



# Infrastructure Innovation for Ageing Societies

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September 9<sup>th</sup>, 2017

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- Hong Kong's ageing population: implications and challenges
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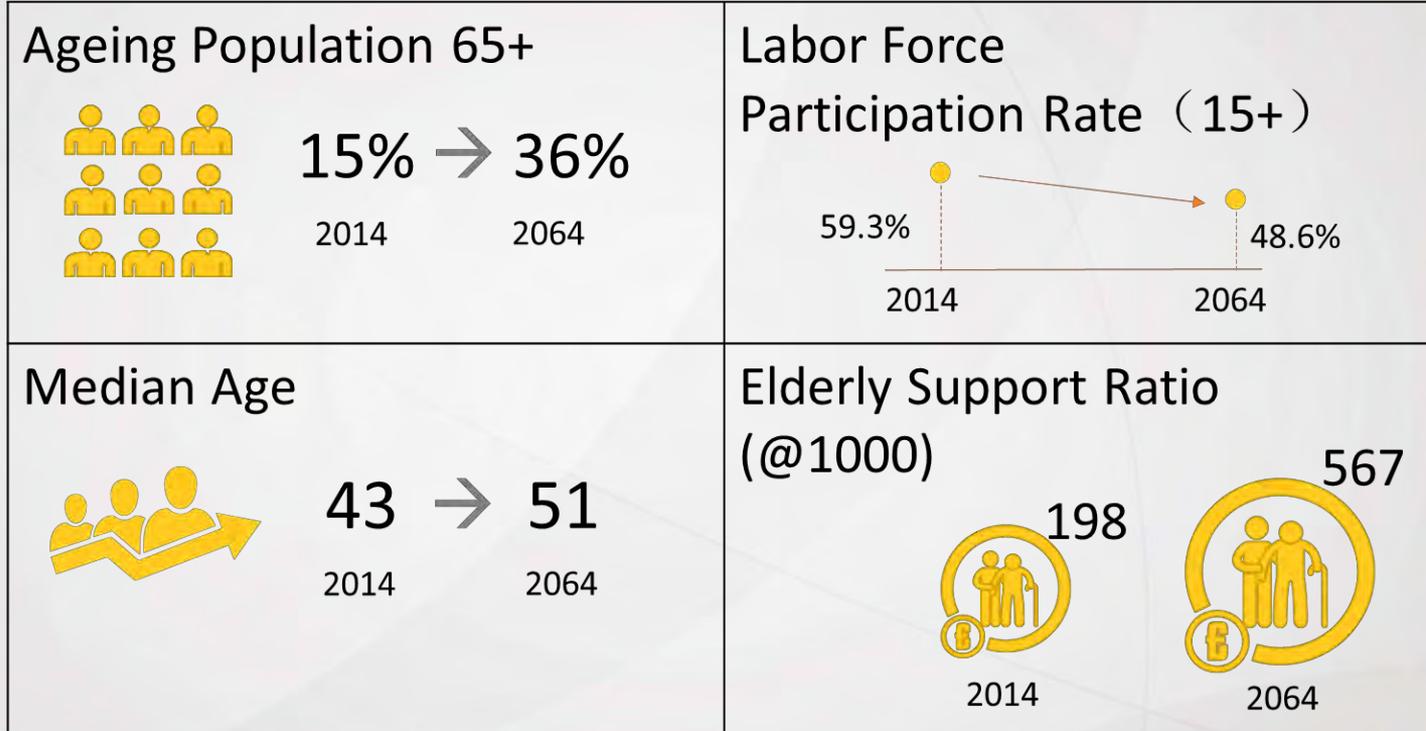


# Hong Kong's Ageing Population

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# Ageing Hong Kong



Census and Statistics Department (2015)

# Implications of Ageing (Economic, Medical & LTC)



<u>Projected Economic Cost</u>	<u>Projected Medical Cost</u>	<u>Projected Long Term Care Cost</u>
Real GDP ↓ 2006 → 2050	<sup>2</sup> 6% of total GDP in 2050	5% of total GDP in 2036

*IMF (2006), Census and Statistics Department (2013), Chung, et al. (2009)*

# Economic Contribution of Older People



## In the UK

- Older people's unpaid work through volunteering and providing social care valued at £44 billion (Cook, 2011)



## In Australia

- Women aged between 65 and 74 contribute AUD \$16 billion per year in unpaid caregiving and voluntary work (Vaus, Gray & Stanton, 2013)



