Paper 141

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TITLE

Ubiquitous Design Studio. Using New Technologies to understand the Contemporary City

ABSTRACT

Over the past 5 years the [Team] team at the University of [Institution] has been experimenting with new ways of teaching the studio practice outdoor with direct learning from the interaction with the build environment and people in the urban context. Preliminary findings have been published in Authors (2018). This paper presents new findings with the case study of New York, where students have been mapping the impact of digital technologies on the use of physical space. Students have been using a series of tracking apps to gather on-site data that have been interpolated with drawing-based models elaborated in class.

The first part of the paper outlines the theoretical framework that underpins these activities, including a brief discussion on key case studies (Lupton 2016). The second part describes the studio activities, highlighting the findings, with the support of a set of maps and digital visualisations. The third part discusses the findings offering a generalisation of the results of this study within the wider context of architectural education. This contribution addresses the conference's themes by reflecting on the importance of on-site mapping, and observational and representational activities with a critical evaluation of the depiction of urban life in the renaissance through life sketching (cf. Zimmerman and Weissman 1989) and their possible connections with today's digital technologies (Carpo 2013) in architectural education. Secondly, everyday routines of urban life are reconsidered as main elements for students to design future cities. In particular, social accounts (Gehl 2004) are included in this study, and the importance of future architects to be well-versed in a variety of disciplinary fields (technological, social, cultural and political). Finally, this paper offers a speculation into future models of learning by looking at how technology offers new venues for students to observe, analyse and understand cities and the people living in it.

DESIGN STUDIO – CURRENT POSITIONS AND PREVIOUS FINDINGS

The notion of built environment is increasingly enriched by new digital technologies that are ubiquitous and invisible. Over the last decades we witnessed the combination of an extensive new telecommunication infrastructure (Graham and Marvin 2002) and the expansion of the number and computational power of the servers that, combined, constitute the Internet. The extent of the built environment is no longer merely confined to what is tangible and physically experienceable. The same notion of space has been gradually enriched by new facets that are characterised by the activities that each of us carries out in the digital environment (among others, Benedickt 1991, Dodge and Kitchin 2003, Lessig 2009). Although during the 1990s and early 2000s, the two ideas of digital and physical have been considered separately, often as a dichotomy, these two notions have gradually converged into one inseparable new understanding of space (Carta 2018). Digital aspects still remain invisible to the naked eye of the person walking on the street. However, their influence on people's public behaviour is increasingly becoming apparent and somehow tangible.

Since the access to the Internet has become widely available, people started using their mobile devices everywhere for recreational, social and work-related purposes. The physical and digital experience in the city has now become seamless, whereby individuals pass from the digital world of social media to the tangible dimension of pavements and steps without even realising it. This phenomenon is more acute in the younger generations (Boyd 2014), yet it is quickly characterising the majority of the urban population around the world.

This aspect is perhaps more clearly visible within the context of smart cities, where the invisible presence of a ubiquitous computational action is considered at the outset, as one of the main design principles, in opposition to the historical city whereby the Internet comes an extra layer of communication on top the configuration of elements that have stratified over centuries. To date, one of the most innovative project of a city configured around the digital side of our lives is probably Alphabets' Sidewalk Toronto. This new town is being designed with the aim of being "the world's first neighbourhood built from the internet up" (Quayside Toronto 2017:15). This advanced version of a smart city is characterised by the omni-presence of connected computers and sensors that regulate any facets of the public space, from accesses to lighting, and continuously monitor, analyse and compute every aspect of the urban life. All these activities are operating in the background. According to the developers of this large-scale project, this allows people to enjoy pollution-free air, an extremely safe environment and a new way of living and interacting without practically any concerns. On the one hand, the prospect of the Internet of Things to easier people's burden of mundane tasks (e.g. buy

grocery or pay electricity bills) appear enticing. On the other hand, in such a scenario the complex relationships that characterise individuals and their built environment would need to be entirely redefined. People would need to establish a new balance between mundane activities, a ubiquitous technology and their experience of the urban life.

