Heuristic Approaches to Urban Livability

RAY WYATT

ABSTRACT

It is argued that although complexity theory might be useful for simulating various urban processes, it is probably incapable of throwing much light on such a mysterious concept as urban livability. Realistically therefore, city planners trying to boost urban livability can only adopt approximate and heuristic strategies which they think might increase livability and which will probably do no harm. Examples of four such strategies are discussed here. Firstly, improving urban connectivity seems important, and it is argued that Personal Rapid Transit (PRT) achieves this the most effectively. Secondly, clear communication, between the planners and the planned for, seems essential as well, and various innovative methods for achieving this, both now and in the future, are discussed. Thirdly, methods for optimizing urban layouts are likely to help, even if they do not act as prescriptive blueprints but serve rather as discussion generators for assessing the most desirable directions in which the city should be shaped, and two examples of suitable optimization methods are outlined. Finally, it is argued that no city planner can increase urban livability unless they have a viable way of predicting what the city's residents are likely to prefer, and so a generic, preference-prediction method is presented here. The conclusion is reached that in Malaysia, it is the locals who will best understand what urban livability actually constitutes, and so foreigners should demonstrate only technical implementation procedures rather than how to go about achieving such a goal.

ABSTRAK

Dihujahkan bahawa walaupun teori kompleksiti mungkin berguna untuk simulasi bandar yang mempunyai pelbagai proses, ia mungkin tidak mampu untuk menjelaskan satu konsep yang misteri iaitu bandar berdayahuni. Secara nyatanya percubaan perancang bandar untuk meningkatkan bandar berdayahuni hanya boleh mengambil strategi-strategi kasar dan heuristik yang mereka fikir mungkin boleh meningkatkan

kelestarian dan tidak akan merosakkan. Empat contoh strateginya dibincangkan di sini. Pertama, membangunkan rangkaian perhubungan bandar, dan ia dapat dibuktikan dengan Personal Rapid Transit (PRT) yang begitu berkesan penggunaannya. Keduanya, komunikasi yang jelas antara ahli perancang dan yang dirancang, dan pelbagai kaedah inovatif untuk mencapainya pada masa kini dan pada masa akan datang, kedua-duanya turut dibincangkan. Ketiga, kaedah-kaedah untuk mengoptimakan susun atur bandar mungkin boleh membantu, walaupun tidak bertindak sebagai rangka tindakan preskriptif tetapi hanya lebih sebagai penggerak perbincangan untuk menaksir arahan yang baik bagaimana bandar boleh dibentuk, dan dua contoh kaedah-kaedah pengoptimuman yang sesuai digariskan. Akhirnya, dihujahkan bahawa tiada perancang bandar boleh meningkatkan bandar berdayahuni kecuali mereka mempunyai satu cara berdaya maju meramal apa penduduk bandar lebih cenderung dan secara berterusan, keutamaan kaedah ramalan dibentangkan di sini. Kesimpulan yang didapati bahawa di Malaysia, masyarakat setempat lebih memahami apa keperluan bandar berdayahuni sebenarnya manakala warga asing hanya boleh membentangkan prosedur pelaksanaan teknikal daripada bagaimana untuk mencapai sesuatu matlamat.

INTRODUCTION

Complexity theory has played a role in many useful simulations of urban phenomena. However, it is very difficult to simulate something so complex as "urban livability". It is probably impossible, therefore, both to rank different cities in terms of livability and to predict whether or not city planners' interventions will eventually boost a city's livability. Hence city planners cannot anticipate whether or not they will properly do their job - boost urban livability.

In other words, city planners do not really know how to go about their task, and so they can only fall back on those heuristic actions which will at least probably do no harm. We recommend four such actions here, in the form of goals whose achievement will *probably* boost urban livability, albeit in a general rather than a measurable and precise way.

Figure 1 contextualizes this. It suggests that all human occupations are either part of science, philosophy or management and the sizes of the circles, whilst nowhere near to scale, attempt to express the relative number of jobs within each category. It is suggested that nearly everyone works in management, whether it is management of production, a road sweeper, an

office, a farm, a file, a city, a garden, a household or whatever. By contrast, a few privileged people work in science, and still fewer make their living as philosophers - almost always within large research laboratories and universities.

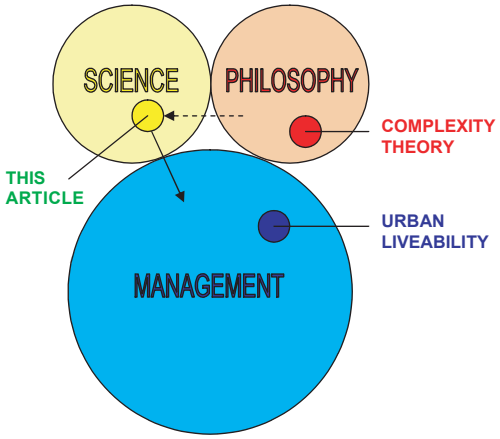


Figure 1 – Complexity theory, urban livability and this article in context

Complexity theory is depicted as being very much part of philosophy because its specialists have more interest in pure mathematics and theorizing than they have in making precise predictions, for planner/managers, about phenomena like urban livability. Some of their work is scientific in the sense that it is informed by scientific observation, and more than a few complexity theorists touch on management by thinking about the practical upshots of their work. Nevertheless, such apparent links from the philosophy to the other circles have struggled to satisfy both science's demand for controlled experiments and management's need for precise predictions of interventions' consequences.

Urban livability, on the other hand, is very much a human concept. It is felt inside the psyches of individuals, and so it is only amenable to management by other humans, if at all. Science finds it hard to measure urban livability accurately, and philosophy is incapable of theorizing it in a coherent and consensual way. Hence urban livability remains firmly within the management circle and is, therefore, destined to be tinkered with by managers even though it is not properly understood by anyone else, at least for the foreseeable future.

