

# The Role of *Technology* in *Design*



*a 3-horizons approach*



## **2015 ACS Design & Construction Forum**

Novotel, Brighton Beach | 27 October 2015



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# content, credits & references



The **Big Picture** on **nano**  
 Your future has already started, integrate technology to deliver on your vision

**2015 ACS State Conference**  
 Rosehill Gardens, Sydney | 6+7 May 2015

**Giovanni Di Noto**  
 Head Consultant, Management & Technology | GDN consulting firm

**Systems Integrations**  
 The Next Horizon

**2014 Technology & IT Conference**  
 Current & future directions of technology in the sector  
 Rydges Sydney Airport | 24 March 2014

**Giovanni Di Noto**  
 Head Consultant, Management & Technology | GDN consulting firm

**Retrofitting state of the art IT care systems**  
 A case study

**Design & Construction for an Ageing Population**  
**2012 Sydney Brighton Beach**

**CEO Alexandra Zammit**

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 Head consultant | management & technology  
 GDN consulting firm  
 www.giovannidimoto.com

**2015 ACS**  
 Design & Building

**Thomas Holt**  
 love where you live

**Cardinal Stepinac Village**  
**Rockdale nursing home**



## 3<sup>rd</sup> Horizon

How today's design might mitigate potentially disruptive technologies & future-proof long-life AC assets?

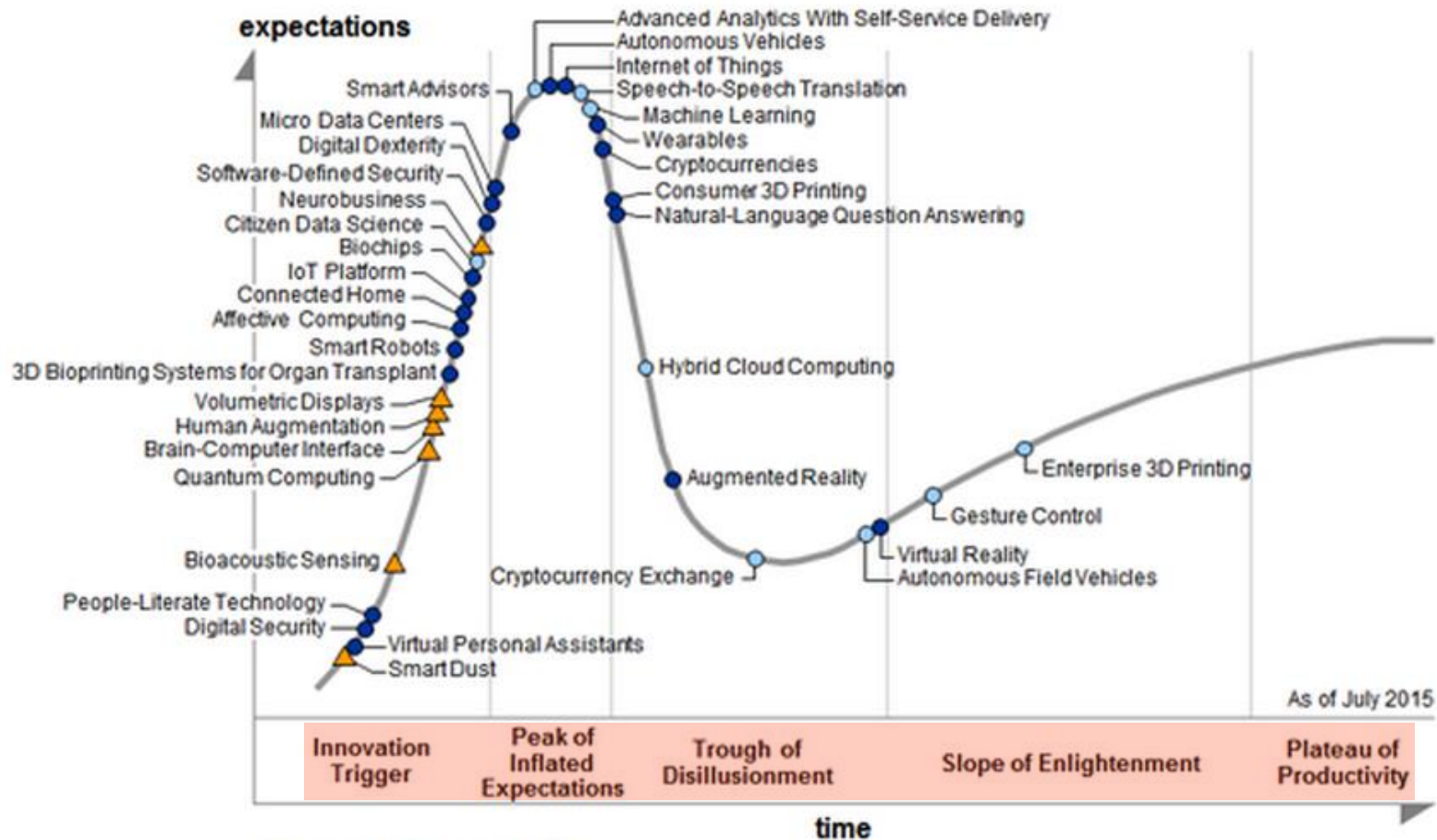
## 2<sup>nd</sup> Horizon

Foreseeable trends impact on AC building design?

## 1<sup>st</sup> Horizon

Technology-aware client brief to designers (practical guidelines)

# Preamble | Gartner 2015 technology hype curve



As of July 2015

Plateau will be reached in:

- less than 2 years
- 2 to 5 years
- 5 to 10 years
- ▲ more than 10 years
- ⊗ obsolete before plateau

# 3<sup>rd</sup> Horizon

How today's design might mitigate potentially disruptive technologies & future-proof long-life AC assets?



