

# **[De] Coding Architecture**

Open source methods of spatial simulation

## **Training Report**

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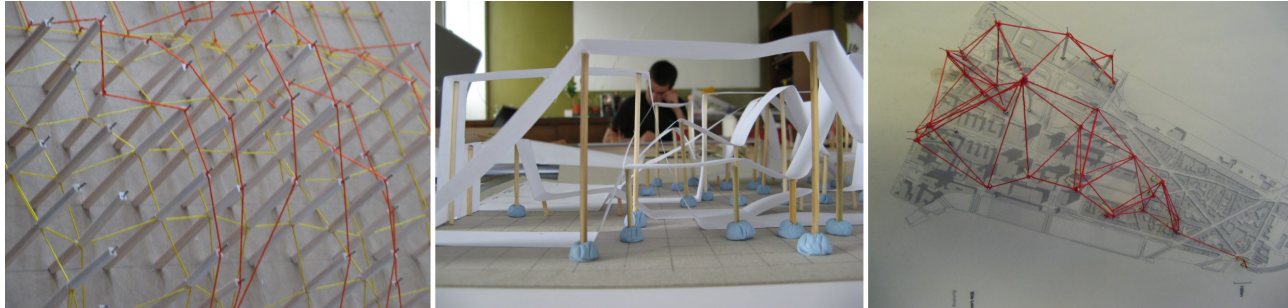
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# 1. Conference presentations

AHRA PhD symposium, Lund Sweden – May 2013

Title: TACTILE PROGRAMMING: 'Material Computing' For Architectural Design



## Abstract

Architects are typically consumers of software as products, rather than users of software as technology and the relationship between computers and architecture can often be fractious - viewed with either complete suspicion or total devotion. In either case the role of the computer is often seen in the same way - to supplement a pre-existing design process rather than to fundamentally change it .

This paper investigates how critical approaches to computational methods can inform a practice of architecture that is defined by computational methods, rather than simply composed of computational tools. To that end, this paper proposes a specific method for data modelling that replaces the computer [and its software] with a physical modelling technique. This method has been developed during a series of generative and parametric workshops, entitled “Digital Design Tactics” with students of the School of Architecture at the University of Sheffield .

Central to these workshops were two ideas - the basic of a computer algorithm understood through the syntax of a programming language - 'loops'...'ifs'...'ands'...'ors' – as well as the use of simulation to explore emergent conditions. These are then re-conceptualized as physical, almost 'mechanical' processes that can be recreated through making physical models. The models created by students were based on data collected for their projects could be spatial or abstract, at the scale of the city or a the site, but were always relational. The models were used to develop strategies within complex projects that combined multiple scales, actors and changing over significant periods of time. The models became a kind of manifold for the discovery of the projects possibilities that may not otherwise have been visible.

As well as playing with the tradition of architectural model making, this is a kind of tactile programming, where the syntax and semantics are replaced with physical operations, and represents both the software and hardware of the conventional computing paradigm. Within this method, there is no longer a computer and user. The conventional notion of interface is outdated.

This proposal of material computing offers a means of democratising technology and provides a pedagogical frameworks for teaching a critical approach to such technology. The use of computers is often restricted due to the high entry requirements in terms of cost and specialist skill. By reconfiguring what software and hardware represents, the 'user/ designer' of this new form of computer, no longer constrained, is able to create, maintain and modify their own 'machine'. This is also then a means of technological resilience – the purpose, portability and functionality of this method are determined by the user and not other forces [i.e. software designers or hardware manufacturers] and the 'science' of computational technology can be appropriated separately from its physical manifestation.

*Reflections*

This presentation was a reflection on a series of workshops that I have undertaken with Masters students at SSoA over the course of a number of years. It was an attempt to evaluate the workshop, both the brief itself and the work that the students produced, within the context of my current research. The symposium was also the first presentation that I made of any of my PhD work.

The conference was for PhD candidates only and there was a wide range of topics. However, it was clear that I was the only one presenting work in the field of computational design and there was also clear hostility amongst the audience to the idea of addressing computer as method rather than tool. This made the presentation difficult and limited the feedback that I received. For example, the first question I was asked was;

*“Where do you see role of the pen in all of this? “*

The symposium gave me an early opportunity to test the structure and approach I am adopting for my current research against some previous work and it was a very useful experience to present to a 'non-expert' audience.