Note that different attitudes emanate from different individuals depending on which circle they work in. For instance, ordinary people typically have little time for impractical philosophers in their "ivory tower", and they are seldom interested in pure science. In fact, Berry (URL 1) points out that throughout history many great inventors and thinkers, those who have altered the course of civilization, have actually been persecuted throughout their lifetime as social deviants. Then, once the benefits of their contributions become obvious, ordinary people step forward to claim these benefits for themselves. This is unfortunate because society has a great need to nurture its best scientists and philosophers. After all, one of them might make a breakthrough one day.

For their part, scientists and philosophers have sometimes regarded anyone who is interested in management implications, or "policy consequences", as some sort of intellectual lightweight who must be unskilled in both science and philosophy. Such an attitude is every bit as unhelpful as is the common person's anti-intellectualism. Moreover, it blithely ignores the possibility that sometimes, social science does not become interesting *until* its policy implications are examined.

Accordingly, this paper tries to steer a middle course. It is mostly composed of weak science in the sense that it suggests some livability-boosting methods simply because they seem to have worked elsewhere, to some extent. But it is partly predicated on philosophizing, as indicated by the dotted arrow in Figure 1, and it is keen to impact on management, as shown by the solid arrow.

Note that different authors will always have different life experiences, which will make them suggest different policies for boosting urban livability, and nobody can say whose prescriptions are better or worse than someone else's. Nevertheless, the author has thought about urban livability for decades, and the considerable applied research that he has conducted towards boosting it will be partially outlined in this paper. Given the immeasurability of urban livability, this is about as rigorous a defence of this paper's methodology as can be expected.

Four goals for boosting any city's livability are suggested:

1. Connectivity
2. Communication
3. Optimization, and
4. Preference prediction.

The rest of this article will discuss each suggestion in turn.

Connectivity

At a seminar about complexity theory that was organized by the planning school at University College London in 2005, a paper was given by Richard Coyne (2005) suggesting that the "rhizome" concept (URL 2) could be a useful alternative method for viewing complex phenomena. This has relevance for Malaysian planning since the rhizome refers to the intricate network of roots underlying the tropical bamboo plant, in which everything seems connected to everything else to ensure great resilience and flexibility.

Most Western philosophers remain ignorant of the rhizome concept because all of their thinking is affected by their reductionist view of the world, in which it is assumed that complex problems can always be solved by breaking them down into ever smaller problems for separate and easier solution. Yet there have been instances where the Western way of thinking has been outperformed by the Eastern way.

An example is the theories of Kinji Imanishi, who travelled the world in1958 to espouse his idea that wild animals can, and do act altruistically towards one another. He was ridiculed as being misguided at Harvard, Oxford and other bastions of Western thought because, reared as they are on doctrines of evolutionary competition and the survival of the fittest, Western scientists simply could not understand how his idea was plausible. But this lasted only until Imanishi presented examples of snow monkeys in Japan teaching other monkeys how to cook potatoes in hot springs. The ideological straight jackets of Western scientists had prevented them from seeing the truth.

Oliver Sacks (1986) suggests that the West's problem stems from its being obsessed with ranking people on the basis of intelligence tests that assess only the left, analytical side of people's brains. He points out that not enough emphasis has been placed on the capabilities of the right hand, synoptic side of the human brain and its ability to see connections between things. Indeed, many of Sack's mental patients, who have been institutionalized due to apparently low intelligence, can actually perform feats of stunning power by using their right brain in order to view situations as coherent wholes.

A similar case is Daniel Tammet (URL 3), who in addition to being able to recite the value of *pi* to 5000 decimal places, actually learnt the notoriously difficult Icelandic language in just one week, and he can multiply six-digit numbers in his head with ease. Being more articulate than

most of the autistic people who perform such feats, Tammet has explained that he sees every number from zero to 10,000 as a different shape, size and colour and that he is able to instantly see their inter-relationships and so fit them together to solve problems.

This contrasts greatly to the more mechanical, technology-oriented calculation methods employed by most Westerners. Hence Malaysian planners who seek advice from the West on how to boost cities' livability might already have some of the answers, locally and close at hand. For example, it seems logical that connectivity, between people and things within urban environments, should be revered by city planners all around the world and not just within the East.

If everyone knows what everyone else is thinking; potential for genuine co-operation is boosted; transparency and trust are maximized and true democracy to implement the wishes of the people becomes more likely. Therefore, one way to boost urban livability would be to hook everybody up to the World Wide Web which, after all, specializes in connecting people, their thoughts, interest groups, businesses and social movements.

It also follows that connectivity in terms of urban mobility should be a good thing. That is, if people can move around their city freely, quickly and safely, then surely their city will become more liveable. Accordingly, transport experts have suggested various methods for achieving full urban mobility. But in the author's opinion, by far the best method is actually the 1970's idea of Personal Rapid Transit (PRT). This technology so much appears to be the only way of achieving sustainable and complete mobility that the author wrote a paper, in 2007, entitled "Is PRT inevitable?" (Wyatt, 2007), and he concluded that it is.

PRT covers a raft of implementation options, ranging from large monorail trains to small, ultra light vehicles, and it is the latter that are being advocated here because they are by far the cheapest. They travel three or four meters above the ground on elevated guideways which are supported by poles thirty meters apart. At the stations the carriages queue for people instead of people queuing for carriages; carriages run continually throughout the day and night and, best of all, they do not stop – either to pick up and put down other passengers or at traffic lights. Indeed, they take each individual(s) non-stop to wherever they want to go in the city at 60 kilometres per hour, a performance that is impossible to match by any other form of urban transport. PRT delivers universal urban connectivity and sustainable mobility.