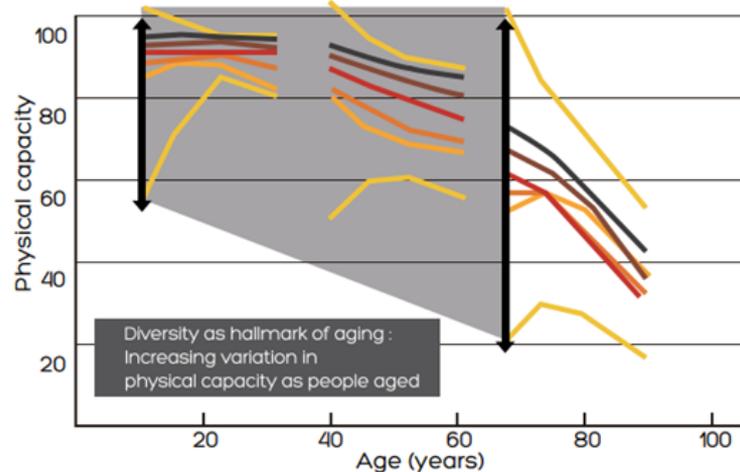
## In HK

- Economic contribution of volunteers in Hong Kong aged 60 to 79 valued at USD \$117 million in 2017, or 0.55% GDP (Leeson & Harper, 2007)

# Diversity as the Hallmark of Old Age

The external environment is a large determining factor for older people's diverse abilities

Physical Capacity Across the Life Course Stratified by Ability to Manage on Personal Finance



- Impossible to manage
- Always difficult
- Sometimes difficult
- Not too bad
- Easy
- Range of physical capacity

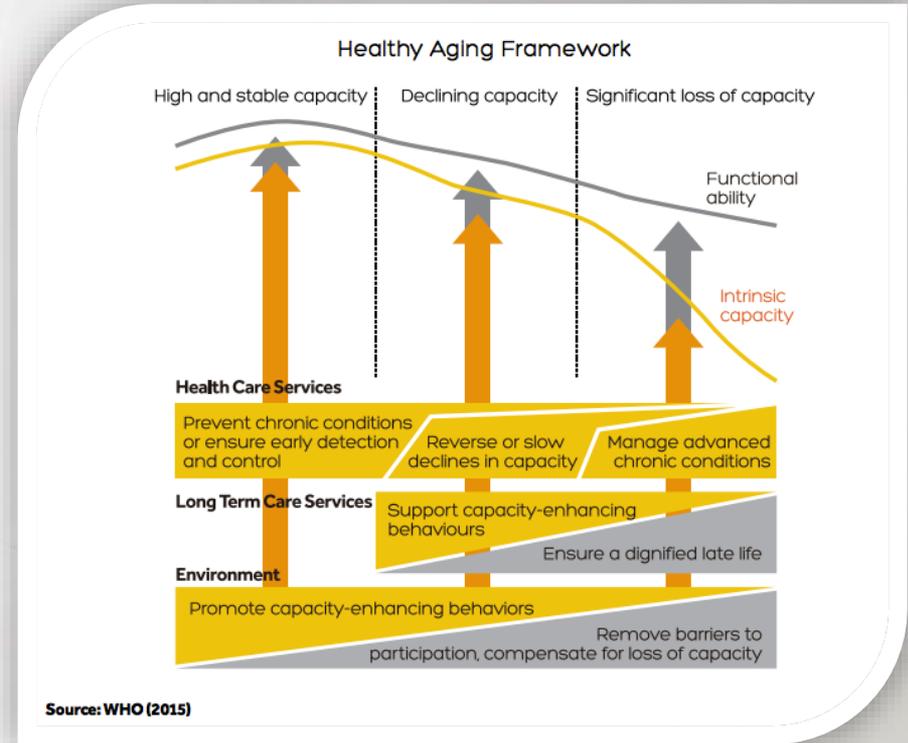
Source: WHO (2015)