# the rise of metabolic *alive* buildings

**Mobile technology**  
**Organic electronics & biotics**

**IoT (Internet of Things) or**  
**IoE (Internet of Everything)**



**smart information**  
**smart machines**  
**smart cities**

**New AI and advanced analytics**

Deep domain expertise & learning algorithms  
merging genomics & informatics  
6, 7 & 8<sup>th</sup> level normalization  
unstructured data

## Vertical Urban Farming



### **AeroFarms** aeroponics product<sup>1</sup>:

- **95% water** needs reduction
- **75 times** more productive
- Integrated **sprinkler grid**
- biosphere size increase
- carbon-capture system
- 0-pesticide & 0-soil
- 16-days cycle

## Mobility as a Service



- **300%** more infrastructure efficiency<sup>2</sup>
- Recover cars' **92% unused**<sup>3</sup> value
- New real estate value dynamics
- Usage-tailored vehicle choice
- Enhanced transfer times<sup>2</sup>
- Recover parking space<sup>2</sup>
- **99.999%** road safety<sup>2</sup>
- Enhanced mobility

<sup>1</sup> 2015 AeroFarms results in New Jersey

<sup>2</sup> 2011 ABC Google driverless car project

<sup>3</sup> 2014 Stanford Energy Institute research

**neuromorphic  
biocomputing**

**nanomed  
BMI, 4D**



**0-device  
Web 4.0**







**DNA storage**



# brain research & neuromorphic computing

## *advent of non-Von Neumann computing*

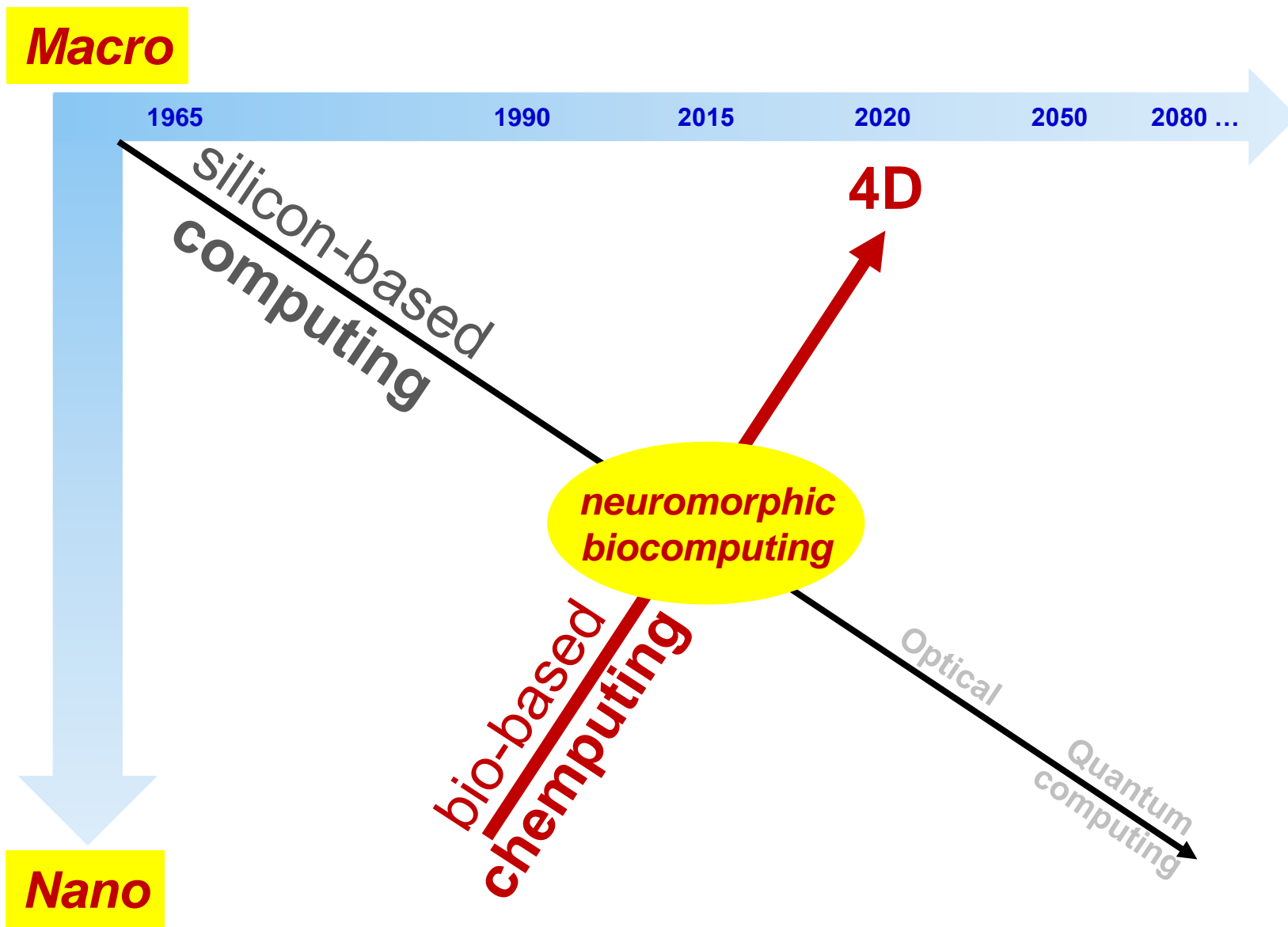


When	2013 → 2023	
What	Budget	Who
 Human Brain Project	€ 1.2b	 European Commission
 BRAIN INITIATIVE	US\$ 3b	 USA

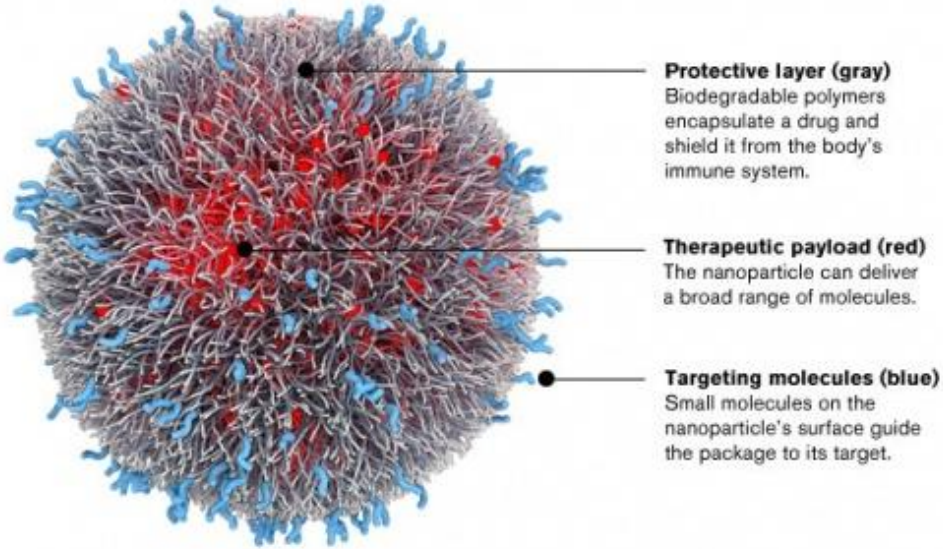


Both projects triggered by ***too lengthy delays*** in solving brain disorders and degenerative conditions via cognitive & neuroscience

