; the mentally stored navigation tool.

The above confirms the strong relation between users and their environments through wayfinding, whether in a habitual trip or in a state of being lost. Through wayfinding, users form their cognitive map to be oriented throughout urban space and equally on such maps as tools users can reach habitual trips, but is this still the same in the digital age?

### 4.3 Global Information Systems (GIS) and Cognitive maps

By the year 1996, mapping and navigation were linked to the Global Information Systems (GIS) and opened the door for fundamental changes within particular aspects of human’s lives. Due to the digitalization of navigation programs in mobile devices, both the concept of location awareness and cogni-

tion of space took a new turn. Mobile navigation services are wide-spreading as they are becoming more convenient, easier, accessible and facilitate useful supplementary location wise information. Today, as people get to depend more on programs as google maps, they may no longer need their cognitive mental maps to gain sense of direction and improve wayfinding abilities.

#### 4.4 Mobile interfaces and Location Aware Technologies (LAT)

With the rise of Internet, the urban life became characterized by blurred lines between the physical and digital spheres. Internet embedded in mobile devices shed new light on existing configurations of public spaces, in terms of geo-location cognition rather than anything else. Location Aware Technologies (LAT) are programs that help users to better orient themselves spatially and find their way, especially when lost. They are defined by De Silva and Frith (2012) as mobile interfaces that allow users to retrieve place-specific digital information and connect to nearby people depending on their location, "they enable people to filter, control and manage their relationships with the spaces and people around them" [26]. Location throughout mobile interface is defined as a set of geographic coordinates used to access data through mobile devices. The introduction and vast adoption of Internet and mobile devices allowed users to be constantly connected to the Internet, using location aware technologies (LAT), while moving through the urban space. The ease of use of some mobile portable technologies, specially cell phones, and their connection to the internet led to a difficulty in addressing the connection/disconnection between physical and digital spaces in terms of cognition of space, location and mental maps. Accordingly, both spaces the physical and digital are layered in a crisscrossed space.

#### 4.5 "Hybrid Space"; a crisscrossed space

The physical and digital space have come to define and layer each other through people's use and participation. Such layering results in a new spatial structure that influences cognition of local urban fabric and the concept of space in urban planning and architecture [3]. Physical space represents the source for digital information in the formation of digital maps, while digital space helps users locate themselves and their destination through LAT. The augmentation of the digital space with the physical space creates a new "hybrid" space [38], [39]. As stated by Silva (2006) [40], the widespread of ubiquitous technologies has empowered the rise of "hybrid spaces" where "users do not perceive physical and digital spaces as separate entities, and do not have the feeling of 'entering' the Internet, or being immersed in digital spaces". Experiencing space through the connection to the internet via mobile technologies resulted the hybrid space. As explained by Frizzera (2015) "Mobile media are [therefore] the lens of our interactions in the hybrid digital-physical space: mapping our location on a mobile app, interacting with other people via social media,

participating in a large community through locative games, and interacting with temporal and spatial narrative" [39].

In their book, "Mobile Interfaces in Public Spaces: Location, Privacy, control and urban sociability", Silva and Frith (2012) described location as an example of a hybrid space where both the physical and the digital construct what the location is [26]. The inter-waviness between the physical space and digital space through wayfinding will be referred to as hybrid space throughout the research. Hybrid space will represent participants' use of the physical space guided by their presence in the digital space; represented by the embedded system where mobile devices represent the bridge between both forms of spaces. Thus, participants are increasingly able to move across the physical space guided by the digital space since they are present in a "hybrid space". The paper will adhere to Kitchin and Blades' (2002) definition where wayfinding is meant to involve interactions between people and their physical space, the psychological and social dimensions of the cognitive map will not be considered, [36].

## 5 METHODOLOGY:

The extent and usage of digital space has grown very rapidly in Egypt in the last years. More than 73% of the internet users are students, which include university students and post graduate students. Mobile internet growth is 25.15% from September 2016 to September 2017, [41]. Mobile Internet subscriptions increased to 32.07 million in April - June 2017, compared to 27.37 million in April - June 2016, representing an annual change rate of 17.16 % [42].

