Wheeling a Trojan Horse to Teach MLA students Geoinformation methods

Philip Paar and Jörg Rekittke

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1 GIS newbies

The early days of Geographic Information Systems (GIS), the 1960s and 70s, were strongly tied to landscape architecture in both research and education. GIS was largely inspired by MCARG’s (1969) spatial concept in design and manual overlay techniques (SUE 2008). In the academic field, Harvard University Graduate School of Design (GSD) had been a very early innovator in terms of integration of landscape computing, particularly the use of GIS. Their “Laboratory for Computer Graphics and Spatial Analysis” attracted ambitious students, faculty, and other researchers (COPPOCK & RHIND 1991, CHRISMAN 2006). The Lab attracted students, faculty and other researchers including such luminaries as Jack Dangermond, landscape architect, supposable multi billionaire and founder of ESRI.

Meanwhile, GIS are established software tools, well established in the daily work of planners, geographers, engineers and scientists to display and analyse geo-referenced and geo-referenceable data from multiple sources about the health, status, history and future of our environment. Beyond these traditional application areas of geo information science, GIS is ubiquitously used in business, for example in energy sector, financial and telecommunication industry as well as in marketing. Nevertheless, in today’s practice of landscape architecture computer-aided design (CAD) systems, graphics design-based and site-oriented approaches are still prevalent. The use of GIS has not yet gained wide acceptance compared to CAD software. Findings of BUHMANN and WIESEL (2003) show the discrepancy between the adoption of CAD (98%) and GIS (35%) in German landscape architecture firms, even though GIS is catching up (Fig. 1).

Fig. 1: Slow adoption of GIS in German landscape architecture offices (BUHMANN & JÖHNMANN 2000)
Early workstation GIS was too costly and complicated for most of the predominantly small offices. The advent of desktop GIS in the early 1990s made the software more affordable. Spatial concepts in GIS are relevant and compatible to certain design tasks; especially at the landscape level because of the cartographic heritage of GIS (e.g. overlay function) rooted in landscape design SUE (2008). Nevertheless, GIS is still deemed of being very complex and difficult to learn – at least for ‘visual animals’ such as designers. Therefore, e.g. HANNA (1999) and ESRI try to “make GIS more comfortable for reluctant landscape architects”.

Most of our master students of landscape architecture (MLA) in Europe or Asia have already become masters of the Adobe Design Collection, frequently flavoured with remarkable skills in Google SketchUp and professional CAD systems. Designers have recognised the fundamental importance of spatial thinking in their curriculum (DILLION et al. 2003). In some MLA programmes such as in Harvard GSD, GIS is at least used in studio projects for an initial site analyses or as a map-making tool. Often GIS specialists assist the studio coordinator to develop basic datasets for the studios. In other faculties or countries, students may not yet have been ‘GIS-enabled’. These white spots on the GIS map almost remain a niche bastion, even if the license server runs ESRI ArcGIS, unnoticed by the potential users.

Anecdotal evidence suggests that MLA students rather apply 2D and 3D graphics based workflows than GIS enabled ones and prefer photo and video collages for design and design communication. In this way, students might never get to know the advantage of a GIS assisted iterative design-analysis process. What is the issue with this? While CAD, Illustrator, and Photoshop are suitable for design, they are weak on landscape analysis and assessment. In contrast, GIS is strong on handling large spatial datasets and on analysis but traditionally weak on design tools, and photorealistic 3D visualisation (CLASEN & PAAR 2007; FLAXMAN 2010). Robust landscape models and tools need to take into explicit account both geographic location and the passage of time (ERVIN 2006). Non-spatial and non-temporal approaches are of increasingly limited value. “This is true both of scientists’ models and designers’ models” (ibid.).

The authors are teaching master students in landscape architecture at an internationally top-ranked and engineering-oriented university. However, many of these students have, according to their own statements, never touched, sometimes never heard of GIS. This paper deals with teaching strategies directed on the procurement of geospatial thinking to design-oriented students. How can we prepare them to become more ‘GIS savvy’ and overcome perceived flaws? We intend to present findings concerning teaching basic GIS literacy based on a ‘hands-on’ approach at site level (Oct 2009 and 2010) at National University of Singapore (NUS).