But alas, in the author's opinion, the PRT concept has been discredited in the past by its advocates recommending city-wide systems which, as their opponents point out with horror, cost an impractical amount of money to build. But two comments are in order here.

Firstly, PRT, as well as being the best form of urban transport, is actually the cheapest. For a start, it does not need roads, and rights of way often prove to be the single most expensive component of any new roads-based infrastructure. Moreover, nobody seems interested in adding up the true costs of cars – their purchase price and their costs for registration, insurance, fuel, maintenance and accidents. If all such private expenditure were added together, it would far exceed the cost of a PRT system, even at a generously estimated cost, for the latter, of $10 million per kilometre.

Secondly, if PRT were introduced gradually, its construction costs would be spread out over a much longer time period, and so the money would be far easier to find. That is, if PRT could first be built in a way that compliments existing forms of public transport, its benefits would begin to become obvious after only modest expenditures. Indeed, the author has demonstrated this by designing a prototype, small PRT system for the city of Melbourne, Australia.

In this system PRT routes are kept entirely away from green and leafy suburban streets and routed only along already low-amenity main roads. Moreover, PRT carriages are stored overnight above existing freeway breakdown lanes and at railway station car parks. Moreover, only a small amount of guideway is suggested and it is located just beyond walking distance from existing commuter railway lines. Hence the PRT system should encourage car-driving suburbanites onto the PRT and railway system for their commute to the central city.

By overlaying proposed the PRT routes onto an urban density map and using buffering, intersections and standard deviation ellipses in a GIS that incorporates journey to work statistics, it proved possible to estimate how many such car-driving commuters would probably leave their cars at home, along with the reduction in fuel use and central city air pollution that would result.

It transpired that the complete prototype system will cost about $(AUS)7 billion and achieve a reduction in peak-hour, central city air pollution of around 16%. This contrasts to a soon-to-be-opened freeway in one part of Melbourne's eastern suburbs which will cost $(AUS)5 billion and which is guaranteed to *increase* central city air pollution. The evidence in favour of PRT seems overwhelming, as outlined in Figure 2.

- **no driving**
- **no waiting**
- **no standing**
- **fast**
- **safe**
- **comfortable**
- **uncrowded**
- **spacious**
- **private**
- **always available**
- **all-weather transport/ inside-to-inside**
- **fewer accidents**
- **fewer roads**
- **fewer terrorism targets**
- **less air pollution**
- **less energy**
- **less noise**
- **more parks and gardens**
- **mobility for seniors and children**
- **moves goods, mail and waste as well**

Figure 2 – Private and community advantages of Personal Rapid Transit (PRT)

Yet transport planners are remarkably reluctant to embrace the PRT concept. Many seem to like trains, buses, trams or cars for their own sake, and so they simply will not hear of more radical alternatives. This happens even in Asia. For example, the chief planner of the remarkably successful public bus system in Seoul, South Korea, argues that PRT is unsuitable for a densely populated city (personal communication) even though it is not. Although buses might be better than cars, they are still noisy, expensive, slow, require expensively maintained roads and have to return half empty after peak periods. PRT carriages have none of these disadvantages.

Also, pictures of traffic arteries in Bangkok, Thailand, featuring cheek-by-jowl motorcycles all travelling one way along a traffic channel are sometimes held up as an illustration of private transport in its most effective form. Yet the motorcycles in these arteries eventually have to

disperse sideways, and the traffic carried by the densest such arteries can be handled by only five PRT lines that are already dispersing over the urban hinterland away from the artery – noiselessly, without accidents, and available to all ages and levels of disability, unlike motor bikes.

Best of all, a PRT system means that the people get their city back. There is no longer any need to give up 20-30% of a city's area to tarmac for carrying traffic. Where the roads once were there can now be parks, gardens, walking tracks, cycle trails, lakes, sports facilities, flora and fauna and genuine urban livability.

In this sense, PRT has the potential to finish the job begun by the originators of town planning who used the garden city concept to bring the countryside back into the city. Their efforts only succeeded while everyone lived within waking distance of public transport, an era which ended within developed countries when car-based commuting grew from about the middle of the 20th century. For more recent, sprawling cities, more imaginative solutions are necessary, such as PRT.

Hence Malaysian city managers, if they consult transport planners from both the West and the East, are likely to be told that they need bus systems, rail systems and various hybrids. But for genuine urban livability that springs from completely connected and sustainable mobility, PRT is the only transport system that should be considered.

Communication

Since urban livability seems to be a mental phenomenon that resides inside people's heads, city planners need to extract from the residents what they really think about urban livability, along with their attitudes towards alternative ways for achieving it that have been suggested by planners.

Yet most ordinary people find it difficult to communicate what they really feel about urban livability; it is something they just "feel", and they find it difficult to explain why. The result has been that many urban planners have tried to formalize the people's sense of urban livability themselves, by using contrived scoring mechanisms, almost certainly misconceiving people's mental processes in the process.

It follows that any attempt to boost urban livability needs to incorporate improved methods of communication, both for the people to try to convey their true feelings to the planners, and for the planners to effectively explain their intentions to the planned for. A start can be made by always dispensing with words in reports wherever possible, and substituting charts and diagrams in their place. The old adage that

a picture is worth a thousand words is very pertinent in situations where clearer communication is at a premium.

Developing this further, maps are a particularly concise form of picture, and so the popularization of GIS can play a part here. In fact, several well known statistical analysis packages intend to boost their mapping capabilities by accessing shape files along with their attributes data for analysis, and so eventually GIS systems will be as ubiquitous as a button on a spreadsheet.