# Reverse Moore's Law\*



# nanodrugs, nanotheranostics & 0-incision medicine



**Bio-markers**



**Container/s**

**Cargo/s** (inside the container/s)

# next stage with advanced nanotheranostics

## *the new metaphors*



from **DNA origami techniques**

to

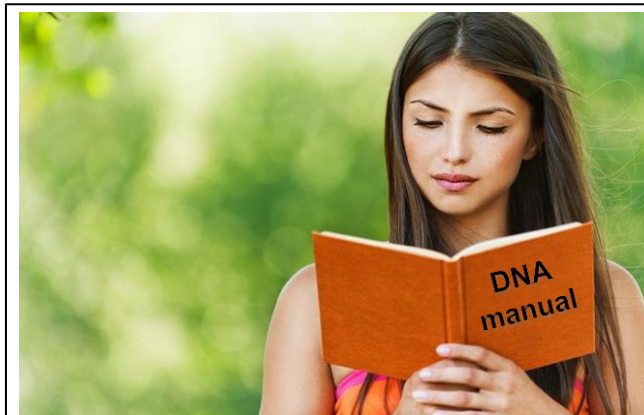
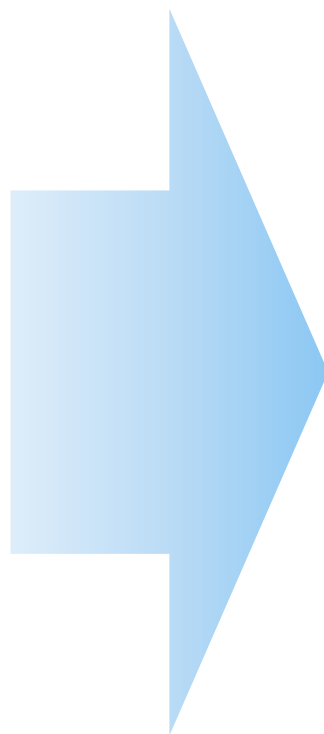
**RNA/DNA 3&4D printing**



use DNA as bricks to build nano-machines



and deliver drug/s directly to the pathogenic site



Let RNA/DNA be the nano-machine



and responsively produce custom drugs



- **700 Tb of data** stored in **1g DNA** (2012 Harvard) *stable for millions of years* (2015 ETH Zurich)
- **700 Tb of data** = 233 x 3 Tb hard-disks = **150 Kg hardware** (excl collateral infrastructure)
- **Stability** of conventional IT storage *unguaranteed over very long periods of time*





*The **entire world wide web** stored on DNA fits the back of a **compact pickup***

# predicting the next (easy-to-swallow) gizmo



- 1. Rewrite your cells internal clock**
  - cell regeneration beyond 40 subdivision cycle
  - prolong existence to 150, 200, 300 years or
  - ... until you get bored to (literally) death
- 2. Your 24/7 personal bodyguard**
  - protect dynamically against all diseases
  - DNA-tailored nanotheranostics
  - universal built-in nanofactory
- 3. Instant knowledge access**
  - merged neuromorphic processes
  - bio-synthetic knowledge storage
  - cloud-connected augmentation
- 4. Tele-kinetic powers**
  - wirelessly control 4D objects
- 5. Telepathic powers**
  - subvocalized brain-2-brain
  - cloud-connected brains
  - **BrainNet** aka **web 4.0**



What are you waiting for?  
**Get Smart**

with **Smarties** you truly are what you eat



**2 for 1 offer**  
1 x supercomputer  
+ 1 x nano-factory  
= only 1 x pill

**Connect with your loved ones**



**Available soon Anywhere**



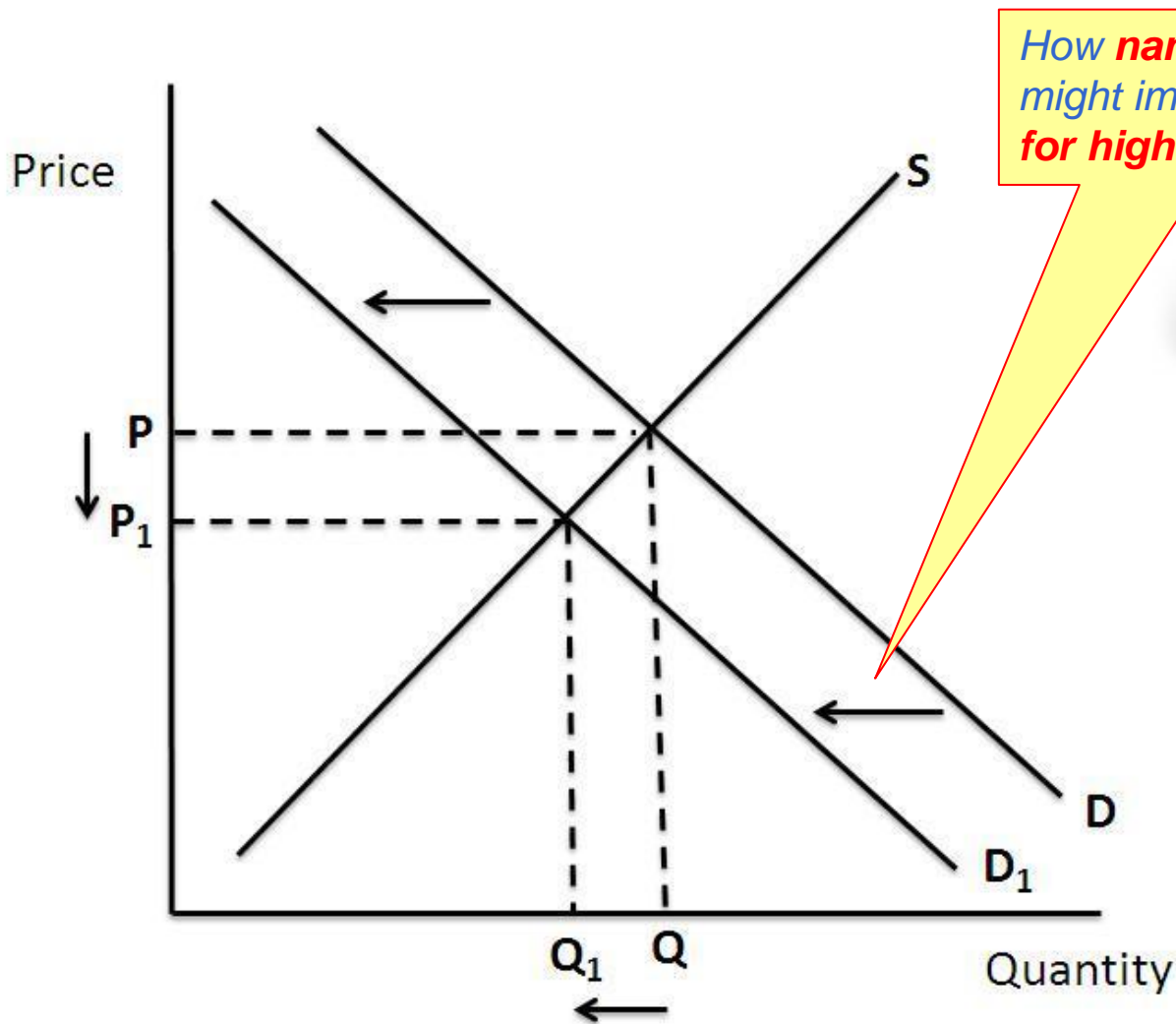
# The new *immortals*' lifestyle & leisure



