COMPLEXITY AND PROBABILITY IN SIMULATION

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(WITH A SLIGHT REFERENCE TO HIGH RISE)

A key issue in strategic planning is that planning should be informed by a sense of the future — not only the obvious possibilities that are already forecast, but also an array of other possibilities that may not have been imagined, or at least may not have been understood as serious possibilities. Various devices, including brainstorming sessions and human gaming, have been developed to raise effective awareness of possibilities. Over the last decade, Simulation-based analysis has been used to generate an exponential number of possible scenarios.

Although for purpose of this report, simulations are mainly thought about in their computational variant, that is software that is able to through encoding and compressing information about the world in bytes to render a picture of evolutionary states of some system visible with enough resolution for observers to make inferences about future states of that system. It is however important to acknowledge that being able to forecast and respond shifting or evolving environmental inputs is perhaps the functional definition of evolution through a thermodynamics viewpoint.

Cities are complex systems constituted of physical elements interrelated into elaborated spatial relations,whose complexity increases as its shape and structure change and evolve. To try to understand the dynamics and the processes shaping our cities, we must coherently make models according to the dynamic and complex nature of them, but also insure that these models remain understandable and simple enough to be operationally useful.

Hence, any attempt to model the spatial system and the dynamics of the cities should involve this non-determination and instability of the cities and this theoretical framework as one of its basic features.

GENERICITY AND PATHOLOGY OR (PARTS OF) THE CITY AS A VIRUS

There are often places in cities that can feel like portals, not so much because moving through them brings you to a new place or for being able to evoke other perhaps more familiar spaces, but because they feel as they could be anywhere in the world. In the end of Italo Calvino’s the invisible cities, Marco polo reveals that he never went anywhere, that all the cities, their problems and quirks were drawn from Venice.

The path of development of economies over the last 10 years or so has been moving along two axis, one is towards financial inequality. Societies have been growing increasingly unequal from an economic standpoint, towards concentration of wealth on the hands of the few. The other axis of movement is towards a scenario where most of the worlds population lives in cities. This movement is compounded by the fact that after the 2008 financial crisis, real estate purchase emerged as a largely stable investment hedging against the volatility of the derivatives market.

Climbing out of the elevator in any of the many towers of MBIC you can easily have the feeling that when the door opens the landscape you will find has changed, that you are no longer in Moscow, but in Canary Wharf or Shenzen or in La Defense. The aesthetics of 3D modelling dominate these places, unsure if we are inside the simulation,or if predictive architecture is only predictive to the extent that the tools used to make it skew reality in its apophenic machine vision.

What that means is that the same problems and peculiarities can be found in all of these places. It means that the path of development on track for the better half of the last 30 or so years has managed to partially homogenize our landscapes, to reproduce and distribute standards even when these are not the best possible scenario for these places. Buildings and city planning has often been driven by the fallacy of economical development, but to a certain extent these buildings are machines of producing spaces which are somehow driving towards Uncanny valleys of spatial design.

Isn't high rise about Trellick tower in the end? Perhaps a hyperstitional variant in which high rise conjures scenarios which haunt spaces such as these. Summoning from the future a techno capitalist coruscant, that covers the surface of the planet in an accidental megastructure with the same design directives. Although distant in ideology, the modernist building is the morphological older brother of the financial center skyscraper, and to a certain extent the role of architecture has been largely hijacked from an utopian engine for re-imagining the city, towards a meat doll stitch job of 3D render aesthetics and half remembered utopian forms stuffed with a taxidermy of neoliberal discourse.

THE CASE FOR SIMULATIONS

Simulations are to be thought both as means of evaluating the implementation of changes previously imagined as well as being the engine behind generating new ideas about planning in an urban context. These imagined changes are devised through understanding the degrees of complexity to be found in any of these problem spaces and also through modelling the consequences that this complexity entails for the implementation process of changes in these spheres, meaning the impact of network effects in unforeseen consequences. Simulation is the imitation of a system and its dynamic processes in a model capable of experimental deployment in order to generate knowledge of particular aspects of certain systems. In order to generate enough data to be analysed these processes are generated or run through within a specific time frame. Simulations use simplifying assumptions to make their dynamics manageable, what that means in effect is that one of the challenges that any simulation framework faces is the problem of computational tractability, the possibility of an computer actually running this simulation.

Boeing simulates new wing designs in a weather hangar. Amazon simulates website variations to discover the interface that elicits the most clicks. Law enforcement units simulate real combat situations. This kind of simulation ends when it reaches an optimal state and some truth emerges. Another kind of simulation simply goes on forever accreting more and more instances, with each epoch that it passes new inferences are made, new connections unveiled. Narrative is itself an intuitive technology for making sense of dynamic systems, for defining parameters for experience in a sequence of causal encounters.

