# An Interactive Approach to Planning for Informal Urbanisms

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**This research project proposes an interactive platform for rethinking the approach to the redevelopment urban village as a dynamic process. As opposed to a totalizing masterplan, the model instead suggests incremental changes that can engage with the existing village metabolism—mitigating the labyrinth of dead-end alleyways by introducing small setbacks during new construction to function as pedestrian links, inserting pocket parks into unusable parcels, or coordinating building heights to better ensure access to light and air. The significant aspect of this platform is that these proposals can be automatically generated by a computational analysis and that, implementing a multiagent system, they are inherently distributed computation. This leads to punctual interventions, that do not need to disrupt other ongoing informal activity and are neither reliant on any singularl part for the overall success of the project. The combination of dynamic modelling and a limited, 'myopic' multiagent analysis makes this model robust to the kind of irregularities in informal development that cause problems for conventional masterplans. In this way the project can introduce some planning guidelines while also respecting the villagers' self-determination, everyone can play along, each in their own way—accepting proposals, rejecting them, or just going their own way.**

## INTRODUCTION

China's rigid division of land into either rural or urban classification based on legal, rather than descriptive, categories governs the property ownership model, development potential, and migration prospects of the land.[1] When urban growth has expended to the surrounding region, villages that have become engulfed by the city are not been incorporated into the metropolitan region but become enclaves of rural land, separate from the metropolitan planning authority and still held in collective ownership by the village. While agricultural prospects are no longer viable, these urban villages provide a valuable function in providing rental housing for migrant workers who may be restricted from relocating to 'urban' classed areas. Although it fulfils a necessary role in the functioning of China's major cities, urban villages are often seen as a blight because new construction is typically developed to maximize rental income without any coordination at the planning scale and only minimal consideration for light access, privacy, or public space. The process of converting rural land to an urban classification can be complex, but urban villages are regularly designated for redevelopment into high-rise apartment buildings. Despite an increase in the negotiating strength of villagers, redevelopment typically involves the displacement of residents and complete demolition of the village structures.[2-3]

In Guangzhou, where this project has been developed, the morphology of urban villages follows patterns originally set down by irrigation canals, resulting in an urban fabric that is labyrinthine and disconnected, but is also capable of producing a kind of picturesque atmosphere. This quality of urban villages is coming to be appreciated, particularly in comparison to the placeless apartment developments that often replace them.[4] Specifically within the urban villages on Haizhu Island, there are restrictions on development as the area is set aside as the 'green lungs' of Guangzhou. In this area, redevelopment efforts by the municipal government have avoided tabula rasa approaches and emphasized 'beautification' efforts that focus on clearing tourist-friendly promenades through the dense fabric and refacing the adjacent buildings in a style that vaguely recalls historic Lingnan architecture using brick veneer and prefabricated ornamental details. Unfortunately, these attempts have been both incredibly superficial and at odds with the natural development of the villages.

Figure 1: The scenic potential of the urban village—the view along a canal in Longtancun on Haizhu island, Guangzhou (photo by author)

Apart from these outside efforts, the urban villages themselves boast an impressively robust pattern of internal redevelopment. At any given time, it is possible to find properties at every stage of the redevelopment process within a single, small village. The typical pattern begins with the demolition of an older, low building, cleaning and

Figure 2: The urban metabolism in operation. Here an older building in Xiaozhoucun is being torn down. The bricks are carefully cleaned of residual mortar, stacked, and stored somewhere nearby for their eventual reuse in the this or another location. The typical new construction is a concrete frame with a single layer of brick used as infill meaning the same material salvaged from a cavity wall masonry structure such as this one can be used to enclose a much larger building. (photo by author)

setting aside the bricks salvaged from the demolition, digging foundations and pouring a concrete frame structure, filling in the frame with a thin layer of bricks and cladding the entire thing in small tiles to give it some weather resistance. Material stores—stacks of bricks, or piles of sand—can often be found scattered around the perimeter of the village or at certain wide spots in the alleys. This pattern can best be described as a kind of sociomaterial metabolism in the way that the flow of materials in and out of buildings from plot to plot, mediates the processes or reconstruction within a bounded territory.[5]

This research project proposes a framework for proposing and implementing upgrades to the urban village that address public space, accessibility, and the commons but does so within and alongside the existing metabolic processes that drive bottom-up redevelopment within the village. This is accomplished by abandoning the idea of the masterplan as a singular image as an end goal and reframing it as an ongoing dynamic activity that makes tactical alterations and continually re-evaluates its goals against a changing field of potentials.

