Using parametric methods to understand place in urban design courses

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ABSTRACT  Today, many urban design studios begin with the data collected and analyzed by others and in their abstraction is experientially distant from the place itself. New digital parametric methods of urban design education today support the inclusion of everyday experience of phenomena through 1) the systematic comparison of urban characteristics; 2) the inclusion of experience as phenomena over time and 3) open formulation by each student of urban characteristics. This article describes the methodology of three courses taught in Eugene, Oregon, Barcelona, Spain and Portland, Oregon. Each course integrated urban design principles and table-based geospatial information (GI) computing techniques that included phenomena of place. Unlike GI planning software such as ESRI ArcGIS (1999) and City Engine (2008), the parametric software Rhino Grasshopper, with open plug-ins for CSV tables and OpenStreetMaps (OSM) and custom scripting, allowed students to formulate their own open tools to understand people and place. This codification of time-based phenomena using digital methods today is especially critical for the current generation of urban design students in a world of ever increasing digital connectivity.

Introduction

Traditional urban design studios begin with site visits during which students gather information that is grounded in their own experiences in an intuitive and rarely systematic manner. Fortunately, parametric urban design tools now offer a way to bridge these two realms by (1) drawing upon existing data sets and (2) gathering and analyzing one’s own data both in-situ and off site. New methods of urban design education today focus students’ understanding to the phenomena of a place, as defined as the real-time, everyday experience and behaviors (Norberg-Schulz 1976), rather than directing them to rely on more abstract and fixed geometric modes of research and analysis such as GIS shape files and municipal CAD files. The new use of phenomena is evident in the software tools used by urban design students as well as everyday users of new software and mobile technology to enhance our understanding of everyday phenomena in time and space (McCullough 2013). Examples of this include recommendations to users for selecting driving or bike routes based on live-traffic input (Google Maps) and Twitter ‘Tweets’ of urban events based on live feedback from users. These methods attempt to ‘attach’ (Latour 2008) people to place over time through the inclusion of observable phenomena, and make it possible for urban design students to develop their own open tools to formulate the complex and evolving ways people experience urban space. Static geometry information is no longer the starting point for urban design.

Parametric urban design, similar to parametric architectural design, has moved beyond metaphoric and formal design to become more engaged in the performance or the ‘practical’ (Allen 2005). A generation of students acclimated to a more digitally connected life engage design processes to observe, codify and systematically relate information from qualitative experience to quantitative measurement, and vice versa, both consciously and unconsciously. Apps may be the new sketchbook. Workflows using handheld mobile devices with built in sensors and apps along with open professional parametric design software allow students to creatively formulate their own design methods to understand place, sometimes even in real-time (Nabian 2013). Parametric design, thanks to mobile apps and real-time inclusion, has gone from practical measures to understanding phenomena.
The collapse of computing and traditional techniques to measure observed social and natural phenomena, and subsequently understand place, occurs in two ways: 1) using open interface software Rhino Grasshopper (Rutten 2007) to codify data both off-site and in-situ; and 2) simultaneously integrating analysis and synthesis methods with design output solutions to gain understandings of phenomena over time such as transit, weather or people’s behavior. Perhaps place itself is the combination of temporal phenomena and physical space, best seen in the example of public art work by Ned Kahn or Janet Echelman that make visible natural behaviors of air flow over small undifferentiated movable tiles. The form is not fixed but awaits a measured phenomenon using parametric modeling. Similarly, new urban design methods use parametric design use not fixed formal relationships alone but by the careful inclusion of dynamic phenomena in real-time.

The analysis and design methodology described here does not only inform analytical decision making but identifies urban characteristics that design proposals may support through design strategies including: the use of materials to affect the experience of people, acknowledge environmental forces, the visualization of data in public space, the use over time, and other design strategies. A design student is empowered to use computing power to measure their experience both virtually off-site and first-hand in-situ and synthesize design responses that measure phenomena over time.