The interweaving of physical and digital aspects in the city and the people's activities that are related can be considered as a combination of a top-down approach, like in the extreme case of Sidewalk Toronto, and a bottom-up one, whereby individuals contribute to the digital life of the city by continuously sharing data (images, texts, locations, ideas etc.) and tracking themselves (Mattern 2018).

Architects and urban designers, as well as start-ups and more established companies, are increasingly paying attention to the ways in which our cities and the people living in them are evolving. Companies like the New York-based Numina or Waymo (Mattern 2017) have developed technologies by which we can monitor in real-time how our cities are performing and what happens in them. Projects within well-established architectural practices like KPF-ui (Urban Interface) are investing in the study of "*innovations as urban data collection, scenario analysis and 3D visualization* [that] *allow us to more quickly understand and better design for contemporary cities*" (KPF-ui 2019).

Architectural students of today across the world are in an advantageous place to be able to embrace such rapid changes and new configurations of cities and urban life. Not only do they have all these new technologies and digital tools at hand, but their view on the future of our cities is significantly important, for they will be possibly driving the ways in which the urban life will soon work. As educators, it is our responsibility to provide them with a sound combination of technical as well as critical tools to be able to interpret the facts and qualities of the urban life and design their future configurations. The project which follows is considered an experiment in this direction, whereby our students have actively engaged in a challenging exploration of New York through the combination of physical and digital tools, some of which required dislocation of resources and team work across London and New York, in the continuous bridging of the boundaries between physical and digital.

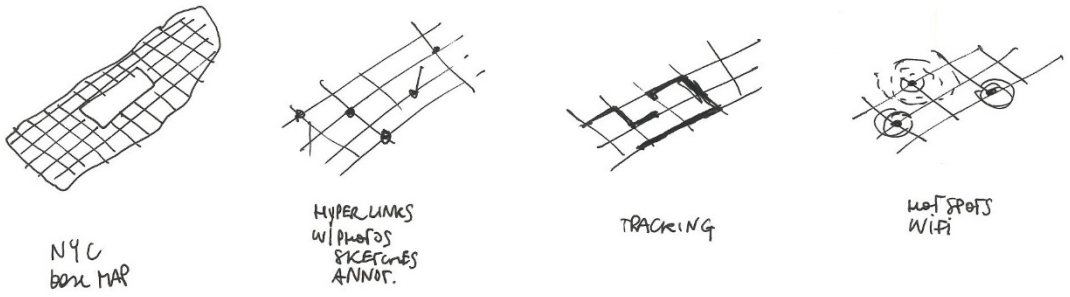

Figure 1 – Layering of the different datasets gathered within eh same map.

MAPPING NEW YORK CITY

Twelve undergraduate students from Architecture and Interior Architecture & Design, spent five days immersed in the culture of one of the USA's most capitative and technological cities: New York. Since 2011, New York has observed a technological revolution and strategically planned and positioned themselves as the "world's premier digital city" (nycroadmap 2011). As such, New York was the ideal location in which to unveil new patterns of use of public space, public behaviour and the presence of digital technologies in the built environment.

Students were separated into four groups: three centred in New York and one located on the University of [Institution]. The on-site mapping project took place over one entire day as each of the three-groups set out from the corner 66th St. and Central Park West anticipating a wide range of distinct typologies – including urban, corporate, commercial, historical and cultural significate areas. Equally, the fourth group – five hours ahead of GMT – awaited live tracking data back in the Design Studio in [Institution's Town].

Prior to the study trip, students attended two preparation meetings where the brief was introduced and discussed, alongside clearly defined goals, objectives and a plan of execution. The objective, as set out in the project brief, required the students to map a series of events to evaluate the impact of digital technologies on the use of physical space. Students were asked to use a series of tracking apps to gather on-site data that were interpolated with drawing-based models elaborated in class. In turn, live data was sent to other students at the University of [Institution] who combined them into a set of interactive digital maps. All four groups, employing different digital mapping techniques were asked to consider following aspects.

OBSERVATION – PHYSICAL (GROUP 1)

Routines of Urban Life: This includes the ways in which people interact with each other and with the built environment, the social interactions of individuals and groups, and people's behaviour in public space in general (with special focus on digital technologies).