A field questionnaire was carried out involving college students because they are resilient, adaptable, tech smart and thus most likely to use Internet [43]. According to Pew Research Center's Internet/Broadband Fact Sheet (2017), the age group 18-29 was found to have the highest internet usage and smartphone dependency [44]. Students were chosen guided by Piaget's theory of cognitive development, where youth is considered the last stage of human development [45]. Moreover, literature reveals that young people have a significant ability to generate abstract thoughts, and for their high ability to draw conclusions from information, which supports the aim of the research [46].

Participants were recruited from undergraduate architecture students (Term 6) enrolled in Theories 5 course at the Arab Academy for Science, Technology and Maritime Transport (AASTMT), Department of Architecture, Cairo branch, as this course deals with proxemics and cognitive mapping as part of the curricular subject area "Environment and Behavior". A pilot test was performed on few students, who were not part of the sample, and their feedback was merged in the final version of the questionnaire before it was distributed. Questions' design included categorical, scaled and ranked response. The questionnaire was distributed in class and addressed three situations of wayfinding: reaching new destinations, when

lost, and habitual means of wayfinding as addressed by Kitchin and Blades [36].

A total of 52 students (40 males and 12 females) answered the questionnaire. Their age ranged from 18 to 26 years. Students were informed beforehand of the aim of the questionnaire. The questionnaire consisted of three parts; the first part dealt with the demographic characteristics in terms of gender and age, the second included 7 questions addressing the process of wayfinding and the third was to draw the map of the spatial surroundings of their habitual trip, Fig 1. Mental maps have been traditionally used in research to measure the mental images of various types of the environment [4], [47], [48], [49]. As proved by Lynch, most people can draw maps that present their spatial surroundings [4]. The main objective of the study is to analyse the spatial aspects presented in the maps, thus accuracy of the illustrated maps is not significant to the study.

10. When you are lost, you feel more oriented and secured when you
- ask a friend for direction
  - depend on road signage
  - ask people around for direction
  - use navigation programs (e.g. google maps, GPS, ...) in mobile devices
- Other please specify: \_\_\_\_\_
11. Please draw the map of your daily trip (from work/college/ school to your home or vice versa), use the below space

This questionnaire aims to explore to what extent is spatial awareness affected through the use of digital navigation programs imbedded in mobile devices. It is much appreciated if you could answer the following questions

1. Age \_\_\_\_\_
2. Gender \_\_\_\_\_
3. Occupation \_\_\_\_\_
4. To what extent do the physical surroundings grab your attention in your daily trips
 

Not at all	moderately	very much
1	2	3
5. Is there any remarkable buildings/landmarks that you usually notice in your daily trip?
 

Yes	No
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 If the answer is yes, please mention \_\_\_\_\_
6. Do you use navigation programs (e.g. google maps, GPS, ...) in your mobile?
 

Yes	No
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 If the answer is Yes, why do you use it:
  - easier
  - to avoid traffic jams
  - share location with friends
  - more accurate
  - saves time
 Other please specify, \_\_\_\_\_
7. How do you usually know your way to reach new destinations? (you can choose more than one)
  - ask a friend for direction
  - depend on road signage
  - ask people around for direction
  - use navigation programs (e.g. google maps, GPS, ...) in mobile devices
 Other please specify, \_\_\_\_\_
8. Please rank the most used tools of wayfinding where (1 never used 4 mostly used)
  - ask a friend for direction
  - depend on road signage
  - ask people around for direction
  - use navigation programs (e.g. google maps, GPS, ...) in mobile devices
9. Do you lose way frequently?
 

Yes	No
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 If the answer is yes, why? \_\_\_\_\_

Thank you!

Fig. 1. Questionnaire format

## 6 RESULTS AND DISCUSSIONS

The analysis of the 52 collected questionnaire formats revealed that nearly half of the students claimed that they are moderately attracted to their surroundings (52%), very few are weakly attracted (13%) and the rest are strongly attracted. Most of them claimed that they notice remarkable buildings in their habitual trips (83%). All students claimed that there are remarkable buildings that they usually notice in their daily trips.