## Pedagogy meets BIM and Big Data, The Bartlett UCL, London UK – July 2013

Title: Branch, Merge, Commit New forms of Open Source for Designing With BIM

### Abstract

*This paper proposes a new method of designing with BIM technology firstly with the application of two contemporary methods of computing – open source and object orientated - and secondly the adoption of the versioning software platform 'GitHub' as a means of harnessing them and to encourage wider participation in the processes of designing with BIM.*

*BIM software represents a significant move from the traditional skeuomorphic paradigm of CAD as drawing board to something new, that is in and of itself. Whilst this offers the designer huge potential, it also presents a difficulty. BIM software requires alternate, and unfamiliar, design processes and work flows – collaborative, concurrent, continuous.*

*I propose to re-configure two existing methods of computing; open source (from software design) and object- orientated (from approaches to programming and code).*

*Open source is traditionally understood as the release of the source code for computer programmes. Typically, however the environment of open software is one where the users and developers are basically the same and in which the 'extended negotiation' between user and programmer becomes a closed loop. This is analogous to existing BIM working practices – closed loops of expert users. In the method proposed here, the loop must be prised open, to allow access and contribution to a wider range of participants. In programming terms, an object orientated approach is one whereby elements of the code are organised in such a way that they may be more easily understood and edited as well as quickly reused and re-structured – they are assembled components in the same way that BIM can be described as a technology of 'assembled objects'.*

*By viewing BIM design methods as component assemblies, and then opening access to both the components and the rules of assembly, BIM practitioners have the possibility to create new methods of designing with BIM, through wider participation in the processes associated with it.*

### Reflections

I gave this presentation at what was supposed to be a conference about BIM and education. I have significant practice experience in the use of BIM and I am familiar with many of the issues around its use. I attempted to 'merge' this with my research interest in open source methods.

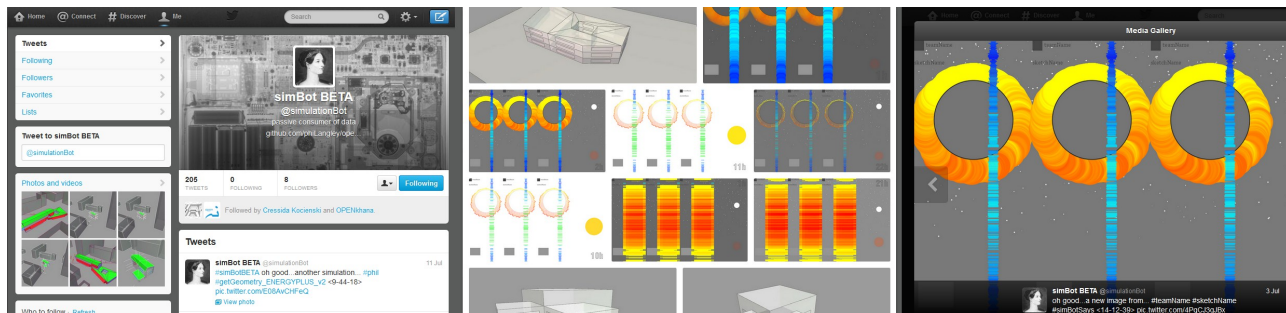
The conference itself, however, was not really about BIM and Pedagogy and was instead was a reflection of how much the discussion around BIM has been taken over by commercial industry. One of the keynote speakers was Phil Bernstein, Vice-President of Autodesk AEC Solutions and his presentation amounted to little more than a sales pitch for his companies software tools.

My presentation was a speculative proposal for the use of contemporary versioning software to develop wider models of involvement for BIM through open source. In the context of the conference, a discussion around methods of open source was not particularly welcomed. However, some weeks later I received an email message of encouragement from Bob McNeel (CEO of McNeel Associates who make the Rhino 3D modelling package) who had viewed my presentation online. He at least was supportive of attempts to 'open source' the tools 3D design (although he does run a commercial software company.)

