A PATTERN LANGUAGE
FOR
SAUDI CITIES AFTER COVID

مركز الإدارة المحلية
Center for Local Governance

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What is a pattern language?

> *"Each pattern describes a problem which occurs over and over again in our environment, and then describes the core of the solution to that problem, in such a way that you can use this solution a million times over, without ever doing it the same way twice"*
>
> *– A Pattern Language, p. 3*

A "pattern language" is a way of sharing best-practice design solutions, which can be applied in particular combinations that are unique to a given problem.

In many fields today, pattern languages have been used successfully to develop and share effective design tools and strategies. Perhaps the widest usage is in computer science, where pattern languages of programming (also called design patterns) are used to develop many operating systems, most games, and many other kinds of programs. In a remarkable spinoff, pattern languages also led to the development of wiki, which was created as a tool to share patterns of software design, and later used (more famously) to create Wikipedia, as well as many other widely-used websites. Additional software spinoffs included Agile development, Extreme Programming, and Scrum methodology.

Pattern languages have also been applied usefully in a surprisingly diverse number of other fields, including human-computer interaction, sociology, molecular biology, business management, manufacturing, and production engineering, to name a few. In fact, many thousands of pat- terns have been written, not only for software and computer architecture, but also for structural principles of organizations, education, social interaction, communication and information technology, even music, chess and poetry. Researchers in these disciplines have adopted the convenient pattern format to present their results, and were also encouraged to try and find links among their patterns. The pattern format is now embraced as a convenient standard in which to write new results in a variety of disciplines.

Pattern languages were introduced most famously in the 1977 book by the architect Christopher Alexander and his colleagues, *A Pattern Language: Towns, Buildings, Construction.* The book offered three remarkable achievements all at once. First, it gave the pattern format for expressing a discovered design result in compact and logical form. This made it easy to reference the result as a best

practice, and to update, edit or revise it as needed later. Second was the idea of a pattern language in which the individual patterns link up using grammar-like rules. Importantly, this emphasized that design patterns are not isolated entities, but are embedded in a contextual web-network. Third, the book presented the specific collection of 253 numbered patterns developed by Christopher Alexander and his associates at that time, as an impressive initial collection.

Since then, many authors have developed new patterns and pattern languages for a variety of specific projects. One of them was a collection of 80 patterns for rapidly developing parts of the world, developed at our centre (The Centre for the Future of Places, KTH Royal Institute of Technology, Stockholm) in partnership with UN-Habitat and others, and titled *A New Pattern Language for Growing Regions: Places, Networks, Processes.* This collection includes 80 new patterns aimed at many emerging challenges for cities, including finance, governance, technology, and other issues crucial for implementation. We have selected some of the most appropriate patterns for this collection.

Additional patterns in this collection were written specifically for the challenge of Saudi cities as they emerge from the COVID pandemic, and as they face other related challenges for the future. The Table of Contents (on the following page) outlines these.

The patterns are organized by topic (*Thermal Comfort Patterns*, etc.) and by time scale (*Tactical and Low-Cost, Intermediate,* and *Long-Term*). Each topic includes nine of the most relevant patterns, organized according to the three scales.

This is not an exhaustive collection of patterns for Saudi cities after COVID. Rather, it is meant to provide a point of beginning for community leaders and stakeholders, so that they can select, modify, add, delete, and/or develop their own local project-level pattern languages. The patterns included here are simply the most relevant ones we have identified, within the context of our own research on Saudi cities and their post-COVID challenges. As such, they are meant to serve as a useful resource in adapting to this and related challenges of our urban future.

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WHITE SHADING CANOPIES

…When planning a WALKABLE STREETSCAPE,* make sure to provide for thermal comfort – even when budgets are limited.

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Problem-statement: What is a practical and low-cost way to create shade in urban areas?

Discussion: While street trees are beautiful, they are not appropriate for all locations, and they can take years to grow to sufficient size. Arcades and other permanent shading structures are also expensive. A simpler, lower-cost and more immediate solution is to suspend white canvas (or suitable synthetic) fabric across public spaces, between buildings or on sign posts. They can be fashioned to take on swooping sail-like shapes, or other pleasant forms. They can me remarkably effective in promoting thermal comfort.[1]

Care must be taken to keep the canopies high enough that they don't interfere with pedestrians or vehicles, and strong enough (with reinforcing cables if necessary) that they don't get caught in high winds.

Canvas canopies combined with trees in a souk in Turkey.

Therefore:

Add low-cost canvas canopies and tarpaulins to walking paths, suspended between buildings and sign posts. Take care to suspend them high enough, and with adequate reinforcing.

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To create a more attractive environment, add TEMPORARY PLANTERS AND FURNISHINGS, and make people more comfortable with VEGETATION EVERYWHERE…

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[1] There are a number of research papers that document the significant thermal comfort benefits of canvas shading canopies. See for example: Galán-Marín, C., López-Cabeza, V. P., Rivera-

Gómez, C., & Rojas-Fernández, J. M. (2018). On the influence of shade in improving thermal comfort in courtyards. *Multidisciplinary Digital Publishing Institute Proceedings, 2*(22), 1390.

DEPAVE GARDENS

…In planning WALKABLE MULTI-MOBILITY,* make sure the balance between vehicular pavement and pedestrian amenities supports the choice to walk, with attractive vegetation.

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Problem-statement: In too many streets and parking lots, there is far more paving area than is needed. This excessive use of paving contributes significantly to urban heating and thermal discomfort.

Discussion: In many locations, pavement can be removed, and gardens can be added in its place. These gardens not only lower the actual urban heating. Research shows that they also promote the subjective perception of thermal comfort.[1] Furthermore, such gardens can have the effect of narrowing the apparent width of traffic lanes, which has been shown to slow traffic and improve pedestrian safety. Lastly, they help to beautiful streets and neighborhoods, and make them more attractive to pedestrians.

It is important when creating such a garden to prepare the subgrade properly. Many times there are unsuitable materials that will not provide adequate drainage, and these must also be removed. A new planting bed can then be prepared, including suitable drainage material and adequate depth of soil.

It is also important to provide protection from vehicles, which can be done with curb materials, bollards, or other barriers. It may also be advisable to add a gravel strip or "verge" at the edge of these gardens, so that water from the road will drain into them before contaminating the garden itself.

Lastly, in the Saudi context, it is important to use low-water vegetation, and to provide irrigation at whatever level is needed (ideally while the plants are becoming established).

Families and children involved in a depaving project in Portland, Oregon, USA. Photo by Depave.org.

Therefore:

Identify places where depaving projects can occur. Work with local community groups, neighbors and businesses to organize the depave garden projects. At the municipal level, provide the appropriate permitting and incentive funding for projects to proceed at low cost and low administrative complexity.

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Create depave garden projects using PUBLIC-PRIVATE PLACE MANAGEMENT. You can install STREESCAPE FURNITURE or even PARKLET BOOTHS in some locations…

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[1] There are a number of studies that document this effect. See for example Nikolopoulou, M., & Steemers, K. (2003). Thermal comfort and psychological adaptation as a guide for designing urban spaces. *Energy and Buildings, 35*(1), 95-101.

COOL COLORS

…In planning your PUBLIC SPACE SYSTEM,* make sure that the surface colors promote comfort.

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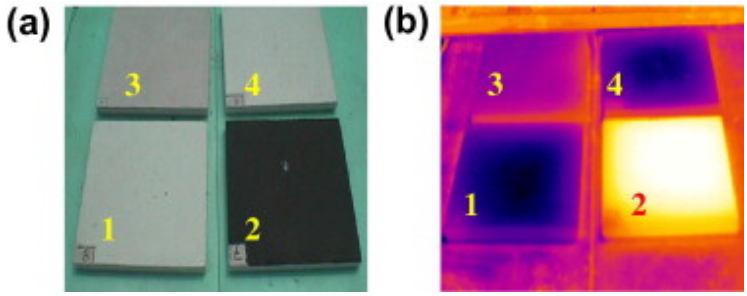
Problem-statement: Many urban surfaces radiate heat, increasing urban heating and thermal discomfort. Sometimes, the problem is simply that the color chosen produces heat radiation.

Discussion: It is known that different paints and other surface coatings absorb solar radiation differently, and radiate it out as heat to different degrees. In general, lighter colors reflect solar radiation away from an urban area without warming the surrounding air as much as darker colors. This is called "solar reflectance." In addition, lighter colors tend to have lower infrared emittance, which is the degree to which a surface will release absorbed heat. Both factors result in lower heating of the surrounding air, and significantly better thermal comfort for residents. Both factors can also contribute to reduced demand for building cooling, when applied to roofs and walls.

It is not only the visible color of the coating that is a factor, but the behavior of the material itself. So-called "near infrared pigments" can have superior performance because they do a better job reflecting the portion of the spectrum that generates heating than other piments of the same apparent color.

There are other sophisticated materials that can enhance thermal performance, including so-called nano-materials. This is a promising area of research. [1]



A normal photograph (left) and infrared photograph (right) of four concrete tiles: 1) a cool white coating, 2) a black coating, 3) an unpainted concrete tile, and 4) a different cool white coating. As can be seen in the infrared, the black coating is radiating much more heat, and the cool color coatings are radiating the least. From Santamouris, M., Synnefa, A., & Karlessi, T. (2011).

Therefore:

In retrofit and new projects, look for cool colors and materials for exterior surfaces, including walls, ground surfaces and roofs. Generally, these will be white or off-white, but they can employ other kinds of materials too. Consider repainting or coating dark surfaces with cooler color and materials. Replace hot asphalt wherever possible with lighter materials.

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Use cool colors for your PAVEMENT PAINTING and your DISPERSED PASSAGES throughout the city…

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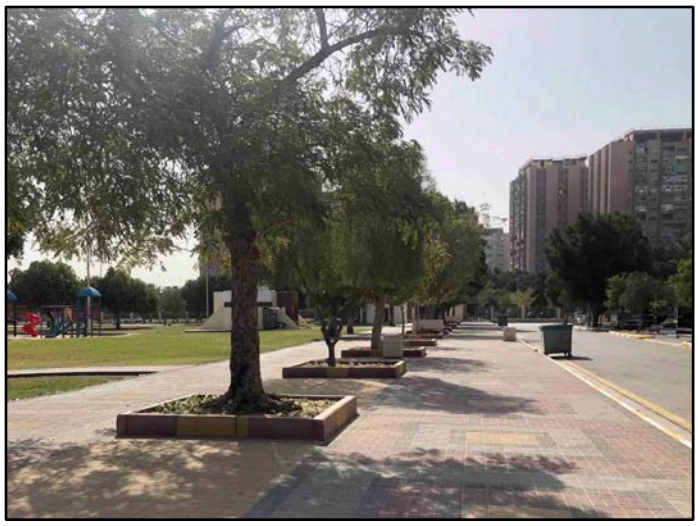
[1] See for example Santamouris, M., Synnefa, A., & Karlessi, T. (2011). Using advanced cool materials in the urban built environment to mitigate heat islands and improve thermal comfort conditions. *Solar Energy, 85*(12), 3085-3102.

STREET TREES



…Make sure your WALKABLE STREETSCAPE* is comfortable and attractive.