*super-healthy, hyper-knowledgeable, brain-connected  
(and most probably ... bored to death) 300+years-young*



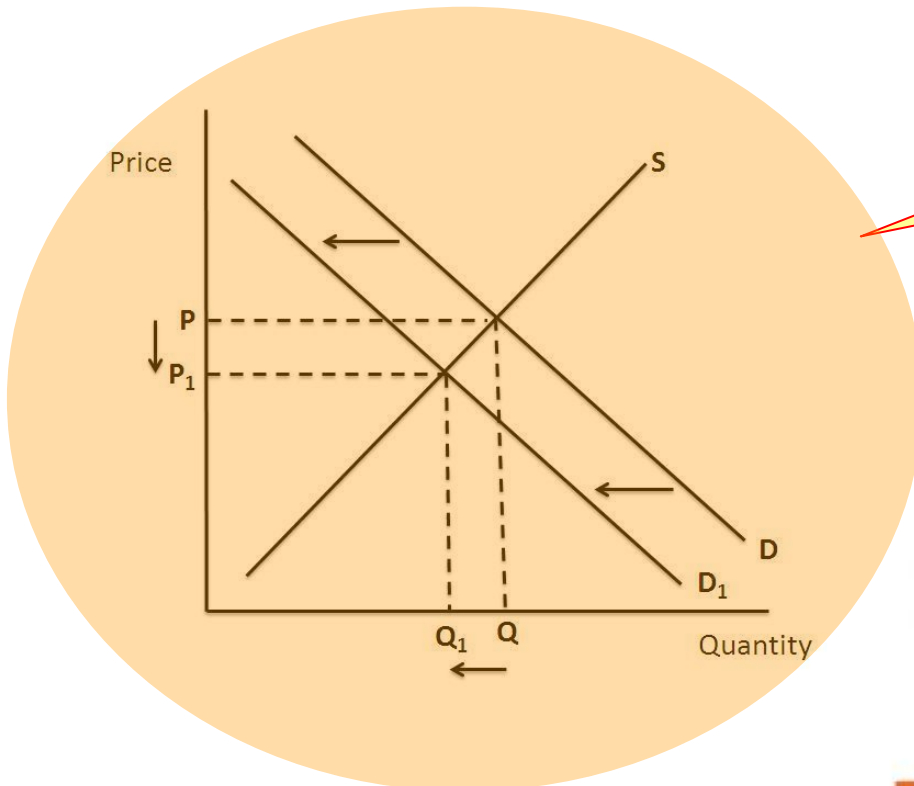




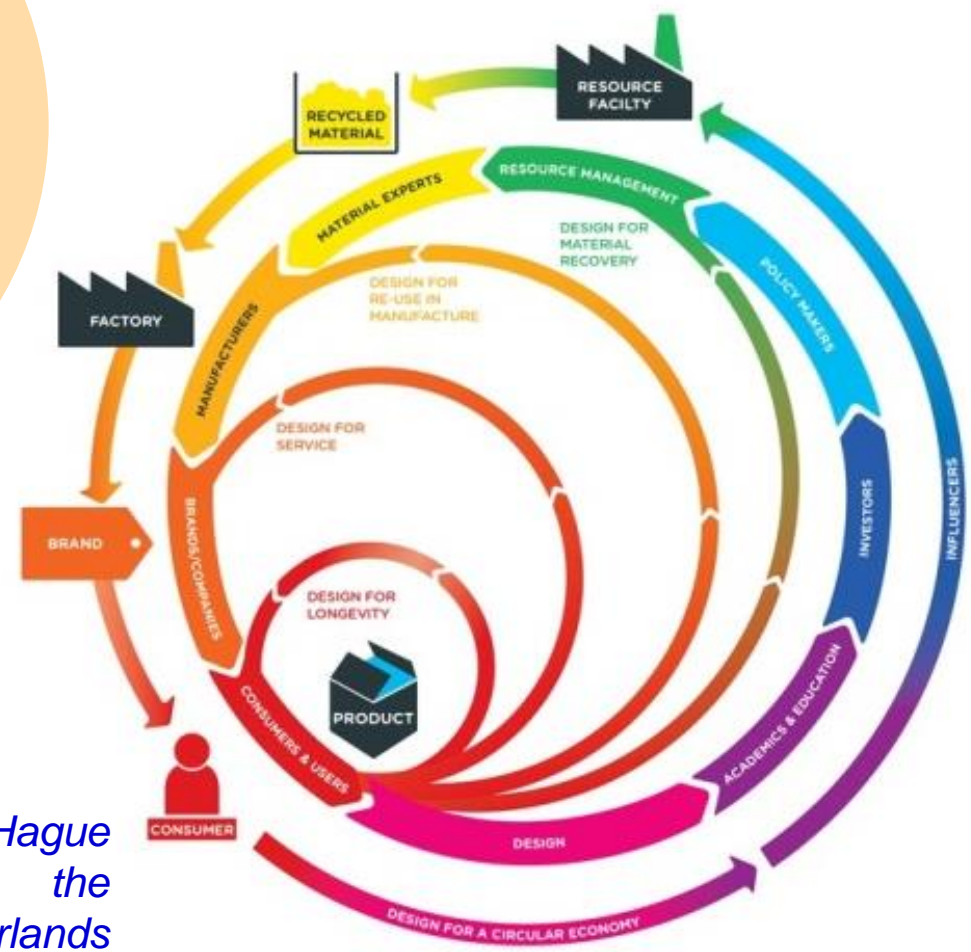
How **nanotheranostics** might impact **demand** for **high care** needs?