Social Segregation and Organisation: Students were to observe the ways in which digital technology can create a separation between groups of people, or in which it can foster the combination of individuals into groups.

Social Interactions. Students mapped how individuals interact both physically and digitally in streets, parks and other public parts of the city.

Use of Physical Space: Students were to describe through diagrams, notes and symbols how people use the public space (e.g. how benches, alleys, gates, parks etc. are utilised).

The group 1 produced the following outputs:

- Photographs (geolocated)
- #mappingNY (shared via geo-location enabled Twitter messages)

OBSERVATION – DIGITAL (GROUP 2)

Tangible Presence of Digital Technologies: Through the use of wi-fi signal scanners, this group searched for any clue that may be leading to the presence of some digital device in a public space, including routers, antennas, signposts, etc. In particular, they focused on the presence and impact of invisible technologies in the urban context. This includes inside shops, cafeterias, lobbies and any type of interior/exterior public space. Examples of technologies scanned have been: Wi-Fi and hot-spots, RFID tags, beacons, tracking technologies, self-tracking, and the use of social media. Group 2 produced the following outputs:

- Photographs (geolocated)
- Map of Wi-Fi and hotspots in NYC annotated on printed map
- Wi-Fi Tracker[1] (Android) and Fing or Network Scanner[2] (iPhone) map of the networks found in NYC
- #mappingNY

[1] https://play.google.com/store/apps/details?id=org.prowl.wifiscanner&hl=en_US
[2] https://itunes.apple.com/gb/app/fing-network-scanner/id430921107?mt=8

TRACKING – DIGITAL (GROUP 3)

Mapping Techniques Digital-Based: Students explored the city and chose one particular site for exploration. Students described the space and locations that they found particularly relevant by tracking their own position with their phone, producing a series of mappings.

Digital process: In order to do this, students installed a tracking app on their phone called mapmytracks, My Tracks or equivalent[3]. They navigated through the areas investigating those parts that they found interesting at that particular time. The app generated a GPX file (or GPS Exchange Format), which is an XML schema designed as a common GPS data format which included location data, elevation, time, routing, and other information. The GPX data have been sent via email to students' laptops and then elaborated with a series of GPX visualisers[4]. Some example is given in Figure 4.

Group 3 produced the following outputs:

- GPX or GPS files
- Tracks saved on phone
- #mappingNY

CREATING MAPS (GROUP 4)

All students in New York used the #mappingNY during their urban explorations. The Group 4 used a block-programming tool (Rhino/Grasshopper/Mosquito) to extract data like geolocation of the #, users, recurrence and other interesting information.[5] The outputs were:

- 3D model of the surveyed are in NYC
- Overall map
- Interactive map
- #mappingNY