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Problem-statement: Few elements provide more cost-effective benefits to neighborhoods and cities – including thermal comfort – than street trees.[1] But there are challenges with their placement and maintenance.

Discussion: There are many considerations for selection and placement of street trees, and one of the most important is the ability of trees to survive with low maintenance in what can be a stressful urban environment and climate. Many neighborhoods have lost huge numbers of trees due to disease. It is therefore important to pick hardy, climate-appropriate species, and mix them so that a die-off of any one species will not denude the entire street.

Street trees must also be placed to avoid interfering with overhead power lines, and with buried utilities. So-called "root guards" — barriers that force the roots to travel downward and not sideways — can protect utilities as well as concrete sidewalks. Trees

that are in vulnerable locations, prone to damage, need to be protected with curbs or bollards.

Therefore:

Plan streets with street trees at their edges and medians, varying in species and in placement as appropriate for building frontages. Select species and placements that will provide maximum shade for pedestrians. Place trees to avoid conflicts with overhead power lines, and protect buried utilities with root guards if needed. Protect them with tree guards when young.

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Street trees can be an important contribution to VEGETATION EVERYWHERE…

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[1] A review of benefits and challenges can be found at Mullaney, J., Lucke, T., & Trueman, S. J. (2015). A review of benefits and challenges in growing street trees in paved urban environments. *Landscape and Urban Planning, 134,* 157-166. A shorter overview of some of the same issues is provided by Dan Burden, at Burden, D. (2006). 22 benefits of urban street trees. Orlando FL: Glatting Jackson and Walkable Communities, Inc. Available on the Web at http://www.walkable.org/download/22_benefits.pdf

*Thermal Comfort Patterns * Intermediate*

PEDESTRIAN PERGOLAS

…To promote WALKABLE MULTI-MOBILITY,* make sure there are attractive protections from too much hot sun.

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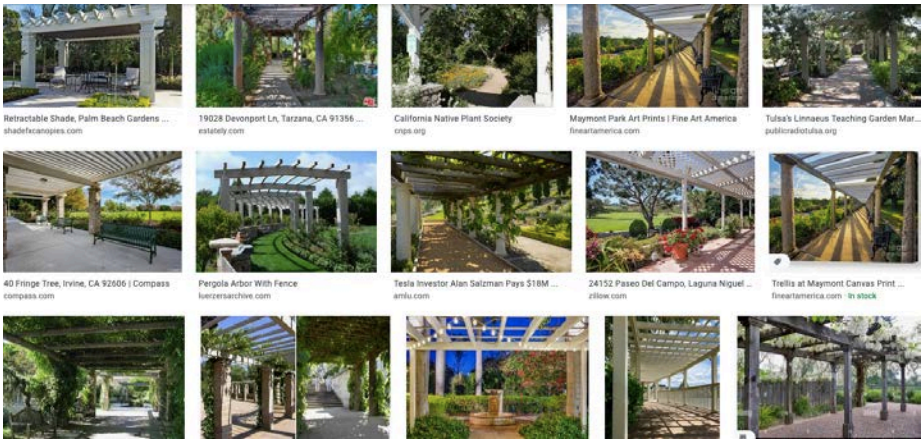
Problem-statement: Walking paths and sidewalks do not need to be hot, boring and unpleasant. In particular, thermal comfort can be improved with pergola structures.[1]

Discussion: There are many attractive examples of pergolas and trellis structures that have been introduced to urban pathways. Typically, they have "vine pockets" or small beds in which vines can take root, and grow onto and over the structures. The vines can then provide shade as well as attractive vegetation at eye level. The vines should be low-water species, and the vine pockets should be irrigated as needed.

The pergolas need not run the entire length of a block or street: they can run in segments, interrupted with small focal points, fountains and seating areas.



A selection from the many kinds of pergola structures shown on Google Images.

Therefore:

Wherever possible, add pedestrian pergolas to streets and parks, to provide shade as well as beauty. Make them with vine pockets to support climbing vines. Select low-water species.

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Use the pergolas to create VEGETATION EVERYWHERE, and to create memorable segments within the network of PATHS AND GOALS…

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[1] See e.g. Ridha, S., Ginestet, S., & Lorente, S. (2018). Effect of the shadings pattern and greenery strategies on the outdoor thermal comfort. International Journal of Engineering and Technology, 10(2), 108-114.

COOLING WATER FEATURES

…Water features can be woven into the city's BLUE-GREEN NETWORK.*

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Problem-statement: In hot weather, people want to be near water, and to be cooled by it.

Discussion: Water features can be expensive and extravagant – but they don't have to be. Even a small fountain or pool can be a boon to a hot pedestrian. It is better to spread out many small and medium-sized water features, than to have only a few extravagant displays.

Instead, the water features can be located periodically along the streets, squares, park paths, and other pedestrian pathways in the city. They should include pools, which help with surface evaporative cooling, as well as streams of water. These provide cooling, and their splashing sounds are also pleasant and inviting. Misting jets can also be added for additional cooling effect.

A beautiful fountain.

Therefore:

Periodically along the sidewalks and pathways of the city, create small and medium-size places for water features. Create shade and seating areas around them. Allow the water to shoot up into streams or patterns of mist, in order to enhance the cooling effect and delight the senses of passersby.

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Make the water features part of the network of PATHS AND GOALS. You can also locate them near OUTDOOR DINING AND REFRESHMENTS…

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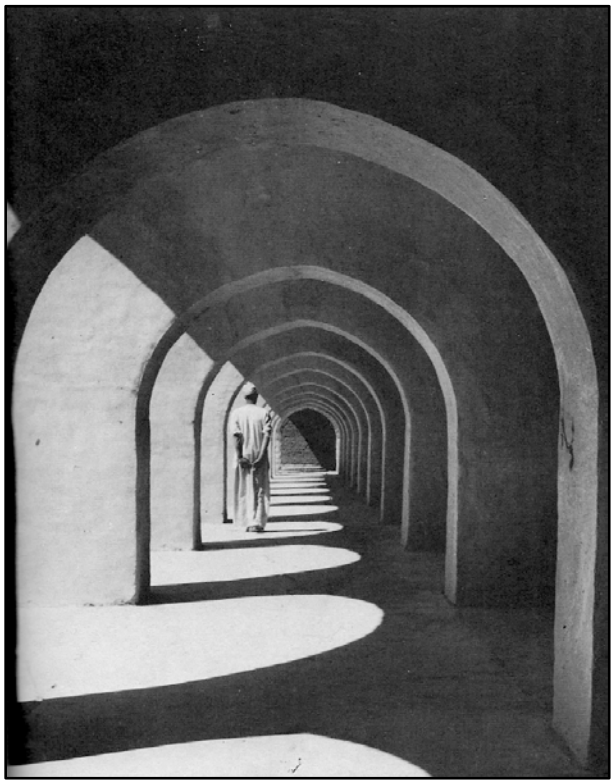
[1] Setaih, K., Hamza, N., & Townshend, T. (2013). Assessment of outdoor thermal comfort in urban microclimate in hot arid areas. In *13th International Conference of International Building Performance Simulation Association,* Chambery, France (pp. 3153-3160).

ARCADES**



…As part of the LAYERED ZONES* of the WALKABLE STREETSCAPE,* add arcade structures to the buildings.

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Problem-statement: Arcades - covered walkways at the edge of buildings, which are partly inside, partly outside - play a vital role in the way that people interact with buildings.

Discussion: Buildings are often much more unfriendly than they need to be. They do not create the possibility of a connection with the public world outside. They do not genuinely invite the public in; they operate essentially as private territory for the people who are inside.

The problem lies in the fact that there are no strong connections between the territorial world within the building and the purely public world outside. There are no realms between the two kinds of spaces which are ambiguously a part of

each - places that are both characteristic of the territory inside and, simultaneously, part of the public world.

The classic solution to this problem is the arcade: arcades create an ambiguous territory between the public world and the private world, and so make buildings friendly. But they need the following properties to be successful.

1. To make them public, the public path to the building must itself become a place that is partly inside the building; and this place must contain the character of the inside.

If the major paths through and beside the buildings are genuinely public, covered by an extension of the building, a low arcade, with openings into the building - many doors and windows and half-open walls - then people are drawn into the building; the action is on display, they feel tangentially a part of it. Perhaps they will watch, step inside, and ask a question.

2. To establish this place as a territory which is also apart from the public world, it must be felt as an extension of the building interior and therefore covered.

The arcade is the most simple and beautiful way of making such a territory. Arcades run along the building, where it meets the public world; they are open to the public, yet set partly into the building and at least seven feet deep.

3. Arcades don't work if the edges of the ceiling are too high. At the same time, they need to be high enough, and shallow enough, that people can see in to retail shop windows.

4. In certain cases, the effect of the arcade can be increased if the paths open to the public pass right through the building. This is especially effective in those places where the building wings are narrow - then the passage through the building need be no more than 25 feet long. It is very beautiful if these "tunnels" connect arcades on both sides of the wing. The importance of these arcades which pass right through a building depends on the same functional effects as those described in Building Thoroughfare (101).

Arcades that pass through buildings.

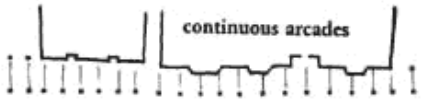
In those parts of the world where this pattern has taken hold, there are miles of linked and half-linked arcades and covered walks passing by and through the public parts of the town. This covered space then becomes the setting for much of the informal business of the city. Indeed, Rudofsky claims that such space "takes the place of the ancient forum." A good deal of his book, *Streets for People,* is concerned with the arcade and the marvelous ambiguities of its space:

It simply never occurs to us to make streets into oases rather than deserts. In countries where their function has not yet deteriorated into highways and parking lots, a number of arrangements make streets fit for humans; pergole and awnings (that is, awnings spread across a street), tentlike structures, or permanent roofs. All are characteristic of the Orient, or countries with an oriental heritage, like Spain. The most refined street coverings, a tangible expression of civic solidarity - or, should one say, of philanthropy - are arcades.

Unknown and unappreciated in our latitudes, the function of this singularly ingratiating feature goes far beyond providing shelter against the elements or protecting pedestrians from traffic hazards. Apart from lending unity to the streetscape, they often take the place of the ancient forums. Throughout Europe, North Africa, and Asia, arcades are a common sight because they also have been incorporated into "formal" architecture. Bologna's streets, to cite but one example, a re accompanied by nearly twenty miles of portici. [1]

Therefore:

Wherever paths run along the edge of buildings, build arcades, and use the arcades, above all, to connect up the buildings to one another, so that a person can walk from place to place under the cover of the arcades. Take care that the arcades are not so low that they obscure the visibility of shop fronts in the buildings.



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Maintain ACTIVE BUILDING FRONTS at the edges of the arcades. Where the arcades turn and pass through buildings, if they are narrow, make sure they include PASS-BY NICHES to allow social distancing when needed…

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** This pattern was drawn in part from a pattern in the book *A Pattern Language: Towns, Buildings,* Construction (1977), Oxford: Oxford University Press. Patterns without asterisks are from this collection.

[1] Rudofsky, Bernard (1969). *Streets for People.* New York: Doubleday, 1969, p. 13.)

INTERNAL PUBLIC PASSAGEWAYS

… Conceive of the PUBLIC SPACE SYSTEM* as including some internal parts of buildings.