Three courses that explored the use of parametric methods and to understand place in urban design pedagogy were taught in Eugene, Oregon, Barcelona, Spain and Portland, Oregon. Each course integrated urban design principles and table-based geospatial information (GI) computing techniques measure phenomena of place. Unlike GI planning software such as ESRI ArcGIS and City Engine, the parametric software Grasshopper, with open plug-ins for CSV tables and OpenStreetMaps OSM (Coast 2004) and custom scripting to allow students to use these methods to create customized urban design approaches for application at the human scale of urban space and time to understand people and place.

In the first course Parametric Places taught (held in spring 2012, 2013 and 2014) students developed design tools using Rhino 3D, Grasshopper and custom scripting to analyze urban characteristics relationships including open space, social housing, social services and historic building protection requirements and other qualitative characteristics in Barcelona’s “22@” information activities district. The second course, part of Life City Adaptation: Barcelona Urban Design summer program, added on-site measurement of urban characteristics at sidewalk parcel street fronts to off-site parametric modeling pedagogy. The third course tested the application of previously developed tools in Portland at the scales of urban public space, building envelope and building space and transformed the use of these tools from analysis to design synthesis.

The Parametric Places course (PP) and Life, City, Adaptation: Barcelona program (lcaBCN) both study Barcelona but the first is taught off-site while the second is taught in-situ. The Portland Measured Attachment (PDX) course used similar in-situ methods as the similar to lcaBCN program but unlike the other two courses was an architectural design studio allowing for both analysis and design synthesis. The pedagogy of each course responds to the contextual problems of each place while addressing urban design principles, parametric design skills and design strategies when time allowed. The student projects in each course balance two needs—the human experience of place and the systematic nature of open formulation in parametric software. The design of these courses and subsequent design of student projects acknowledge both traditional and new digital methods to support people and place over time.

“Parametric Places” (Off-Site Analysis)

This media elective in urban design taught in Eugene, Oregon titled Parametric Places in the spring of 2012, 2013, and 2014, used parametric software Rhino/Grasshopper (GH) and associated plug-ins to study open-ended planning relationships in the “22@” information activities district in Barcelona. Formalized in the year 2000, these guidelines include block-by-block requirements new developments for 10% open space, 10% social housing, 10% social services and requirements to protect buildings of industrial cultural significance. Students consider these and additional urban relationships while off-site in Eugene, Oregon collecting data from documentation provided by the 22@ planning office, online mapping resources and general research of the Poblenou neighborhood, Barcelona and Catalunya.
The course began with teaching and writing exercises in urban design principles as applied to the City of Barcelona in parallel with exercises in parametric software Rhino Grasshopper, transitioned with case studies in urban design and parametric design and culminated with a two-person project to develop an urban analysis tool.

**Barcelona and 22@ Urban Design Background, Weeks 1-2**
- Theory Reading and Writing Assignment
- Eixample Study with unit block tiling exercises in 2D and 3D

**Case Studies in Parametric Urban Design, Weeks 3-5**
- Analog parametric design in Rhino / Illustrator
- Digital parametric design in GH for individual relationships

**Student Projects, in parallel with weekly GH plugin and scripting workshops, Weeks 6-10**
- Background problem and project purpose
- Comparative statistics to Portland, Oregon
- Formulation of urban characteristics to include
- Dataset gathering
- Analog parametric drawings, digital parametric drawings in Rhino Grasshopper
- Urban design strategy and drawings using analysis tool

Students understand a place from an urban design approach and only then consider the use of parametric design to creatively formulate a design solution off-site to a local problem in Barcelona. They use the more open software of Grasshopper vs ESRI’s ArcGIS and new City Engine to formulate comparative ‘definitions’ in Grasshopper. Existing datasets such as land use files and new datasets are combined by each student using online information. Projects are conceived as tools for planners, residents and business owners to affect behavior change of human experience rather than formal design.