However, some other forms of very communicative mapping are less well known. For instance cartograms have great potential, as exemplified by the well known topological diagram of the London underground system, and by other cartograms produced by people like Daniel Dorling (1994). Indeed, cartographic forms of cartogram can be quite spectacular in their ability to convey a large amount of information concisely, quickly and clearly.

These latter distort each country, municipality or whatever so that its size is proportional to the variable being mapped, and some GIS can already do this by using specialized scripts. For example, most people would have seen a cartogram showing each nation's population size. It instantly conveys international relativities, something that would take many pages of text to describe fully. Other well known examples are the cartograms that were posted on the Internet after the US presidential election of 2004. They showed the extent of Republican and Democrat support in different parts of the country, making it clearly obvious that the Democrats polled well in many of the larger cities and Washington DC whereas Republican support came more from small towns.

It follows that if maps and cartograms are good communicators, then animated maps and cartograms are probably better still. Who could forget, for example, the moving cartogram depicting settlement of the continental US, with the population bulge moving west into California and also south into Florida during the twentieth century?. There is also the famous animated movie of the length of provincial growing seasons for each Chinese province (URL 4) and the lesson that it draws about the consistency of cultivation conditions within Sichuan province. Finally, the" Linguistic Twister" movie, which animates how a world map slowly morphs into a cartogram showing the number of languages spoken in each country, is far more instructive, about patterns, than even the cartogram itself.

Nevertheless, there are some visionaries such as Kevin Warwick who argue that we are always going to make communication mistakes no matter how cleverly we use words, diagrams, maps, cartograms or movies. The only way we can convey feelings about complex concepts such as urban livability, says Warwick (2002), is to achieve direct communication between individuals' nervous systems. Moreover, he has actually achieved this, and he argues strongly that such mechanized telepathy is surely the communication method of the future.

Specifically, Warwick had a 100-pin, one centimetre square plug inserted, without anaesthetic, into the radial nerve of his wrist. This plug was then wired to a transmitter attached to his wrist. This transmitter was able to send out signals, from his nervous system directly to a computer, which enabled him to drive a computer-controlled wheelchair simply by thinking "stop", "go", "left", and "right". Also, signals could be sent into his transmitter and, therefore, straight into his nervous system. For example, ultrasound signals were sent to the transmitter from various stationary objects, and so he was able to find his way around perfectly, whilst blindfolded, just like a bat does.

Warwick then went to New York and delicately picked up an egg with two fingers. When he did this, the nerve signals going from his brain to his fingers were intercepted by his implanted transmitter and sent to a computer in the room, which then sent the signals to the Internet and across to England where a robot hand mimicked his actions perfectly. It picked up an egg without dropping or crushing it. Warwick points out that he could have had several robot hands around the world to do this simultaneously - in Paris, Kuala Lumpur, Sydney and so on. Likewise, he could have received signals directly into his nervous system from several places on earth. Hence he could be "everywhere" doing "everything" – true omnipotence.

Warwick's wife then had a similar implant; he went back to New York; he wriggled two fingers and she, in England, straight away said without prompting that he wriggled two fingers. She then said he wriggled four fingers, one finger and so on, and she did this with perfect accuracy. Moreover, on Warwick's return to England his wife wore a light emitting necklace, and when Warwick thought certain things it would turn red, and whenever he thought other things it would turn blue. As such, they are the first people ever to achieve direct, nervous system to nervous system communication. They could be trailblazers for all our futures.

Naturally, research has progressed since Warwick's experiments and helmets are now available which will intercept brainwaves without the need to use implants into the body's nervous system. Warwick himself argues (personal communication) that such devices are less satisfactory because if they re being used to say, drive a wheel chair, the mental signals can easily be distracted by the sights and sounds that the person sees along the way, thereby interfering with the driving task at hand. Nevertheless, it is probably only a matter of time before the skull cap alternative is perfected, after which we will get much closer to non-invasive, perfect communication between human beings.

Until then, urban livability will remain a mysterious phenomenon that is fashioned by individuals and communicated, inexactly, using our existing, crude mechanisms such as scoring formulae and qualitative musings. This can be better understood by imagining that urban livability is like a termite mound. The latter is built to an exact specification by the ant colony collective, even though individual ants cannot even see the mound and they are all unaware of how it is constructed. Similarly, humans formulate collective feelings and actions about how urban livability can be boosted, but they are incapable of clearly seeing how and why.

In other words, as Herbert Simon and Godel have implied, it could be that humans are designed so as they can never fully understand concepts that are actually part of themselves:

> *No problem can ever be solved by the consciousness*
> *that created it. We must learn to see the world anew.*
> (Albert Einstein)

It follows that if true, unadulterated communication is ever achieved between humans who are maximally connected to each other, then perhaps one day a collective "wiki" will be able to look upon urban livability in a way that no single individual can, in much the same way that higher intelligence seems to emanate from ant colonies, bird flocks and swarms of bees.

In the meantime, extra effort devoted towards clearer communication between citizens is almost guaranteed to make a city seem to be more liveable, if only because such communication makes people slightly more aware of the true nature of livability.

Optimization

If complete connectivity as well as perfect inter-personal communication are ever achieved, people and planners will be much better at judging which cites are liveable and which ones are less so. But we will be no closer towards being able to prescribe how to fashion cities so that they become more liveable still. Since the number of ways in which a city can be laid out is, for all intents and purposes, infinite, it is unrealistic to believe that optimally liveable environments will ever be designed straight out of humans' heads.

Enter optimization techniques. Methods are available to prescribe how to layout various urban activities such that the payoff is an urban morphology that is, if not demonstrably optimal, at least a lot better than current patterns or anything else that has ever been thought of before. To demonstrate this, two examples will now be given.