The conference and presentation was again formative in developing my presentation techniques and experience, but was also another example of importance of finding the right audience to present to in the first place.

### 3. Teaching, hacking and prototyping

@simulationBot – prototype for hacking design simulations



#### Summary

*This project attempts a critical engagement with techniques of spatial simulation in architectural design. A 'bot' is proposed that can collate, filter, interpret and re-present live design work. The prototype version of the @simulationBot is a twitter creature - it is fed with images automatically generated from developing architectural projects, designed using open source software. It then interprets the performance of these designs in the form of abstract graphs at different scales and granularity. In this first iteration, the @simulationBot is 'feeds' on the vast amount of performance data that is generated from the designing using environmental design software.*

*The @simulationBot is built using Processing and the twitter4j library.*

*The @simulationBot prototype was tested at The Environmental Simulation Workshop, School of Architecture, University of Sheffield, July 2013 organised by Mark Meagher and Julien Nembrini.*

#### Description

The @simulationBot is a prototype for the 'research by hacking' case studies that I intend to carry out as part of my future research. It uses twitter to create a 'live data feed' of iterative design processes as well as acting as a 'companion app' to view and interpret this feed.

This version of the @simulationBot is designed to sit within existing modes of design, iteration, simulation and evaluation rather than replacing them and acts as a 'bolt-on' to a pre-conceived simulation workshop.

The work flow of the workshop was as follows;

- Create simple models of design problem using Sketch Up
- Import the model into Processing, using Anar+ library
- Apply parametric controls with a Processing code
- Run energy simulations directly from Processing using Energy Plus
- Evaluate results and modify design accordingly

For the prototype @simulationBot I created the following tools to hack this work flow;

- A custom Sketch Up plugin using rubyscript to export simple models to .obj file format. The exported files included geometry as well materials and topological data suitable for use in environmental simulation software.
- Code templates for Processing that would automatically send tweets of the students design data and images when they ran a simulation.
- simBot, written using Processing, that 'picked up' and re-interpreted the data of each student's design

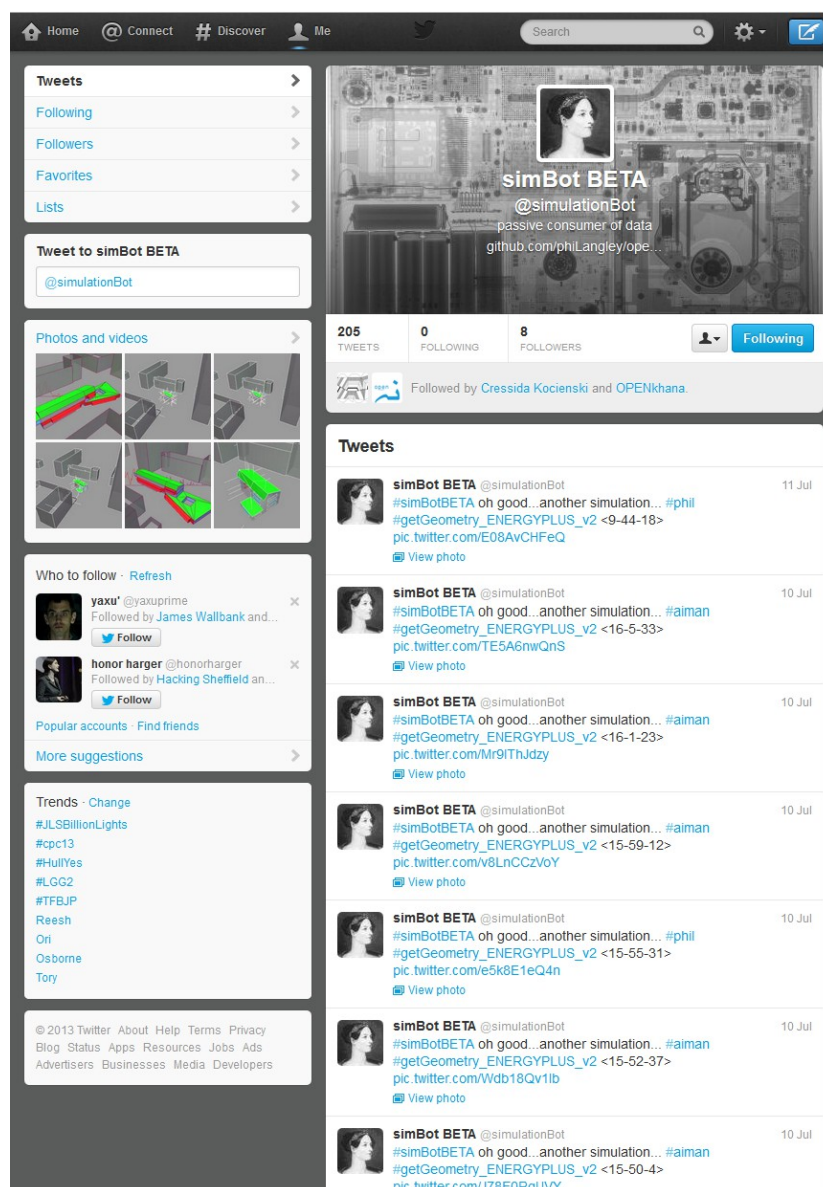
The code embedded in the processing sketches tweeted an image of the design at the time of the