# From 'broken lines' economics to circularity

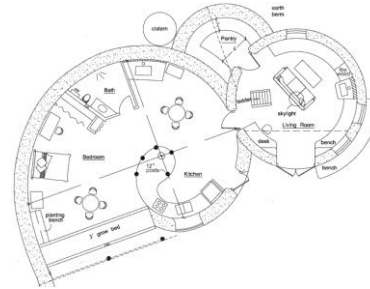
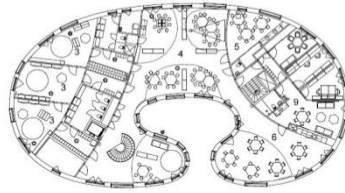


How **new economics** might drive the supply-demand entire **graph** to irrelevance?



**June 2015.** The HDC (Hague District Court) orders the government of The Netherlands to implement Circular Economy

# Design & planning strategies



- 1) Ever-changing **metabolic sites** for boredom-prone *immortals*
- 2) Diversify, overlay and integrate site **usages** & value streams
- 3) Positive impact, self-sufficient and **earlier ROI** (5~8 years)
- 4) Apply **biophilia**, **archibiotic** and **biomimetics** principles
- 5) Modular design for **re-purpose** and re-configurability







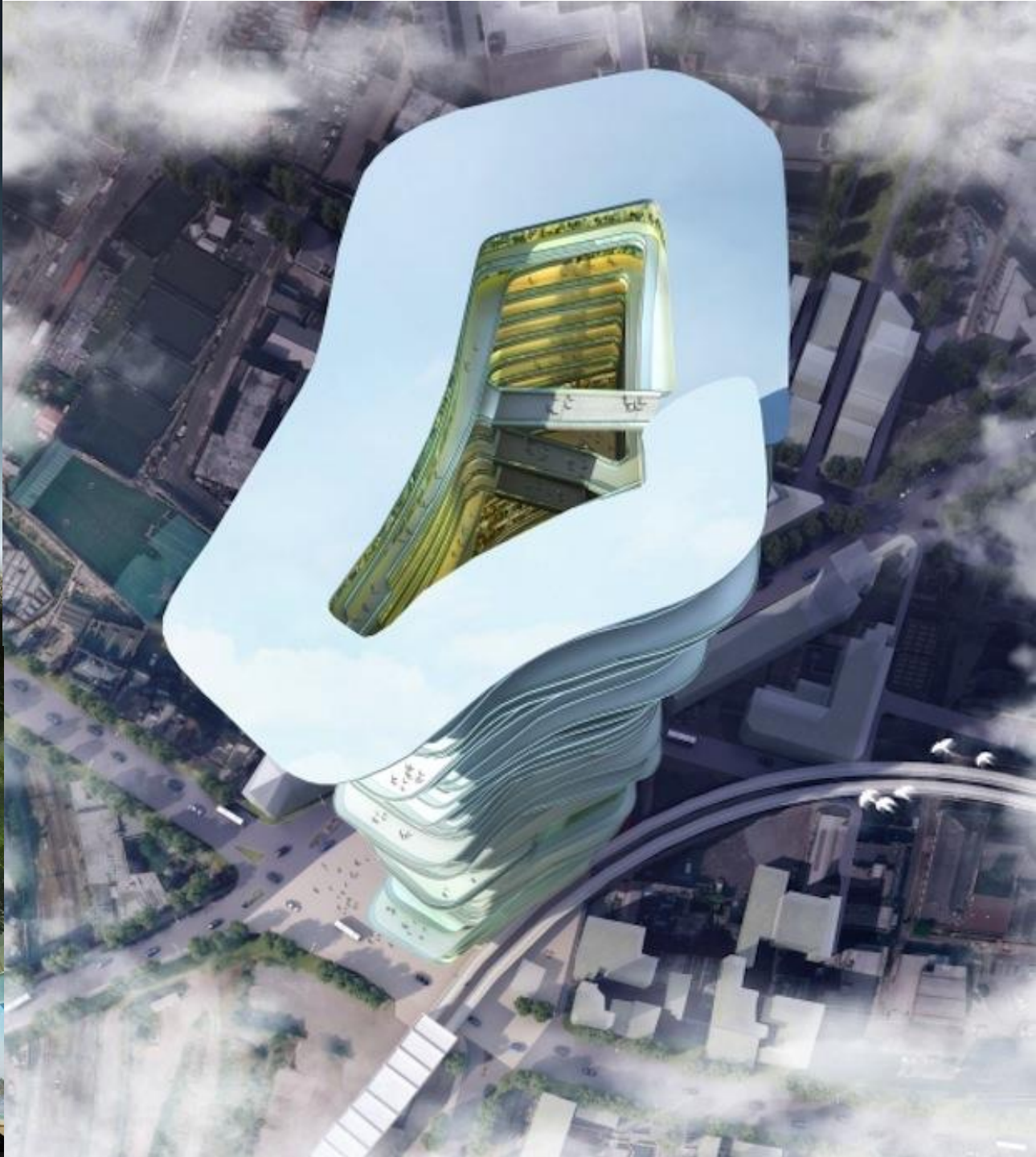




















## 3<sup>rd</sup> Horizon

How today's design might mitigate potentially disruptive technologies & future-proof long-life AC assets?

## 2<sup>nd</sup> Horizon

Foreseeable trends impact on AC building design?