The first one involved the seemingly unsolvable problem of how best to amalgamate municipalities into more efficient and effective "super municipalities" within the inner ring of Melbourne, Australia. Local government in this part of the world had always been notorious for ill feeling and bitter rivalry between adjoining councils, and so obtaining agreement amongst them, about which neighbours ought to be joined together, was for all practical purposes impossible.

Undeterred, the state government in 1995 insisted that the 21 municipalities surrounding the central city needed to be consolidated into about 12 super municipalities which would have 120,00 to 200,000 people each. Moreover, the consultant being paid to decide which municipality would amalgamate with which managed to assemble the city manager and the city planner from each of the 21 existing municipalities into one room.

One way he could have proceeded was to ask the assembled people to agree on a new structure amongst themselves. However, given the air of paranoia and jealousies that was palpable within the room, this tactic would have taken "forever" to achieve, if at all. His second alternative was to simply decide himself which municipality would join with which. But if he had done this the meeting would have simply rejected whatever he proposed on the grounds that he was being too aggressive.

The consultant, therefore, opted for a third approach. This was to ask the author to write a computer program that generated a set of amalgamations which was optimal. Accordingly, a rudimentary linear

programming algorithm was duly written in *VisualBasic*, the author took it along to the meeting and it was explained to the assembled officers what was to be done.

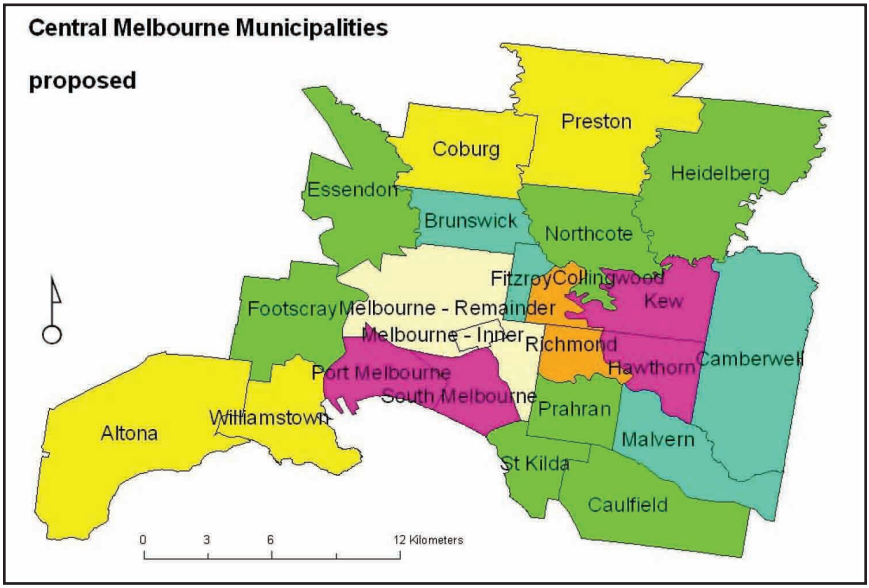
Specifically, each council had a number of amalgamation options and so it was allotted 100 points of "anguish" to spend on these options. The latter were written on a piece of paper and if an option was particularly unwanted respondents could spend a large number of their hundred points of anguish on it. Alternatively, if they did not object to another option so much, they could allocate less of their 100 points of angst to this choice.

The author then collected all council's pieces of paper, walked down the corridor, entered the data into a computer, ran the algorithm and so produced a map of optimal amalgamations which minimized the group's total amount of anguish. This map is shown in Figure 3a. It recommends that Altona municipality should join with Williamstown municipality, Port Melbourne should amalgamate with South Melbourne and so on.

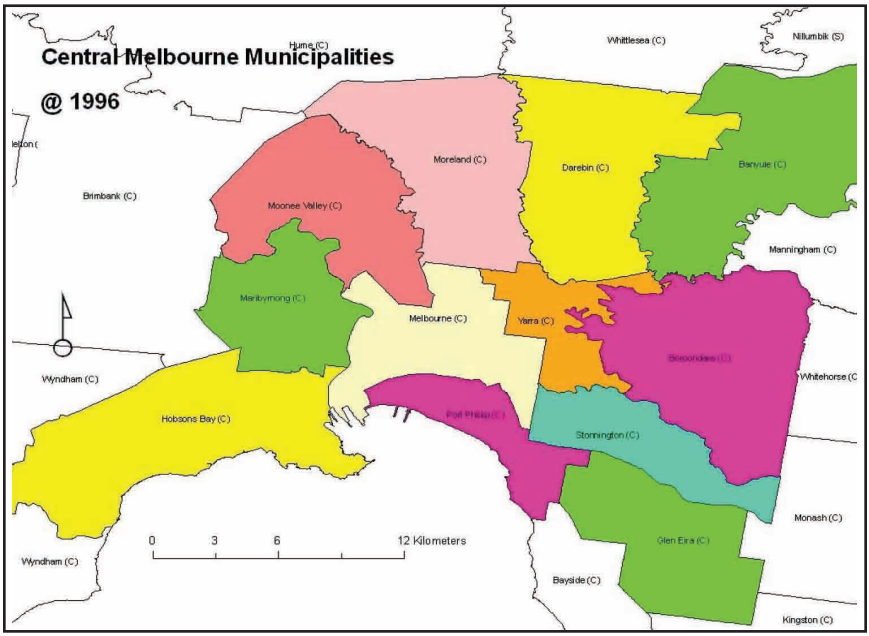
Before continuing, some comments are in order. Firstly, no close neighbouring council wanted to amalgamate with Footscray because it is a fairly depressed industrial area that is plagued with crime and drugs. The result was that Essendon, which has a small shared boundary with Footscray but considers itself far from it and so was probably less vehemently opposed to joining with it, has been amalgamated with Footscray, rather artificially, by the anguish-minimizing, optimization program.