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Problem-statement: Building passageways are often important segments of the public space pathways of a city – and they are places that afford shelter from heat and inclement weather.

Discussion: It is customary to think of public spaces as only consisting of parks, and perhaps streets and outdoor passages. But interior building passages can play an important part in providing through movement in a city. Often they are shopping centers and other places of commerce (like the example of the Galleria in Milan, Italy, shown at the top of this pattern). They can also be public buildings, or even streets that have been covered with roof structures (as in Fremont Street in Las Vegas, USA).

Therefore:

Wherever possible, provide passageways to the public through buildings and building complexes. Include small retail and café uses, with seating areas for rest and refuge from the outdoor heat. Keep them open and accessible to the public (e.g. with easements, rights of way, or public-private agreements).

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Assure that the passageways form PATHS AND GOALS, and help to form DISPERSED PASSAGES throughout the city…

*Thermal Comfort Patterns * Long-Term*

LARGE-SCALE MISTING SYSTEMS

… The PUBLIC SPACE SYSTEM* must be kept within the range of human comfort – even its very large spaces.

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Problem-statement: In large gathering areas and places of high pedestrian traffic volume, the heat can be unbearable and dangerous. These are appropriate places to use large-scale misting systems to cool the air.

Discussion: Large-scale misting systems have been used effectively in many areas, including mosque squares and other gathering places. Turbine fans can disperse the mist, as in the example from the Al-Masjid an-Nabawi mosque at the top of the page. Another approach is to use arrays of misters, as shown along the street arcade below.

Misting array in Dubai.

Therefore:

For larger public spaces needing greater cooling, use large-scale misting systems. Use turbines to disperse the mist, or arrays of misting jets arranged above pedestrian spaces to cool the people below. [1]

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Cooling systems are important for WALKABLE PUBLIC SPACE EVERYWHERE…

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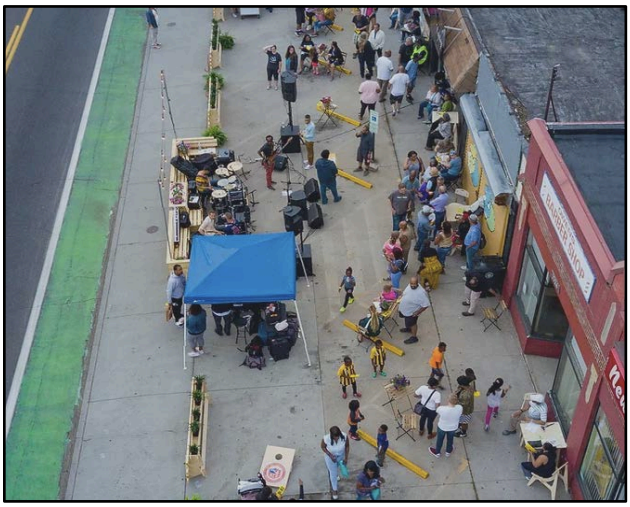
[1] A number of researchers have published guidance on the size of misting equipment and how to place it for best effect. See for example Ulpiani, G., Di Giuseppe, E., Di Perna, C., D'Orazio, M., & Zinzi, M. (2019). Thermal comfort improvement in urban spaces with water spray systems: Field measurements and survey. *Building and Environment, 156*, 46-61.

TEMPORARY PLANTERS AND FURNISHINGS



… To create a WALKABLE STREETSCAPE,* use modest resources, creativity and teamwork.

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Problem-statement: Not every street or sidewalk project needs to be permanent or expensive.

Discussion: When funding is scarce, and when neighbors and businesses are reluctant to approve changes, temporary improvements can allow everyone to experiment without risk of permanent change or high cost.

A number of non-profit institutions have developed methodologies to make temporary changes to streets and sidewalks promote walkability, including Better Block in the USA (pictured above). Their projects are fun gatherings for neighbors and stakeholders of all ages, as well as important opportunities to try out different alternatives before settling on more permanent designs.

An example of a project by the USA non-profit Street Lab.

Therefore:

Set up a process whereby temporary changes can be made to streets and sidewalks to install planters, furnishings, and other improvements. Create a municipal permitting process as well as resources for the neighborhoods and their organizations. [1]

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You can create temporary SIDEWALK EXTENSIONS and STREET FURNITURE that can be made permanent later…

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1 Very helpful guidance has been offered by Neighborhood Commons, an initiative of the Design Trust for Public Space in the USA. They offer a range of resources and recommendations, from city permitting processes to institutional resources to strategies and approaches drawn from instructive case studies - see: https://neighborhoodcommons.nyc/4-Enhancing-the-City-s-Approach-to-Public-Space-Management

*Walkability Patterns * Tactical and Low-Cost*

PAVEMENT PAINTING

… Use COOL COLORS to improve thermal comfort of neighborhood streets and intersections.

Problem-statement: Bare pavement is a blank canvas offering an opportunity for the neighborhood. It is an opportunity for placemaking, for community collaboration, for cooling the air, and for providing exercise and play.

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Discussion: Pavement painting is relatively inexpensive, fun, and helps to calm traffic as cars slow down to enjoy the sight. Bright colors can also help to cool the area – see COOL COLORS. What's more, pavement painting can be used to test out temporary lane changes, sidewalk widening and bike paths that can become permanent later. It does require that the municipality must create a permitting process, but this has been done in many places – for example, by City Repair in Portland, USA (above) and by Better Block in Dallas, USA (below).

A sidewalk plaza is created from an excessively wide intersection in Dallas, USA by Better Block, with pavement paint and planters.

Therefore:

Create a process at the municipal level where neighborhood institutions and citizens can be permitted to paint pavement areas, following local guidance.[1] **Use non-toxic paints that will not degrade water quality when they gradually wear away.**

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Use the pavement painting to decorate SIDEWALK EXTENSIONS. Furnish the area with TEMPORARY PLANTERS AND FURNITURE…

[1] See for example the guidance provided by The Pop-Up Placemaking Tool Kit, by Team Better Block and the American Association of Retired Persons: https://www.aarp.org/livable-communities/tool-kits-resources/info-2019/what-is-a-pop-up-demonstration.html

*Walkability Patterns * Tactical and Low-Cost*

POP-UP VENDING

…Enliven your WALKABLE STREETSCAPE* with temporary retail destinations.

Problem-statement: Where permanent retail is not viable, it may be possible to place temporary or "pop-up" commercial outlets.

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Discussion: Pop-up commercial centers are becoming a more common sight in the wake of the pandemic, when people have felt safer in outdoor settings. But even before the pandemic, food trucks and other temporary retail outlets have become more common, particularly in areas where there is not sufficient for larger retail establishments. But the pop-up units can help to develop a market to support more permanent facilities later on. Moreover, they can offer a low-cost way that small businesses can get a foothold in the local economy, and grow their offerings. (Some very successful restaurants got their start as food trucks.)

A food cart "pod" in Dammam.

Therefore:

Develop policies and procedures for allowing pop-up vending throughout the city. Provide guidance and resources for local community organizations, small businesses and neighborhood groups to find places and recruit vendors. Support their growth into permanent businesses. [1]

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Make the pop-up vending part of your network of PATHS AND GOALS. Incorporate OUTDOOR DINING AND REFRESHMENTS in some locations…

Pop-up vending has been popular in Seaside, Florida for many years.

* NOTE TO READER: Patterns with one asterisk are references to those found in the book *A New Pattern Language for Growing Region: Places, Networks, Processes* (2020), Portland: Sustasis Press. Patterns with two asterisks refer to those in the book *A Pattern Language: Towns, Buildings,* Construction (1977), Oxford: Oxford University Press. Patterns without asterisks are from this collection.

[1] See Greco, J. (2012). From pop-up to permanent. Planning, 78(9), 14-18., https://www.joanngreco.com/wp-content/uploads/2011/01/Popups-Planning-mag-Nov-2012.pdf

*Walkability Patterns * Intermediate*

SIDEWALK EXTENSIONS

… A WALKABLE STREETSCAPE* is not walkable if the sidewalks are of an inadequate width.

Problem-statement: In many places, sidewalks have become narrow, cluttered with obstructions, and too often dangerous.

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Discussion: In the last half-century, we have done a good job making cities for cars – but not a good job making cities for pedestrians. An effective way to remedy

that problem is to increase the width of sidewalks, and to decrease the width of lanes for vehicles.

Although it may seem that this is likely to reduce traffic flow and cause traffic jams, that has often not been the case. In fact, modern policies of street widening have produced even more traffic, in a phenomenon known as "induced demand."[1] By reducing lane width and increasing sidewalk width, we encourage more walking and less driving – and we create safer environments for pedestrians, including children and families.

An unsafe pedestrian environment in Dammam.

Therefore:

Change policies that favor street widening as a default response to favor sidewalk widening instead. Accept narrower traffic lanes and slower design speeds, which are safer for pedestrians as well as vehicle occupants. Allocate funding to sidewalk extension projects, including community-led placemaking projects. Include new planters, trees, and street furniture.

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Include STREETSCAPE FURNITURE, but be careful not to restrict the width for passing pedestrians. Work to create ACTIVE BUILDING FRONTS…

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[1] See for example Litman, T., & Colman, S. B. (2001). *Generated traffic: Implications for transport planning. ITE journal, 71*(4), 38-46.

STREETSCAPE FURNITURE

…Make sure your WALKABLE STREETSCAPE has amenities for pedestrians, including lights, planters, and places to sit.

Problem-statement: People need furnishings on streets in order to be comfortable, to have places to sit, to chat, to be protected, and to watch other people go by. But there are a number of challenges.

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Discussion: There are many forms of furniture that can make a streetscape more active and appealing. Among them are protective bollards, fencing, planters, lamps, string lights, signs, banners, flags, and of course, works of art. In fact, any of these elements can itself be a work of art — like the pedestrian barriers in Stockholm that are lion sculptures, symbolizing the Swedish coat of arms.

In addition to being secure (by being bolted down or tethered), these and other street furnishings also need to be durable and resistant to moisture and damage.

A clever and attractive lion sculpture provides pedestrian and anti-terrorism security in Stockholm.

Therefore:

Provide a generous complement of street furniture, including benches, chairs, sculptures, planters, lampposts, and other amenities.[1]

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Your streetscape furniture can include MOVABLE CHAIRS,* as well as trees and other VEGETATION EVERYWHERE…

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[1] There are many references available for the design of street furniture. See for example Yücel, G. F. (2013). Street furniture and amenities: Designing the user-oriented urban landscape. In *Advances in Landscape Architecture*. London: IntechOpen.

VEGETATION EVERYWHERE

… A city with WALKABLE MULTI-MOBILITY* and BIOPHILIC URBANISM* needs a strong complement of vegetation.

Problem-statement: People have a fundamental need to be in and around plants and greenery. This need is especially acute in cities, where hard surfaces of concrete and metal have a measurable negative effect on health.

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Discussion: A 1984 study by environmental psychologist Roger Ulrich[1] demonstrated a surprising connection between the experience of vegetation and the measurable health outcomes of patients in a surgery recovery ward. Since then, man more studies have confirmed this "biophilic" effect. We have evolved to be around vegetation and greenery, and it seems that we are not at our best when we are deprived of it.