[3] Iphone: http://www.mapmytracks.com/blog/category/tips
Android: https://play.google.com/store/apps/details?id=com.google.android.maps.mytracks
https://en.wikipedia.org/wiki/MyTracks
[4] http://www.maplorer.com/view_gpx.html
[5] https://github.com/CenterForSpatialResearch/gis_tutorials/blob/master/13_Downloading_Spatial_Data_In_Grasshopper_Using_Mosquito.md
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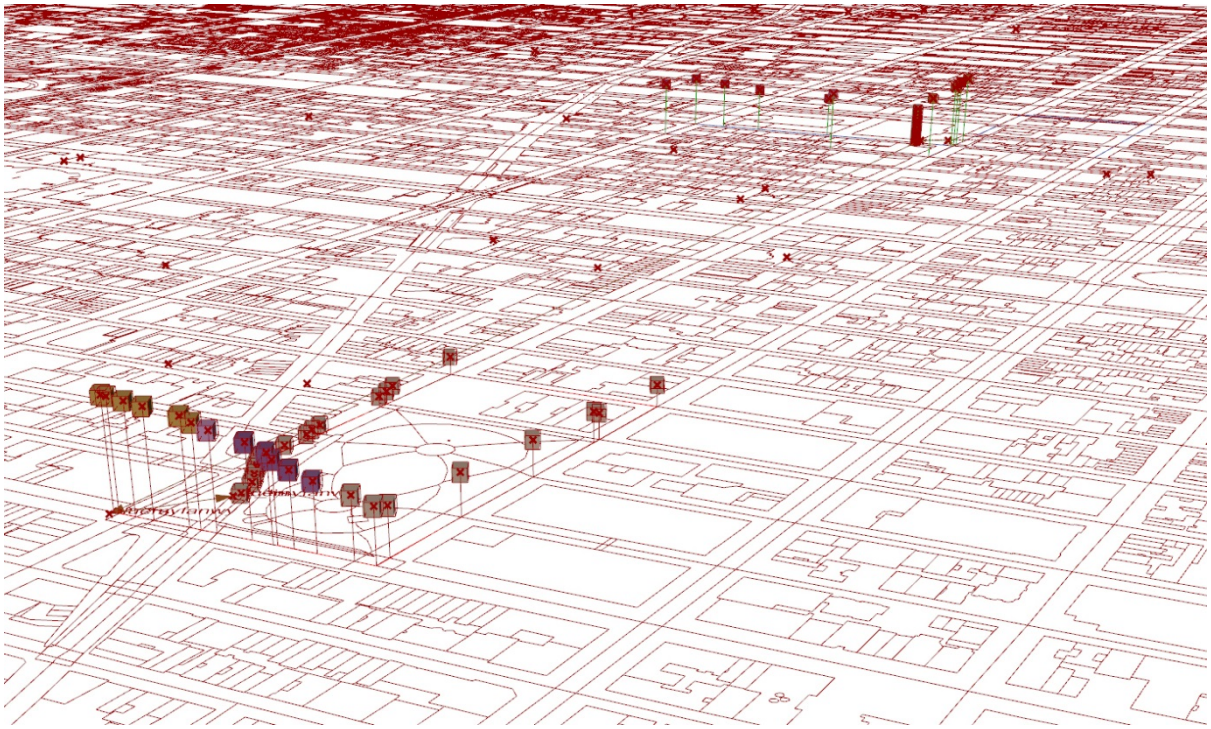

Figure 2 – Tracking of the students in Manhattan from [Institution Town]. The tracking has been done using geo-located tweets tracked with Mosquito, a plug-in for Grasshopper/Rhino developed by Carson Smuts.