# Healthy Ageing Framework

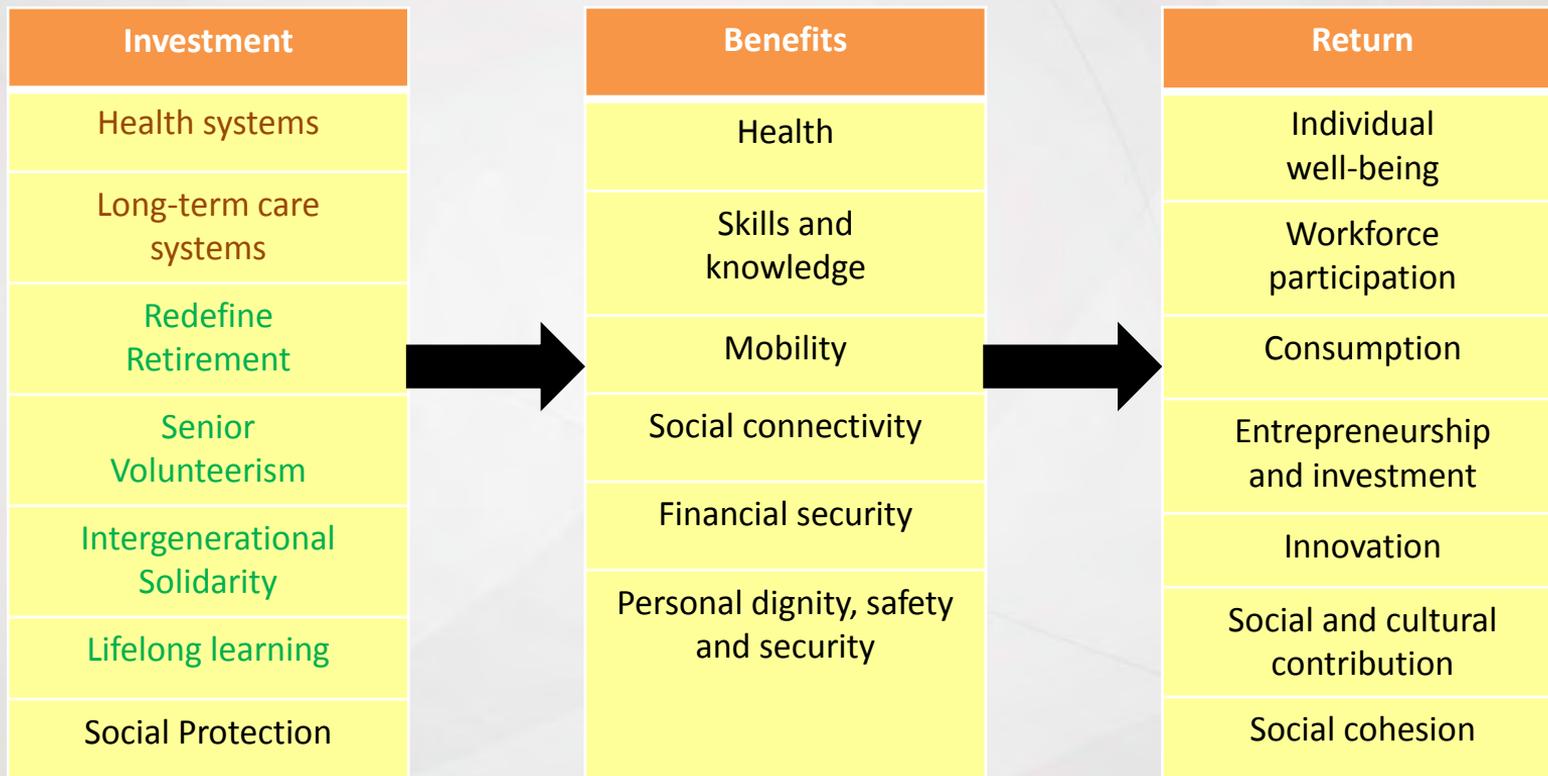


Promote good health to allow endless variations in ageing and benefit individuals and society.

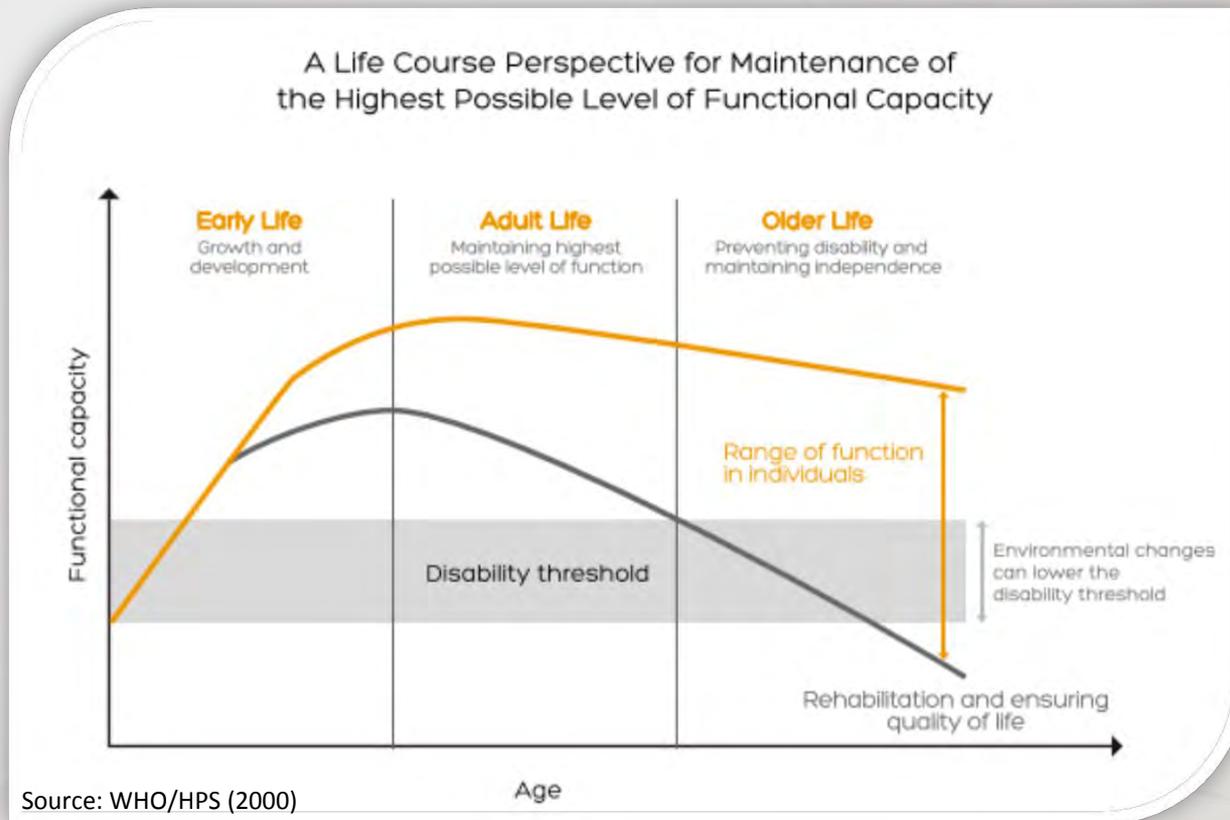
Creating an age-enabling environment, through changing the political, physical and social institutions, so that older people can contribute through participating in workforce and other social activities.