In their project for the course “Intergenerational Interaction” students Vincent Mai And Ryan Kiesler addressed the needs of Barcelona’s aging population as caregivers today. In Barcelona, one in every five people is aged 65 or older (compared to half that percentage in Portland, Oregon). One in every four seniors is living alone. One in every four seniors has income lower than 532.51€ / month. (Barcelona 2013-2016). In addition, the current economic crisis has left the elderly as the primary caregivers of the youngest generations. The indicators above have left both demographics vulnerable and defined the problem to augment the quality open spaces for the two to meet. The purpose of this project was to create an analysis and optimization tool to inform the design of intergenerational spaces in 22@ Barcelona, promoting social cohesion and community connectivity.

Note: Percentage of population aged 65+ increased from 14% to 20.5% between 1981 and 2010 (Barcelona 2013-2016).

Applicable urban characteristics are identified and indicators (seen below in parenthesis) are used to measure and formulaically compare them to each other.

a. Seniors Accessibility (senior housing; senior services)
b. Youth Accessibility (kindergarten; elementary schools)
c. Popularity (third spaces)
d. Visibility (visibility of third spaces)
e. Shading (3D geometry and building height)
f. Safety (street traffic)
g. Capacity (size)
h. Feasibility (location of open space)

To gather data base geometry was taken from the 22@ zoning map PDF provided by the City of Barcelona. The primary source of 2D information was Google Map and Satellite. Google Street view was used to confirm street level information and Microsoft Bing Maps were used to supplement locational and descriptive information when views were not available. Google Earth provided 3D building information.

To codify data this project used a method previously developed with another off-site student project City Farm (author SIM, 2013) to assign existing input values such as roof material types and building structural type to building lines and points in Rhino, similar to a method using ESRI ArcGIS shape files often collected my
municipalities for off-site data management of size, tax, owner and other values for properties and infrastructure. The HUMAN plug-in component “ObjectAttribute” was a key software element newly used in this application to read the attributes of layers and names in Rhino as data inputs in Grasshopper, mirroring the ESRI ArcGIS process.

The Grasshopper plug-in Galapagos was then used to compare the existing and the optimal location of open spaces formulated with other urban design characteristics. The analytical Rhino data set to Grasshopper process was reversed using the “AttributeOutput” component in HUMAN to output a custom designed spider chart that comparatively evaluates the eight urban characteristics of each study block.

a. Seniors Accessibility (number and location of senior housing and senior services)
b. Youth Accessibility (number and location of kindergarten and elementary schools)
c. Popularity (number of location of third spaces)
d. Visibility (site line and number of 3rd spaces or streets within 5m of open space)
e. Safety (shaded / shaded + exposed = building height / tan 0 / width of block. 0 is simplified as the 12pm sun angle on June 21st.)
f. Shading (SF 1 = 1 lane of traffic, buffered, wide sidewalk; and SF 8 = 3+ lanes of traffic, unbuffered, narrow sidewalk. Overall safety factor = safety factor / shortest distance. 0.36 = SF 9/25 m)
g. Capacity (Size): Size of open space complies with a minimum of 10% block area requirement; and Size of open space support 35% (youth + elderly percentage) of residents
h. Feasibility: proximity to existing open space (area of proposed open space to existing open space, 0m-160m)

Many of these indicators were measured as distances in meters (a,b,c,d,g and h). Shading, Building Height (e) measured a numerical count and ‘housing’ used the ‘name’ attribute of each building to list the number of stories. ‘Safety, street line with rating’ was measured using the ‘layer’ attribute as numbers 1,2,3 and 4 for the number of traffic lanes, value 7 at the major street Pere IV and value 0.1 at limited access passage streets within example blocks.

Figure 1. Formulation of eight parameters and output.

The output of final spider charts for each block demonstrates the value of systematic codification and formulation of various characteristics to understand a place. The quality of intergenerational space was made measurable with this tool. All measurements were also spatially located. The custom selection of characteristics, the custom formulation and the openness of Grasshopper scripting and plug-ins allowed the two students to creatively explore their understanding of place for the elderly and youth in Barcelona. Such a ‘tool’ or project would otherwise be very difficult to achieve in planning software such as ESRI ArcGIS that do not easily allow open formulation. In this case, off-site experience of the site was very focused via early reading and statistical research, data collection via a
familiar source such as Google Maps and Google Street View and processed in the familiar architectural scale software Rhino/Grasshopper with exploration of various plug-ins and custom scripts.