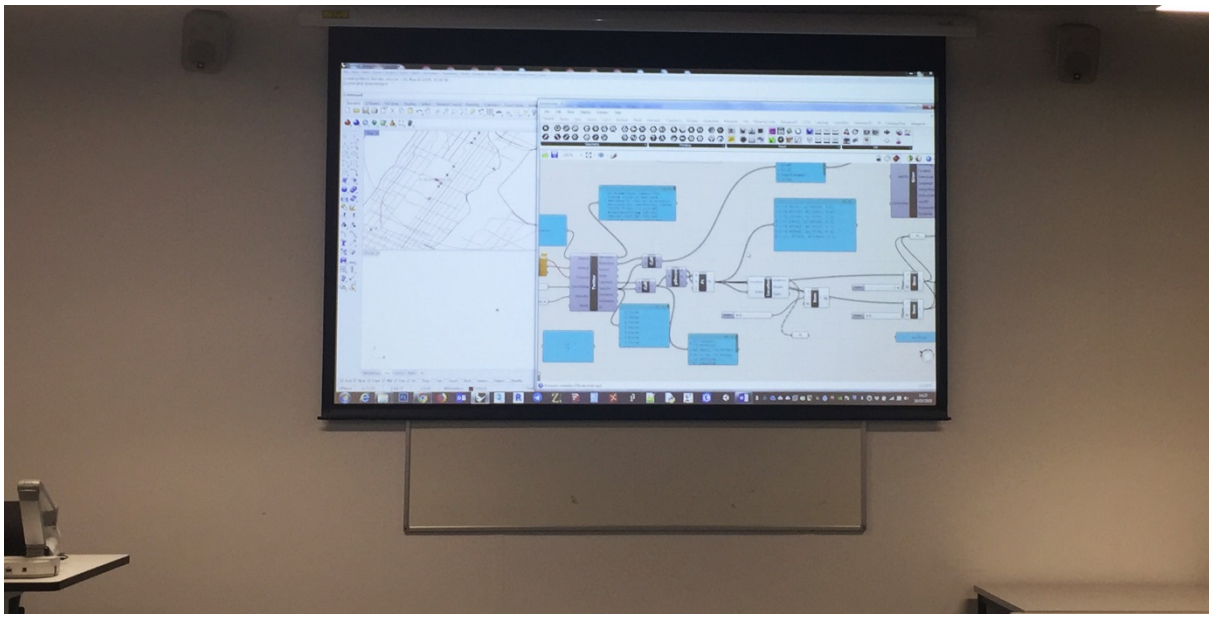

Figure 3 – Tracking of the students in Manhattan from [Institution's Town]. Grasshopper definition used by the students in [Institution's Town] with real-time tracking of colleagues in NY.

Through this interactive workflow, live events where streamed instantaneously through geolocated photographs which, in turn, inferred the exact positions where social interactions took place (via #s). As

Group 4 continued to track the users along their walks through New York, they quickly built a relatively accurate three-dimensional digital site model.

The table below summarises the finding for each group and the overall organisation of tasks in the group observation, tracking and mapping.

	Physical + Digital Observation	Tracking
Urban Lifestyle & Digital Technologies	• Day/night pattern of usage of public space. • Intense people movement in areas adjacent to public transport. • People stayed longer in locations with free Wi-Fi hotspot in public space. • People were drawn to places with visible digital movement such as giant billboards on Time Square. • Gamers who used mobile phones and digital maps to track among landmarks in public space, e.g. Ingress, Pokémon Go, Jurassic World. • On the go entertainment, people continue to listen to radio, music, watch video while walking or travelling.	• Used fastest routes to get from one destination to another. • Used scenic routes to cut through parks, e.g. Central Park to get to destination. • Used mobile apps, e.g. Uber, Google Map to help navigating around the city. • Social network to leave urban footprint, e.g. check in on Facebook, Twitter with location.
Architectural Spaces & Digital Technologies	• Digital advertisement is applied to the skin of buildings. • Conglomeration of digital billboards created a landmark of its own, e.g. Time Square	Digital technologies were used as a storytelling tool to give narratives to important urban place and buildings: • Landmarks were presented to visitors via digital technologies, such as the audio guide on Statue Island and Ellis Island. • Process of construction are digitally re-created and presented in key building, e.g. video showing construction of Empire State building on the ceiling inside the lifts.
Evaluation on Students' Learning Pattern	• Students were able to build a connection between building/ public space and people. • Students were focus more on users rather than architectural design. • Students were able to identify the tangible and intangible layers of information among a city. • Students worked less effective without local collaboration, who have more local knowledge and insights. • Students should start the project before heading out to NY, allowing them to research and do relevant readings.	• Students were more aware of the orientation of buildings, e.g. walking towards the North while tracking with a digital map. • Students learned the relationship between pathways and destinations. •

Table 1. Overview of the 3 contributions from the 3 surveying groups.