# Invest for Return



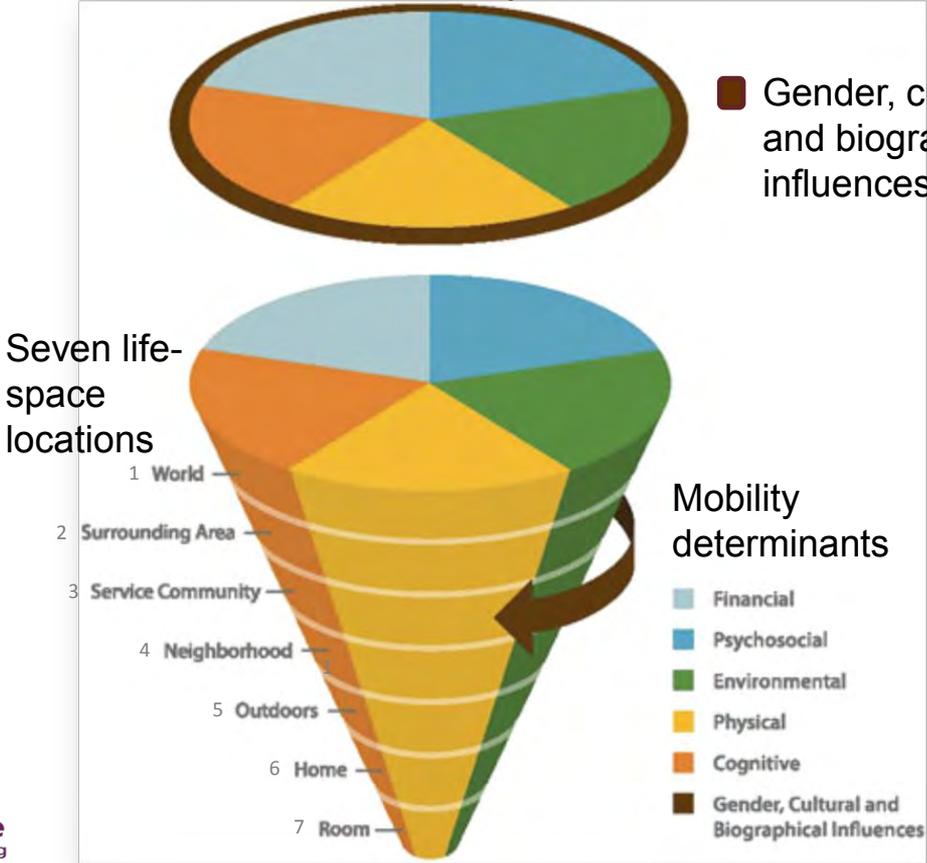
# Functional Capacity Gradually Declines