The student project Intergenerational Interactions is being shared with the City of Barcelona and development will continue with comparison in Portland, Oregon. Future research will investigate the differentiation of districts and neighborhoods within one city, the effectiveness of indicator data and further design synthesis strategies.

Figure 2. Spider charts for each of the nine study blocks.

“Life City Adaptation: Barcelona Urban Design Program” (In-Situ Analysis)

A second course methodology accredited for urban design and media took advantage of its place in Barcelona in the summer of 2013. The Life | City | Adaptation: Barcelona Urban Design Program began in 2010 with the direct collaboration with the “22@ information activities district” planning office. It builds upon traditional pedagogical methods that understood the ‘genus loci’ of the site (Norberg-Schulz) both in its constructed geometry (Burns) and ‘anchoring’ to the environment of the site (Holl) including air and light (Ando) as well as symbols and cultural rituals (Studio Works 4, Miralles). The program has increasingly used digital media to leverage our understanding to sense the city using both visual (Lynch) and non-visual senses (Vitiello Wilcocks) and folding these into digital workflows through data management software, sensors, Arduino and robotic processors available today (Ratti).

The program begins with half-day neighborhood site-visits, meals on-site, and systematic mapping exercises using a unit based parametric approach to diagram urban rooms by hand. This is followed by skill based digital analog and digital parametric techniques off-site on the computer. Later, a series of in-situ site mapping exercises, first by hand and later marked digitally from a My Places Google map, records 108 points across a 3x3 block grid to systematically collect data of urban characteristics on-site. Traces of pre-digital parametric software from the program begun in 2010 are demonstrated today when students do not bring computers to the four-day visit to Granada, Spain. Since 2012, students use Rhino Grasshopper and other mobile app software to record, formulate, analyze and design tools similar to the Parametric Places course described above. Location in-situ in Barcelona versus off-site in Eugene, Oregon allows these observable field measurements. It allows students to experience everyday life, visits to nearby towns for cultural context and the interaction of local experts in planning, robotics, transit, landscape architecture and architecture.

Similar to the Parametric Places course, this program integrates urban design theory and writing with digital media skills education. The difference with this course was the opportunity to teach urban design through on-site visits to neighborhood as defined by four morphological types over the first four weeks of the program. Like Parametric Places the student slowly build up an analysis project but begin earlier in week two of this more compressed
timeline to define that project. An app and urban installation are aspects of this pedagogy not present in the previous course.

- Urban room diagrams: wall, edge and tree / urban furniture; 60 second timed diagrams in series
- Collage diagrams: time, material, vector and real-time database from online sources
- Analog parametric design: Tiling Exercise of Plan Cerda
- Digital parametric design: Grasshopper unit relationships

II. Student Urban Design Projects, Weeks 2-5
- Theory reading and writing assignment of project definition
- Mapping I, BCN: 108 point ‘heat map’ of indicators, table entries with mobile smart phones
- Group project definition
- Mapping II, GRX: Neighborhood diagrams of Albaicin, historic center and other neighborhoods in Granada.
- Mapping III, BCN: Sample block and 3 x 3 and neighborhood
- Infographics: Diagramming Statistics + Comparative Data
- Grasshopper Urban Analysis Tool Definition
- Geomapping: Grasshopper + Elk, alternative to GIS
- Interface Design I: Mobile Application Interface Design
- Interface Design II: Urban Design Intervention in selected open space.

In-situ experience is unique to individual students. It empowers their critical thinking to discover how to abstract and codify information as designers. Open design tools such as Grasshopper plug-ins and scripting offer more specific opportunities for comparative formulation than ESRI ArcGIS planning software. Students systematically codify their experience first-hand and as a class rather than using traditional methods of intuitive interpretations of site. They critically manage data translation into numerical and typological data that may be compared using parametric software. Students live in a place for up to six weeks and visit comparative locations to modestly understand a culture, experience life in a place and then consider how to formulate existing and self-collected datasets.