simulation, as well as a series of 'hash tags' that the @simulationBot could use to identify the designer as well as locate the performance data that was produced and shared using a *Dropbox* folder.

The 'live feed' that the @simulationBot created was projected on the walls during the workshop for the participants to follow (the feed is also still viewable via twitter).

### Reflections

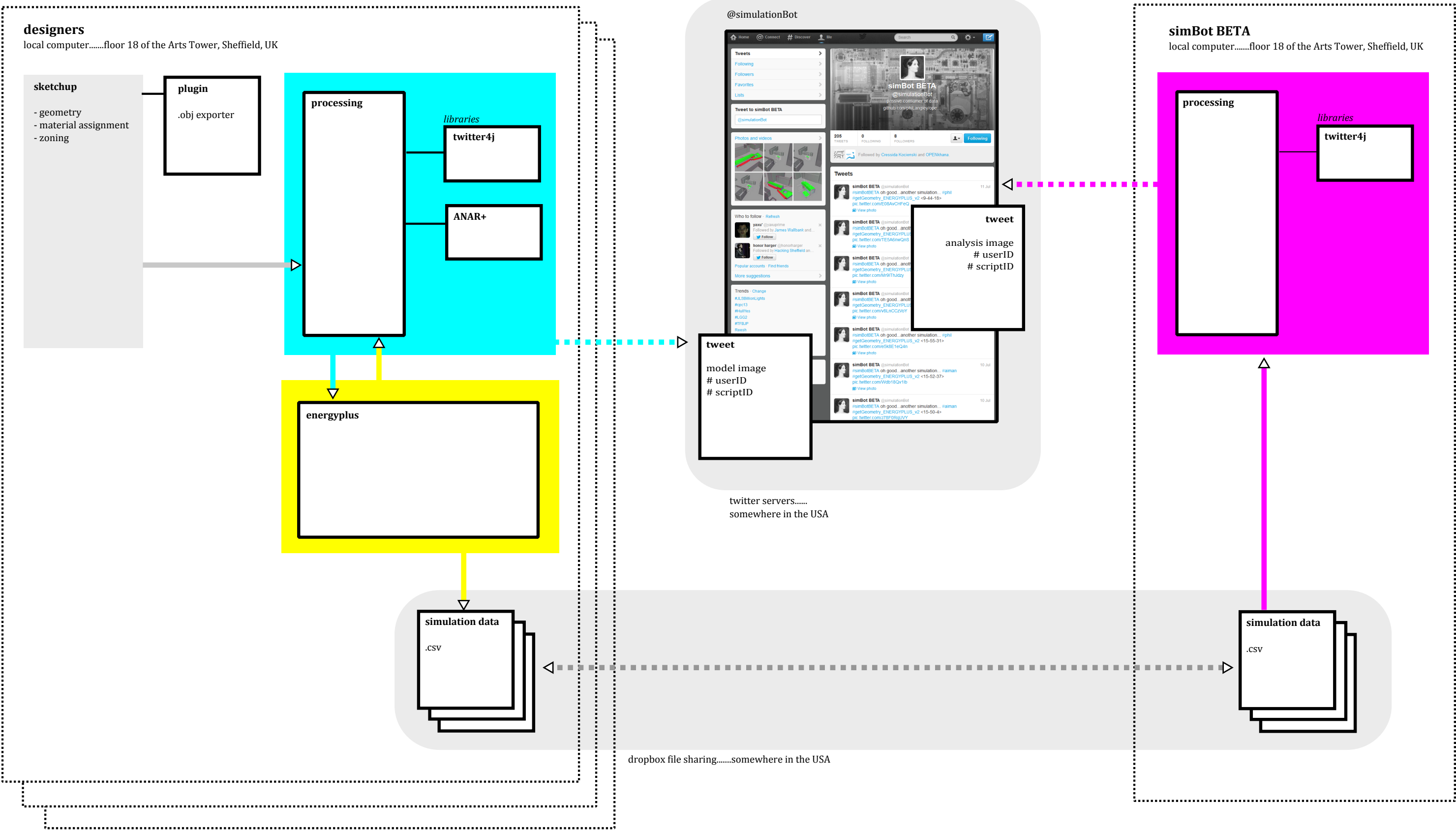
The project involved a range of programming, utilising ruby script, processing as well as two processing libraries (twitter4j and Anar+). While each element was not particularly complex, assembling each of them into a robust work flow was tricky and led to some difficulties in getting all of the workshop participants 'up and running' with the tools. As described, the @simulationBot was a 'hack' of an existing workshop. This provided additional challenges as not only did my tools have to work with each other, but they also had to function within the context of the workshop. Furthermore, testing the @simulationBot prior to the workshop was problematic. It was straight forward to ensure that my own tools would work with each other, but it was difficult to 'simulate' the activities of multiple workshop participants. In fact, not only was the @simulationBot modified 'on the fly' in the workshop, but its functionality was also altered and extended during what became a 'mini-hack'.