One result of these research findings was the so-called biophilic design movement, which promotes vegetation and greenery as a support for human health and well-being. In this movement, the greening of streets and other public spaces has been a major goal. But it has long been known that greenery makes a neighborhood more attractive and more valuable.

One reason that there is not more vegetation on many city streets is that it can obstruct visibility of the buildings – a concern for retailers, and perhaps for egocentric architects. But some buildings integrate the greenery into the façade design (like the example at top – the Musee du Quai Branley in Paris).

Therefore:

Provide an ample budget for streetscape landscaping – street trees, planters, hanging baskets, and ground cover. But don't stop there – integrate vegetation into the buildings and other structures too, with hanging planters, terrace trees, trellises, espaliers, and other places for greenery.

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Vegetation can help to create attractive LAYERED ZONES* at the edges of ACTIVE BUILDING FRONTS. It should be a universal ingredient in WALKABLE PUBLIC SPACE EVERYWHERE…

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[1] Ulrich, R. S. (1984). View through a window may influence recovery from surgery. *Science, 224*(4647), 420-421.

NEW MIXED USES

…A city with WALKABLE MULTI-MOBILITY* needs to have a mix of destinations where people can walk.

Problem-statement: Segregation of uses – shopping here, residences there, workplaces over there – is one of the worst mistakes of 20th century planning.

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Discussion: We now know that segregation by use causes many problems, including auto dependency, lower rates of walking, more frequent and longer vehicular travel as well as more traffic congestion, lower air quality, greater isolation and declining social interaction, and measurably lower health outcomes. Yet commercial uses need to have particular conditions in order to be successful. They need to be on streets with enough traffic to support the businesses, but not streets that are dangerous to pedestrians.

Some mixed-use places can include "vertical mixed-use," that is, buildings with different uses within the same building. However, these can be expensive, because of the cost of providing the proper fire separations and other requirements. A less expensive option is so-called "horizontal mixed-use," where different uses occur in the same area but in separate buildings.

One of the barriers to mixed use is simply the overly restrictive zoning that does not allow it. But another barrier is the market, which is sensitive to the "four Cs" of retail: *connectivity* (a good position within the "movement economy," visible to people coming and going at the right times of day); *catchment* (the pool of potential customers that are or will be nearby), *competition* (the number of similar stores that might divide up the market), and curation (cultivating a mix of businesses that complement one another, that meet community needs, and that make the entire

center more desirable). Curation often means helping small businesses along that may not have the experience or resources of large chains, but that add value through uniqueness of their appeal.

Therefore:

Encourage new mixed-use areas, consisting of vertical and horizontal mixed use, within 400 meters or every home. Locate them on principal through streets, but not streets that are so wide and fast that they are dangerous to pedestrians. If needed, they can go into new PERIMETER BUILDINGS on the poorly-utilized edges of parking lots and excessively large street setbacks.

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New mixed-use buildings in the USA wrap around a parking area behind them. A conventional "strip" center would likely have large buildings behind parking and wasted median areas.

Situate your new mixed-use areas within a network of pedestrian destinations, along PATHS AND GOALS. Make sure that the buildings have ACTIVE BUILDING FRONTS…

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Construction (1977), Oxford: Oxford University Press. Patterns without asterisks are from this collection.

[1] Leyden, K. M. (2003). Social capital and the built environment: the importance of walkable neighborhoods. American journal of public health, 93(9), 1546-1551.

ACTIVE BUILDING FRONTS

…A WALKABLE STREETSCAPE* needs to have active buildings at its edges.

Problem-statement: A blank or inactive building front will kill the pedestrian life around it. However, an active one will bring many benefits.[1]

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Discussion: People need to see other people, and to see activities in the buildings alongside where they walk. There needs to be a minimum number of windows and doors along a walkable street. Ideally, there should also be NEW MIXED USES along the street as well, at periodic intervals (at least every 400 meters).

So-called form-based codes typically specify that buildings must like the street with active uses at their edges. They often prescribe a minimum amount of window glazing on the ground floor – usually 40% or more. They also typically require entrances to all businesses and all lobbies of residences on the street side (additional entrances may be on the back side).

The MIT professor Kevin Lynch wrote perceptively about the reason that we need active building frontages. "An edge may be more than simply a dominant barrier, some visual or motion penetration is allowed through it—if it is, as it were, structured to some depth with the regions on either side. It then becomes a seam rather than a barrier, a line of exchange along which two areas are sewn together." This is how a building along a city street can not only not pose a barrier, but actually connect the building's activities more directly to the street and the people on it.

Not a barrier, but a seam.

Therefore:

Create URBAN DESIGN CODES that specify the position of buildings, minimum number of windows, and required front door locations. Require that the buildings be sited close to the sidewalk (ideally on its edge, but no more than 3 meters away) and that they have a minimum of 40% of window glazing along their length, as well as front entrances onto the sidewalks for all businesses and residential lobbies.

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The active building fronts can be further enlivened with STREET TREES and STREETSCAPE FURNITURE…

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[1] See Heffernan, E., Heffernan, T., & Pan, W. (2014). The relationship between the quality of active frontages and public perceptions of public spaces. *Urban Design International, 19*(1), 92-

102. See also the very perceptive comments of Kevin Kynch in his highly influential book *Image of the City* (1960, Cambridge: MIT Press).

PATHS AND GOALS**

…A WALKABLE STREETSCAPE and a network of DISPERSED PASSAGES needs to have a clear sequence of segments and destinations.

Problem-statement: The layout of paths will seem right and comfortable only when it is compatible with the process of walking. And the process of walking is far more subtle than one might imagine.[1]

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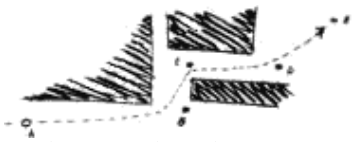
Discussion: Essentially there are three complementary processes:

1. As you walk along you scan the landscape for intermediate destinations - the furthest points along the path which you can see. You try, more or less, to walk in a straight line toward these points. This naturally has the effect that you will cut corners and take "diagonal" paths, since these are the ones which often form straight lines between your present position and the point which you are making for.

2. These intermediate destinations keep changing. The further you walk, the more you can see around the corner. If you always walk straight toward this furthest point and the furthest point keeps changing, you will actually move in a slow curve, like a missile tracking a moving target.

Series of goals.

3. Since you do not want to keep changing direction while you walk and do not want to spend your whole time re-calculating your best direction of travel, you arrange your walking process in such a way that you pick a temporary "goal" - some clearly visible landmark - which is more or less in the direction you want to take and then walk in a straight line toward it for a hundred yards, then, as you get close, pick another new goal, once more a hundred yards further on, and walk toward it. . . . You do this so that in between, you can talk, think, daydream, smell the spring, without having to think about your walking direction every minute.



The actual path.

In the diagram above, a person begins at A and heads for point E. Along the way, his intermediate goals are points B, C, and D. Since he is trying to walk in a roughly straight line toward E, his intermediate goal changes from B to C, as soon as C is visible; and from C to D, as soon as D is visible.

The proper arrangements of paths is one with enough intermediate goals, to make this process workable. If there aren't enough intermediate goals, the process of walking becomes more difficult, and consumes unnecessary emotional energy.

Therefore:

To lay out paths, first place goals at natural points of interest. Then connect the goals to one another to form the paths. The paths may be straight, or gently curving between goals; their paving should swell around the goal. The goals should never be more than a few hundred feet apart.

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You can make your paths and goals more inviting buy placing PEDESTRIAN PERGOLAS along some of the path segments, and COOLING WATER FEATURES and STREETSCAPE FURNITURE at the places that form your goals. You can also include NEW MIXED USES and MANY NEARBY PUBLIC PARKS. The paths and goals are critical components of WALKABLE PUBLIC SPACE EVERYWHERE.

* NOTE TO READER: Patterns with one asterisk are references to those found in the book *A New Pattern Language for Growing Region: Places, Networks, Processes* (2020), Portland: Sustasis Press.

** This pattern was drawn in part from a pattern in the book *A Pattern Language: Towns, Buildings,* Construction (1977), Oxford: Oxford University Press. Patterns without asterisks are from this collection.

[1] Greenwald, M. J., & Boarnet, M. G. (2001). Built environment as determinant of walking behavior: Analyzing nonwork pedestrian travel in Portland, Oregon. Transportation research record, 1780(1), 33-41.

*Safe Public Space Patterns * Tactical and Low-Cost*

SAFE DISTANCE MARKERS

… To be safe in a pandemic, the city's PUBLIC SPACE SYSTEM* needs to have clear guidance on how people can remain at safe social distances.

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Problem-statement: There is a need to provide visual guidance within public spaces for the appropriate social distancing to reduce transmission of disease.

Discussion: Inexpensive, durable markers are now readily available to introduce into public spaces – especially, in places where queues will form to access vending or admissions. However, these markers can be ugly and overbearing. A more attractive option is to develop a unique marker that is locally distinctive, or perhaps has some delightful design features.

Therefore:

Design an attractive, clear, simple marker to guide social distancing in public spaces.

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You can use PAVEMENT PAINTING to create the markers…

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*Safe Public Space Patterns * Tactical and Low-Cost*

PARKLET BOOTHS

… SIDEWALK EXTENSIONS can include former parking areas that are transformed into parklets, and used for dining and other activities.

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Problem-statement: It is possible for family groups and others at low risk to gather safely in small public spaces, as long as the spaces are socially distanced from one another.

Discussion: An example of a safe public gathering space is the parklet booth. These have become a common sight in many places in the wake of the COVID-19 pandemic. Medical guidance has suggested that existing domestic groups, or "pods" – such as families and couples – can gather together safely, and even dine together, since they are likely to have already passed any virus to one another long beforehand.

It is important to recognize that some places benefit from, and even depend upon, on-street parking. The adjacent businesses need spaces for people to stop briefly, or drop off passengers. For that reason, parklet booths should be sited carefully, without removing too much on-street parking where it is needed.

Therefore:

Where parking spaces are in low demand, and where there is aa demand for outdoor dining or gathering, replace the spaces with parklet booths.

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The parklet booths can be integrated into DEPAVE GARDENS. They can also support small gardens, and VEGETATION EVERYWHERE…

PLEXIGLAS STALLS

… Protective structures can be integrated into the STREETSCAPE FURNITURE…

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Problem-statement: People need to be able to gather in public spaces where they are in close proximity to other people, without the danger of disease transmission.

Discussion: It is not always possible to separate people from others within public spaces – even to the minimal amount required for social distancing, between one and two meters or 3 to 6 feet. It is particularly difficult to separate people when they are naturally congregating, for example in lining up to buy products or enter buildings, or in gathering to eat or drink. In such a case, Plexiglas (or safety glass) partitions may be an appropriate intervention.

It is important to make these structures temporary, and easily removed if they become damaged or discolored.

Therefore:

When social distancing requires it, consider using plexiglass panels to provide isolation. Make the panels with trim around their edges, so that people are not likely to bump into them inadvertently.

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The Plexiglas stalls can be used for SOCIAL DISTANCE PLAY STRUCTURES in parks…

*Safe Public Space Patterns * Intermediate*

SOCIAL DISTANCE PLAY STRUCTURES

…Within the PUBLIC SPACE SYSTEM, give children nearby places to play safely.

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Problem-statement: Children need to play with other children – especially during a pandemic – but in a way that also protects them from disease.