Secondly, in the lead up period Malvern had tried to poach the best areas of Prahran and Caulfield while rejecting their less wealthy neighbourhoods, thereby offending all its adjoining councils, and so nobody wanted to amalgamate with Malvern. Moreover, the officers from the wealthy eastern municipality of Camberwell thought that this exercise was beneath their dignity, they left the meeting and did not fill out a form showing their levels of angst associated with each of their options. Accordingly, the computer program assumed equal anguish scores for all of their options, and so it had no choice but to amalgamate Camberwell with the unpopular Malvern municipality.

The author left the venue at 11am, noticing on his way out that various groups were arranging meetings to discuss their possible future amalgamation and cooperation. Others were playing politics. For example, Preston really wanted to amalgamate with the more up-market area of Heidelberg to their east rather than take up the optimization program's suggestion that it join with the more industrial municipality of Coburg



.a.



.b.

Figure 3 - Optimal and adopted solutions to the municipality-amalgamation problem in central Melbourne, Australia

to its west. For this reason officers from Preston were plotting to attend the meeting between Heidelberg and Eltham to see whether they could be included into a super municipality in the north east.

So discussion had at least begun. By contrast, the first two approaches that the consultant might have taken would have been useless in the face of an apparently unsolvable problem. Discussion would certainly not have started that day had it not been for the optimization program. It pointed the way to a local government structure that the council officers could at least live with.

In the event, the political process did not generate a final set of amalgamations as specified by the optimization model in Figure 3a. The final result was that shown in Figure 3b. But the two solutions are remarkably similar. The author likes to think, therefore, that although he can never prove it, his humble and imperfect optimization model was at least useful for beginning a co-operative discussion about a hitherto unsolvable problem.

The second example involves some work that the author is currently undertaking for the Australian State of Victoria's Department of Primary Industry. The problem addressed is how to determine the optimal distribution of crop types across a rural region. At present it is the farmers who decide which crops are grown where, but if rigorous analysis of prices, market demand, soil suitability, environmental fragility and transport costs occurs, planners might be able to prescribe a better distribution than the current one. Once again, the optimal solution generated might never be achieved, but at least it constitutes a useful direction towards which the farm production system might move in pursuit of greater regional health.

The crops-allocation problem is so complex that it is unsolvable using conventional optimization approaches, and so in this instance the author wrote a genetic algorithm to "evolve" ever improving crop distribution patterns. As the solution gets better and better, a map of the best solution evolved so far is generated on the computer screen. This map represents different crops by circles of different colours, and the sizes of these circles are the hectares under each crop at each location.

Note that the input parameters as well as the optimal output are all on the computer screen together, so that results of user-prompted changes to inputs can always be seen. Hence the program is analogous to a kind of "flight simulator". Again, this generates insights into the nature of the problem being addressed along with the effects of tampering with the regional system of production. The latter is almost certainly of more value than the supposedly optimal crops pattern.

It follows from this discussion that one way to boost the livability of any city might be to generate optimal distributions of various facilities and activities within it. Such ideal patterns might never be attained, but at least more insightful discussions will be started about just what it takes to achieve a more liveable environment. That is, indications will be forthcoming of spatial directions in which the city ought to evolve if its overall livability is, probably, to be improved.

Preference prediction

Finally, any city will never be truly liveable unless it takes a form that its residents prefer. It is necessary, therefore, to have a method for predicting people's preferences. The author has been working on such a system for a long time, and to demonstrate its power it will now be used to predict which forms of settlement, within the Klang Valley, Malaysia, are likely to be preferred by different sorts of people.

Basically, the author has formulated three alternative layouts for the area:

- Trend - a "business as usual" projection of current policies
- Wealth - a layout that maximizes economic profitability and inflows of foreign investment
- Protect - a development pattern that makes maximum efforts to protect the natural environment.

Note that these three scenarios have been hurriedly formulated for illustrative purposes. If they were being generated seriously, some spin off from complexity theory and simulation modelling, such as the swarm software, would perhaps have been used to generate alternative scenarios of greater validity.

Each of the three scenarios has been scored by the author on the nine evaluation criteria that his *Preference Prediction* software uses. Moreover, every one of the 288 past users of the *Preference Prediction* software has provided information about themselves, as well as their opinions, wand this information allows the software to "learn" the relationships that users believe exists between criterion scores and scenario merit.

Hence given a set of criterion scores for the scenarios, the software is able to predict how different sorts of people – the old, the young, males, females and several other groups, will rate the scenarios. This is shown in Figure 4.

RATINGS ACCORDING TO EACH GROUP

ACCORDING TO:	Trend	Wealth	Protect	ACCORDING TO:	Trend	Wealth	Protec
Everyone	**1.28**	1.07	1.23				
Males	.84	.64	**1.07**	Females	**1.13**	1.04	.91
18-29	-.21	-.02	**.18**	30-39	**1.96**	1.81	1.78
40-54	.84	.70	**1.11**	No children	.89	1.01	**1.05**
1 child	**.89**	.72	.41	2 children	.98	.84	**1.19**
in Australia	**1.28**	1.07	1.23	M.Easterns	**.89**	.72	.41
Asians	**.53**	.40	.05	Australians	1.09	.98	**1.23**
Others	.64	.67	**1.28**	Anglicans	-.21	-.02	**.18**
O. christians	.84	.70	**1.11**	Muslims	**.89**	.72	.41
O. non-christians	**.53**	.40	.05	No religion	1.46	1.57	**2.13**
Moved in 5 yrs.	**1.27**	1.11	1.17	Stayed in 5 yrs.	**1.03**	.88	.75
Extract. industry	.35	.27	**.76**	Other ind.	**1.55**	1.37	1.51
Professionals	1.31	1.11	**1.39**	Other occ.	-.21	-.02	**.18**
Uni. graduates	**1.10**	.79	.79	Cert./Dip. holders	1.45	**1.67**	1.64
Sing. pers.	**.53**	.40	.05	Couple - children	.88	.89	**1.06**
Couple + children	**1.82**	1.53	1.35	Hm. owners	**1.03**	.88	.75
Hm. buyers	.35	.27	**.76**	Pve. renters	**1.67**	1.55	1.62
Reg. comp. users	**1.28**	1.07	1.23	$600-$1500/week	**1.28**	1.07	1.23
Groups' ave.	**.95**	.85	.95				