## DEFINING THE MODEL

Such a task is uniquely suited to and approach based in computational modeling that supports both autonomous, encapsulated behaviors as well as an open responsiveness that enables interactive engagement. It is argued that in contradiction to the tendency of algorithmic design approaches toward 'black box' processes that obscure the design process, interactive simulations actually deemphasize the end product and focus the user's attention on the

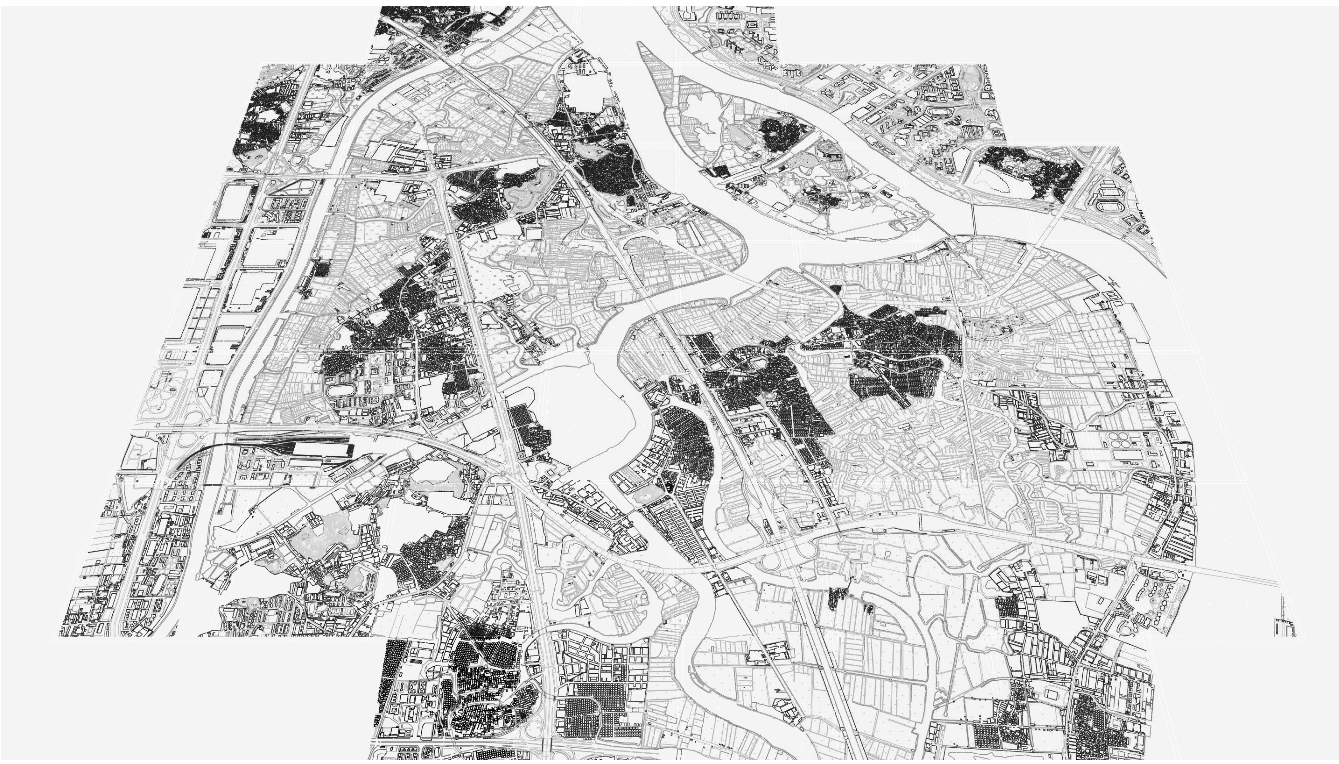

Figure 3: The model begins with the selection of the village, much like the level select menu of a video game. This view is looking toward the east end of Haizhu island.

