Proxi modelling: A tacit approach to territorial praxis

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1. Introduction: Process thinking and territorial praxis

Territory, it is argued, has recently undergone a substantial change in the way it is referred to by designers and geographers. In his article ‘What has happened to territory’, Antoine Picon (2010) describes how the advent of the environmental discourse has pushed the term away from its earlier meanings resonating with ideas of distance, power and representation to a closer relationship both with the general public and the designer. Territory becomes lived experience and environmental performance, as opposed to its previous associations with an administered and controlled piece of land. To fully engage with this newly gained proximity without losing critical focus, the skill lies in avoiding an excessively benevolent green touch brought about by ecological approaches, while remaining thoughtful of the political forces and human struggles behind the formation of the territory as we perceive it.

This article intends to put forward methods of design and analysis of territories that open up such potential, making the case for methodologies of material and ecological simulations as the basis for such practice. It starts by describing the implications of envisioning territory and matter as formed through time as opposed to being of static form, outlining the ideas of tacit forms of design and knowledge. It next moves to describe past experiences of applying material models to the territory, outlining both potentials and limitations, then proposes a methodology to explore new forms of using these models within a design environment, focusing in particular on how the representation techniques used in order to deal with processes become a key element of consideration.

2. Importance of time in territorial discourse

Territory, as opposed to concepts of land or terrain, has an inherent critical connotation derived from the fact that it is produced, both physically and culturally by the interaction between different social groups and their material environment. As Stuart Elden (2010) would point out, this production is never neutral, since in one way or another it embodies a struggle between those social groups themselves and conditions of scarcity or exploitation of natural resources.
resources. These sometimes violent processes build up the spatial structures which we later inhabit and it is precisely this aspect of understanding our environment as a formation, rather than as a form, that opens up the possibility of a practice that deals with the inherently political act of defining territory. The task of the designer, it could be argued, is to start engaging with the processual nature of our landscapes and cities, developing an understanding of how to insert or thread human intervention within this process in a conscious way.

As part of this exercise of engaging with process, it is paramount to consider forms of conceptualising change and transformation, moving to forms of generating design through time. Sanford Kwinter, in the introduction to his book Architectures of Time, advocates a form of thinking which tries to immerse itself within the passage of time in order to seek radical novelty (Kwinter, 2002). Kwinter uses the metaphor of the surfer as an example of engagement with the environment, where the individual is forced to take immediate decisions according to his or her surroundings, producing results which, while specific and highly constrained, cannot be fully planned or predicted. Novelty and radicality, the argument goes, cannot be fully prescribed from a distant rational interaction with reality, but must be practised and learnt through a progressive, immediate and temporal engagement with the material conditions that surround us. Being able to conceive of matter as formed through time, and developing modes of acting within the duration of its becoming is therefore key in fostering any radical engagement with novelty and, one could argue, with the concept of territory.

There are certain qualities inherent in the formation of matter that can only be engaged with through a design methodology which is constrained and driven by time. These two roles, constrainer and driver, shall put the designer in a position of having to respond to immediate situations, depriving him or her of the possibility of planning as new material conditions continuously emerge. Here the difference between constrainer and driver is that in the former, time amplifies the limitations which the environment pushes onto the designer, while in the latter, opportunities will continuously emerge and drive the way forward; somehow time has to exercise both a positive and negative role in the design process.

The role of constrainer immerses the designer within the process of material formation, preventing any chance of him or her operating from an external position. Any action at moment ‘T’ influences the material formation differently than the same action at T-1 or T+1. This condition of immediacy impedes any possibility of rationalisation, which brings the designer to what has been termed a tacit dimension. This idea, developed by Michael Polanyi, is centred on the belief that ‘we can know more than we can tell’: meaning that in creative acts, concepts and sensory information must be brought together before we can attempt to make sense of them. Time-based constraints not only immerse the designer in the act of material formation but also impede the designer from reaching an external rationalisation process, amplifying the sensory information and the development of concepts in a mode of intuition.