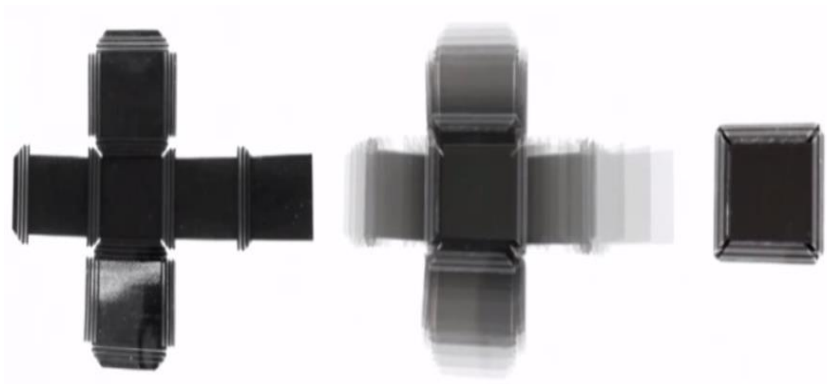
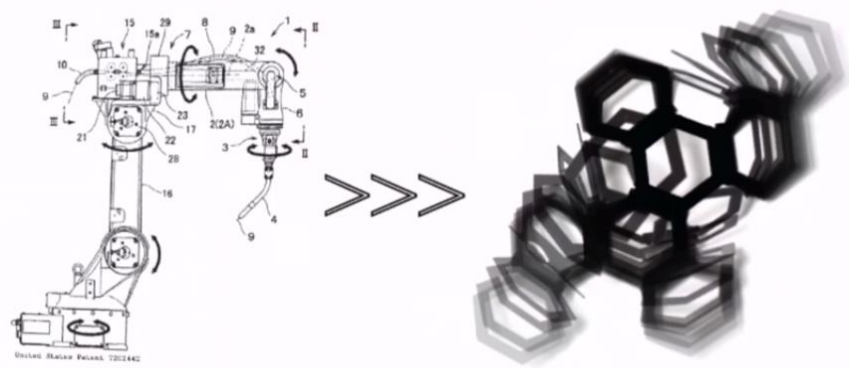


# 4D smart materials = 3D + 1D time / transformation G

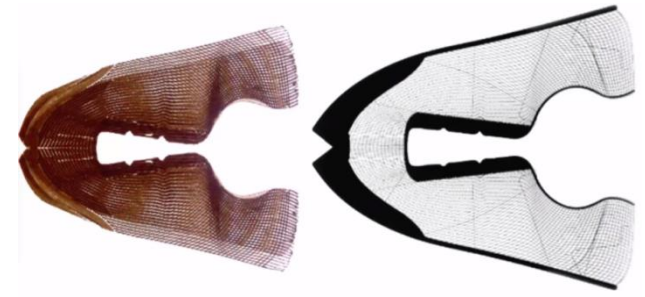


**Self-repairing active pipes** (no mechanical pumps)

**Robots** → **smart material**  
(robot without robots)

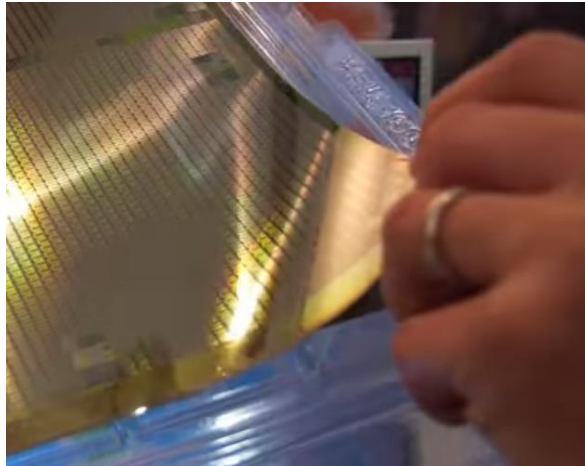


**Self-assembling products from 2D to 3D**  
**Self-adaptive packaging & 2D storage**  
**Lower-engineered adaptive furniture**

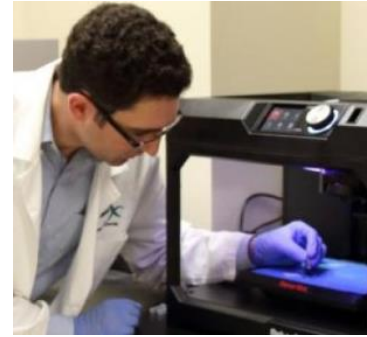


**Adaptive, supporting & assistive textile**, apparel & footwear as an alternative to exoskeletons

# print your own electronics



# on-demand 3D-printed personalized medicine prescription



**more direct well-suited 3D-printed drug value chain**



# Processing and Device Fabrication Facility



THE UNIVERSITY  
OF QUEENSLAND  
AUSTRALIA



structural, active, organic, living & electromagnetic/graphene (for BMI) **inks + printers**



2015 ACS  
Design & Building

## 3<sup>rd</sup> Horizon

How today's design might mitigate potentially disruptive technologies & future-proof long-life AC assets?

## 2<sup>nd</sup> Horizon

Foreseeable trends impact on AC building design?

## 1<sup>st</sup> Horizon

**Technology-aware client brief to designers (practical guidelines)**

**1<sup>st</sup> → Person-centred**

**2<sup>nd</sup> → Pervasive Grid**

**3<sup>rd</sup> → Passive design**

**4<sup>th</sup> → Pre-fabrication**

1) lower carer-to-resident ratio (from ~1:8 to 1:20)

2) Zero-training approach for site users

3) higher levels of well-being for all



### *ME-llennials & the TEAL (“no collars”) organization*

- 38% prioritize promising **start-up over college degree**<sup>1</sup>
- 46% want to **start their own business** within 5 years<sup>2</sup>
- 91% expect to stay **less than 3 years** on current job<sup>3</sup>
- 80% want **constant feedback** not periodic reviews<sup>4</sup>
- 81% want to set their **own work hours**<sup>4</sup>
- 70% want and need **“me time”** at work<sup>4</sup>
- 75% want **mentors** not managers<sup>4</sup>
- 58% OK with 15% pay cut if employers **share their values**<sup>5</sup>
- 45% OK with 15% pay cut if job has a **socio-enviro impact**<sup>5</sup>
- 35% OK with 15% pay cut if employers **committed to CSR**<sup>5</sup>

<sup>1</sup> source: 2013 oDesk survey

<sup>2</sup> source: 2012 CNN Money / Kauffman

<sup>3</sup> source: 2013 Future Workplace survey

<sup>4</sup> source: 2012 MTV study

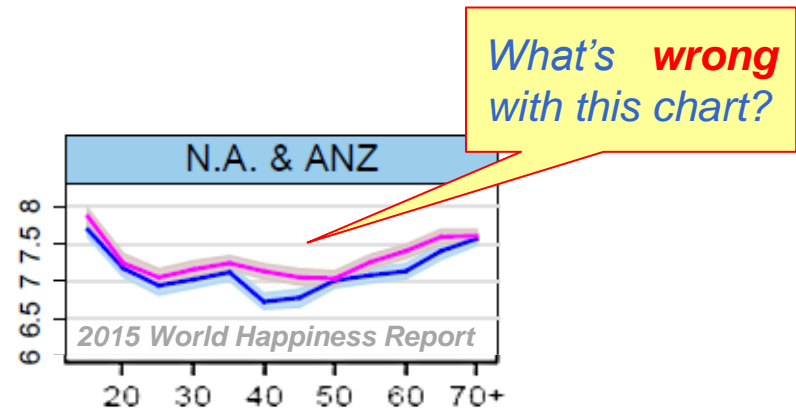
<sup>5</sup> source: 2012 Net Impact survey