Moreover, in terms of their usage of LAT, it was found that 88% of the sample use navigation programs for wayfinding and 12% do not use them. Reasons of the use of LAT varied; most students used it to share location, followed by easiness of use, then to avoid traffic jam, save time, then accuracy and least when get lost and looking for new destinations, as other reasons, ranked last, Fig 2. Such outcomes support what Graham claims that ICTs are tools that save time and defeat space restrains [12]. To reach new destinations and when lost, the majority prefer to use navigation programs, ask people, whether friends or strangers, more than depending on road signage shown in fig 3. Accordingly, most students depend on navigation programs more than other means of wayfinding.

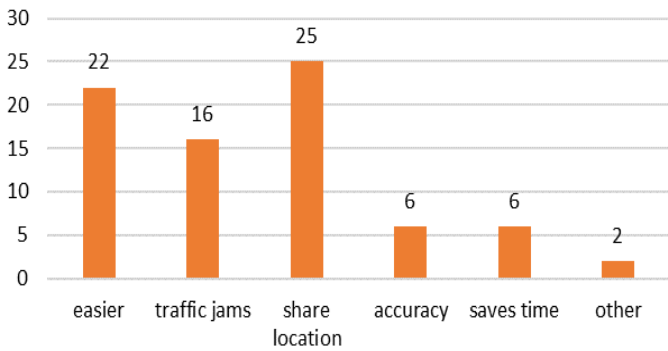


Fig. 2. Reasons of using LAT

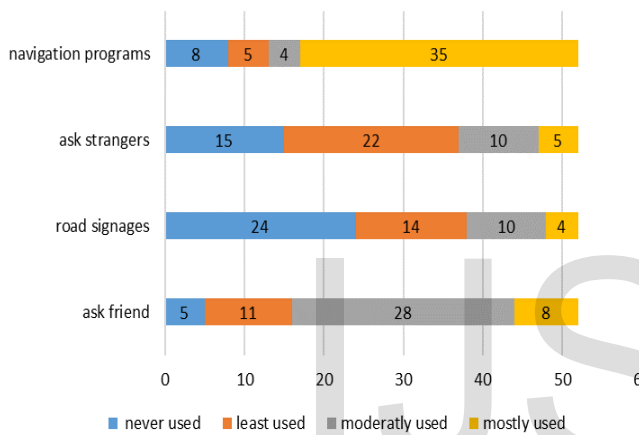


Fig. 3. Preference of used tools for wayfinding

When analyzing the drawn cognitive maps, it has been noticed that out of the 52 students only 41 maps were significant as two did not draw any maps and nine drew lined diagrams with no annotations. All maps showed that streets and landmarks were the most remarkable drawn elements, followed by districts and nodes and very few included edges, which is understandable according to Lynch (1960) and others in the field of perception of space and locations [1], [4], [5], [6], [7], Fig 4.

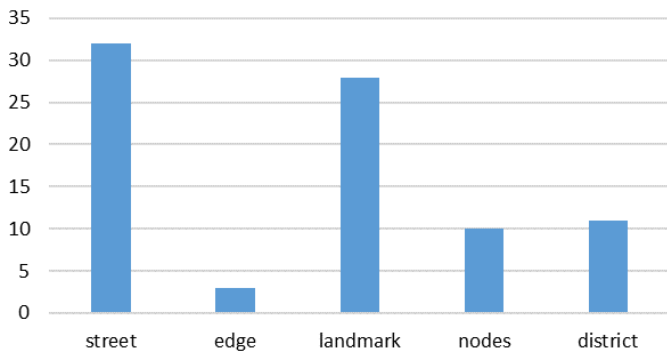


Fig. 4. Illustrated elements of the drawn cognitive maps

The students' sketches were abstracted and varied in style; they used lines, annotations, signs and diagram, which agrees with Down and Stea (1973) statement that; "cognitive maps are complex, highly selective, abstract, generalized representations in various forms" [50, p. 18], Fig 5, 6, 7, 8.

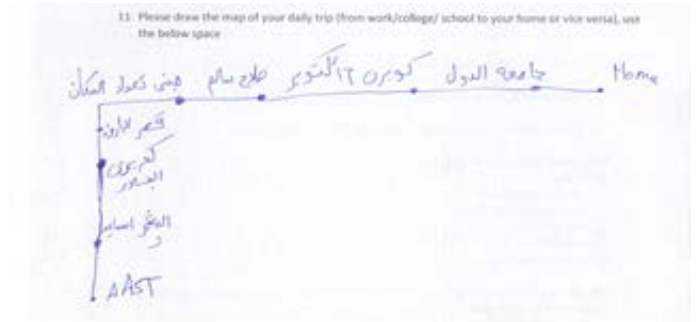


Fig. 5. Cognitive map lines and dots, 'cm#1'.