Time also constrains design by making all actions irreversible, since at any given moment ‘T’ it is impossible to return to the material state at T-1. This fact has implications related to the argument developed by Argyris and Schön (1978) in which the authors differentiate the mental maps that people use to deploy action from the theories they explicitly espouse. In real action, it can be argued, there is a difference between what people say and what they do as inner feelings emerge when behaviour is exposed. In an environment of continuous and irreversible change, interesting contradictions inherent in the designer emerge, and theories and conventions are exposed as the designer is continuously confronted with his or her own mental maps.
Deeply rooted in these mental maps is the development of tacit knowledge. Tacit knowledge is contained within the individual and his or her involvement in a specific context; it is rooted in action and centred in experience and skills, rather than codified in language and conventions (Nonaka, 1994). In material formation, context is given by the properties of the material the designer has to engage with; time forces designers to constantly update their mental maps, establishing an intimate relationship between these and the material. Material becomes an active agent in the design process, following its own logics of formation, with the designer constantly adapting to synchronise his or her responses; action and response occurs in both directions. The level and intensity in which both designer and material deploy action will depend on the specific context.

Coming back to the territorial discussion, tacit forms of engagement with the physical reality of landscapes would imply the development of an entire mental map where natural material pattern and intention become intimately linked within the flow of time. Experiments that promote this type of thinking could be the starting point to engage with the fabricated and formed quality of territories. The decision to place material research in the centre of disciplinary approaches to landscape, city and the urban has implications for the way in which we define the modes of operation and ultimately the documentation associated with a territorial praxis. The skill is, then, to look for modes of scaling up the results of the laboratory test while keeping an eye on the social dimension behind any form of territorial formation.

3. Material research at the territorial scale
The use of material research as part of a project dealing with the territory can be traced back to the experiments of networks and self-organising systems carried out in the 1960s and 1970s by Frei Otto in the Institute for Lightweight Structures in Stuttgart. This body of work has permeated urban planning and design disciplines and is linked to a prior movement that involved reading the territory as systems of networks and organically assembled optimising systems, as we shall discuss using the examples of Walter Christaller, along with the design methodologies of Kevin Lynch.

The work of Frei Otto was framed within a wider project of extracting logics of distribution and form derived from the careful study of material behaviour. His works on the territory consisted of the study of the properties of connective systems and distribution networks and their comparison with existing territorial patterns. Material experiments were carried out in order to find abstract organisations which presented particular forms of connectivity or properties of space occupation (hence the name of his masterpiece on the theme Occupying and Connecting) (Otto, 2009). These systems of organisation were generated through physical tests, studied and compared with real cases of landscape patterns, with a particular emphasis being placed on connectivity and movement.

One example of this type of study comprised the generation of systems of homogeneous distributions of points in space while maintaining a minimum overall length of connections. In the material formulation of this experiment (Figure 1a), a series of magnets were placed floating on water and allowed to self organise, investigating the repelling and attractive forces that will push and pull the needles until these naturally find a status of minimal energy or static equilibrium. In this final configuration, the amount of lines linking all of the points would reach a minimum when compared with the area linked by these lines. These principles are also linked to experiments with soap bubbles, mathematical formulations of Voronoi diagrams and close-packing systems and material experiments. Other experiments included threaded wool systems that when soaked in soap
water tended to morph, generating a system of new connections which, if measured by length was substantially smaller than the addition of all the original lengths.

In *Occupying and Connecting*, Frei Otto brilliantly illustrates the principles behind these experiments, creating links to the logics of distribution of settlement which can be assimilated into principles behind the economies of means reflected by the aforementioned optimisation mechanisms (Figure 1b). Ideas of optimal distribution of resources in the territory are explored together with the ‘emerging’ or naturalistic qualities of the formal results from the experiments. Materials, in this case, are used as abstract machines that would replicate or approximate the behaviour of certain socio-economic systems when left to operate in purely utilitarian ways (i.e. minimising the cost of infrastructure while maximising the extraction of value from land, etc., and ignoring overriding aesthetic or political decisions).

This type of study of the territory as material ‘blindly’ following rules of efficiency can be further

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**Figure 1:**

Frei Otto.

*(a)* Occupation with simultaneous distancing and attracting forces.

*(b)* Speculations on organisational principles derived from close packing systems.

(Source: Otto, 2009)

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**Figure 2:**

*(a)* Central Place Theory diagram, Walter Christaller.

(Source: <http://www.nap.edu/obbook.php?record_id=11013&page=89>)

*(b)* Catalogue of urban models by Kevin Lynch.