2 GIS in Disguise

These days, first semester students enter the university with often remarkable though time-killing digital and social media skills. Cloud computing ‘breeds’ web services such as Facebook or Gmail, where technical details are abstracted from end-users, who no longer have need for expertise with or control over the technology infrastructure that supports them.
However, most of professional planning and design software still runs on ‘old-fashioned’ desktop PCs.

In Architecture / Engineering / Construction (AEC) semantically rich modelling of buildings (BIM) using tools such as Autodesk Revit or Bentley Microstation are fundamentally changing the process of building design and construction. BIM also has changed the way data are organised, described, and stored. However, BIM software ignores the broader (urban landscape) context. ERVIN (2006) looks for ‘Landscape Information Models’ (LIMs) serving the needs of multiple constituencies, analyses and evaluations, based on a single robust model.

Around 2008, the term ‘Geodesign’ was invented to describe the concept of a progressive framework, which “[…] brings geographic analysis into the design process, where initial design sketches are instantly vetted for suitability against a myriad of database layers describing a variety of physical and social factors for the spatial extent of the project. […] GeoDesign lets us design and test various alternatives, helping us make the most educated and informed decisions about the best possible future” (DANGERMOND 2009a). In other words: the creation of planning and design proposals should be coupled with impact simulations informed by geographic context. Geodesign is not a software application; it is rather the notion that computer-aided planning and design processes should be interfaced with impact simulations informed by geographic context. Recently, some research projects in land use and landscape planning have introduced components of a Geodesign framework (FLAXMAN, 2010). ESRI ArcSketch (DANGERMOND 2009b) is worth mentioning, a kind of ad hoc “geo drafting” tool that refreshingly stands out from the complicated and traditionally clumsy user interfaces and user experience of established desktop GIS. In addition, Autodesk’s project Galileo and their Cloud-based tool Green Building Studio fit to the Geodesign framework supporting the early-stage design process.

Since 2010, a module of the MLA programme at NUS is named Geodesign. In the lectures of the module, attention is given to some of the building blocks of Geodesign such as geographic information science, CAD, visualisation, landscape architecture and environmental planning. How can students learn to use spatial data, information sources, and advanced digital tools both effectively and responsibly?

3 Trojan Horse

In the computer domain, Trojan horse is often associated with ‘malware’ computer programmes presented as useful or harmless to induce the user to install and run them. The core of the Trojan horse approach implies that GIS comes packed in a catchy label – Geodesign – and that the question is not CAD versus GIS but learning integrated workflows. Our digital toolbox comprises collaborative fieldwork, web mapping, students’ smartphone devices and mapping Apps, desktop GIS – ‘in small doses’ – as well as 3D software, including popular software applications such as Google Earth and SketchUp.

1 http://en.wikipedia.org/wiki/Geodesign
2 http://labs.autodesk.com/utilities/galileo
3 http://en.wikipedia.org/wiki/Trojan_Horse
MLA Students at NUS had to collect and map data on site, organise spatial information, do some ‘geo drafting’, analysing, visualising, exploration of phenomena and information sharing with others.

3.1 Walk on the Map Site

The private IT equipment pool of young students is impressive. It just has to be applied for the right purpose. In 2010, students were thrown in at the deep end, equipped with some smartphones inclusive free mapping Apps and a few additional GPS devices (Fig. 2).

Fig. 2: Gathering for very first Geodesign encounters after a sunrise breakfast inside West Coast Park (by ALICE FISEROVA Oct 2010)

Fig. 3: Example of a student’s fieldwork and mapping result (by YVONNE TSUI SUEN YUNG Oct 2010)
Instead of a malware, the Trojan horse sneaks in as beneficial and cool freeware: GPS-enabled Apps such as Google Maps, Camera or MotionX GPS lite. The aim was to take georeferenced photos and map footpaths, and solitary trees (incl. plant identification) at West Coast Park, a public park near the NUS campus. Suddenly, the students turned into “volunteer geographers” (GOODCHILD 2007).

3.2 Cool and Analytic Maps

Back at the campus, students got themselves an Open Street Map (OSM) account and uploaded their GPS data or edited existing OSM data. The OSM server takes care on the cartographic representation.