*“We have to care about relatives as much as (often more than) residents”*

frequently heard carers’ comment



Rethink AC sites as **tourism** destinations

Combine short-term **hospitality** services

*“Food quality is such a core aspect of residents’ happiness”*

frequent comments in Aged Care

Urban gardens integration  
the *rare crops* opportunity

Restaurant integration  
the *foodie* opportunity

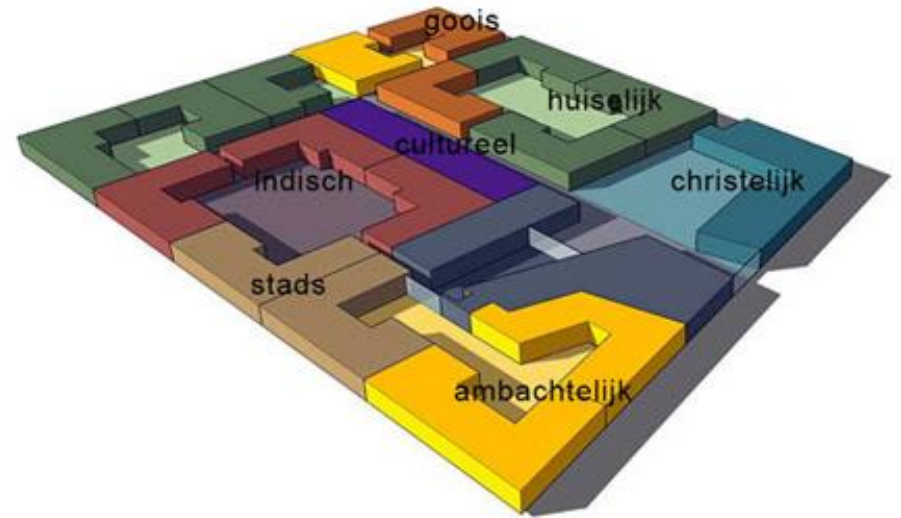


The Rocksalt@Carrington  
restaurant



Carrington at night



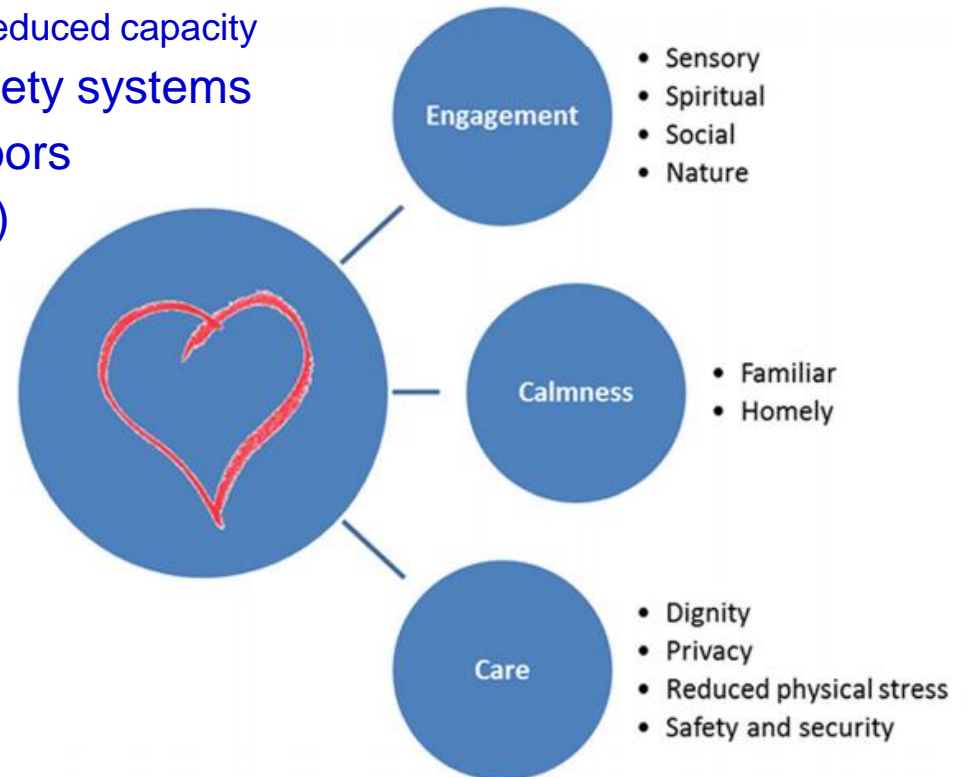


*The De Hageweyk dementia villages* experience in Amsterdam

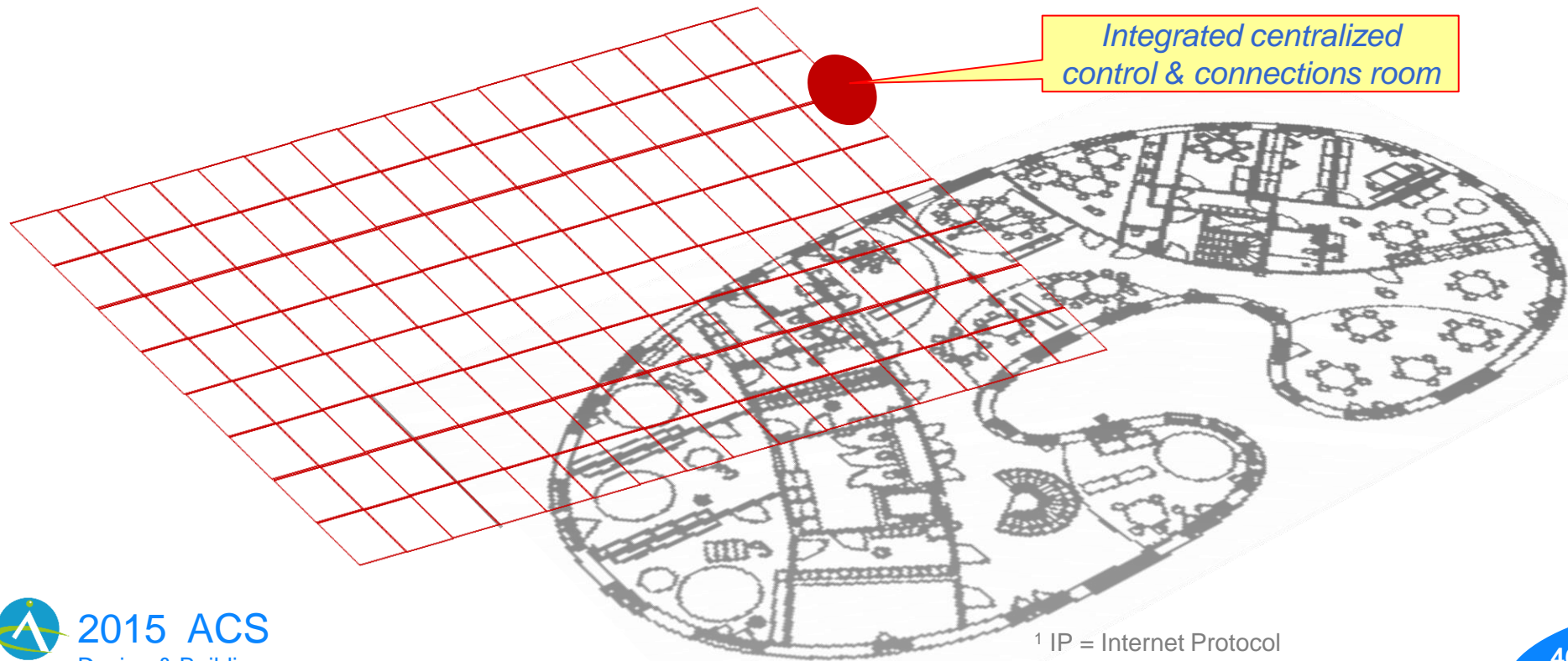
*“Because the last thing I want to happen to me is to be moved. I want to feel at home...”*

2015, UOW Research on environmental design for dementia / palliative care

- Ceiling screens (for people in bed or reclined position)
- Technology should not be fearsome or diminutive
  - An electric hoist might only emphasize reduced capacity
- Communication, monitoring and safety systems
- Sensory design, biophilia and outdoors
- Privacy (for both carers & residents)
- Familiar homely environment
- Calmness / quietness
- Spiritual engagement
- Social engagement
- 360° care
- Dignity



- **All-in-1** power + data **IP<sup>1</sup> grid** across **entire site** in + outdoors + all levels:
  - entrances, exits, parking, garages, basements, paths, rooftops, lawns
  - kitchens, bathrooms, toilets, utilities, storage areas, back-office
  - corridors, lifts, staircases, public rooms
- **One scalable** location for all systems **control room** (for easier integration)
  - data, communications, energy, security, emergency, HVAC<sup>2</sup>, control
- **Spare capacity** power + data (approx. 50% every 20 m<sup>2</sup>)



<sup>1</sup> IP = Internet Protocol

<sup>2</sup> HVAC = heat, ventilation, air conditioning