# @simulationBot

schematic diagram





## Appendix

i. TNA

## TRAINING NEEDS ANALYSIS FACULTY OF SOCIAL SCIENCES

### [Skills and experiences that a PGR student should obtain by the end of their higher degree studies]

To become an effective researcher in the social sciences, you need to have extensive knowledge and experience in a range of areas and need to develop a variety of skills. Please place a number in the Competency box to indicate your current level of experience and understanding, where

- 1 = I have no competency in this: for example, I have no knowledge or experience of this
- 2 = I have limited competency in this: for example, I have some knowledge, but no experience of this
- 3 = I have some competency in this: for example, I have done this only occasionally
- 4 = I am moderately competent in this: for example, I do this regularly, but require more experience to become proficient
- 5 = I am sufficiently competent in this: for example, I have extensive knowledge and experience of this
- 6 = I consider myself highly competent at this: for example, I could train others in the area

Please fill in the Evidence/Comments box to illustrate how you have gained your skills. Evidence may come from education experiences (e.g. degree transcripts, training courses) or other experiences (e.g. jobs held, voluntary work, etc.). Your training needs will be identified when discussed with your supervisor.

Skills	Competency	Evidence/Comments	Training Needs
<b>Becoming an effective social science researcher</b>			
An understanding of research in social sciences <i>in broad terms</i>	<b>5</b>	<i>As an independent researcher I have undertaken cross-disciplinary and collaborative work dealing with research in the social sciences;</i>  <i>I have co written a journal article for the following publication;</i> Invited article for special issue of <i>Space and Culture</i> : 'Topologies', Celia Lury (ed.) 'Mapping topological deformations of space as diffused migrant territories' [with N. Awan, University of Sheffield]	
Philosophical issues in the social sciences	<b>5</b>	<i>As an independent researcher I have undertaken cross-disciplinary and collaborative work dealing with contemporary philosophical issues in the social sciences;</i>  <i>I have co written a journal article for the following publication,</i> Invited article for special issue of <i>Space and Culture</i> : 'Topologies', Celia Lury (ed.) 'Mapping topological deformations of space as diffused migrant territories' [with N. Awan, University of Sheffield]	