# Mobility in Older Adults: A Comprehensive Framework

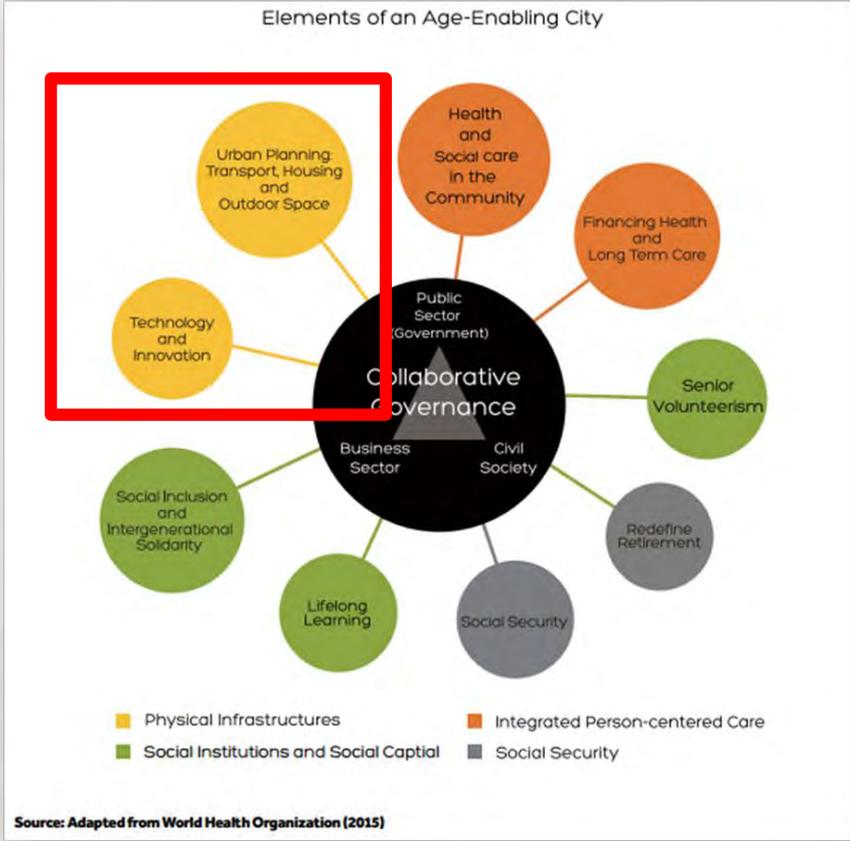


Conical model of the theoretical framework for mobility in older adults



*Webber, Porter and Menec, The Gerontologist (2010)*

# Investing in an Age-Enabling City



# Various Functional Capacities & Environments

## Universal design pyramid

### Group A

Rows 1 & 2: Able-bodied people. Current architecture design aims for a full consideration

### Group B

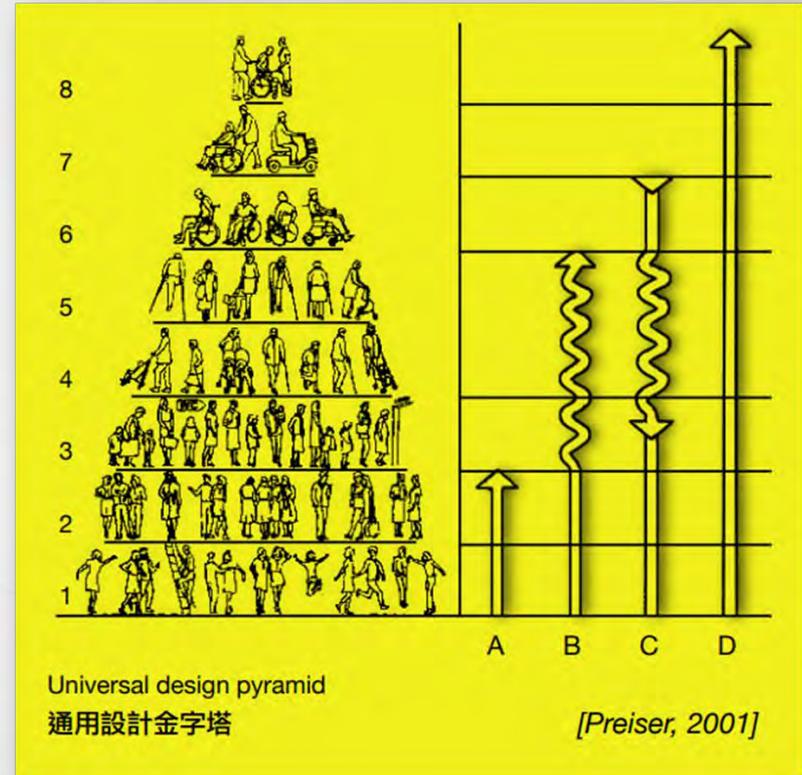
Rows 3, 4 & 5: People who need caregivers or who have disabilities. Need more design feature

### Group C

Row 6: People in wheelchairs able to live independently. Have higher requirements of spatial design

### Group D

People in wheelchairs who need caregivers



# Universal Design



“**Universal Design** is an approach to design that incorporates products as well as building features which, to the greatest extent possible, can be used by everyone.”

*(Preiser, 2001)*

# Universal Design



- Guided by an all-inclusiveness design strategy
- Goal of creating an environment usable by all in the community: Infants, toddlers, children, youth, adults, pregnant and nursing mothers, older persons, disabled, vulnerable groups, the frail and persons in need of care-givers
- Informed by understanding and empathy for the range of human needs and abilities throughout the life course

# Principles of Universal Design



## 1. Equitable use

- useful and marketable to people with diverse abilities

## 2. Flexibility use

- accommodates a wide range of individual preferences and abilities

## 3. Simple and intuitive use

- easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level

## 4. Perceptible information

- design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities

## 5. Tolerance for error

- minimizes hazards and the adverse consequences of accidental or unintended actions