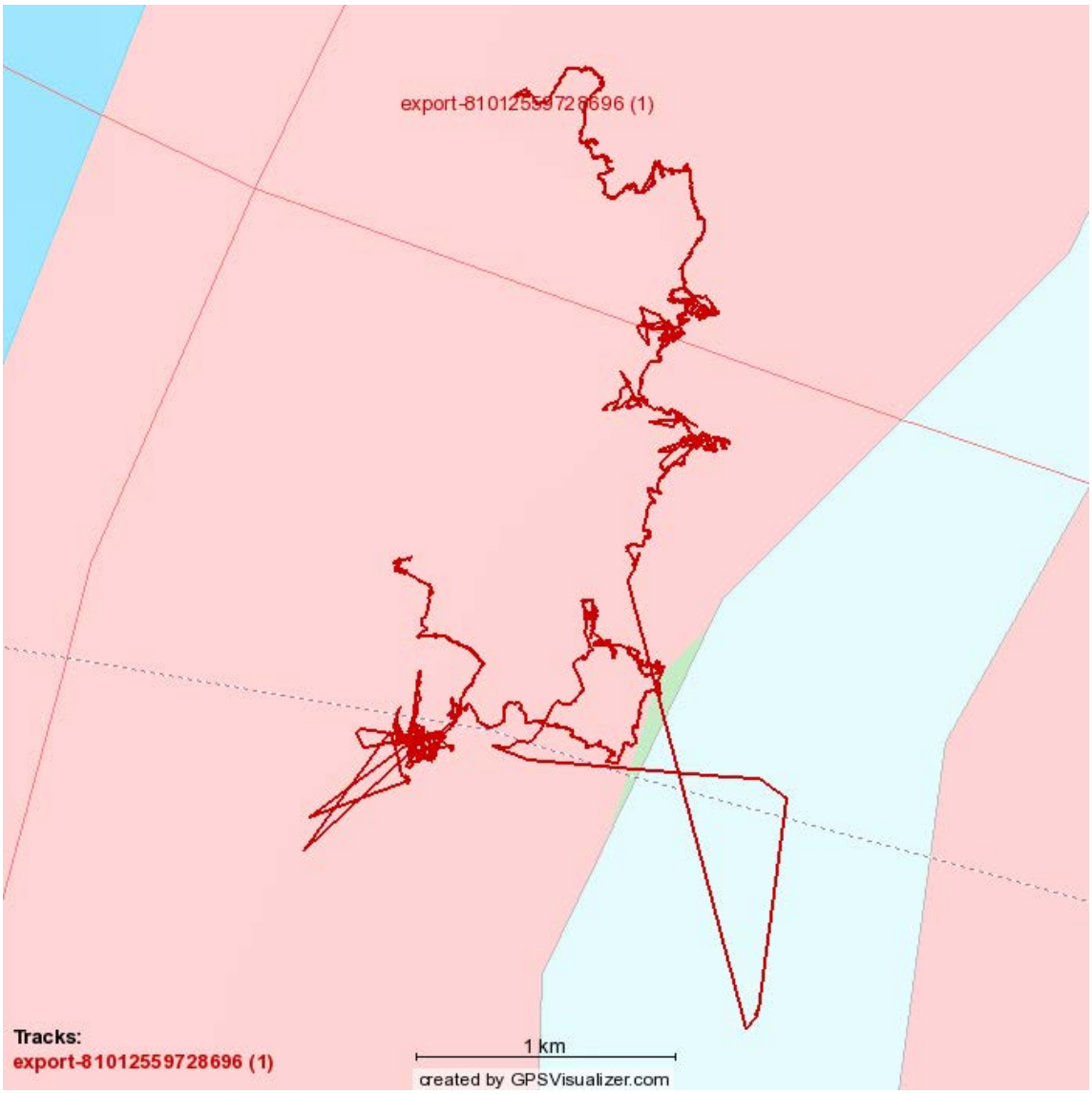

Figure 4 – Tracking of the students in Manhattan using the mobile app: mapmytracks. (Image: I. Owen).

ARCHITECTURAL EDUCATION

The theoretical and technological work that underpins this project stems from previous research developed at the University of [Institution] (Authors 2018). The research explores new ways to deepen and extend the learning by applying Kolb's cycle of experiential learning. This is where a student learns by effectively repeating a learning experience in different ways, and in each 'turn' of the cycle they have reached a deeper level of understanding. Kolb and Kolb explained that "*Effective learning is seen when a person progresses through a cycle of four stages: of (1) having a concrete experience followed by (2) observation of and reflection on that experience which leads to (3) the formation of abstract concepts*

(analysis) and generalizations (conclusions) which are then (4) used to test hypothesis in future situations, resulting in new experiences". (Kolb and Kolb 2005)

In this paper we observed how a live project associated with a study trip can be regarded as a practice where some learning activities are facilitated while other are disadvantaged. This practice can be considered as a circumstance where, on the one hand, the intention of the students is supported by their own emotional involvement and, on the other hand, distractions can play a hindering role contributing to the loss of students' commitment (Barnett 2004).