procedural aspects of the model.[6] In the following paragraphs, we will describe the foundations of the model at the core of the project.

Acknowledging that the informal development patterns are driven largely by the household control over individual plots, we take the division of the village into plots as a semi-permanent substrate on which future development will be based. This condition is translated into a mesh representation wherein the edges of the mesh correspond to the plot divisions and the faces are the plots themselves. Where two plots are divided by a street, alley, or pathway, the corresponding edge is denoted as traversable and its width recorded. From this, a network of circulatory space can be extracted. Meanwhile, the mesh faces record the current height of the building occupying the related parcel and the state of that building (recently constructed, and historically listed buildings will persist in their location longer than aging or derelict and collapsed buildings).

Most of the encapsulated behaviors of the model relate to the circulation network and borrow analytic techniques from network and graph theory but with a translation that takes into account the inherent spatiality of an urban network.[7] In particular, we are interested in the way that disruptions in the connectivity that are disorienting to visitors can be inferred from inefficiencies in the comparison of geodesic distance (that is, the length that must be traversed through the network) to the straight-line distance between locations. The overall complexity of the circulatory network in the village makes it difficult to assess these properties visually and it is tedious to calculate them manually, while they these characteristics can be calculated in a fraction of a second by the computational model. Jn action, the model distributes across the entire village a collection of multiple agents that have the ability to assess their immediately surrounding local network. The focus on localized networks instead of the entire village network is both a strategic decision and a tactical response. First, the inefficiencies within the urban network are at their most pronounced when analysing a localized subset of the village network: these are the occasions when a dead-end or the lack of a bridge may cause detours that increase the length of a short trip by three or four times. Secondly, the informal context almost insures that there will be moments where the current state of the village differs from the official cadastral survey. The impact of these errors is reduced by limiting the scope of analysis but multiplying the quantity when compared with a singular result for the entire network. By taking a large number of overlapping analyses a fuzzy image of the whole can be constructed that is more robust in the face of possible representational errors.

## SIMULATION ENACTION

In addition to analytic capabilities, the agents also possess a mobility function that allows them to traverse the circulatory network in a weighted random walk which is recorded in the network. While this record at first appears to replicate traffic patterns, the agents' movements are not motivated by a set destination nor is there an attempt to replicate the behaviour of actual pedestrians in the city. Rather, it is more accurate to say that the traces left by the agent movements makes visible a certain implicit pattern in the network morphology: certain paths are traversed more often because they are important linkages that have to be crossed to move from one region to the other while other paths are travelled more often precisely because they lack good connections and trap the agents in a loop or force them to backtrack. Both of these situations are rated highly as possible sites of transformation whether because they have a high utility value or because transformation could have a high impact.

In addition to recording aspects of the existing circulation network, the agents also assess the potential for new linkages to be added to the network. As it moves through the village, each agent is also continuously assessing its local network, calculating the distance to every point reachable within a 120 meter walk and comparing that value to the distance it would take to reach if every link in the urban fabric were traversable. That is, if new alleyways were to open up between every building, how much of a shortcut would be gained. The record of the most impactful of such shortcuts is also recorded in the network edges.

Figure 4 shows a screenshot of the simulation in operation where the aggregate of the agent trace and potential shortcut values is denoted by the color of the edge segment in the network and represents its likeliness for transformation. As the simulation progresses, the sum of these values around the perimeter of every parcel is compared to the state of the building on that parcel. In cases where a building's persistence is outweighed by the combined potential transformation values, the parcel may be selected for redevelopment as indicated by the yellow highlight and its addition to the list at the left of the screen. The most impacted edges, which may be widened (or, in the case of shortcuts, newly created as paths) are noted with an orange line.