The sensory experience of sound is combined with other indicators of urban design characteristics to provide a tool for citizens to understand place and sound in real-time in the student project “Interactive Sound Tool” by Pedro Peralta, Eleazar Racoma and Alexandra Lambrechts. The tool measures both quantitative decibel and qualitative types of sound qualities in-situ in Spain such as human sounds, natural sounds and natural sounds. Personas such as young families looking to buy a first apartment, people looking for street activity on a weekend evening or an individual looking for a quiet place to read on a Sunday afternoon might use the tool.

The following initial urban design characteristics were measured and geospatially located using latitude and longitude numbers in CSV tables (codification in parenthesis): zoning use (type), sensitivity to noise (rated 1-5), fenestration operability (open/closed), density of people (count), construction (yes/no), noise source (type) and decibel level (number). A mobile app and urban kiosk were designed as ways to collect live data and for people to interact with this analysis and make informed behavioral decisions.
Zoning Use (particularly measuring residential and ground floor commercial activities)
Noise Source + (type of noise source)
Decibel Level + (measurement of decibels at location and time)
Sound Output (type of sound)
User Persona +
Sensitivity to Noise, rated 1-5 (not used)
Fenestration Operability {Open/Close} (not used)
Density of People (not used)
Construction {Yes/No} (not used)
+ indicates in-situ measurement necessary

Data was gathered with all indicators observed first-hand including verification of zoning use with existing off-site data. Decibel levels were measured with mobile phone app Decibel Ultra (Schafer). Data was recorded and mapped with 108 points over a 3 x 3 grid of Blocks in the Poblenou area of the 22@ district in Barcelona and later comparatively in small placetas in the Albaicin and avenues neighborhood in Granada, Spain. Data mapping was done iteratively over a 24 hours period. Again, the Human plug-in for Rhinoceros Grasshopper was used to visualize data into colors. An important differentiation of data occurred when students realized that sound data was not only quantitative but qualitative. This led to the differentiation of sound in types as human sounds, vehicular sounds, and natural sounds against an abstract scale of human tolerance of sound (Figure X).
Data was codified with sound quality types cataloged and differentiated for use by a 0 to 5 rating system for use as inputs in Rhino Grasshopper using CSV tables with location based latitude and longitude information like ESRI ArcGIS. GI locations were brought to the CSV via custom Google My Map pin, exported as KML and converted to CSV format. The Grasshopper Human plug-in is then used for custom indicator formulation, analysis and visualization of the information using color outputs over neighborhood maps.

This project, like other in-situ projects, benefitted from measuring both observable use of space by people and the physical indicators of these behaviors. A challenge to this observation by students both seen in the first 108 point 3 x 3 test area in Barcelona, the more diverse test areas of various sizes in Granada and in final case study areas in Barcelona, was the interest to measure people’s behaviors directly over time. An observation at any single time, for example, around 4pm in summer months of July or August in these locations, would reveal very little use of public space. Some of these spaces, especially those in the everyday spaces of the city, come to life late at night. Temperatures reaching 45 degrees Celsius could explain this behavior by local residents. This revealed the value to record fixed indicators such as benches, waste or operable windows of more transient behaviors. Observations over time occurred but posed the challenge of other environmental variables being different.

The output for this tool in an interactive visualization (Figure X) of sound quality and type for a given neighborhood and urban room location. The interface would provide a feedback loop with users as a mobile phone app or located at situated technology such as a kiosk. The intermediate step of designing a mobile app interface between time-based design drawings and final urban intervention was particularly facile for this generation of students accustomed to mobile app interfaces through their daily lives.