Figure 4 – Predicted merit scores for the three Klang Valley scenarios according to each group

It can be seen that the most popular plan, at least according to most groups who have so far used this software, is the "Trend" scenario. But there are exceptions. For instance, the "Protect" scenario is the most popular amongst males, people aged between 18 and 29 and between 40 and 54, people with no children or two children, people born in Australia and in Europe/America/Africa, non-Anglican Christians, people with no religion, extractive industry workers, professionals, people in "other" occupations, people who are part of a childless couple and home buyers. Moreover, the "Wealth" scenario is actually the favourite of those who have been educated to the Certificate/Diploma level.

In more detail, Figure 5 shows the ratings for the three scenarios according to males on the left and according to females on the right. As indicated in Figure 4 above, males are predicted to prefer the right-hand "Protect" scenario (merit = 1.1) whereas females will probably prefer the left-hand "Trend" scenario (again, merit = 1.1). That is, whereas females will be more in favour of the *status quo*, males will prefer a policy that will incorporate greater protection for the natural environment.

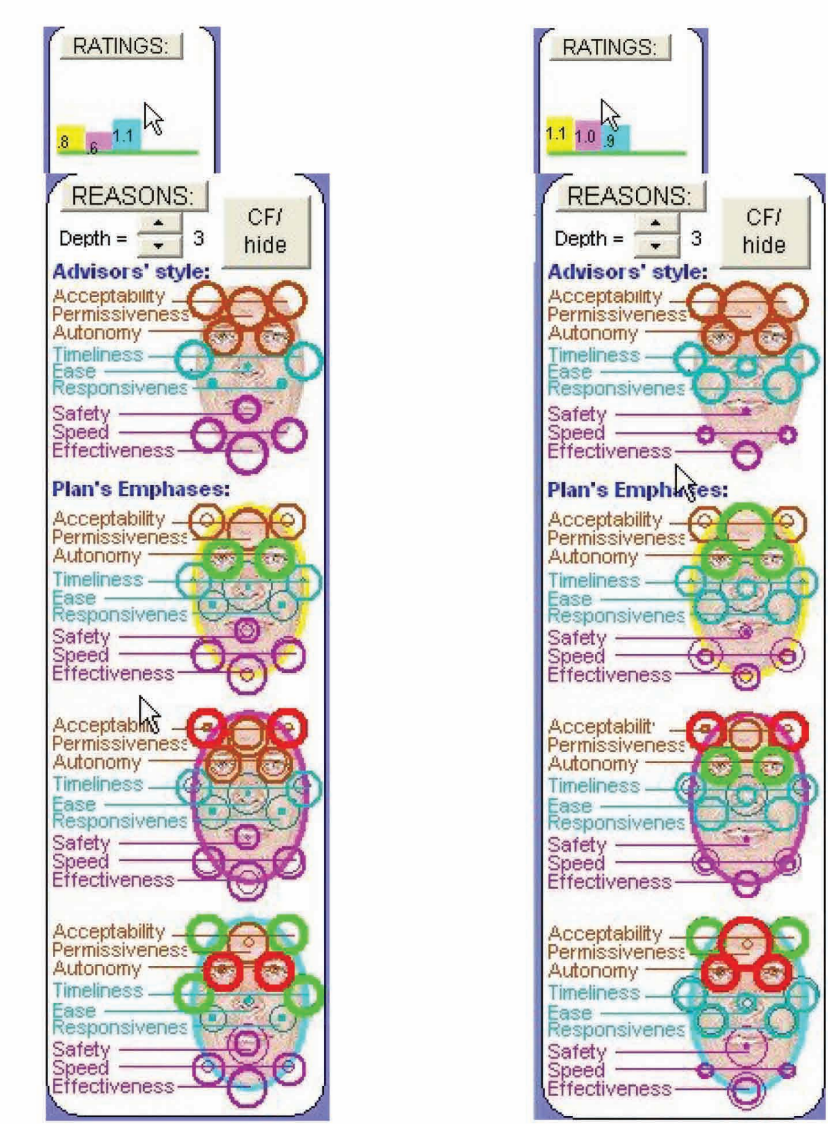


Figure 5 – Reasons for the predicted preferences of males (left) and females (right).

The face charts examine why this might be so. The top two faces show the priorities of males on the left and females on the right, and the sizes of the circles represent the importance placed on that evaluation criterion. Hence the three most important criteria according to males are Acceptability (hair), Autonomy (eyes) and Timeliness (ears), and for females the three most important considerations are Acceptability (hair), Permissiveness (forehead) and Autonomy (eyes).

Hence faces further down the figure, pertaining to the Trend, Wealth and Protect scenarios respectively as we move down, indicate that males prefer the third, Protect scenario because it scores well on two out of three of what they regard as important criteria – Acceptability and Timeliness. By contrast, females prefer the first, Trend scenario because it scores highly on two of their important criteria – Permissiveness and Autonomy.