(Source: Grahame Shane, 2006)
linked back to the initial experiments of Walter Christaller in his Central Place Theory of urbanism, where the distribution of activities in the territory, in the case of a featureless and isotropic landscape, are approximated by a series of ratios and geometrical principles that yield geometrical results of hexagonal grids and bubble-like diagrams not too dissimilar from those later obtained by Frei Otto (Figure 2a). Questions of spatial connectivity and its capacity to form spatial structures were further incorporated by Kevin Lynch in his catalogue of models of settlement form (Figure 2b). This catalogue was intended to help planners and designers devise spatial structures that could respond to the realities of the economies of the territory in ways that the single use of rigid urban grids could not afford to do (Grahame Shane, 2006).

During the 1960s and 1970s, these conceptualisations of territories as complex material organisations became a partial critique to modernist ideas of top-down visions, (mostly characterised by orthogonal grids) and have been defended for their capacity to approach territorial reality in more immediate and efficient ways. Further studies in computational urbanism, such as the use of cellular automata to approximate the development of urban growth, have claimed this space within urban design and planning (Batty, 2007).

However this reading of territories as material systems cannot be left entirely without criticism, particularly with regards to the underlying assumptions implicit in the methodology. On the one hand, the almost ‘natural’ character of the formal and organisational outcomes of the experiments helps to present them in a positive light by virtue of their spontaneity as well as their inherent efficiency. The methodology, it has been argued, within a larger framework of diagrammatic architecture (Spencer, 2009) turns a blind eye to any potential critique of the social and economic forces that may have formed these patterns, whether they concern unregulated exchange of goods or the living conditions of those in charge of their generation and maintenance.

On the other hand, it could be argued that some of the material conceptualisations of the territory become static once the time span of the model has finished and the forces of equilibrium have been reached. While the models take place in time (i.e. the needles take time to push and pull amongst each other before they reach equilibrium), the results become static in themselves once the experiment is ‘done’, therefore forming a frozen blueprint or fixed network for further thinking of urban terms. For all the dynamism and flexibility implicit in their generation, the models do not necessarily promote time-based thinking of territories and are used in many cases as a form finding mechanism.

It is mainly these aspects which the use of proximate models attempts to overcome. The work with proximate mod-elling, as we shall describe in the next section, starts from the generation of approximations of how landscapes change and mutate in time which, in turn, are transformed into design mechanisms of new intersections between natural and artificial patterns. Time, as argued in Section 2, forces the designer to forget about the possibility of predefining the final outcome while taking continuous formal decisions, opening the door to forms of thinking which are both systematic and immediate, suggesting the role of the designer as generator of time-based protocols of punctual intervention, rather than masterplanner of fixed futures. Moreover, the work with live process also points to consideration of even the most seemingly natural landscapes as deeply intervened or engineered environments, leaving no room for lack of decision and rendering pure spontaneity out of the question.

One of the main consequences of working with this type of model, however, is the necessity to partially scale down through Central Place Theory from the geographical studies to the focus of territorial
formations (whether natural or artificial) which can be achieved through the miniaturisation of materials. This idea of scaling down process and the validity of results is linked to a long tradition of engineering models and theory of dimensional analysis considered in the following section.

4. Physical modelling of the territory, similitude and dimensional analysis

The work with scaled down physical models has a long history within the realms of geology and engineering and offers valuable precedents for designers. In most cases, these models are geared towards the prediction of movement of materials, generally linked to fluid dynamics such as air and water. The purpose of these models tends to be either predicting the behaviour of the fluid itself (study of how the water or air behaves and the pressure it generates on surfaces) or a study of the movement of the medium where the flow takes place (study of the movement of sediment in river beds or coats).

The fundamental problem of this type of scale modelling is the consideration of reduction factors of different dimensions and properties both in the materials as well as geometries (i.e. how to compare forces and patterns of models that take place at different scales), which is studied in the theoretical framework of dimensional analysis. This theory allows the study of properties of large systems through the observation of scaled down laboratory models which approximate one or various properties of their large counterparts. Examples of the use of dimensional analysis include experiments with wind tunnels or hydraulic models of estuaries, amongst others.

The fundamental purpose of dimensional analysis is the control of properties and variables in the reduced prototype (size, fluid speed, density of materials, etc.) in order to achieve similitude with the real case. Similitude is the property of two models (real one and prototype) where properties present comparable ratios between each other. Similitude can be geometrical (scaling down), kinematic (similar shape of flow lines) or dynamic (where ratios between forces and pressures are similar) (Figure 3). While obtaining total similitude is almost impossible, it is nevertheless practicable to obtain similitude for some properties, while ignoring others.