The question this project raised was whether such a tool without a physical intervention in public space and without a fixed, traditional guide to urban information is urban design. It also suggested that user behavior changed by the tool might also affect the synergies of qualitative and location based information.
The third course titled “Measured Attachment- Big Data Meets Urban Design” was an architectural studio in Portland, Oregon in the winter of 2014, and provided greater opportunity for digital analysis and design synthesis in an integrated workflow where the Rhino Grasshopper software/file as a tool achieves an agency or authorship of its own to be used in various locations over time. Previous digital parametric software such as Maya in the 1990’s were closely related to theories of time and ‘event architecture’ (Tschumi 1996) acknowledged philosophers Jaques Derrida, Theodor Adorno, Paul Virillio and Gilles Deleuze as way to approach site and context in a new way with digital media. Parametric inputs of existing formal site conditions of rivers, streets and topography used Maya MEL scripting to acknowledge place (Schumaker 2008). Later ideas of agents (Allen 1999) and mapping of materials and time (Corner 2004) (McHarg 1969) led to more recent understandings of agency (de Landa 2011) (Latour 2005) of the seamless process of analysis and synthesis of design. This was evident in this project.

The building program called for an approximate 60,000 square foot industrial office or ‘maker’ space and complementary third-spaces for Portland transit agency TriMet’s forthcoming Milwaukie Alignment light-rail corridor. The first part of the studio began with two parallel studies: 1) a traditional site analysis done as a class; and 2) students working in groups of two or three to each identify and measure two indicators of urban design characteristics for a 3 x 3 study area within the project’s Brooklyn neighborhood located between Division Avenue and Powell Boulevard in Southeast Portland. The students then repurposed existing Rhino Grasshopper based ‘tools’ from previous PP and lcaBCN coursework. In a second part of the course students tested the application of these reworked analytical tools for design synthesis with one student each focusing on urban space, the urban envelope and extension into the interior building space. The last third and final part of the term was devoted to design development also using parametric design. Similar to in-situ work in Barcelona, but to a greater extent, the studio worked closely with local stakeholders including the property owner Stacy Witbeck and its development team of urban design consultant John Spencer and DECA Architects, Portland’s Department of Planning and Sustainability and TriMet.

The course approach here took advantage of the case study approach of the Parametric Places course but began from urban analysis tools developed in previous iterations of the courses described here. The development of individual tools was similar especially by week three of this ten-week studio course but by week four of the program students were already deeply investigating the application of these analysis tools as tools for the synthesis of design at the scale of architectural building and urban design spaces rather than the smaller urban installations such as kiosks seen in previous courses.

I. Analysis, repurpose existing PP or lcaBCN tools, Weeks 1-3
   - Problem and Purpose statements
   - Traditional site analysis: city, neighborhood, district plans; 3 x 3 test area plan and 3D model; existing city and academic planning analysis of the site; site material and time maps; transit analysis; district scale physical model
   - Parametric analysis tool using existing tools but reformulated with new urban design characteristic indicators.
II. Application to Design Synthesis, Weeks 4-6
   - Application of analysis tool as tool for design synthesis at three scales of urban space, urban envelope and urban architecture
III. Design Development, Weeks 7-10
   - Parametric design tool at three scales
   - Scaled drawings and 3D modeling
Previous courses described here were either off-site or lacked a significant design component. This architectural studio allowed in-situ data collection, critical design understanding from analysis to design synthesis, and design development. Projects were ultimately self-formulated. Rhino Grasshopper software was used to both analyze and synthesize creative solutions that followed the on-site understanding gained by students in the immediate 3 x 3 test. The design development allowed a simultaneous use of parametric design from input to design output to recreate not immediate formal relationships in traditional design methods but ways to support a qualitative experience from existing urbanism understood by each student on-site.

The two student designers Dan Davis and Ryan Dirks of this project “Intersecting Locality” questioned if the design of the built environment could be linked to its urban conditions based on a heightened understanding of selected experiential qualities. The studio method provided them with a way to sift through the aspects of a building that determine its sense of place and identity, allowing a targeted design response at social intersections on the site. Careful repurposing of existing Rhino Grasshopper tools allowed the observation off-site and the in-site adjacent 3 x
3 study area of seven urban design characteristics listed below. Three characteristics were especially informative on-site for the later project and recorded to a CSV table as follows: numerically counting seating, the depth measurement in feet of space from the sidewalk into storefronts and a 0 to 1 factor that measured the material diversity of façade materials.