Especially students from developing countries or countries with authoritarian regimes liked to learn about such free geo data sources and mapping tools. The geodata was also loaded to ArcMap to create a geodatabase, cartographic maps, and to learn some basic GIS functions (Fig. 3), e.g. making queries. Some students got more in depth into analytical and 3D GIS (Fig. 5) creating, visualising and exploring models of phenomena and relationships.

Fig. 4: Upload of a newly mapped footpath connection between NUS Kent Ridge campus and West Coast Park in Open Street (osm.org)

4 http://www.openstreetmap.org
3.3 Go 3D but Geo-referenceable

In 2009, the Geodesign module topic was synchronised with the MLA studio theme ‘Urban Jungle Singapore’. Students had to screen grab a Google Earth areal picture, georeference and georectify it using ArcGIS, create a rough mass model from footprints and design step-by-step an interactive 3D park model (Fig. 6 and 7).

Fig. 5: Topographic study of NUS Kent Ridge campus (by YIT CHUAN TAN Oct 2009)

Fig. 6: Step-by-step interactive 3D park design at Orchard Road (by YIT CHUAN TAN Oct 2009)
Fig. 7: Geo-drafted Urban Jungle park at Orchard Road (by SHIJE TAI Oct 2009)

These models were based on a height map, texture maps, Shapefiles and 3D plant models. The 3D model provided real-time navigation and enabled interactive editing of parameters such as sun position, depth of field, water level and adjustment of colours by layer. Interactive 3D visualisation supports greater spatial comprehension by allowing, e.g. students to position themselves within their designs, to view from multiple angles, to zoom into and out of various spatial connections and details, and to see if it is making sense (DANAHY 2001). This approach supports better understanding sites and site designs in broader context.

3.4 Real-time Collage

In 2010, the students applied their fieldwork geodata of West Coast Park to create an interactive 3D model of the park. Additionally, the free NASA SRTM terrain dataset, SketchUp models, 3D trees, Shapefiles, and texture maps were added or generated to the landscape model. The first result was an interactive landscape model based on virtual globe (PAAR & CLASEN 2007). After that the students began to render stills and decided to edit the images in Photoshop, adding people, more plants or different skies. The resulting images apparently do not much differ from outcomes of traditional digital methods in landscape architecture. What is different is the workflow. The additional application of billboards and photomontage might be both a reflex of accustomed 2D Photoshop approach and designers’ fashion (Fig. 8).
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4. Facebookers into Geodesigners

Students should learn how to use geospatial data, data sources, and mainstream and advanced digital tools both effectively and responsibly. Sui (2008) argues that common thread for a new curriculum, which stimulates spatial thinking in both GIS and design will be a renewed emphasis on creativity. Our students’ feedback and results such as OSM inputs and edits gave evidence that the hands-on and workflow-oriented approach helped to clear the hurdle of understanding geoinformation methods. The creation of 3D visualisations – bringing together GIS techniques with advanced real time visualisation – is capable to sweeten students’ commitment to look into the subject – as long as the PC is good enough to handle the 3D landscape models fluently. Advanced digital modelling, GIS analysis, and simulation tools as well as multi-scale and more ecological landscape planning approaches promise to become essential methods in landscape architecture, extending the digital toolbox (Steinitz 2010). The first attempts entering this new territory were successful but didn’t yet make it into students’ day-to-day business in the design studios. In fact, the introduction to digital tools doesn’t automatically lead to a new pictorial language. However, it became apparent that developing and applying concepts of embedding GIS based spatial analysis and interactive 3D visualisation methods into landscape design processes and curricula would still be innovative and consequent. In that case, the Trojan horse approach should already induce understanding of cultural and physical contexts of architecture and landscapes sites at Bachelor level.
The common recording of the private lives of our students – ‘Generation Facebook’ – is latently more location-based and geo-enabled than their conventional digital design methods. Therefore we advocate meeting them at their (geo) level and try to get beyond. They won’t easily mutate into ‘Geodesigners’ and not every graduate student has to become a GIS expert. However, FEE (2011) makes the point, that “Place is critical to any planning and thus whether you are a GeoDesign believer or GeoDesign agnostic […] the concepts of GeoDesign matter even if calling it that makes your skin crawl.”

5 References