Models at the territorial scale mostly consist of water flow or sediment analysis where, in many
cases, vertical dimensions need distortion in order to represent accurate results (to avoid viscosity problems), maintaining a ratio between properties such as velocity, density of fluid and sediment, etc. (governed by the so-called Froude Number) (Sleigh and Noakes, 2009). These models are likely to be large in order to overcome problems of capillarity and surface tension (governed by the Reynolds Number) and are commonly used in order to assess the behaviour of civil structures and river dynamics, or as validations of otherwise cheaper computer-based analysis. Early examples of the use of these models include the legendary models for Mississippi River and Chesapeake Bay built by the US Army Corps of Engineers (Figures 4 and 5). These models were instrumental in the generation of management policies at almost a continental level, applicable to the entire scale of basins, some of which spanned several States. However, the sheer scale and cost of these models made them impracticable to build and furthermore to run, bringing them into disuse with the advent of computer simulations.

Physical modelling, however, remains applicable to smaller elements of study or as sources of calibration for computer-based analysis. Within sciences that study territorial elements (rivers, bays, etc.), the majority of models tend to be linked to tests of hydraulic behaviour, where values of speed, drag over obstacles, etc. can be easily measured. A typical application of these models is the assessment of stability of structural elements under stress scenarios (dykes in storms, bridge abutments in floods, etc.). Two types of models can be described within this category depending on which elements of the model are dynamic.

In the first category of models, the fluid is the element which moves or changes shape while the medium is static. The examples shown of the

Figure 4:
(Sources: <http://worldofdecay.blogspot.co.uk/search/label/Waterways%20Experim ent%20Station> and <http://en.wikipedia.org/wiki/File:Miss-Basin-Model2s.jpg>)

Figure 5:
Chesapeake Bay model, Virginia, 1978.
Mississippi in Figure 4 are of this type, with the territory rendered at scale but remaining static for the duration of the study. In the second category of models, both the fluid and the medium are allowed to change. These studies are linked to shifts of sediment bed for rivers and estuaries and require a careful consideration of the material itself, since some of the properties of the material need to be ‘scaled down’ in order to comply with relations of similarity. This brings an extra constraint to these models, which require materials with ‘unnatural’ properties regarding density, internal friction, etc. The results of this second model type need to be read more at a qualitative level, with empirical measurement of material shifts (i.e. evaluation of volumes of sediments moved, etc.) requiring a more cautious interpretation.

The second category of models, while being widely used in applied sciences field, is less frequently used as source of design process or formal design tool. This tendency is addressed as part of the work with proxi modelling, which attempts to apply ideas of scale modelling as forms of education and design oriented research. Along these lines, models that describe changes of landforms over time (river, deltas, etc.) can be used to inform design processes that try to deal with the complexities of these territorial formations.

The relevance of this category of models within the design field is its dynamic character and the fact that changes and shifts of different parts of the landscape can be observed almost in real time (however, this will depend on the setting of the model). While the quantitative results of this model type are compromised by the availability of the right type of materials and careful instrumentation in order to achieve dynamic similitude, they nonetheless give valuable information about dependencies of different elements in the landscape and indicate general characteristics of the results of actions in dynamic environments. This idea relates back to the arguments previously outlined of the application of methodologies that ‘force’ the introduction of design intention within the flow of time, generating forms of tacit knowledge of the process prior to the generation of design intentions. The designer needs to build an intuitive understanding of change and process, then move to define unexpected typologies born out of immediate interactions between matter and intention across the time span of the simulation.

The example shown in Figure 5 is part of the development of academic projects in Relational Urbanism Research Cluster 18, UCL Bartlett. The main purpose of the study is the development of a design methodology that enables the project to deal with the large-scale transformation of the landscape occurring through mining and extraction processes in Alberta, Canada. In this case, demands for water and generation of sediment in tailing pods produce landscape patterns that have a size and scale comparable to that of natural formations which can be practically modelled in a laboratory. Figure 6 then shows the generation of tailings ponds for the settlement of sediments from the mining process in the area near Fort McMurray (Alberta), which in terms of size and characteristics rival the natural formations of sand braided channels in rivers such as those in the natural park of Athabasca Lake, miles north of the aforementioned mining area. Rivers in the area are also diverted and interrupted in order to generate small height dams to capture water for industry.