*Urban Design Characteristic Parametric Indicators List*

a. Seating + (including accessible interior spaces)
b. Planting
c. Spatial expansion +
d. Material variation +
e. Façade transparency
f. Lighting effects / shadows

+ indicates in-situ measurement necessary

Data was gathered in the test area using observation and ratings based on the codification above. The one exception is material variation, which was defined as the number and percentage variation of materials on the façade (not counting small areas like flashing, coping, etc). Google maps and Google Street View was used before and after in-situ observations to help focus indicator selection and ways to record and confirm the data. Underlying geometry was imported to Rhino Grasshopper via the Elk plugin using crowd-sourced OpenStreetMap (OSM) file downloaded online from openstreetmap.org (Steve Coast 2004).

![Data Analysis: Expansion & Contraction](image1)

![Data Analysis: Façade Transparency](image2)

**Figure 7. Analysis of neighborhood test area elevation indicators.**

Data was codified with image bitmaps used to analyze storefront elevations in the neighborhood test area and to rate patterns of indicators for consideration in the new design proposal. Although some directional inputs were on the new site proper, the analysis was used more for critical design decisions for types of urban experiences including various qualities of spatial expansion in the new site, seating and material use. The exploration of ‘third spaces,’ defined as places for people to meet in public space demonstrated a difference in United States conception of public meeting space versus ideas for meeting space in Europe via the original repurposed tool’s use in Barcelona.
This project revealed the usefulness of these open methods to measure unique qualities and translate to output of various landscape urbanism and architectural scales. These parameters are not available in ESRI ArcGIS software nor easily found in existing database files by municipal or private sources. As seen in the other in-situ project in Barcelona the use of table based CSV files of point locations in occupiable sidewalk right-of-ways were preferred to object attribute assigned values from the Parametric Places projects including INTERgenerational INTERactions.
Conclusion

Place and time are important aspects of phenomena that may be included in urban design education with the use of new digital methods. The careful work comes in systematizing quality. New methods of urban design education today support the measurement of of everyday phenomena through: 1) systematic comparison of urban qualities; 2) the measurement of phenomena as experienced by students over time and 3) open formulation of urban characteristics by each student using digital methods. The three courses described here use off-site and in-situ learning to test these ideas. The codification of time-based phenomena using digital methods today is critical for a generation of students in a world of ever increasing digital connectivity.

GIS planning software first seen in geography and planning education courses taught by Edward Horwood at Northwest University in 1963 and Howard Fisher at Harvard (Chrisman, 2006) did not initially achieve these three goals. The software initiated a shift in pedagogy and practice from geometry-based CAD files to ESRI ‘shape files,’ geospatially relating non-spatial information in table-based format including latitude and longitude with zoning use, number of stories, tax records and other parametric values. Recent ArcGIS work at the Spatial Information Systems Lab and GSAPP by Laura Kurgan has advanced the emergence of table-based understanding and was disseminated through previous lab assistant Brian Brush and later as a Graduate Teaching Assistant and PhD student contributing to table-based understanding in ESRI ArcGIS in the architectural studio Public Use of Private Space set in and visited Detroit, Michigan but taught in Eugene, Oregon.

Systematic Abstraction of Information

The traditional use of existing ESRI ArcGIS planning data in urban design removes students from their individual approach to abstract the phenomena they experienced with a comparative language of design. While the codification of qualitative experience into quantitative measures and types is a careful one to maintain limit subjectivity, it also generates a important individualistic understanding of design formulation in urban design by each student. Examples of GI tools that assisted in the objective codification of urban information include the software Space Syntax by Bill Hillier (1980) and the subsequent criticism of its consistency by Carlo Ratti (2004) at once points out the value of a broad system of comparative data and the danger to flatten individual understanding by codifying urban design analysis and design synthesis.

