How Ubiquitous Digital Connectivity Adds Value to Floor Space

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Phone boxes near the end of the line

They are as British as double-decker buses and bobbies on the beat, but after a tradition spanning more than a century BT has announced that it will stop building telephone boxes, because, in the era of mobile phones, few people are using them, writes Keith Perry.

Revenue from BT's 140,000 boxes has dropped by 37% over the past two years. According to the industry watchdog, Ofcom, only 2m people a day make calls from public phones, while mobile phone users talk for 96m minutes every day.

The first payphones were introduced in Britain in 1884, eight years after the invention of the telephone. They were placed in shops, but people were an embarrassed about using them that curtains had to be hung around them.

The red phone box, designed by Sir Giles Gilbert Scott, has changed little since being introduced in 1936. It was replaced in the 1980s with a steel and tinted glass version. About 2,400 of the original red boxes have been given listed building status, and 36,000 are still in use.
Lemelson-MIT list (1995) of the top 25 technological innovations of the last 25 years:

1. The Internet
2. Cellphone
3. Personal computers
4. Fiber optics
5. E-mail
6. Commercialized GPS
7. Portable computers
8. Memory storage discs
9. Consumer level digital camera
10. Radio frequency ID tags

11. MEMS
12. DNA fingerprinting
13. Air bags
14. ATM
15. Advanced batteries
16. Hybrid car
17. OLEDs
18. Display panels
19. HDTV
20. Space shuttle
This all boils down to five points of a new architecture:

1. Wired communication provides infrastructure
2. Wireless communication provides mobility
3. Miniaturized, inexpensive electronic devices provide access points everywhere
4. Digital memory and processing power provide intelligence everywhere
5. Software and online content provides new functionality
What practical difference does this make to architecture, urban design, and real estate development?

How does development traditionally add value to a patch of ground?

1. Provides basic shelter and protection
2. Intensifies the use by multiplying the footprint vertically
3. Forms synergistic clusters of uses
4. Provides comfort and mitigates climatic problems by adding mechanical and electrical
5. Provides telecommunication
How has the digital revolution changed this?

1. Pre-industrial buildings were skeleton and skin

2. The industrial revolution added pipes, ducts, wires, furnaces, HVAC plant -- artificial physiology

3. Telecommunications added nerves

4. Ubiquitous digital communication, memory, and intelligence, combine to equip buildings with central nervous systems

What additional value results?

1. Pocket and wearable devices extend the capabilities of the mobile individual

2. Laptop/briefcase devices free sedentary tasks from fixed locations

3. Injection of digital information into face-to-face settings produces valuable new social dynamics

4. Buildings become programmable devices that can respond actively and intelligently to changing needs and conditions
How does this affect an organization's yearly space cost?

Can you squeeze more activity into less space?

Are there new ways to intensify site use?

Consider a traditional approach to minimizing annual space costs:
Consider a traditional approach to minimizing annual space costs:


1. There are \( n \) activities and \( m \) available locations (where \( n < m \)), and the task is to find an optimal assignment of activities to locations

2. The locations are embedded in a circulation network, such that there is a known travel distance between any pair of locations

3. The costs of moving activities from location to location are high, so assignments are stable
Computing the costs:

1. There is an annual fixed cost (rent) of assigning a particular activity to a particular location

2. There is an annual interactive cost of that assignment, found by multiplying travel distances by travel volumes and a cost coefficient

3. The total annual cost to the organization is the sum of the fixed and interactive costs

How does an intelligent, networked environment change this?

1. Spaces become more versatile, so the assumption that particular activities are assigned to particular locations breaks down

2. Trips may become unnecessary if you can switch activities without moving (time division instead of space division multiplexing of locations)

3. Telecommunication may simply substitute for trips (email or phone instead of walk)
How does an intelligent, networked environment change this (continued)?

4. Travel time may become productive (telephone while walking, email while flying)

5. The cost of relocating an activity (moving your office) may become negligible -- cannot assume a stable assignment of activities to locations

Some new ways to intensify space use and minimize space costs:

1. Take advantage of electronically enabled versatility to pursue intensification of space use in the time domain as well as the space domain (minimize down time)

2. Manage more spaces like hotel rooms or metered parking spaces, with occupancy assigned temporarily rather than permanently

3. Create a space market and let occupants of space dynamically self-organize
Efficient space use (continued):

4. Unlock value through navigational intelligence (as with Google and the Web)

5. Manage demand by varying prices (cf electronic road pricing)

Rethink some basic design assumptions:

1. Rethink the definition of net-to-gross -- specialized “program” space may have a lot of down time, and be very inefficient in the time domain, while circulation and other “waste” space may flexibly accommodate many electronically supported uses

2. Rethink design for peak use -- provide for electronic overflow (eg pipe lectures to personal computers, and make available asynchronously)
Basic design assumptions (continued):

3. Rethink the need for environmental controls -- robust electronics means that spaces may no longer need them (eg audiovisual no longer needs darkened rooms)

4. Recognize that inexpensive, lightly serviced spaces -- verandahs, balconies, patios -- may now support many more functions

• Manage activity conflicts through time separation, or electronic intelligence, rather than space separation

Provide new levels of amenity and functionality:

1. Workspace with natural light and ventilation (the laptop in the garden)

2. Electronic safety and security

3. Active electronic healthcare (carry amenity and wellbeing to a new level)

4. Enhanced social dynamics and learning

5. Simplified logistics, greater convenience through RFID, etc
Deploy intelligence to enhance sustainability:

1. Take advantage of new opportunities for intensification and concentration rather than dispersal

2. Decentralized control of highly dispersed energy production as well as consumption

3. Control of lighting and HVAC via numerous sensors and behavior recognition rather than simple thermostats, etc

Intelligence to enhance sustainability (continued):

4. Take advantage of the shift of lighting to solid-state (LEDs) to implement more subtle, controllable, and responsive schemes

5. Take advantage of smart materials, micro devices, and nano devices to implement responsiveness (smart wallboard)
How does the mix of space types in a project change?

1. Adjacency is a very scarce resource, and it is rarely possible in buildings and cities to satisfy all the adjacency requirements among activities (otherwise, minimizing interaction cost would be no problem)

2. Weakening of traditional spatial and temporal bonds among activities allows latent demands for adjacency to become effective

3. New clusters of activity result
Barclays chief speeds up cuts and closures

Canadian plans to take bank into electronic era.
How do building infrastructures, design features, and construction costs change?

1. Provide for new wired infrastructure, wiring closets, and server rooms
2. Consider the quality of the wireless environment
3. Take advantage of embedded sensors and active, programmed surfaces
4. Create buildings that work smarter, not harder -- that are intelligently green
Summary:

Instead of rigid assignments of activities to specialized locations, assignments are dynamic and space is used in a more intelligent and efficient way.

New clusters and development mixes need to be considered.

Increasing component of design activity and construction costs is in the intelligent systems -- growing intersection of construction and electronics industries.
What will building users pay for?

Connectivity no longer much of a differentiator, and is not an end in itself.

Connectivity and intelligence (like electric light and AC) should be part of an integrated strategy to build on the comparative advantage of a location, mitigate its disadvantages, make more intense and efficient use of floor space, provide higher functionality, and enhance sustainability.

Connectivity is a catalyst, enabler, and crucial new component of overall project quality.

The challenge to architects and developers is not simply to add connectivity and intelligence to traditionally conceived buildings.

It is to understand and respond to the impact on demand for space, the mix of space uses in a project, adjacency requirements, concepts of efficiency and net-to-gross calculations, building systems and construction, safety and amenity, and sustainability -- in other words, to fundamentally rethink building types.