Discussion: Some play structures place children into contact with each other, while others allow them to interact while remaining at a safe distance. For example, a see-saw or teeter-totter allows children to play together while separated by at least one meter of space (often more). Swing sets can be set so that children remain at least one meter apart from each other, while still swinging together and enjoying the interaction.

Other play structures are more difficult to adapt to social distancing, including carousels, monkey bars, jungle gyms, and fort and slide structures. It may be more appropriate to have smaller versions of these play structures adjacent to one another, so that individual children can play on individual structures separated from other children.

Therefore:

Provide appropriate play structures for children, allowing them to maintain social distancing (minimum one meter). Use structures that keep children separate (see-saws, swing sets at sufficient distance, and similar structures) or use individual play structures that are close enough that children can play together while maintaining social distancing.

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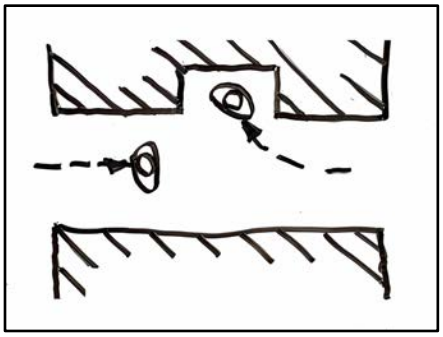
Place the play structures in MANY NEARBY PUBLIC PARKS…

*Safe Public Space Patterns * Intermediate*

PASS-BY NICHE



…Within the PUBLIC SPACE SYSTEM, maintain the ability to practice social distancing, even in narrow passageways.

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Problem-statement: When narrow passageways are a necessity, it is important that people can pass by one another safely.

Discussion: It is helpful to have many pedestrian passages throughout the city. However, some of these are likely to be narrow – perhaps just the spaces between two buildings, or a public corridor within a building. In such cases, it is important that people can avoid others coming from the other direction by stepping aside into niches in the corridors, and allowing the other party to pass.

These niches do not need to be large: they can be perhaps one meter by one meter, or large enough that a person can maintain one to two meters of social distance from others.

Therefore:

When making narrow passages, create niches where people can pass by others coming from the other direction. Space them no further than 15 meters apart, so that people have time to see others coming and step aside. Make them at least one meter square.

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Build many DISPERSED PASSAGES and other forms of WALKABLE PUBLIC SPACE EVERYWHERE to reduce the pedestrian traffic in any one corridor…

*Safe Public Space Patterns * Intermediate*

OUTDOOR DINING AND REFRESHMENTS

…POP-UP VENDING can include places to stop and get refreshments, or linger and sit while eating, drinking and visiting.

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Problem-statement: People need to be able to access food and drinks within the walkable public space system, but in a safe health setting.

Discussion: The outdoor food truck or pop-up café is an increasingly common sight, particularly in the wake of the COVID-19 pandemic. It is a logical and effective response: outdoors, the likelihood of disease transmission is low, and the benefits of walking, socializing, and being out of doors are high.[1]

But there are a number of requirements that have to be met for the success of outdoor dining and refreshment facilities. One is the appropriate location, with sufficient pass-by traffic. Another is the compatibility of the offering with the activities in the area (e.g. cooling drinks near exercise, etc.) Still another is the ability of the business owners, who are often small and not experienced, to manage their finances and business requirements.[2]

Therefore:

Provide the places, and the permitting procedures, for simple outdoor dining and refreshment facilities. These can be food trucks, pop-up structures, or more permanent pavilions or outdoor service areas within larger buildings. Assure that there are places for people to practice social distancing as they get into line or sit down to consume the food and drinks.

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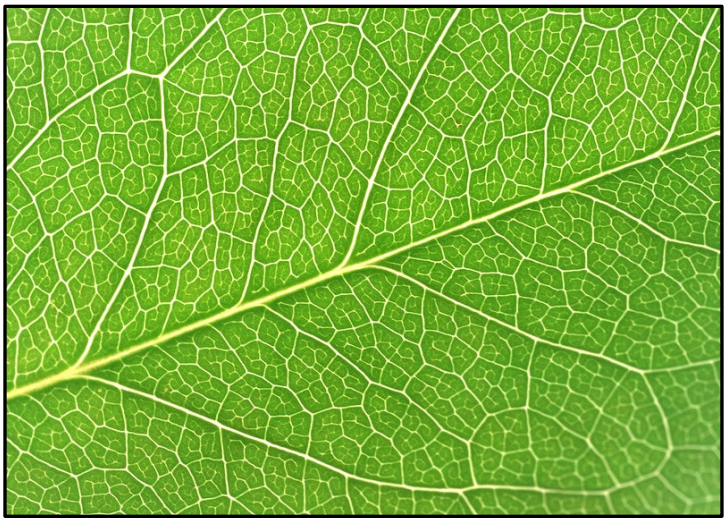
Maintain social distancing with SAFE DISTANCE MARKERS, and if needed, PLEXIGLAS STALLS. Where appropriate, use PARKLET BOOTHS for seating…

[1] An example of research on food carts and pop-up spaces is Newman, L. L., & Burnett, K. (2013). Street food and vibrant urban spaces: lessons from Portland, Oregon. *Local Environment, 18*(2), 233-248.

[2] Portland, Oregon has also been the subject of a study of food cart economics, in Glicker, J. J. (2014). Food cart economics: A comprehensive analysis of Portland's street food market (Doctoral dissertation, University of Oregon). Available at https://core.ac.uk/download/pdf/36692399.pdf

*Safe Public Space Patterns * Long-Term*

DISPERSED PASSAGES



… Link up the city's PATHS AND GOALS with a mesh of small, medium and large passages dispersed across the city.

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Problem-statement: Cities that funnel people into crowded pedestrian passages will experience unnecessary problems.

Discussion: A city's pedestrian pathways are similar to the capillary structures of a leaf: they need to be able to disperse the pedestrians (or the nutrients in the case of a leaf) across a wide area.[1] This dispersed pattern helps to avoid blockages and disruptions. In the case of the COVID pandemic and related challenges, it also helps to provide safe dispersed movement of people, avoiding excessive congestion and contact.

In practical terms, this means that the city must be more than a series of large streets with sidewalks. In fact, these places can be hotter, less interesting, and less inviting to pedestrians, than smaller streets and passages. Moreover, a combination of large, medium and small passages will provide variety and choice to pedestrians, and encourage more walking. This can be enhanced with other attractive features along the way, including COOLING WATER FEATURES.

It is important however to maintain safety along all pathways. This can be done with "eyes on the passage" – buildings with windows that look out onto the paths – as well as other forms of security monitoring and protection. It also helps to provide ACTIVE BUILDING FRONTS as much as possible, including in passageways that do not accommodate vehicles.

Therefore:

Treat all the pathways of the city – streets, lanes, alleys, footpaths, building passages – as an interconnected system of passages, allowing anyone to walk through the

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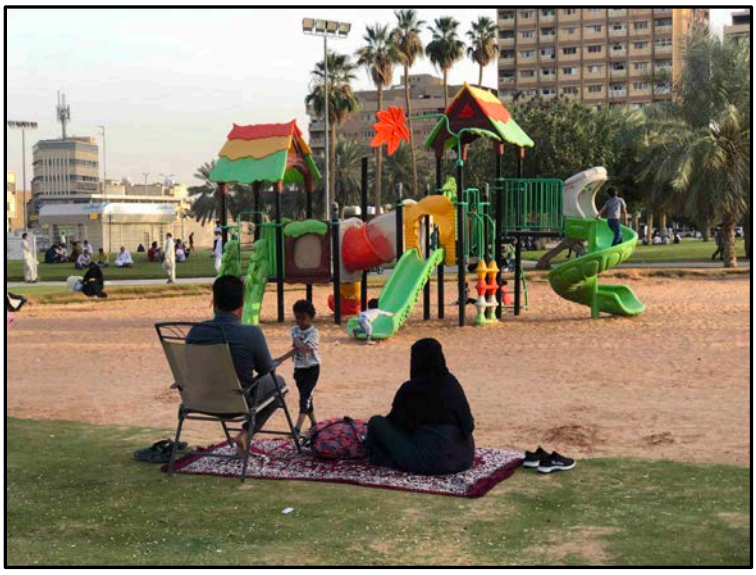
Use the dispersed passages to create WALKABLE PUBLIC SPACE EVERYWHERE. Provide access to MANY NEARBY PUBLIC PARKS…

[1] Our colleague Sergio Porta has documented the interconnected network properties of city pathways, and their benefits. See for example Porta, S., Crucitti, P., & Latora, V. (2008). Multiple centrality assessment in Parma: a network analysis of paths and open spaces. *Urban Design International, 13*(1), 41-50.

MANY NEARBY PUBLIC PARKS



… One of the important regular destinations within the network of PATHS AND GOALS is the neighborhood public park.

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Problem-statement: Families need to be able to have easy access to nearby public parks and play facilities.

Discussion: If people have to drive longer distance to parks, studies show that they won't use them as much. Moreover, the walk to a park is a form of recreation and exercise in its own right – something that the planners and builders of a city should consider as a kind of extension of the park itself.

The importance of proximity to public parks was brought home during the COVID-19 pandemic, when residents were restricted to a small walking radius from their homes. Families who did not have nearby access to parks were impacted particularly hard. Even in normal times, residents gain strong benefits from close access to a park space.[1]

These spaces need not be large, and in fact most of them can be relatively small – perhaps enough for children to access play structures, and throw a ball or play games. Larger parks can be situated between these smaller ones, with the largest reserved for regional facilities – swim parks, large sports facilities and the like. The

smaller parks can be developed and managed by local associations or neighborhood institutions, including homeowner associations. Larger parks can be developed and managed by municipal institutions.

Therefore:

Check that every home is within 200 meters of a public park – small, medium, or large. Where there are gaps, work to build new parks, either with local neighborhood institutions or with the municipal government.

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Use PUBLIC-PRIVATE PLACE MANAGEMENT where necessary to build and maintain the parks…

[1] The benefits of nearby public parks are documented in for example Schipperijn, J., Cerin, E., Adams, M. A., Reis, R., Smith, G., Cain, K., ... & Sallis, J. F. (2017). Access to parks and physical activity: An eight country comparison. *Urban Forestry & Urban Greening, 27*, 253-263.

WALKABLE PUBLIC SPACE EVERYWHERE

… Throughout the PUBLIC SPACE SYSTEM,* assure that it is well-connected for pedestrians.

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Problem-statement: People should be able to walk (or use a wheelchair if needed) whenever they choose to. This is particularly important during a pandemic.

Discussion: Every trip begins and ends with a walking trip – even if only to the car in the parking lot or garage. The most livable cities allow people to walk wherever they choose to. During pandemic lockdowns, this capacity is even more important.

Pandemic or not, the research evidence is clear that there are many benefits to walking and to walkable cities – economic, ecological, social, health – and many negative impacts from an over-reliance on the car and its urban systems. Walkable neighborhoods are typically, on the evidence, more desirable and more economically valuable, healthier, have more social capital (trust and willingness to cooperate), and offer many other benefits.[1]

However, in order to achieve true walkability for all, the city must be reconceived as a network of walkable paths all across its urban structure. This

means not only a few large pedestrianized places, but an interconnected web of large, small and medium connections.