While the current philosophy for managing these types of landscapes would favour the re-naturalisation of tailing ponds once the tailing has stabilised or the mining activities have ceased, the research cluster is exploring different potential outcomes that do not necessarily look to conceal what has happened but try to engage with the spatial qualities that it generates in novel ways. The territories produced as part of the mining process are rethought alongside other social and natural forma-
tions as being fabricated in such a way that there is no need to talk about post-industrial landscape. The spatial outcomes of the process are not driven solely by direct revenue to the mining industry, but seek to incorporate other forms of economy linked to wider social and ecological agendas. The territory is formed through time and is spatially conceived as such, avoiding the need for a naturalistic post-rationalisation (devolving the landscape to nature) or a romantic one (describing it as industrial heritage).

In the first example which deals with the generation of tailing settlement ponds, the project tries to understand the mechanisms of formation behind the patterns of canals and material of these artificial formations, which can be approximated through modelling and simulating the formation of the Gilbert delta. This type of delta occurs when sediment enters large bodies of water without substantial currents or wave population, a main characteristic being the absence of spits due to long shore drift, which would be characteristic of marine deltas. The purpose of the models is the generation of knowledge about their behaviour, but also the development of design interventions able to modify the final outcome of these formations, attempting to improve their environmental conditions without losing spatial quality.

In the physical model generated for the project, water and sediments are dropped from the corner of a tank (assumed upstream) which allows water to flow from the other corner. As the process goes on, layers of sediment will expand away from the corner (Figure 7), generating sedimentation fans and channels that accumulate in layers. The model needs to be of a certain size in order to begin generating legible results, with a certain size of delta allowing the generation of preferential streams of water that carry most of the flow. The sediment in

Figure 6:
Comparison between existing tailing ponds in Fort McMurray (left) and the natural Gilbert delta formation in Lake Athabasca (right), both in Alberta, Canada.
Research Cluster 18, UCL, Bartlett School of Architecture, UCL London 2014.
these preferential routes will eventually block the water, generating lateral branches linked to the typical behaviour of outlets in Gilbert deltas.

Experiments are then carried out to evaluate as well as instigate potential interventions and modifications to the main river branches, in this case through the introduction of obstacles to the flow at the point where the first channels begin to emerge. The purpose of these tests is advancing understanding of sedimentary dynamics, then guiding the artificial process of the formation of tailings in new ways that generate alternative landscapes with an inherent potential for future reuse. The results of the tests are recorded over time and captured into a 3D model, then are further analysed for pattern recognition (directions, distances). Both 3D laser capture of micro topographies and chromatic filtering techniques are used. While the first technique works for some models with a steeper topography, the latter was utilised given the flatness of the delta (hence the blue colouring).

The objective of the proxi models is the generation of physical formations which are neither the real delta (assuming the model can be described as realistic or dynamically similar) nor the outcome of a predetermined test (a fixed layout of blocks that gets studied). The idea would be for the designer to follow a design protocol, generating a path de-
In the case of deltas, capture has to be undertaken through the filtering of colours (water being tinted blue) in order to identify deep areas that get turned into 3D. Capture of models directly in 3D laser is also possible, but requires relief results that delta environments are not likely to generate.

Research Cluster 18, UD2, BPro, Bartlett School of Architecture, UCL London 2014.
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Dependent series of interventions which deviate the outcome from its natural state without being fully predetermined as by a fully artificial diagram. The examples in Figure 11 show an example of this type of intervention with a similar case of proxi model in a second experiment in RC18, in this instance intervening in a series of artificially built channels that direct water from small height dams to areas of mine extraction in Fort McMurray. The intention of this second experiment was to study patterns of diversion of water and sediment which generate an enlarged floodplain of these channels which can be used for the imminent urban expansion of the city once the channel is disused.

While the project started with studies of river flow, generation of river braids and meanders, it moved to experiment with different forms of additive growth of dams and obstacles that manage to direct the river over time either in a linear-enclosed pattern or in the opening of a sedimentary fan. The obstacles begin from the left side and a network of small-scale dams is grown over time with two diverging results. In the linear-enclosed test, the dams keep the flow of the river semi-contained in a relatively constant wide band, with the network of obstacles adjusting to a constant channel. In a second case (opening of fan), the dams are used so that the water of the river opens up into a wider sedimentary fan, generating larger open spaces and shallower water bodies. These two results cannot be fully preconceived (i.e., there is no such thing such a diagram that can fully define them) but have to be ‘arrived at’ through a process of human intervention and natural sedimentation.