During the live project, it was noticed by the teaching team that students were quite interested and keen on the digital data collection. For example, the recording of journeys via mobile photographs or videos of the most relevant aspect of the observed streetscape, and the tracking of journeys via apps. It was also noted that during the live process of sharing their observed physical experiences, students appeared to drift consciously from their fellow peers – with long periods of silence and physical inactiveness – whilst they interacted with their friends / strangers across the world. This may be related to the fact that students seem to be quite comfortable in their day-to-day social lives with the use of digital photos and apps to log important facts and notes, record moments and generate data in general terms. This comfort could be considered as a part of an emotional or personal connection to learning.

If the digital data collection was facilitated from the live practice, the critical elaboration of the findings was, in turn, hard to achieve.

One of the tutors felt that having a 'home base' would help the students to focus. Not only would it give a space to prepare, print and work, but it would be a place in which, away from busy streets and shopping distractions, tutors could help to assists and direct students in reflection of their experience and making conclusions before going out to test further while on site.

The application of Kolb's cycle of experiential learning would be appropriate to encourage the collection of data and the following elaboration while on-site. Future participating students could prepare a 'pre-study' exercise in mapping before the trip- (stage 1). They could then go through an observation stage, for example to be asked to critique the work, or peer review and form some conclusions about the work (stages 2/3). To do this, they can then use their mapping conclusions to plan and test their ideas during the study trip (stage 4). As such, they would adopt Kolb and Kolb's theory and repeat the cycle of learning in assembling the collected information back at the University Campus in the UK.

The "pre-study" exercise would facilitate the construction of meaning (Piaget and Vygotsky) and allows students to explore, discuss and meaningfully elaborate concepts around and relationships with the activities they will carry out on the field. This is what Donovan, Bransford, & Pellegrino, (1999) refer as

Authentic Learning. The understanding of the scope, supported by precedents and case studies would offer the opportunity to explore different learning styles and cognitive behaviours, and provide the support the students need when learning something new (Bruner and Haste 2010).

The scheduling of time slots within the study trip for activities that require special attention, such as the elaboration of the finding and focus on the outcomes, would allow to delivery tasks and do not rely upon the natural will of the students.

The comfort and interest in the use of social media could be a powerful tool to encourage and engender what Biggs (2011) defined as Intrinsic Learning. Biggs and Tang (2011:35-37) noted that, in order to make tasks more valuable to students, it is important to motivate them. In their work on Teaching for Quality Learning at University (Biggs and Tang 2011), they elaborated a number of differing categories of importance to students with regards to motivation and interest in academic-related tasks. These categories range from Extrinsic (activities with an external value, such as monetary reward), to Social (e.g. to please family), to Achievement (for example the competition for the highest and best grades) to Intrinsic (strictly related to own interest in a specific subject or area of work). In the Intrinsic learning, students learn because they are interested in the task itself and will pursue a continuous development independently and regardless of the specific academic course on which they are enrolled at a particular time. If the student sees the task as important to them personally, intrinsic interest will be involved. So, the key to this this motivation is to find such meaningful tasks for students (Biggs and Tang 2011:2).

By working with different mapping techniques at the same time, students realised the complexity of urban life and its interaction with the built environment. Amongst other relevant discoveries related to the on-site experience, the notion of dislocation has been particularly explored. On-site and off-site information is usually related to the physical context in which it is experienced. This can be in front of a building or square, or on a website or the pages of a magazine or book. Through this project, students experienced first-hand the fact that information and observations on public life can be captured as a part of their digital context.

As they are datified (converted to digital data by computers and ubiquitous technologies), their content can be extrapolated from their context and be plotted onto a new map in real-time on the screen of the studio; in this case in [Institution's Town]. Real life and real-time mapping techniques with which students are already familiar can be considered a good starting point to spark a wider interest and motivation. Facilitating students' construction of meaning, scaffolding their knowledge, scheduling activities according to different learning attitudes, seem to be key aspects of this practice. Students can use the real-life scenario as a place to learn academic skills. It is the using and capturing their

enthusiasm and connection to the subject to positively move their studies forward – ideally under their own steam intrinsically.

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