These spaces must also be connected to the places where people want and need to go, and interwoven with other forms of transportation. After all, a person may walk for part of their trip, then take the bus or car for part of their trip. If they are going to a store, they may need to bring a car or taxi to load goods. They may not shop in places where vehicles are inaccessible, even when they don't need a vehicle. For this reason, isolated pedestrian zones must be created carefully, and only where there is sufficient pedestrian traffic to support the institutions located there.

Therefore:

Plan and build every increment of the city as a network of walkable paths – small, medium and large. Mix the paths with other forms of transportation – biking, bus, rail, taxi and private automobile.

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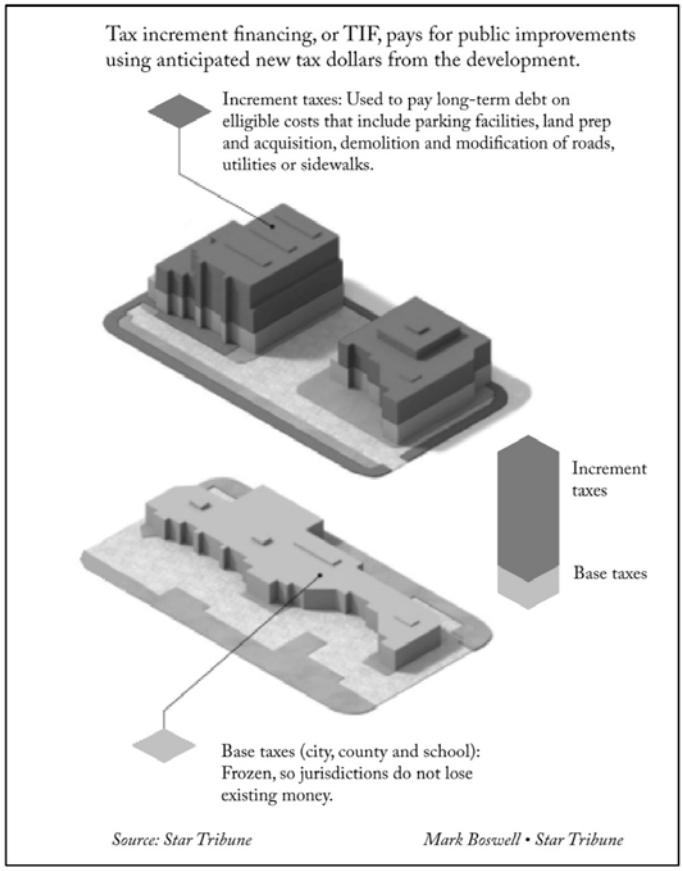
Use SIDEWALK EXTENSIONS and INTERNAL PUBLIC PASSAGEWAYS to create an interconnected network. Keep the paths active with ACTIVE BUILDING FRONTS, and by creating a sequence of PATHS AND GOALS…

* NOTE TO READER: Patterns with one asterisk are references to those found in the book *A New Pattern Language for Growing Region: Places, Networks, Processes* (2020), Portland: Sustasis Press. Patterns with two asterisks refer to those in the book *A Pattern Language: Towns, Buildings,*

Construction (1977), Oxford: Oxford University Press. Patterns without asterisks are from this collection.

[1] There is a large and growing body of research on the benefits of walkability. For economic benefits, see for example Sohn, D. W., Moudon, A. V., & Lee, J. (2012). The economic value of walkable neighborhoods. *Urban Design International, 17*(2), 115-128. For health benefits, see Zapata-Diomedi, B., Boulangé, C., Giles-Corti, B., Phelan, K., Washington, S., Veerman, J. L., & Gunn, L. D. (2019). Physical activity-related health and economic benefits of building walkable neighbour- hoods: a modelled comparison between brownfield and greenfield developments. *International Journal of Behavioral Nutrition and Physical Activity*, *16*(1), 1-12. For social and social capital benefits, see Leyden, K. M. (2003). Social capital and the built environment: the importance of walkable neighborhoods. *American Journal of Public Health, 93*(9), 1546-1551. A good survey of the literature can be found at Talen, E., & Koschinsky, J. (2013). The walkable neighborhood: A literature review. *International Journal of Sustainable Land Use and Urban Planning, 1*(1).

TAX-INCREMENT FINANCING



…Redevelopment and new development projects like URBAN REGENERATION (13.3) and SPRAWL RETROFIT (13.2) need sources of revenue.

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Problem-statement: How can the benefits of future improvements be transmitted financially to the present day, so that they are economically viable in the period before they generate profit?

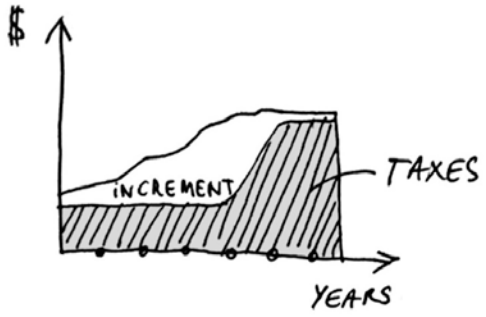
Discussion: One of the most common mechanisms to accomplish this goal is known as tax increment finance. In essence the government entity with taxing power recognizes that the improvements will generate an increment of increased taxes (through sales tax, income tax, property tax or other means) and this increased revenue can be used to service a bond or pay back a revenue expenditure to the taxpayers.

Care must be taken in tax increment finance projects to avoid commingling the public sector with its interests and priorities, with the private sector with its own distinct interests and priorities. This is best done by focusing expenditures on public improvements, including utilities, transportation infrastructure, and especially, public space improvements.[1]

We also have to be careful in how we allocate money raised by such taxes. Spending money optimally has to be done using a "fractal cost distribution" — many small budgets for small projects, a few large budgets for large projects, and a moderate number of budgets for medium projects. When each project competes with the others for funding, it is easy to concentrate on the largest projects, because those need the most money. But this top-heavy mindset too often ignores the intermediate and small-scale projects. A systemic imbalance towards the largest scale will shape the built environment in undesirable ways, and this bias can be overcome by explicitly supporting the more numerous smaller funding parcels.

Therefore:

Use tax increment finance to fund a project early in its life, before it has generated revenue. Take care that the risk of financial failure is mitigated with private forms of insurance, rather than public financial risk. Make sure that the funding priorities are not skewed towards the largest projects, and are targeted to a mix of small and medium projects as well.



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Use tax increment finance carefully with LAND VALUE CAPTURE (17.2), since they can operate at cross purposes. For example, a dependence on property value tax to service debt of tax increment finance can make it difficult to implement land value tax. Therefore, it is better to rely on other streams of revenue than property tax to service tax increment finance. . . .

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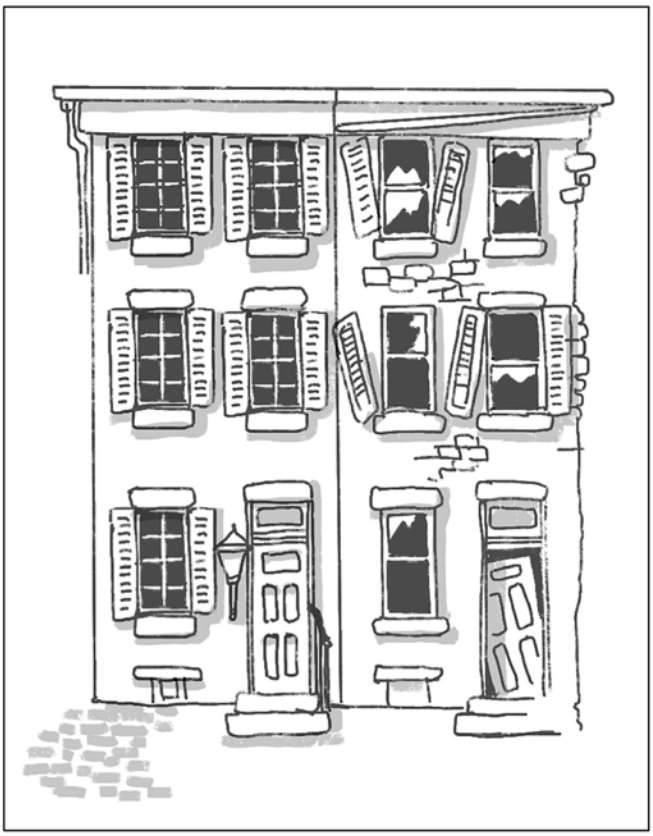
[1] For more see e.g. Johnson, C. L., & Kriz, K. A. (Eds.). (2019). *Tax Increment Financing and Economic Development: Uses, structures, and impact.* Albany NY: SUNY Press.

LAND VALUE CAPTURE



…In creating funding mechanisms for the PUBLIC SPACE SYSTEM (2.3), and accomplishing the other important goals of URBAN REGENERATION (13.3) and other improvements, it is necessary to reform the taxation system, among other systemic reforms.

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Problem-statement: Land and other resources represent shared assets within our commonwealth. We need to maximize their efficient use and productivity by capturing value from their use, not by capturing value gained from the creativity with which they are put to use.

Discussion: There are two separate but related ideas in the notion of land value capture.

One is the idea that at least some of the growth in value of improvements on land needs to be captured so that it can be redirected to public benefit, including the benefit to the public of the improvement itself. For example, a private shop offering services to the public might require public infrastructure before it can be developed. In turn, the private business can pay tax on the land to help to pay back the public debt on the infrastructure.

The other idea is that land itself is a "commons" — a shared resource — that is limited, and the community has an interest in maximizing its capacity to benefit the community economically and culturally. Therefore, we ought to reward those who use such resources sparingly and creatively, over those who use them wastefully.

Both ideas incorporate the tool of land value taxation (among other strategies) to focus on the taxation of the resource, not its creative improvements, as a way of providing relative reward for the efficient use of resources.

Unfortunately, too often the opposite approach is taken, and taxation is made on "improvements" with only a low residual taxation on land (if any). That creates a disincentive to use land and other resources efficiently.

The first major proponent of land value tax was the 19th century economist Henry George. In his landmark book *Progress and Poverty* (1879), he argued that economic rent of land was a more desirable source of tax revenue, more able to incentivize so-called "progressive" goals. (This and related work inspired the Progressive movement of the late 19th and early 20th Centuries.) The book also significantly influenced land taxation policy in the United States and other countries, including Denmark, where 'grundskyld' (Ground Duty) became a major component of its taxation. The principle that natural resource rents should be captured by society is now often known as Georgism.[1]

Therefore:

Implement a land-value tax, carefully coordinated with other taxes to create a maximum incentive to conserve land and other resources, and to maximize urban benefits per unit of urban land.

❖ ❖ ❖

Use land value tax to fund a NEIGHBORHOOD PLANNING CENTER (16.3) and other community resources for better-quality urban development. Create exceptions or rebates for affordable housing projects, and projects that utilize the COMMUNITY LAND TRUST (19.2). . . .

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[1] There is a great deal of research literature available on land value capture mechanisms, including land value taxation. See for example Batt, H. W. (2001). Value capture as a policy tool in transportation economics: an exploration in public finance in the tradition of Henry George. *American Journal of Economics and Sociology, 60*(1), 195-228.