Research ethics & integrity	4	Through my roles in professional practice both at slider studio i have experience in the fields of participatory research [with particular regard to public consultation through questionnaires and interviews], and consequent issues relating ethics and integrity	Modules attended; FCS6100 – Research Ethics & Integrity
An understanding of research <i>methods</i> used in social science	5	<p><i>As an independent researcher I have undertaken cross-disciplinary and collaborative work dealing with contemporary methods in the social sciences;</i></p> <p><i>I have co written a journal article for the following publication,</i> Invited article for special issue of <i>Space and Culture</i>: 'Topologies', Celia Lury (ed.) 'Mapping topological deformations of space as diffused migrant territories' [with N. Awan, University of Sheffield]</p> <p>Further to this, through my roles in professional practice both at [slider studio and BWL], I have experience in the fields of;</p> <ul style="list-style-type: none"> <li>– participatory research [with particular regard to public consultation through questionnaires and interviews]</li> <li>– statistical analysis methods using both advanced and customised software</li> </ul>	<p>Modules attended;</p> <p>ARC6720 Advanced Research Methods</p> <p>Additional training;</p> <p>Visual Research Methods Symposium February 2013</p> <p>Digital Methods Workshop: Interactive visualization and exploration of network data with Gephi 9th May (at Warwick DTC)</p> <p>Exploded Urban Analysis: a workshop on methods of creative inquiry 13th May (at Warwick DTC)</p>
Bibliographic and literature skills	4		<i>Utilise online Library support regrading referencing and bibliography techniques</i>
Understanding plagiarism and how to avoid this	5		
Effective dissemination techniques	5	<p><i>I have previously published work at 3 conferences;</i></p> <ul style="list-style-type: none"> <li>– <i>Generative arts Conference, Milan, 2006</i></li> <li>– <i>EURAU'08 Cultural Landscape, Madrid 2008</i></li> <li>– <i>A Topological Approach to Cultural Dynamics Conference , Barcelona 2009</i></li> </ul> <p><i>As an independent researcher, I have exhibited work at</i></p> <ul style="list-style-type: none"> <li>– <i>Beyond Media Conference - 'Visions' Exhibition, Florence 2009</i></li> <li>– <i>Nous Gallery, London 2007 &amp; 2009</i></li> </ul> <p><i>I have co written a journal article for the following publication, forthcoming 2012;</i> Invited article for special issue of <i>Space and Culture</i>: 'Topologies', Celia Lury (ed.) 'Mapping topological deformations of space as diffused migrant territories' [with N. Awan, University of Sheffield]</p>	
Advanced understanding of methods and analysis techniques	5	Through my MSc course, I have developed an advanced understanding of analysis methods and techniques, with particular	

		regard to statistical analysis using artificial neural networks.	
Anything else identified and agreed by the supervisor and the student [please specify: _____]			
<b>Research and career skills for social scientists</b>			
Time management	<b>6</b>	<i>Through my work in professional practice I have extensive experience in this field.</i>	
Effective Communication	<b>5</b>	<i>Through my work in professional practice I have extensive experience in this field.</i>	
Networking	<b>5</b>	<i>Through my work in professional practice I have extensive experience in this field.</i>	
Project management	<b>5</b>	<i>Through my work in professional practice I have extensive experience in this field.</i>	
Team working	<b>5</b>	<i>Through my work in professional practice I have extensive experience in this field.</i>	
Interdisciplinary work	<b>5</b>	<i>I have demonstrated through my research as an MSc student as well as an independent researcher I have engaged in cross-disciplinary research that has been exhibited and published.</i>	
Teaching	<b>4</b>	<i>I have taught a series of workshops in parametric design for March and MAAD students within the School of Architecture at University of Sheffield from 2007-20012</i>	<p>I have gained the following teaching experience this year;</p> <p>ARC 6710 MAAD - Lecture "Assembling Design" Feb 13, 2013</p> <p>ARC 6987 MAAD - Workshop (2 Days) "Tactile Programming" Feb 13, 2013</p> <p>Computational Design Reviews, Jan 2013 MAAD and MArch Reviews, March 2013 Advanced CAAD Reviews, May 2013</p> <p>Design + Energy Workshop July 8-10, 2013 (with Mark Meagher and Julien Nembrini)</p> <p>I will be teaching a MAAD and MArchh studio in the 2013/ 2014 academic year as co-lead, with Mark Meagher.</p>
Getting published	<b>4</b>	<i>I have previously published work at 3 conferences;</i> <ul style="list-style-type: none"> <li>– <i>Generative arts Conference, Milan, 2006</i></li> <li>– <i>EURAU'08 Cultural Landscape, Madrid 2008</i></li> <li>– <i>A Topological Approach to Cultural Dynamics Conference ,</i></li> </ul>	<p>I have presented papers at the following conferences;</p> <p>- <i>AHRA PhD symposium, Lund Sweden – May</i></p>