In this mode of operation, the model runs can run continuously for a set amount of time, compiling a long list of properties for possible renovation. As the buildings age within the simulation and their persistence values decrease, the selection process will eventually speed up with new parcels being chosen every few cycles. Like the metabolic village itself, there is no particular end state, because the 'renovated' parcels are put back into the model and it is entirely possible for them to be selected again and again.

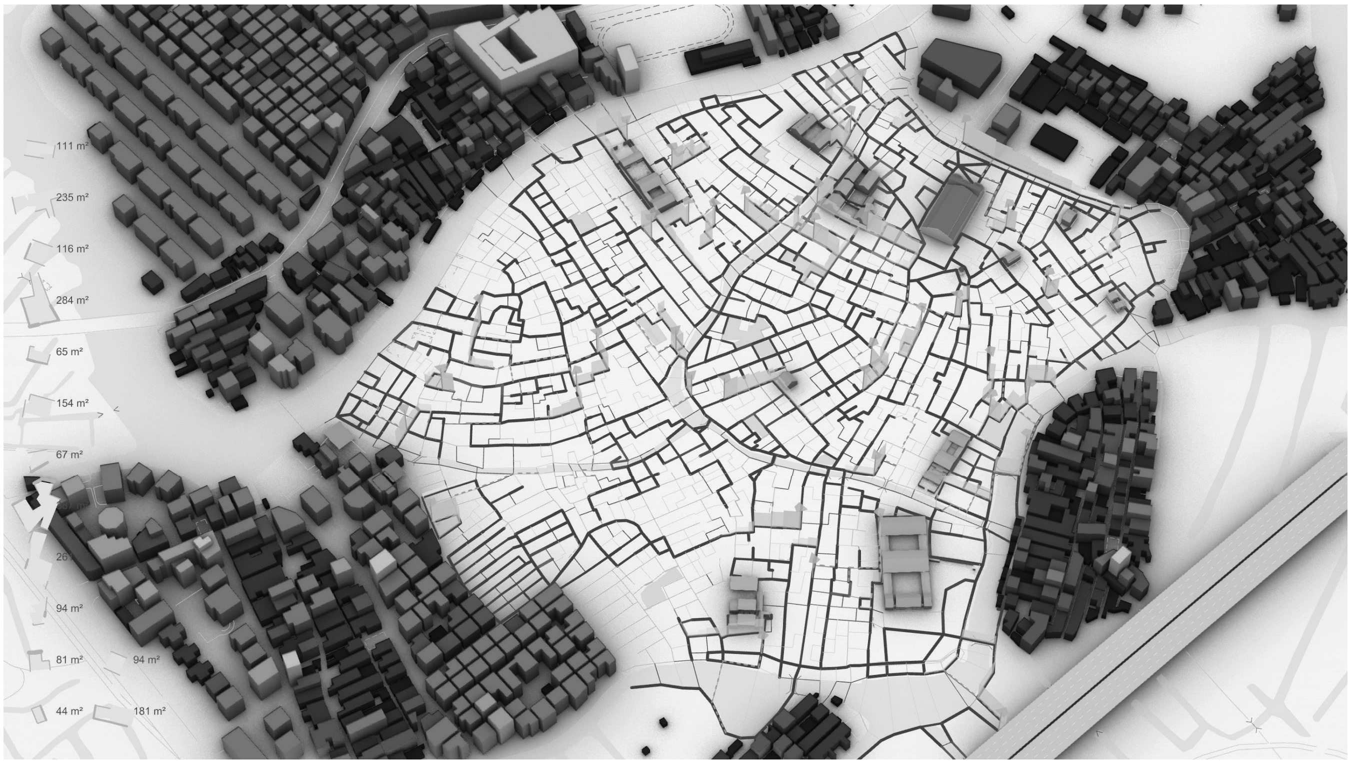


Figure 4: A screenshot of the model in operation. The agents (in blue with trailing tail) are all simultaneously navigating their own way through the urban network, searching for the potential to inscribe new shortcuts (visible as a dashed blue line emerging from certain agents), and leaving a record of their movement in network as indicated by the coloring of each segment (from dark purple to bright orange indicating low values to high). A parcel that is surrounded by edges with high values may be selected for renovation: previously selected parcels are highlighted in yellow and displayed in a list on the left for quick reference.