## 6. Low physical effort

- design can be used efficiently and comfortably and with a minimum of fatigue

## 7. Size and space for approach and use

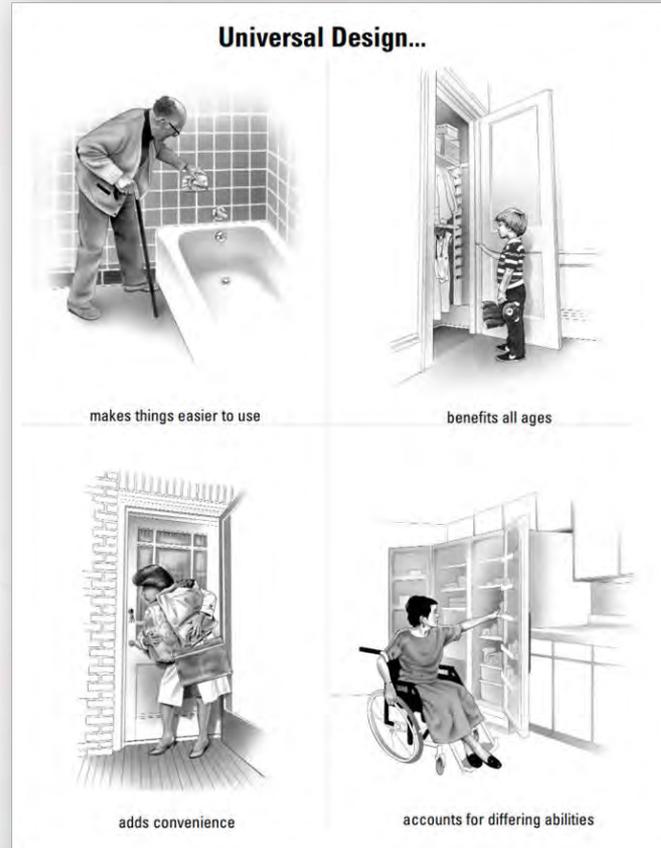
- appropriate size and space provided for approach, reach, manipulation, regardless of user's body size, posture, or mobility

(Preiser, 2001)

# Functional Capacity and Built Environment

The built environment can be enhanced with **barrier-free** & **universal design** principles to better accommodate an increasingly diverse clientele

*The Center for Universal Design*



# Barriers in the Built Environment Today

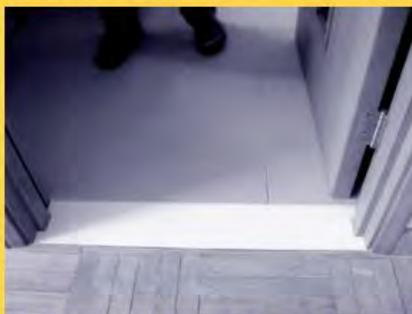
The threshold at the toilet is too high

淋浴室齊平門檻的樣本



Good practice for thresholds at toilets and kitchens

淋浴室齊平門檻的樣本



Example of levelled thresholds for kitchens and toilets

廚房/廁所齊平門檻的樣本



The openings for the gratings are not small enough and are also in the direction of major traffic

渠道格柵開過大且與主要行走方向平行

*Universal Design Guidebook For Residential Development in Hong Kong, Hong Kong Housing Society*

# Barrier-free Infrastructure



*Friends of IFA Japan*

# Universal Design: Hong Kong

## Universal Accessibility Programme

- The Hospital Authority is embracing barrier-free design endeavours



*Ramp at entrance of hospitals*



*Tactile guide paths to accessible lifts*



*Emergency call bell near toilet seat*

# Universal Design: International Example

## Universal Design in Akita Train Station



- 1 Passageway entrance has stairs, an escalator and elevator
- 2 The wide passageway has handrails and a ridged guide path for the visually impaired
- 3 Benches meet the need of a wide variety of users
- 4 Bold and well-lit signs show the multifunctional restroom for children, standard men/women and handicapped

Friends of IFA Japan

# Age-friendly Housing



## The Tanner Hill

- Elderly housing estate in North Point
- Hong Kong Housing Society
- Three-block hub, 588 non-furnished flats from 342 to 821 sq ft
- Chinese and Western medical clinics
- Gymnasium, day care and rehabilitation centres



# Age-friendly Housing



## The Tanner Hill



# 'Gerontechnology' Incorporated into Built Environment



Infrared Thermal Sensing Safety Alert System (LSCM)



Sensara Senior Care Solution (Quoro)



AccurCare (Accurtag Solutions Limited)



Smart Elderly Bed Exit Monitoring System (Rondish Co. Limited)



24-hour Personal Emergency Link System (Senior Home Safety Association)



## Surveillance and Emergency Assistive systems

- One in five elderly community residents aged 65 and above fall every year.
- Surveillance and emergency assistive systems provide senior citizens with care they need and peace of mind for both the user and carers

# International Example: Singapore's Smart Nation



About 80% of Singapore households live in public housing

Government agencies, including the Housing and Development Board (HDB) and the National Environment Agency, are working with industry players to develop and test smart home solutions in HDB estates

Samsung, LG Electronics and StarHub were among 17 participating companies in trials at the Housing and Development Board's Centre of Building Research