		<p><i>Barcelona 2009</i></p> <p><i>As an independent researcher, I have exhibited work at</i></p> <ul style="list-style-type: none"> <li><i>Beyond Media Conference - 'Visions' Exhibition, Florence 2009</i></li> <li><i>Nous Gallery, London 2007 &amp; 2009</i></li> </ul> <p><i>I have co written a journal article for the following publication, forthcoming 2012;</i>  Invited article for special issue of <i>Space and Culture</i>: 'Topologies', Celia Lury (ed.)  'Mapping topological deformations of space as diffused migrant territories' [with N. Awan, University of Sheffield]</p>	<p>2013</p> <p><i>- Pedagogy meets BIM and Big Data, The Bartlett UCL, London – July 2013</i></p>
Thesis writing	4	<i>I have previously written a thesis as part of my MSc course in computational design, for which I received a distinction.</i>	
Preparing for the viva	4	<i>As part of the examination process for my MSC course, there was a viva with internal and external examiners.</i>	
Knowledge transfer and Impact	4	<i>My role in professional practice, particularly at BWL, has centred around both the training of staff with regard to advanced computational design techniques as well developing the industry-wide frameworks for the use advanced software in architecture and construction.</i>	
Applying for research grants	4	<i>I have previously applied independently for AHRC funding for my MSc course [in 2006], which I was successful and received full funding [inc fees and support grant] for 1 year. I currently hold a White Rose Studentship from The University of Sheffield.</i>	
How to keep up to date with new research	4	<i>Through my role at BWL as head of computational design strategies and implementation I have extensive experience in keeping up to date with new research In the field of computational design in architecture</i>	
Anything else identified and agreed by the supervisor and the student [please specify: _____]			
<b>Subject specific skills</b>			
Substantive subject training	5	<i>I have undertaken a MSc in Computing and Design [at UEL] within the field of architecture, for which I was awarded a distinction. This course concerned with the design of generative design techniques using computational algorithms. My thesis project involved the design and testing of an [ANN] artificial neural networks.</i>	
Advanced subject specific training	5	<i>Through my MSc course in computing and design, I have advanced skills in programming suitable for undertaking this research.</i>	
Research methods appropriate to the student's field	5	<i>Through my MSc course in computing and design, I have advanced skills in programming suitable for undertaking this research.</i>	<p>Digital Methods Workshop: Interactive visualization and exploration of network data with Gephi  9th May (at Warwick DTC)</p> <p>Exploded Urban Analysis: a workshop on methods of creative inquiry</p>

			13th May (at Warwick DTC)
Working knowledge of statistical analysis techniques relevant to the discipline	5	<i>Through my MSc course in computing and design, I have extensive experience in writing algorithms for genetic algorithms, artificial neural networks and cellular automata, for use within an architectural context.</i>	
Application of software packages relevant to the research area	5	<i>Through both my MSc course, described above, and my roles in professional practice [at slider studio and BWL], I have advanced skills in programming suitable for undertaking this research.</i>	
Awareness of relevant journals and other outlets for dissemination	5		
Up to date knowledge of current debates in the relevant literature	5		
Anything else identified and agreed by the supervisor and the student [please specify: _____]			

<b>Student signature:</b>	<b>Date:</b>
<b>Supervisor signature:</b>	<b>Date:</b>