Courses taught off-site, for example the Parametric Places course, used Rhino Grasshopper plug-ins HUMAN to assign comparative attributes and Galapagos to generate new locational compositions and offer students creative and critical ways to assess design. In general students connect geospatial information with codified qualitative information. Errors in translation and cultural understanding occur. An example of this was the project “Intergenerational Interaction” pursued off-site in Eugene focusing on Barcelona. Student authors misunderstood Catalan “escola bessol” and “guardarias” with USA kindergartens rather than earlier pre-school and daycare. Still, the students with off-site projects were able to devote more effort to designing and successfully exploring data formulation and parametric computation than in-situ students.

On the other hand, projects conducted on-site used Rhino Grasshopper but with a CSV workflow with latitude and longitude based qualities to sense sound, smell, feeling and taste to complement existing GI data such as tax information, lot size, last sale, address of current owner, zoning use, etc. The on-site project “Interactive Sound” for example related decibel levels, noise source, sound type and user persona with existing residential zoning use and ground floor use first observed in person and confined with Google Street View. As seen with this last urban design characteristic, the patterns of on-site methodology are blurred with both in-situ observation and online confirmation.

Inclusion of Experience Over Time

The projects presented in this article were intended to interject the experience of student site visits, both virtual and physical, in the use of parametric design to understand place. Off-site projects in Eugene, Oregon demonstrated an extraordinary creativity to experience the site virtually from 5,637 miles away beginning with existing data, the exploration of possible new data and the formulation of integrated analytical and design synthesis tools (de Landa 2011). The current generations of students understand how to ‘attachment’ their projects to place despite great distances (Latour 2008, Seamon 2011). In fact, the use of datasets generated from real-time information sources such as Google, Bing and the City of Barcelona suggests that students are quite comfortable today to design not singularity of design for their project but allow the agency of the information and tool itself connect their projects to place over time.
On the other hand projects, executed in-situ in Barcelona and Portland measured a smaller scale of effective phenomena gathered at the human scale in person, such as spatial extension measured in Portland and sounds recorded and categorized in Barcelona and Granada, Spain. This acknowledgement of human scale in-situ often resulted in the identification and measurement of urban characteristics and design solutions deeply grounded in the students’ experience of place, and the project’s connection to its environment, than formal design (Franck 2007). The project “Intersection Locality in Portland” demonstrated this by investigating the qualities of space, seating, material diversity and shading not immediately adjacent to the site but that define the identity and sensory experience of the neighborhood.

Open Urban Characteristic Formulation by Each Student

The third emergent point from these three projects and the pedagogical methodology is the power of open formulation of urban characteristics to measure place. Traditional zoning and planning data found in municipal CAD, shape files and pdf’s do not unlock the creative minds of students. Traditional methods often assume impersonal ways to understand place that are not necessarily connected to the individual constructed experience of each student (Wiggins 1998). Traditional software limits the ways in which urban characteristics maybe compares. The new methods to formulate unique tools for formulate selected urban relationships using Rhino Grasshopper suggest a different approach to site analysis that provides a greater richness of data to methodologically include the experience of a place in urban design projects more than traditional GIS planning approaches.

The value of open software will play an important role in the emerging trends of media methods in urban design pedagogy. Social media critic Evgeny Morozov ‘solutionism’ (2013) reminds us to question data, “Recasting all complex social situations either as neat problems with definite, computable solutions or as transparent and self-evident processes that can be easily optimized--if only the right algorithms are in place!” Morozov is a proponent of open software that empowers the everyday users instead of concealing these algorithms in the hands of large corporate and government interests seen with closed proprietary software.

While the interests of the methods described in this paper are more educational than political, Morozov’s ideas and the methods presented here demonstrate a need to embrace multi-modal approaches that are engage our first-hand experience. Student work in urban design today needs to integrate traditional urban design approaches with parametric software and everyday mobile computing devices such as smartphone apps and sensors. Such a method allows students to connect their everyday digital world with established and emerging urban design practices. The ways to measure observable experiences are different to day than in the past in the way they empower students to personally codified and creatively explore design solutions for people in places over time.

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