## SIMULATION INTERACTION

Also supported is a second mode of operation that encourages more direct interactivity. Rather than automatically selecting parcels, the program will compile a list of two or three candidates and then pause the simulation to allow a user to make a selection. As shown in Figure 5, the potential parcels are shown within a sidebar to the left as an axonometric view that alternates between displaying the current volume of the building and a proposed new state. The proposal is determined by first offsetting the footprint of the building to accommodate changes to the circulation network—including new shortcuts. After rising to its current height additional floors may be added back at the original floorplate dimensions creating short cantilevers over the pedestrian paths. This follows the model of the ‘handshake building’ type, ubiquitous in urban villages.[8] The allotment of additional floors is calculated based on the quantity of material made available by the demolition of the existing structure. After a parcel is selected, the model will indicate its gradual removal and the rising of the new structure within the 3D viewport.

This mode of operation is meant to suggest its potential use by metropolitan planning authorities who are interested in making improvements to the public space of the urban villages. By presenting a list of equivalent options, the model suggests that there are many possible paths that the redevelopment might follow and envisions putting the choice into the hands of a negotiation between the property owner and the planner rather than a technological determinism. If no agreement can be made, then no selection is made in the model and after another round of simulation a list of three new sites will be proposed. This does not preclude the property owner from going on with plans of their own, in fact, the temporality of the model allows it to absorb and adapt to such changes from outside its own logic.

It is important to note that the model retains a division between the two components of the village, the figure and the ground, as it were. Respecting the autonomy of the individual plot, it directly operates only on the public domain, the space of the commons. In a dense urban fabric like this one, any public space is of course entirely determined and defined by the buildings that surround it, and in that sense, the proposals generated in this model require a positive response to be realized. It is envisioned that the proposals could be incentivized by the municipal authorities by offering support of the construction process, sponsoring material exchanges, or investing in infrastructure like a shared lift for taller buildings. These interactions will be programmed into the functionality in the future development of the model.


Figure 5: A screenshot of the model offering a selection of three plots to choose from. In this preview, it is possible to see how the lower volume in set in from the perimeter creating passageways below in the 'handshake building' style. The new vertical extension of the building is indicated by the yellow floors in the preview as well as in the overall view for previously selected buildings.

## CONCLUSION

The goal of this project is to reconsider the ways by which the design and planning of cities is thought, especially with regard to informal urban settlements. Too often informal development is seen as entirely incompatible with any form of top-down planning. This is not necessarily the case, however it does require a new method of engagement to be successful—namely, that urban planners and urban designers must approach informality in its own terms: through dynamic, punctual interventions with a loose alignment of values rather than a coordinated, but rigid, end goal. Cities are themselves procedural formations and not fixed objects. I argue that the capability of computational models to simulate bottom-up formations, especially through multiagent system, opens up a broad, new range of possibilities for addressing urban design practice. Perhaps it is not too much a stretch to compare such agents to de Certeau's pedestrian actors in their myopic inability to see a total or panoptic image of the network, their rejection of a synchronic understanding for an emergent present, and the alternation between appropriation of an existing topological system and the production of discrete topoi over and above that system.[9] Admittedly, the model described here cannot compete with the plurality of practices described by de Certeau, but it might serve as the beginning of a bridge leading the planner away from the place of removal now occupied by necessity and toward an interaction with a more social and more material reality.

### ENDNOTES

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