# People & Environment



## Principles of Interaction

- **Affordance:** possible interactions between people and the environment. Affordance allows interaction, anti-affordance blocks interaction. Some affordances are perceivable, others are not.
- **Perceived affordance:** possible/impossible actions as perceived by people
- **Signifiers:** means of signaling the affordance and anti-affordance of an object. Can be intentional or unintentional. Perceived affordances can often act as signifiers.
- **Mapping:** relationship between the elements of two sets of things.
- **Feedback:** communicating the results of an action. Provision of immediate and informative feedback will improve interaction
- **Constraints:** physical, logical, or cultural limitations to possible interaction

# Human-Centered Design (HCD)



- Design to accommodate human needs, capabilities, and behavior
- Start with understanding of psychology, technology, communication, interaction
- Good design
  - Let people know what actions are possible, what is happening, and what is going to happen
  - Allows people to know when something goes wrong, understand what is wrong, and take appropriate actions to solve the problem
  - Accommodates different objectives of different people

## Story of the Public Rubbish Bin



# Current Problems



Photo: Apple Daily

Rubbish Overflow. Digital Image. Reach the World [internet]. Accessed on 2016-06-13. <http://www.reachtheworld.org/noras-journey-china/nations/waste-management-problem-hong-kong>

# Public Rubbish Bin as Signifier for Garbage Disposal



**Needs:** People generate garbage, and need to dispose of them.

**Education:** Throw your garbage into a rubbish bin

**Affordance:** Public rubbish bins are designed to hold a certain amount of rubbish

**Perceived affordance:** Presence of public rubbish bins signifies where to dispose of the garbage

**Anti-affordance:** Bigger rubbish might have trouble fitting into the bin

**Social signifier:** Public rubbish bin as garbage collection point is observed by the public

**Perceived affordance:** Bigger rubbish are placed next to/on top of rubbish bins for disposal (and are properly removed by government contractors)

**Lack of constraint:** nothing (except the law) to limit disposal next to the bins



# New Rubbish Bin Design



“The new designs include **smaller openings** for disposing of litter and bigger warning notices affixed to the containers, so as to educate the public not to discard refuse at the **side** or on **top** of litter containers and to dispose of bagged refuse properly at refuse collection points.” – *Food and Environmental Hygiene Department*

Food and Environmental Hygiene Department. FEHD to introduce newly designed litter containers in batches [press release]. Hong Kong. 2016 Jun 6.

# New Design Might Not Be Enough



**Affordance:** Public rubbish bins are designed to hold a certain amount of rubbish

**Perceived affordance:** Presence of public rubbish bins continues to signify where to dispose of the garbage

**Social signifier:** Public still perceive public rubbish bin as garbage collection point

**Increase anti-affordance:** Bigger rubbish will have more trouble fitting into the bin due to the smaller opening (as shown in the picture)

**Perceived affordance:** More rubbish might be placed next to/on top of rubbish bins for disposal (and will still be properly removed by government contractors)

**Lack of constraint:** nothing (except the law) to limit disposal next to the bins

# Example: Recycling Bin in Hong Kong



Hong Kong Recycling Bin. Digital Image. Hong Kong Hustle. Accessed 2016-06-13.  
<http://www.hongkonghustle.com/local-culture/17645/litter-cum-recycling-bin-hong-kong/>



- Litter/Recyclables Collection Bin should replace the traditional unsorted type to encourage recycling
- The mere presence of the traditional bin signifies to people that they can throw away their recyclables there
- It takes a very determined person to hold on to their recyclable rubbish, walk pass many traditional bins, while hunting for the rare recyclable bin
- It is next to impossible to expect that from people who are in an unfamiliar environment

# Anti-affordance in Current Design



Hong Kong Recycling Bin. Digital Image. Hong Kong Hustle. Accessed 2016-06-13. <http://www.hongkonghustle.com/local-culture/17645/litter-cum-recycling-bin-hong-kong/>

**Hygienic concern:** Strength of spring-loaded door is sometimes too strong and makes it hard to push the item into the bin without touching the door

**Inconsistent color code:** The bin for plastic are color-coded to either orange/brown can confuse people

**Insufficient capacity:** The bins might not be big enough to hold the recyclable materials at busy location, causing people to put them in the litter bin or outside the bin

# Improve Signifier for Recycling

→ Non-Recyclable

Clearly mark the non-recyclable vs. recyclable bins to provide clearer signifier and cultural constraints



Recyclable



Remove the general rubbish bin from the recycling bins, to give stronger signifier that those do not belong together. But place them close to each other to make it easy for people.

# Recycling in Barcelona, Spain



- Higher-capacity container to reduce the chance of overflow (increase affordance)
- Shaped opening to signify the intended type of recyclable materials (better signifier)
- Easy to read and understand signs on the bin for acceptable materials (better signifier)

Such as recycling in Barcelona. Wikinotica. 2011 Jan 22. <http://en.wikinoticia.com/culture-science/ecology-and-environment/72646-such-as-recycling-in-barcelona>

# Recycling in Barcelona, Spain



- Covered container for organic and general waste (anti-affordance for smells; affordance for organic recycling)
- Foot pedal to open the cover (good mapping: people are used to open indoor rubbish bin cover with foot pedal)
- Foot pedal to avoid the need to touch the cover (increase affordance by removing hygienic concern)

Such as recycling in Barcelona. Wikinotica. 2011 Jan 22. <http://en.wikinoticia.com/culture-science/ecology-and-environment/72646-such-as-recycling-in-barcelona>

# Design a Healthy Environment



This design separates the smokers and non-smokers.