In similar ways to those previously outlined in the Gilbert delta, the results of the physical model are captured in digital outcomes, in this case colour coded capture using tinted water. In the cases where interventions are added into the proxi model, it has to be noted that 3D laser scanning of results can be impractical since the vertical scale of the intervention is likely to be larger than that of the sediment process, hence tending to excessively mask the overall results.
The layout of dams, obstacles and river diversions used to generate the project took place over time and after a series of experimentations with accompanying learning curve. The approach of the designer was both systematic and intuitive, and so has been the combined result of sediment and block layout, resembling more the work of an artisan than a bureaucrat. Relations of cause and effect become more complex and cannot be conceived in a linear way since the end result cannot be known in advance but has to be built through the experiment. The diagram is the result of an intuitive understanding of natural process combined with design intentionality, rather than just a projective tool purely emanating from the designer.

This methodology expands the capacity for interaction given the speed at which the changes take place in the model. This capacity to interact,
produce change, read digitally and generate can be taken to new levels if we acknowledge the potential of the development of tacit knowledge to bring about interaction, not only between designer and model, but also with other stakeholders. This opens the door to a design where the physical outcomes are not necessarily fixed, but are dynamically linked to a different array of variables linked to the social formations of which they ought to be part. In order to be able to think about design methodologies that fully embrace the ideas of time, process and social formation at their core, traditional forms of representation have to be reconsidered and potentially re-engineered, as discussed in the following section.

5. Interaction and design: The role of representation in territorial praxis

Representing dynamism with drawings, which are inherently non-dynamic, is a problem that has long accompanied design but which has particular implications for territorial disciplines. The development and critique of graphic tools that engage with uncertainty and variability has attracted a great deal of attention in the work of practitioners and academics since the birth of regional planning, but has re-emerged with particular intensity over the past 20 years.

The introduction of graphic methodologies as forming the basis of design at the regional scale dates back to the 1950s and the work of Patrick

Figure 12:
Block and river typology derived from interaction between water and obstacles.
Research Cluster 18, UD2, BPro, Bartlett School of Architecture, UCL London 2014.
Geddes with proposals of works such as the Valley Section and the Thinking Machines as mechanisms to achieve new forms of professional synthesis. These were meant to form the tools to explore hybrids resulting from the introduction of nature into the city, trying to eschew the pictorial view of a ruralising urban growth as a way of dealing with sprawl. However, as Levy points out (Levy, 2008), it was Lewis Mumford, Geddes’ disciple, who criticised the use of graphics and Geddes’ ambition of achieving overall synthetic thinking of as a valid approach to the region. Graphic representation and any stable synthesis, Mumford would argue, would be too reductive and ultimately excessively detached from the complexities of the city, turning into a top-down view lacking flexibility and capacity to adapt.

This debate continued well into the end of the 20th century with the embrace of the concept of ‘field’ as an alternative to that of the object and the pursuit of flexibility and indeterminacy within architectural design and its further application into the environmental discourse. The excessive determinism of the masterplan is misplaced, the argument goes, and is to be replaced with the act of ‘irrigating territories with potential’, as Rem Koolhaas would put it (Koolhaas, 1998), partially giving up the definition of fixed forms. Yet, for all the capacity to suggest alternative modes of engagement with the uncertain, the entire edifice of the ‘field’ as a form of design becomes questioned not only from a compositional point of view (Allen, 2011), but also for its excessive openness and lack of political engagement (Spencer, 2014). These design theories, trying to avoid the problem of the fixed object, did replace stable form with a substitute phenomenologically more amenable to be described as flexible, resulting in design practices that privilege fluid structures or blurred boundaries which, it could be argued, become fixed formal outcomes sooner or later. The fact is that design never engaged with the disciplinary problem of formation or time-informed design.

Perhaps, as this article also argues, drawings and traditional forms of representation are just not the correct medium to generate and foster the type of thinking that territorial praxis requires. Perhaps we need to begin imagining other forms of design deliverables and documentation that are not drawings per se, but which engage with the user through graphics and enable the generation of spatial discourses by virtue of tacit forms of interaction described in Section 2.