EXTERNALITY VALUATION

…In promoting a healthy POLYCENTRIC REGION (1.1) with healthy PUBLIC SPACE SYSTEMS (2.3), it is necessary to create healthy financial feedback systems.

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Problem-statement: If we do not learn to value "externalities" — costs and benefits that are not normally included in economic transactions — we cannot have a sustainable future.

Discussion: One of the most important lines in Jane Jacobs' groundbreaking *The Death and Life of Great American Cities* — and also one of its least noted — was this one:

> *"In creating city success, we human beings have created marvels, but we left out feedback. What can we do with cities to make up for this omission?"* [1]

Jacobs was referring specifically to feedback mechanisms to create more geographic diversity, and avoid over-concentration and "the self-destruction of diversity" — as discussed for example in the pattern URBAN REGENERATION (13.3). But in a wider sense, Jacobs had her finger on a central problem of all economic processes. A given transaction will quite possibly include impacts in the future, or felt by others today, that are not reflected in the transaction itself. A new suburb might damage the water quality of the surrounding ecosystem, or a new town center might improve the walkability, exercise and quality of life of residents. The former case is an example of a "negative externality" and the latter of a "positive externality."

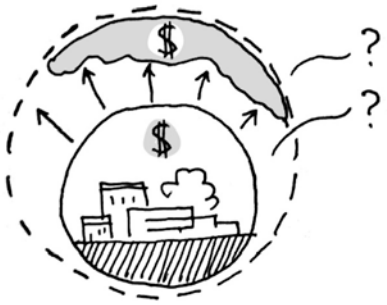
Of course, it is difficult to know what these externalities are in advance, or how they should be valued in the simple scale of a single currency. But governments and companies already do try to value externalities, when governments impose taxes (or use TAX-INCREMENT FINANCING, 17.1) and when companies bring externality costs (like, say, lost employee time) into transactions through contractual agreements (say, requiring payments for the lost time).

We need to do this kind of externality valuation more explicitly, so that we can identify future costs and benefits, and so that we can incentivize and disincentivize the transactions today that will most likely bring them about. This is an imprecise process. But many imprecise processes are made more precise through the pooling of transactions, and through the phenomenon known as "the wisdom of crowds."

Various mechanisms have been developed to take advantage of these dynamics. For example, so-called "Tradable Energy Quotas" function as a way to reduce energy use and greenhouse gas emissions (a major negative externality generated by many energy systems). In effect this is a way of valuing the negative future externality in the present as a cost to be reduced by traders. TAX-INCREMENT FINANCING (17.1) is a way of valuing the positive externality of a new development and redirecting it as an incentive to finance the development. Other mechanisms and tools are in development along similar lines.

Therefore:

Work to create mechanisms that provide externality valuation for both positive and negative impacts.



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Enhance ECONOMIES OF PLACE AND DIFFERENTIATION (17.4) … Use taxation mechanisms where needed, including SPECULATION TAX (19.4), but also other mechanisms of value transfer such as TAX-INCREMENT FINANCING (17.1)….

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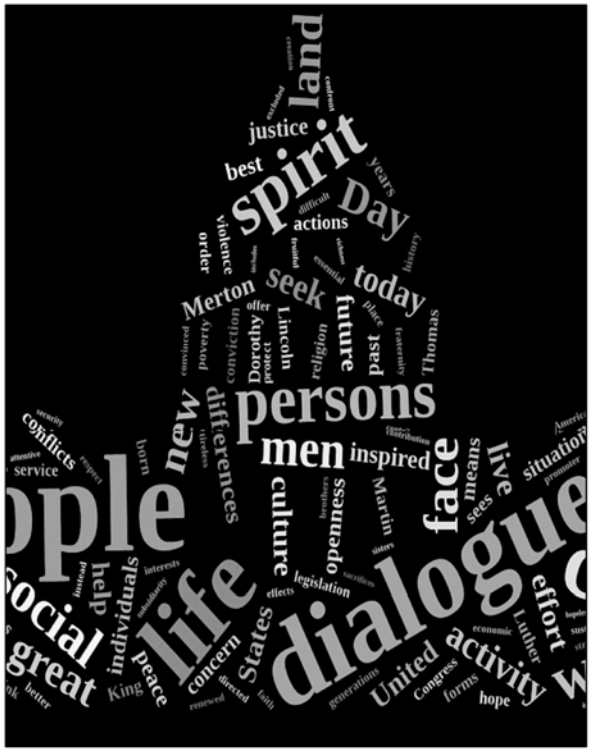
[1] Jacobs, J. (1961). *The Death and Life of Great American Cities*. New York: Random House.

SUBSIDIARITY



… In developing urban projects, it is important to keep the scale appropriate to the project, and as local and distributed as possible — for example in the NEIGHBORHOOD PLANNING CENTER (16.3), and in applying ECONOMIES OF PLACE AND DIFFERENTIATION (17.4).

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Problem-statement: The best-quality adaptive urbanism occurs at the most locally distributed scale possible.

Discussion: We know from the dynamics of highly-adapted complex systems that they often require adaptive actions at small scales, often at the smallest scale possible. In the political realm, this same idea is known as subsidiarity.

The Oxford English Dictionary defines subsidiarity as "(in politics) the principle that a central authority should have a subsidiary function, performing only those tasks which cannot be performed at a more local level."[1] Wikipedia describes "a principle of social organization that holds that social and political issues should be dealt with at the most immediate (or local) level that is consistent with their resolution."[2] The goal is therefore the decentralization of problem-solving to the most distributed scale that is effective. The concept has been developed within and applied to a number of institutions including the European Union, and is stated as a goal of the New Urban Agenda.

What is at stake is not just a working principle of political decentralization, but the ability to solve problems in the most effective way possible. There are indeed times when this requires a centralized response — for example, in creating large-scale infrastructure systems. But very often, a far more powerful approach is to distribute the problem-solving among many decentralized agents within a "complex adaptive system." In the case of urban systems, those agents are the various smaller-scale institutions and individuals that carry out so much of the actual creative work of building settlements.

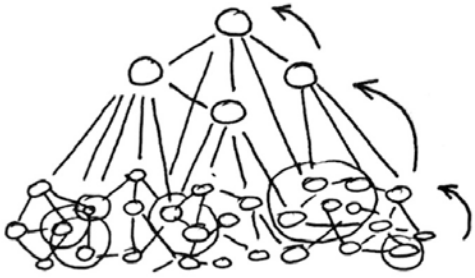
This is not, however, a prescription for a solely *laissez-faire* approach. On the contrary, the role of both the more centralized and the more decentralized units is to work together to establish and maintain cooperative governance structures (see POLYCENTRIC GOVERNANCE, 18.2). This process is dynamic, sometimes messy, but at the same time essential for optimum problem-solving and adaptive quality.

This approach must also be mindful of the pursuit of justice in human affairs. Subsidiarity must not be a license to deprive people of a just opportunity for access to resources and quality of life. In such a case, by definition, the resolution of the injustice must occur on a more centralized scale.

Finally, it is critical to provide mechanisms for monitoring at the smallest scales, to ensure that they actually produce results — not in order to suppress local actions "from above", but instead to provide resources as needed to improve results, using POLYCENTRIC GOVERNANCE (18.2).

Therefore:

Do not centralize decision-making and problem-solving too much in cities and towns — but do not decentralize them too much either. Instead, aim for the distribution of tasks to the smallest possible scale that will be effective in resolving them. Refine and adjust the scales based on results.



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Structure subsidiary institutions according to POLYCENTRIC GOVERNANCE (18.2). Use PUBLIC-PRIVATE PLACE MANAGEMENT (18.3) carefully, without allowing local problem-solving to become too centralized within either public or private entities. . . .

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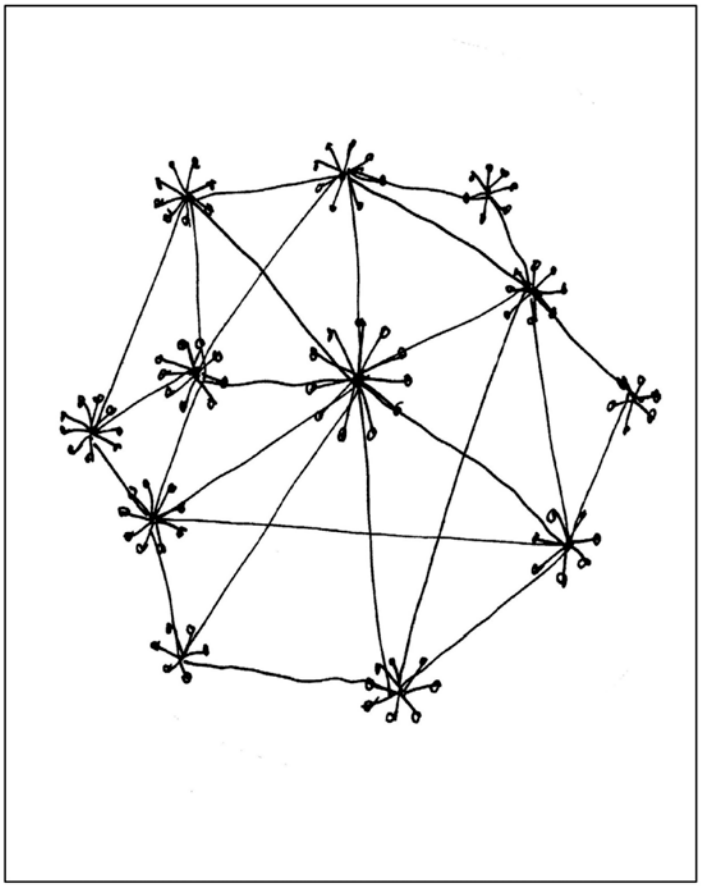
[1] See https://en.oxforddictionaries.com/definition/subsidiarity.

[2] See https://en.wikipedia.org/wiki/Subsidiarity

POLYCENTRIC GOVERNANCE



…The governance of POLYCENTRIC REGIONS (1.1) and all of their components also needs a corresponding polycentric (many-centered) structure…

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Problem-statement: Most of the problems of cities and towns are embedded within inter-connected networks of partly overlapping sub-systems. To be effective, the governance systems of cities and towns need a similar structure.

Discussion: It is crucial for each unit of governance to see itself as embedded within a larger cooperative system which is partly formal, and partly informal. The business of governance of public spaces is thus a matter of continuously negotiating agreements, identifying and resolving problems, working through conflicts (including with other units of governance) and promoting the best interest of the public realm as much as is possible within the constraints of the moment. This is the nature of "polycentric governance."

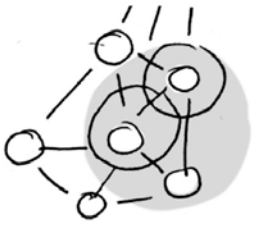
The idea of polycentric governance was developed most thoroughly by the political economist Eleanor Ostrom[1], who described a series of partly overlapping institutions (including governments, businesses, NGOs and individuals) working within a cooperative structure defined by agreements and basic rules. The concept goes back at least to the work of Michael Polanyi, and, as discussed more recently by Aligicka and Tarko[2], is defined as "a social system of many decision centers having limited and autonomous prerogatives and operating under an overarching set of rules". These rules include formal laws, contractual agreements, and informal or even tacit agreements between the polycentric entities.