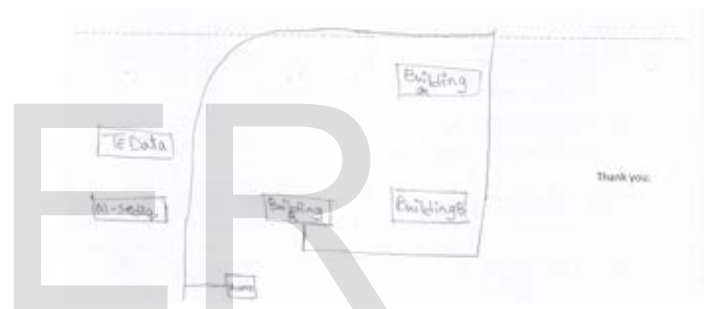


Fig. 6. Cognitive map lines and rectangles (diagrammatic), 'cm#6'.

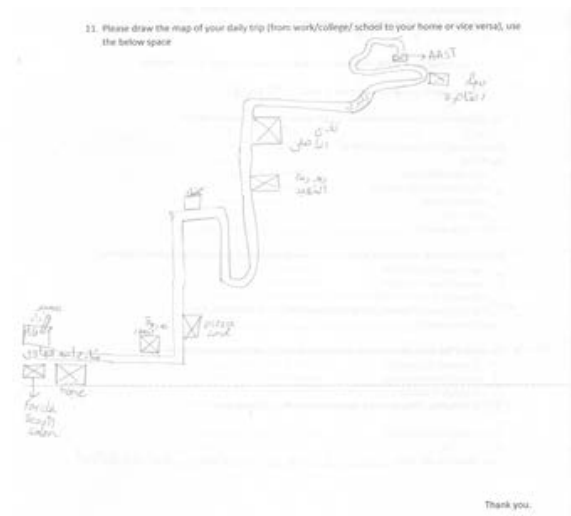


Fig. 7. Cognitive map lines, rectangles, signs and annotations, 'cm#26'.

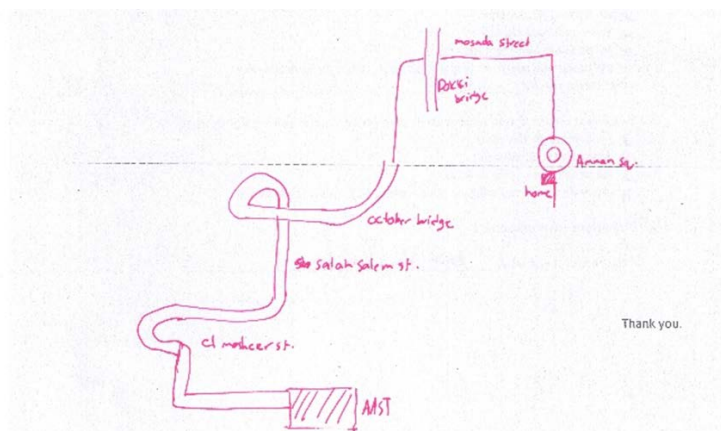


Fig. 8. Cognitive map lines, rectangles, curves, circles and annotations, 'cm#3'.

To know to what extent did the use of navigation programs affected people's awareness of their spatial surroundings, the cognitive maps elements were related to students answers of the questions addressing the navigation tools usage. Two of the eight students who do not use navigation programs did not draw any images, while the rest drew very weak maps in terms of spatial surroundings and detailing, Fig.8, 9. So, it seems that navigation programs are innocent from the accusation that they weaken the connection to the urban space and mentally block people from their surroundings, as confirmed by many researchers in the field, [2], [13], [14], [15], [16]. It also means that mental images and perception, based on individual space experiences and socio-psychological factors, probably still influence today wayfinding experience.