In order to deal with the problem of representation, the current research work in RC18 UDII Bartlett explores the idea of design interfaces linked to the generation and control of proxi models. The idea behind the use of design interfaces is that having the capacity to simultaneously control 3D models of the territory or the urban environment together with intangible parameters linked to these models can help to build a deeper understanding of the relationships and processes behind urban and territorial form. It is the dynamic nature of the interface and the fact that the user can get a feel for the effects of changes of non-spatial variables (increase of traffic, changes in overall built cost) upon the built fabric (growth of built height or number of blocks, etc.) that brings an insight that isolated drawings simply cannot achieve. Interfaces, it could be argued, are the right mechanism to encourage thinking about the relationships behind fixed spatial form.

The development of digital tools controlling urban form through the definition of basic parameters has grown substantially in the recent years with the advent of parametric and procedural modelling software. These types of softwares allow for the quick generation of 3D from the introduction of parameters and control variables, which can be linked to optimisation engines or equation solvers for urban parameters (Llabres and Rico, 2012, p.17). The question being posed in the work of RC18 is to what extent the mathematically defined relationships within a digital model can be applicable to
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materially formed proxi models of parts of the territory. The fundamental difference between digital interfaces based on parametric models and those based on proxi models is that the space where the design takes place in the case of physical models constantly in flux and shifting, with sand and water changing the overall configuration of the landscape and the urban environment.

For the purposes of this study, the research aims to combine the physical models previously described with models that attempt to quantify changes on site ecology linked to the landscape. These ecological systems were modelled following basic models of differential equations which evaluate changes in closed environmental systems based on population thinking. Examples of these models utilise predator-prey models of differential equations which help simulate life cycles of species in a closed environment. The differential equations shown in the figure provide an estimate of how the populations of the prey and the predator relate to each other given their capacities to hunt and reproduce in an environment of plentiful food supply. This type of model is useful in evaluating how different populations interact and how supply of food, culling or harvesting can influence populations over time. While the direct application of these models would yield looped patterns of events (commonly denominated as attractors), the introduction of culling and harvesting from human intervention changes the behaviour, amplifying or reducing natural fluctuations. The use of these models helps build an idea of interactions between natural and human systems within a given landscape, which will be of application once the territorial patterns have been quantified or evaluated through the interface.

The development of the interface rests upon the generation of a design space where the user
can remotely take decisions on how to interact in the physical generation of the proxim model (place obstacles, discharge sediment) and simultaneously understand variables related to the effects that these changes produce in the ecologies within this landscape. This device is formed by the combination of a physical model which simulates the physical environment, a digital interface controlling a robotic arm which actuates on the landscape (places objects, water or sediments), a digital reading of the environment (detection of levels, dry areas or similar) which is further linked to an ecological model that constantly evaluates the different ecosystems being newly formed (riparian landscapes, emerging wetlands, etc.). The result is a design environment where decisions on form and the control of landscape typologies can be linked to human activities and ecological variables which ultimately are related to urban form.

Figure 14 shows the first tests of such interfaces being carried out as part of the RC18 agenda. They include a layout of the information linking a recording of the physical model, its digital interpretation and representation of the ecological simulations to the spaces generated in the model.

The development of these types of tools should, ultimately, help non-designers to understand relationships and dependencies between complex features in the territory. The ultimate goal of design interfaces is to bring design conversations to new levels through their capacity to allow interaction with variables and the description of time-dependent processes. The user of these tools can engage directly with the human and natural processes that build up the territory over time. Such an approach, returning to the initial comments on the concept of territory, may bring us to the radical potential of this term in forming the basis of a future praxis.

Figure 14:
Ecological evaluation of landscape (left) and relational urban model showing physical space (right).
Interaction is meant to take place through robotic arm discharging sediments / water in specific locations.

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6. Conclusions

Traditional ways of representation have failed to bring design ‘into’ time, prompting a preoccupation with forms rather than formations. This, it could be argued, has prevented design from helping to develop radical thinking in the territory. The use of material research as a means of dealing with the problem of time and formation opens great potentials for tacit forms of design on the territorial scale. However, consideration is required as to how we treat the forms of representation of matter if we are to extract its full potential within territorial discourse and ultimately transcend the pitfalls of designing fixed spatial forms. As this article contends, it is the consideration of design as protocol, interaction and interface which may lead the way to modes of thinking that privilege formation over form and process over object.

References