But does it encourage people to quit?

Would it be a trigger to smoke for those who are trying to quit?

# Go Beyond the Built Environment



- The environment should be designed to facilitate the “healthier choice”
- However, the choice to become healthy is not an on-off switch
- Traditional health promotion mostly assume that people are “rational” who would act according to the best of their interest once they know the facts. **But we know that is not true**
- Change of lifestyle is a continuous, long-term effort that riddles with barriers

# Difficulty of Making Choice



- One-time decision such as register for organ donation is relatively simple when compare to lifestyle change
  - As illustrated in the previous “choosing to be active” example
  - For smokers, they are constantly attacked by cravings and withdrawal
  - For healthy diet, research found that people have to make 200-300 decisions about what to eat on a typical day
- (Wansink and Sobal, 2007)

# Dual-system framework of human behavior



## 1. Automatic System (default system)

- rapid intuitive solutions
- associative, influenced by context
- sensitive to immediate pleasure
- save cognitive effort

## 2. Slow System

- takes over when default solution feel wrong
- controlled
- deliberative
- dependent on cognitive capacity

# Human decision making



- We are not aware that we made those 300 dietary decisions every day because we don't actually “think” about them when we made the decisions
- Decisions that require deliberate thoughts are processed by the (slow) Reflective System (System 2)
- Using the Reflective System is mentally taxing. And it requires the person to have complete information about the situation (which we usually don't have)
- Therefore, we mostly make decisions under familiar situations using the (much faster) Automatic System (System 1) to reduce cognitive loads
- We typically use a few rule of thumbs as mental short-cuts to make decisions through the Automatic System (Amos and Kahneman, 1974). That can lead to seemingly irrational behavior

Amos T, Kahneman D. Judgment under uncertainty: heuristics and biases. Science. 1974;185:1124-31.

# Choice architecture



- The real choice is not between healthy and unhealthy lifestyle
- Thaler and Sunstein (2008) coined the term “choice architecture” to reflect the needs to design the a system that could “nudge” people towards more desirable behaviors
- For example, using opt-out or forced choice for organ donation registration instead of opt-in increased registration rate (Johnson and Goldstein, 2003; Thaler et al, 2010)

Thaler RH, Sunstein CR. Nudge: improving decisions about health, wealth and happiness. New Haven: Yale Univ Press. 2008.

Johnson EJ, Goldstein DG. Do defaults save lives? Science. 2003;302:1338-1339.

Thaler RH, Sunstein CR, Balz JP. Choice Architecture (April 2, 2010). Available at SSRN: <http://ssrn.com/abstract=1583509>

# Choice architecture



Process of designing systems and services in such a way that the “good choice is easy and rewarding and does not take much effort.

# Guided choices



- The choice architecture approach respects the personal freedom to choose, to make informed-decision
- The key is to construct the different options in such a way that people are more likely to choose the more desirable option, **even when their behaviors are controlled by the Automatic System**
- Attention should also be placed on the “user experience”, the experience of the people who need to make the choice and change their behavior

How would you open this door?

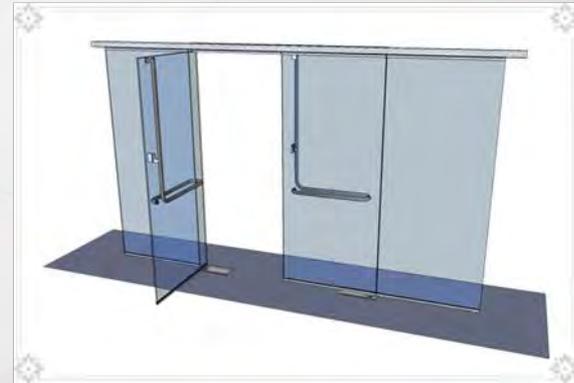


What about now?



# Stimulus response compatibility

- Seeing flat plate on door signals pushing
- Handle on door signals pulling
- But many of us have encountered doors with handles on both sides that can only be opened to one side. **That violates stimulus response compatibility**



# Ageing in place



- To achieve “ageing in place”, instead of the current top-down approach that placed the responsibility on the people themselves, a more supportive environment is needed
- Not just the built environment, but the choice environment should be carefully constructed
- The aim is to **create good choices and user experience** for the people so they are more likely to perform the desired behaviors (not smoking, active lifestyle, healthy diet, etc.)
- That is the future for managing NCD in an ageing society

# Collaboration Between Various Sectors: Urban Planning, Tech, NGOs, Government, etc.



Greater collaboration between technology and urban planning industries in Hong Kong is needed for development of a more age-enabling environment

More innovative collaboration ideas with social enterprises, NGOs





# Thank you

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