Moreover, both males and females do not like the second, Wealth scenario because it scores poorly for Acceptability (albeit well for Autonomy, which is important for females). Also, females do not like the third, Protect scenario because it scores poorly on two of their important criteria – Permissiveness and Autonomy. Finally, males are less keen on the first, Trend scenario because it scores highly on just one of their top three criteria - Autonomy.

It follows that one way to increase the desirability of the first, Trend scenario for males is to alter it slightly so that either its Acceptability and/or its Timeliness is increased. Also, one way to make the third, Protect strategy more appealing to females would be to somehow alter its Permissiveness and /or Autonomy. Hence the *Preference Prediction* software not only predicts groups' preferences, but it also suggests ways in which the planners might alter such preferences.

Finally, the groups whose preferences we have predicted actually correspond to groups that are identifiable by the Australian Demographic Census. This makes it possible to map the areas, using Census data, of where the greatest community support for each of the scenarios is likely to be located. For instance, if a certain scenario is likely to be scored highly by old people, areas in which many old people live will be regions where this scenario is likely to have strong community support.

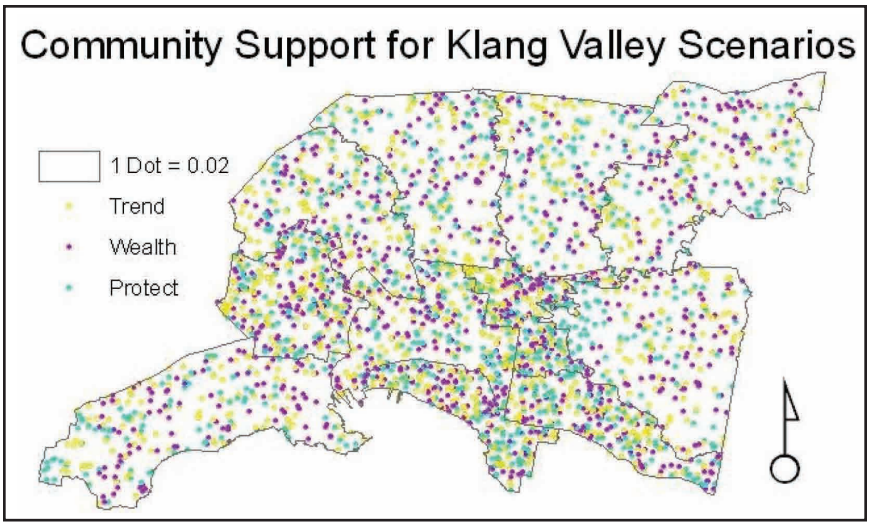


Figure 6 – Where the community support for each of the Klang Valley scenarios is located

An illustration is shown in Figure 6. Here the relative support for the scenarios has been mapped across an area of Melbourne, Australia, based on Census data, even though most people living there have probably never heard of the Klang Valley and its possible planning scenarios. As such, Figure 6 represents one of the great advantages of the *Preference Prediction* software. It is generic; it can be used to map community preferences anywhere, no matter what problem is being addressed. The *Preference Prediction* software has, therefore, great potential for estimating what people living in different areas want in terms of a more liveable city. Indeed, such estimates can be made so long as only a reasonably representative sample of the total population has used the software in order to acquaint it with their planning styles. There is no need to conduct extensive household surveys.

CONCLUSIONS

Urban livability is likely to remain a mysterious concept for the foreseeable future. Complexity theory can throw some light on it by simulating and discussing possible urban futures and their associated livability levels. Yet for planners who want to boost a city's livability *post haste*, there are more

pragmatic actions they should undertake – aim at the respective goals of connectivity, communication, optimization and preference prediction.

Such goals can be approached to any desired level of achievement, but even after they all have been it is still most probable that genuine urban livability will prove elusive. This is because urban livability is very hard to even define, let alone measure, and perhaps individual humans are simply destined to never fully appreciate why a particular place is more liveable than another.

It follows that because some of Malaysian urban design is nothing short of spectacular and extensively copied around the world, the pursuit of urban livability which acknowledges the Malay tradition of revering the countryside rather than the city is possibly best left in Malaysian hands. Foreign experts can always advise on technical matters, but deep knowledge of the intrinsic nature of any city's livability is best understood by locals.

REFERENCES

Coyne, R. 2005. The net effect: Design, the rhizome, and complex philosophy in Alexiou, K., Gesussi, E. & Zamenopoulos, T. (eds.) *CUPUM-ECiD Joint Workshop: Design out of Complexity.* University College London

Dorling, D. 1994. Cartograms for visualizing human geography. In Unwin, D.J. & Hearnshaw, H.M. (eds.) *Visualization in geographical information systems* Chichester, John Wiley, 85-102

Sacks, O. 1986. *The man who mistook his wife for a hat.* London, Picador

Warwick, K. 2002. *I, cyborg* London, Century

Wyatt, R. 2007. Is Personal Rapid Transit (PRT) inevitable?, *Proceedings of the Tenth International Conference on Computers in urban planning and Urban Management (CUPUM),* Iguassu falls, Brazil (on disk)

Wyatt, R. 2003. Face diagrams *Journal of Machine Graphics and Vision* 12 (3), 335-352

URL 1: Adrian Berry - http://www.time.com/time/magazine/article/0,9171,879345,00.html?promoid=googlep

URL 2: *Dan Clinton's description of the rhizome* - http://www.chicagoschoolmediatheory.net/annotations/deleuzerhizome.htm

URL 3: Daniel Tammet - http://en.wikipedia.org/wiki/Daniel_Tammet

URL 4: *Can China feed itself?* - http://www.iiasa.ac.at/Research/LUC/ChinaFood/data/anim/lgp_ani.htm

Melbourne School of Land and Environment
University of Melbourne
Melbourne, AUSTRALIA