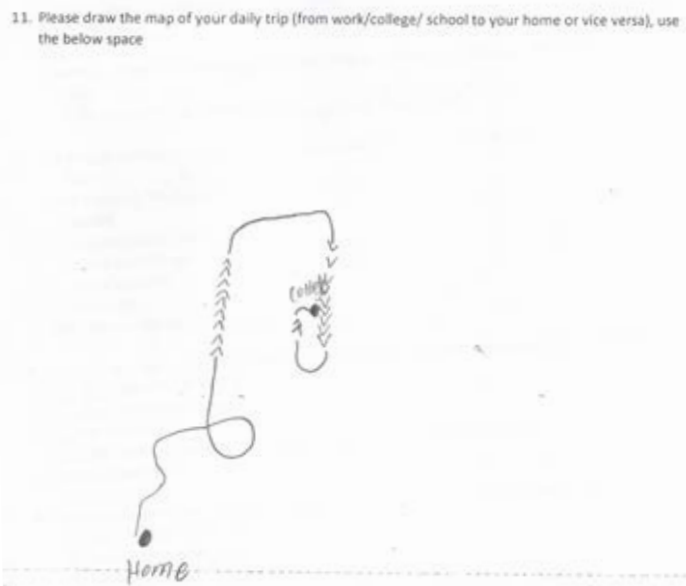


Fig. 9. Cognitive map for one of the students (cm#32) who depend on spatial surroundings and do not use LAT.

## 6 CONCLUSION

Due to the small size of the analyzed sample and the preliminary statistics carried out, no definite conclusion can be deduced, only a tentative one. However, still the study can give a further understanding of how people experience hybrid spaces, how physical and digital spaces have overlapped and how this affect people's awareness of their spatial surroundings. Traditionally people have been used to know their ways through verbal orientation or recalling the physical elements perceived and illustrated in their mental maps. Nowadays, people are becoming more dependent on technology than their cognition of spatial surroundings. When it comes to wayfinding, reasons are more concerned with easiness of use, and to undermined urban constraints. Through such tools, they either need to recall images of the physical surroundings, or to get guided by description of such surroundings.

Because of the limited sample, it can be speculated to claim that the illustrated mental images showed the relationship between the students and cognition of their spatial surroundings. In other words, it cannot be claimed that the weakness of the illustrated elements is due to the use of technology or other reasons, e.g. the weakness of the existence of such elements in the spatial surroundings. Even though the sample showed how people have become more and more dependent on digital devices more than the significance of their spatial surroundings, still navigation programs cannot be held fully responsible for the weakness of people's perception of their physical surroundings. Such findings may provide notations to a wider study. Thus, the absent presence of peoples' perception of their physical surroundings raise a new meaning to the urban form.

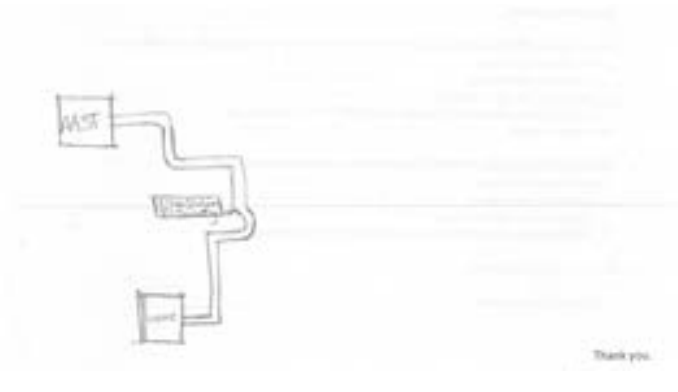


Fig. 8. Cognitive map for one of the students (cm#30) who depend on spatial surroundings and do not use LAT.

Further investigation is required to explore the impact of the growing use of navigation programs on people's awareness of their spatial surroundings. We cannot foresee at this point which scenario is likely to emerge. Will the inexorable integration of technology in the urban life diminish the significance of the use of cognitive maps? Or will people get bored with their experience of the hybrid space and return to seek their physical surroundings, which is less likely to occur? Should urban designers be aware of the progress in digital devices and consider involving people ways of perceiving space in wayfinding while elaborating digital technology and further collaborate it with human perception and community physical geography? In other words, should designers consider "hybrid space" while designing physical spatial aspects? Will the presence of LAT lead to the absence of the representation of the physical surroundings in people's mental image?

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