Uber Self driving cars on the other hand model the behaviours of drivers and pedestrians in realtime, and as a means of adapting to these agents patterns of movement, it predicts how to behave in certain scenarios. Each trip of these cars tweaks the movement protocols inscribed within the system, generating not only a procedural account of driving, but in effect a framework able to predict traffic as a complex ecosystem with astonishing degrees of accuracy.

The strong argument for the necessity of these simulations rests on the assumption that any changes that might have strong effects on communities of any scale need to be evaluated before implementation, therefore in order to make any sort of judgement about the detailed consequences of changes either in policy making or urban planning might have, requires a framework where a series of stakeholders can visualise and perhaps understand these consequences with a high degree of granularity.

THE GENERAL PROBLEM OF REPRESENTATION

There is an argument to be made, that some of our most challenging contemporary problems are problems of over-complexity. All of these problems are a product of the entanglement between the realms of the social the economical and the ecological, these problems are not to be understood as designed, but as the negative externalities of several design processes. A fundamental part of trying to grapple with any of these questions is how to characterise complexity.

This idea though doesn't necessarily needs to be tied to the disciplinary limits of complexity, but rather a more abstracted, generalised version of it, one that is concerned as its scientific counterpart is, with the relations between certain systems, and what kind of insight these relations may offer about these systems. In philosophy and the scientific image of man, the philosopher Wilfrid Sellars introduces two problems which are important for this particular perspective. One of these is the idea that, the task of 'seeing all things together' has been broken down into specialities. And the other that, the ways in which humanity views itself in the world clash with the description that science gives of humanity in the world, or as he terms it "the clash of the images'. In his perspective, to be able to properly understand both the human and the world and their increasingly complex relation, we must able to integrate these images in true stereoscopic fashion — where two differing perspectives are fused into one coherent experience.

The difficulties to integrate these two images can be properly expressed within the realm of physics, namely the way in which our conception of ourselves as made of atoms is incredibly difficult to come to terms in relation to our seemingly contiguous and discrete bodies. While Sellars himself names these different modes of conception 'the scientific and the manifest image' he states that this does not mean, that the contrast that he wishes to make is between scientific and unscientific, but rather, between a conception that relates to directly observable phenomena and a conception that posits imperceptible objects as a means of describing the relations between perceptible ones. Now, i would like to briefly return to the first idea Sellars introduces in his text. The task of 'seeing all things together' has been broken down into specialities; Sellars through this formulation, suggests that while it is thoroughly necessary that we as humans come up with sufficiently detailed descriptions of our world, it is also of extreme importance, precisely in order to create epistemic models of the world that can lead to action, to put these descriptions of the world together.

Here is where these two concerns coalesce into each other. On the question of how to integrate seemingly disparate regimes of thinking into a more or less cohesive picture, since problems get the solution they deserved, related to how they are described. This challenge then is compounded by the general image of the world we find ourselves in. Whatever problem you might see as the most urgent for your community, be immediately localised or diffusely distributed, it is represented by a large scale abstraction. While these large-scale abstractions are of immense help as part of the task of thinking globally about thinking about the world, they also can lead, precisely because of their 'largescale-ness' to the feeling that these problems are completely beyond our reach both in cognitive and in political terms.

If we are to come up with a robust model of our world, that is one that even if piecemeal and incomplete affords the possibility of action we need to not only be able to come up with a description of these macro-scale abstractions but also towards a general de-composability of them. That is, be able to create models that are able to transit between the large scale and the embodied agent.

That is not to say however that we should forego abstractions, quite the contrary actually. These abstraction are conceptual laboratories of our own making, and it's easy to address any question you may have through them. To be able to extrude particular strategies from these abstractions though, these need to be mapped onto the real world we inhabit. We certainly need new abstractions to understand these problems of complexity and we sure have been getting them wether is the Anthropocene, Extractivocene, Capitalocene or Chthulucene. What we need is strategies to render these models actionable.

Historically speaking, controlled and simplified laboratory worlds and abstraction are designed by cognitive scientists or decision theorists to reduce the response of an agent to a lower degrees of freedom in order to simplify theory testing. But in practice, they only reveal partial maps as to how we ought to respond in worlds of many degrees of freedom and interacting constraints.