Consider for example a restaurant with a sidewalk café. The restaurant does not own the sidewalk area, and in fact may not even own its building. It may have a lease with the building owner, and a permit with the city authority controlling the sidewalk. At the same time, the city may have authority over the cleanliness of the restaurant, as well as the fire safety of the building and its owner. In addition, a business association may have less formal control over the kind of signage and street furniture allowed on the sidewalk café. Finally, restaurant staff may have informal control over people who use the seating area, with the right to ask non-customers to leave — even though the staff does not own the sidewalk, does not own the building, and may not own the restaurant! Many overlapping layers of formal and informal governance come together in a network of relationships.

It is important therefore to respect and support these multiple levels of governance. Too often, however, centralized institutions (especially governments) suppress polycentric governance networks, often because they are simply more difficult to manage. This tendency must be resisted, in order to tap the superior problem-solving power of self-organizing and distributed networks.

Therefore:

Structure the governance of place in your city, town or neighborhood as a series of many overlapping formal and informal institutions, a system of "polycentric governance." Various institutions will have formal control over specific defined parts of a structure, but many other institutions will have overlapping and informal controls. Work to cooperate with these various entities from your own position or, very often, multiple positions.



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Recognize and support the least structured forms of place governance, including INFORMAL STEWARDSHIP (18.4). Assure that PUBLIC-PRIVATE PLACE MANAGEMENT (18.3) is balanced, and does not serve the interest of private over public interests.

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[1] See Ostrom, E. (2010). Beyond markets and states: Polycentric governance of complex economic systems. *American Economic Review, 100*(3), 641-72.

[2] See Aligika, P. and Tarko, V. (2012). Polycentricity: From Polanyi to Ostrom, and Beyond. *Governance: An International Journal of Policy, Administration, and Institutions, 25*(2), April 2012 (pp. 237–262).

PUBLIC-PRIVATE PLACE MANAGEMENT

… A PUBLIC SPACE SYSTEM (2.3) must be cared for by a variety of entities, often including a mix of public and private institutions…

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Problem-statement: There are many advantages to involving private as well as public entities in the management of urban spaces, including the construction, improvement and ongoing care of public spaces. But there are important dangers too that must be avoided.

Discussion: A familiar vehicle for the co-management and/or co-development of public places is the public-private partnership. Often these partnerships include private structures as well, forming the ensemble of a neighborhood center or commercial district. At a smaller scale, private entities often become involved in managing the public spaces around their properties.

There are many advantages in engaging private businesses, non-profit institutions and individuals in these formal collaborations. They can often generate the financial and personnel resources needed, they often have expertise about how to address market dynamics, and — perhaps most important — they are often best situated at the more local and distributed scales of public spaces.

At the same time, there are considerable dangers in such an arrangement. Private entities have financial interests which might be in conflict with the interests of the public and its public realm. There may be a slow erosion of true public access in favor of only those members of the public who might become customers of the private entities, or who are perceived to be less "trouble" for the private entities — thereby excluding, say, young people, ethnic minorities, or others who should have access especially to the public realm (with all the normal responsibilities and conditions thereof). In some cases, the exclusion can be tacit or even unintended — perhaps as the result of exclusive symbols or characteristics that remind some of a painful past.[1] In addition, there are requirements in many places for "public accommodation" within private businesses open to the public, and this access must be safeguarded as well.

It should also be recognized that private entities can be allies in making public spaces more accessible to all — for example, by providing "eyes on the street" and other forms of INFORMAL STEWARDSHIP (18.4), thereby making them safer for women, children, and other groups.

It is therefore important to determine which entity is most appropriate to take responsibility of different aspects of place. For example, a win-win strategy may be to divide construction and upkeep so that larger scales are taken care of by public-sector institutions, whereas smaller scales are taken care of by more nimble and more local private entities.

Therefore:

Structure agreements carefully between public and private entities to provide for the development and management of urban spaces, especially public spaces. Provide ongoing public reviews and social surveys, to assure that groups are not being unduly excluded from the public realm. Do not let private entities usurp the proper access to and enjoyment of public spaces — but at the same time, use the distributed capabilities of private entities to improve urban space.

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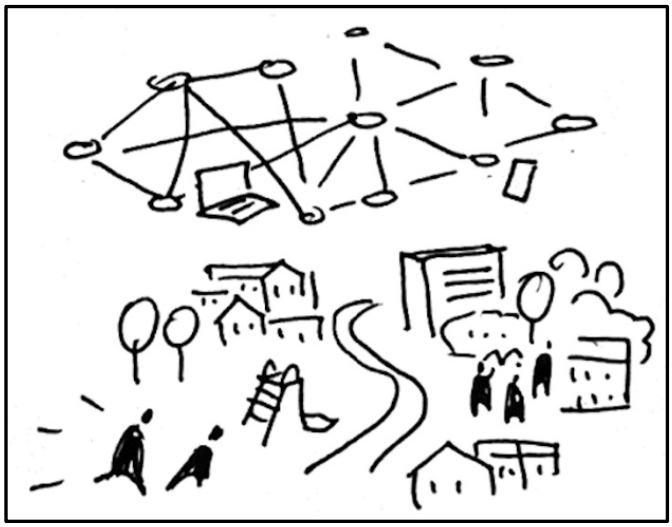
Provide for INFORMAL STEWARDSHIP (18.4) of public spaces within a structure of POLYCENTRIC GOVERNANCE (18.2). . . .

[1] Our colleague Setha Low has written extensively about this challenge. See for example, Low, S. M. (2011). Claiming space for an engaged anthropology: Spatial inequality and social exclusion. *American Anthropologist, 113*(3), 389-407.

SMART CITIES FOR PEOPLE



… A key requirement of POLYCENRIC GOVERNANCE within a scheme of SUBSIDIARITY is to be able to measure progress in relation to goals. Urban data technologies can be indispensable aids in this process.

❖ ❖ ❖

Problem-statement: "Smart cities" that do not empower people to improve their lives cannot actually be smart.[1]

Discussion: There has been much discussion in recent years of so-called "Smart cities" – using technology to become safer, more attractive, more resilient places. There is indeed powerful new technology available to smooth traffic, reduce crime, quickly respond to maintenance needs, manage crowds, and meet other administrative needs.

But this "top-down" model is far from the only form of governance needed. On the contrary, there are many other layers of governance in a healthy city, from institutions to families and individuals. They also need smart technologies, to report problems, find resources and organize effective responses.

Therefore:

Assure that technology is available not only to aid administrators, but to empower local citizens and institutions to meet challenges.

❖ ❖ ❖

Use Smart city technology to build capacity and empower CITIZEN DATA…

[1] There is a great deal of literature critiquing Smart cities, and emphasizing the need for a more human-centered model. See for example, Lara, A. P., Da Costa, E. M., Furlani, T. Z., & Yigitcanla, T. (2016). Smartness that matters: Towards a comprehensive and human-centred characterisation of smart cities. *Journal of Open Innovation: Technology, Market, and Complexity, 2*(2), 8.

AUGMENTED REALITY DESIGN

…When doing COMMUNITY MOCKUPS (16.4), or as part of a NEIGHBORHOOD PLANNING CENTER (16.3), provide digital tools that help residents to assess the character of proposed designs, and participate in their development.

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Problem-statement: It can be difficult for residents to visualize how a new design proposal will fit into their neighborhood.

Discussion: New augmented reality tools are increasingly being used in design projects.[1] Evolving tools can now provide the capability for anyone with a smartphone device to see a model of a new design as if it were in front of them, by looking at their smartphone (or VR headset if they

have one) as if it were a window, with the new design superimposed on the existing scene. This makes it possible for stakeholders to visualize the form and approximate character of a proposed new structure, and even to participate in the design of the structure.

For project design teams, this technology offers a potent tool for public participation, and for gathering feedback and research on evolving design ideas. The technology can also reassure stakeholders that the project is producing a desirable result. Of course, it is crucial that the design team maintain the most honest possible photo-realistic representation of the design, and not falsify it with appealing characteristics that may not be present in the actual built project.

The coming design revolution could well make architecture far more adaptive to human sensibilities. Critics of architectural education condemn how it has focused for one century on making tiny cardboard models and judging aesthetics based on them. Practitioners interested in adaptation have long argued for re-introducing real-world experience into design. This could be done through full-scale mockups, as suggested in COMMUNITY MOCKUP (16.4). Now, with virtual reality methods finally reaching a high level of sophistication and low enough cost to be used by everyone, the situation is changing. Any individual can participate in modeling the sensory experience of a proposed design, which no longer depends upon "experts" imposing an unproven design top-down. We need no longer ignore the users' emotional and psychological reactions in order to focus exclusively on the designers' own aesthetic judgments.

Therefore:

Develop augmented reality tools so that they can simulate proposed designs for stakeholders.

❖ ❖ ❖

Use design with augmented reality in conjunction with CITIZEN DATA (20.4) projects. . . .

[1] See for example Nee, A. Y., Ong, S. K., Chryssolouris, G., & Mourtzis, D. (2012). Augmented reality applications in design and manufacturing. *CIRP Annals, 61*(2), 657-679.

CITIZEN DATA

…In SLUM UPGRADE (13.1) and URBAN REGENERATION (13.3), it is especially important that citizens have access to digital technology to be able to manage their own local issues.

❖ ❖ ❖

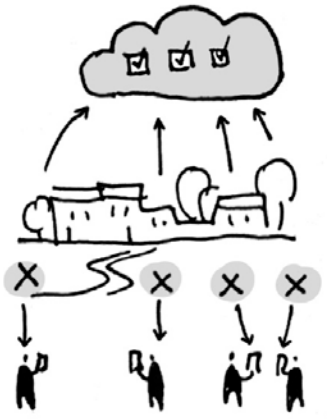
Problem-statement: Many urban problems are known only to the citizens who live there, and reporting is often cumbersome and ineffective.

Discussion: A new generation of citizen data is being used to gather information about neighborhood-scale issues and to identify resources that can be brought to bear to address these issues. They include relatively small-scale problems like potholes, graffiti, vandalism, garbage and the like. Citizens armed with a new generation of digital reporting tools can notify agencies, who are able to take this information in an efficient and aggregated form, and develop a response that is locally calibrated to be effective.[1] For example, a community worker can respond to a series of individual reports in sequence, avoiding the need to respond to each report individually (or more often, to simply ignore the reports).

At the same time, we must be aware of worrying trends that create an imperative need for vigilance. Data is being gathered by private entities, to be used (and abused) in surveillance and in manipulating consumers. Since this collection of big data on such a large scale is unprecedented, it is not yet clear how we can prevent it from becoming a tool for manipulation and even oppression. The endless possibilities of using such data towards a positive goal need to be protected from an equally possible abuse.

Therefore:

Use the new digital reporting technologies to respond to neighborhood-scale challenges where they occur, without the need for individual time-consuming and expensive responses by staff.



❖ ❖ ❖

Work with a local NEIGHBORHOOD PLANNING CENTER (16.3) to make citizen data available at the grass roots. . . .

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[1] There are a number of groups developing citizen data initiatives, including the Citizen Data Lab at the Amsterdam University of Applied Sciences, faculty of Digital Media and Creative Industries. See citizendatalab.org.

Image: Curtis MacNewton via Unsplash.