THE PROBLEMS WITH SIMULATIONS BASED ON STATISTICAL METHODS

A general feature that is useful to have in mind in the first place is that, complex system are more than merely the sum of its parts. That is, they exhibit behaviour that emerges from the relations between their components, emergence being maybe one of the most important attributes in defining a particular system as complex rather than just complicated. This defining feature also sets it apart from its predecessors especially the systems described by Newtonian physics, which could be interpreted as being no more than the sum of the interactions of their parts. Complexity science then suggests that many systems can only be understood as systems, rather than as large agglomerations of parts. Gravitational bodies, large collections of gases or liquids and perhaps human crowds, financial markets, cellular automata and neural networks, all of these can be thought of as complex in relation each of their behaviours as whole systems. Another specific feature of these systems is their relationship with time, in newtonian physics the systems described are all, or at the very least commonly time-reversible. What that means in effect is that if you could run these systems in reverse with exactly the same mathematical equations undergirding the relationships of their physical entities, you would arrive as exactly the same starting point. Complex systems are by definition, completely irreversible, it would not be possible for example to run evolution in reverse.

These systems feature feedback processes which enable the system to change over time in a non-linear way. Feedback is a form of circular causality where the effects are fed back into their own cause. This is the main postulation of the pioneers of cybernetics, feedback is also the way in which emergence occurs, through the circular causation between the components of a system and the effects that emerge out of the relationship between these components, fed back into the constituent elements through downwards causation, that is the process of establishing a causal relationship from the higher level parts of a system to the lower level parts of that system, for example sending your arm an impulse to lift and it doing so. So to summarise, complex system are those that are irreversible, that exhibit emergent behaviour and that evolve through feedback loops.

The current paradigms of agent simulation are insufficient to represent the inherent complexities of spaces. Much of the discourse surrounding simulations and the way these are used in urban environments fail to acknowledge and achieve the granularity necessary for the qualitative rather than quantitative improvements that are expected of these technologies, if human interactions elude methods of mathematical minimisation or the reduction of interactions to unexplained explainers which are given vaguely understandable names such as expected value maximisation, then perhaps the way that these simulation methods might achieve a quantitative leap is precisely through the attempt of first making these interactions explicit and then encoding them through computational means.

In models of interaction, the world or environment of the computation is part of the model and plays an active part in the computation by dynamically supplying the computational system, or agent, with inputs, and consuming the output values the system produces. The environment cannot be assumed to be static or even effectively computable; for example, it may include humans or other real-world elements. A computing component is modelled not as a functional transformation from input to output, but rather in terms of observable behaviour consisting of interaction steps. For example, interactions may consist of interleaved inputs and outputs modelled by dynamic streams; future input values can depend on past output values. The interaction paradigm provides a new conceptualization of computational phenomena that emphasizes interaction rather than algorithms. Concurrent, distributed, reactive, embedded, component-oriented, agent-oriented and service-oriented systems all exploit interaction as a fundamental paradigm.

The question that is weaved through this two lines of inquiry, addresses the overall capability of simulation systems to generate meaningful inference about the world when considering the future behaviour of human agents, how to model and how to affect it. A fundamental question implied here and much beyond the scope of this report is the general question of the validity of statistics being the sole form of deriving probability from existing data. One way to formalise this question is through an epistemological angle — Probability calculations are problematic because they essentialise the future of a system as being dependent on its past, something that would fall strictly within a mechanistic account of said system. Furthermore it requires to assume a relation to a larger pool of events, one in five, one in a hundred so on and so forth and while these abstractions are mathematically sound, they aren't empirically testable as each event is the product of a specific set of convergences which are not time reversible.

The other way of addressing such problems is through a specifically social account of statistical models and questions of bias. Generally speaking statistical model are simply an account of the regularity of certain events, meaning the way in which certain events can be made discreet in relation to a larger pool. And while these are useful towards the averaging of certain indexes of activities when they describe the behaviour of human agents we find ourselves caught in the fallacy of social determinism, the assumption that the frequency of an event is a reliable indicator of the future of that behaviour without qualitative analysis is the recipe for maintaining the status quo.

In order to address some of these issues as key design challenges in the design of simulation systems particular features are imagined as operational, so as to generate at the very least a model to strive towards as a standard for the modelling of the complexity inherent in large scale spatial simulations. Through devising a system that uses camera footage from the site as a starting point to generate agents, that seeks ways of modelling agents which are not personified psychometric models, but rather ways of encoding particular decision and interactive pathways in a discreet agent model. Through recording actions and movement in the building the software extract a set of behavioural patterns which can be generalised or differentiated to spawn numerous other synthetic agents. Allowing the system to make generalisations of the effect of certain patterns or behaviour have on how the building is managed and used. Through each interaction inside the premises, the system classifies users in four categories, human, machine, organisations and space. So as to understand the causal relations between different sets of behavioural patterns extracted from the world.

If we expect the convergence between design program and architectural program to continue and that as a consequence of this convergence, simulations will perform a key role in the design of future cities, it is of extreme importance that these systems are built taking into account these considerations as a means of ensuring that they don’t simply reproduce the pathologies that already run amok in our cities.

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