# Pervasive plug & play grid (2P) | the smart energy grid 2/4



- The **internet of electricity**

- Redundant supplies for continuity
- Seamless switchover
- Smart local storage
- Distributed energy

- **Wireless electricity**

- **magnetic resonance** v induction

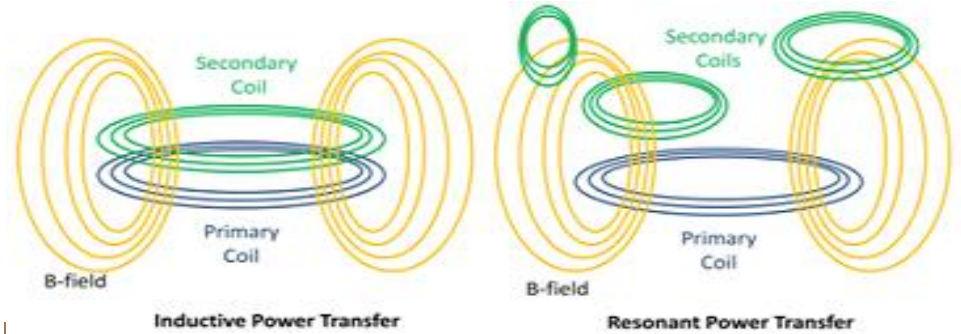
- **Low-consumption devices**

- EMS<sup>1</sup> + BACS<sup>2</sup> integrated
- LED<sup>3</sup> lightning
- Smart HVAC<sup>4</sup>

- Onsite energy **micro-harvesting**

- kinetic / **piezo**
- thermo
- hydro
- **solar**
- wind

Smart storage



fast wireless recharge  
0-cable devices



French Colas/INES solar highways  
wirelessly charging electric cars



Piezoelectric floors  
Vendors: Veranu, Pavegen



BlueScope BIPVC world-1<sup>st</sup>  
integrated solar energy / cooling  
and heating roof system in Glebe

<sup>1</sup> EMS = Energy Management System

<sup>2</sup> BACS = Building Automation and Control System

<sup>3</sup> LED = Light Emitting Diode

<sup>4</sup> HVAC = Heat, Ventilation, Air Conditioning



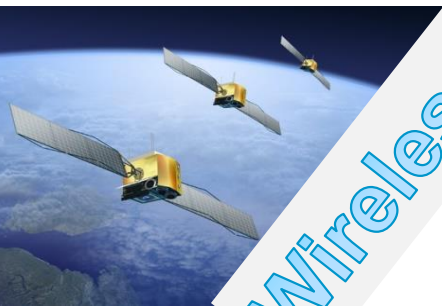
Optical

- **speed** advantage over long distances → **backhaul links**:
  - inter / intra-building between wiring closets and server room
- future-proof for upcoming digital **optical devices/endpoints**?
- **no specific manufacturer plans** for optical end-devices
  - 0-device trends over Horizon-3 (wireless interfaces)



Copper

- **RJ45** copper from nearest network nodes to endpoints
- category 6 up to 37~50m or category 6a up to 100m
- easier **connectivity** (termination / splice connectors)
- **PoE** (Power over Ethernet) applications
- copper **ruggedness**



Wireless

- **integrate** CCTV web cams + Wi-Fi broadcasters + comms
  - Optical Wi-Fi broadcasters??
- design for **redundant** internal & external **connectivity**
  - ensure seamless switchover (cable / Wi Fi / 5G / Satellite)
- **neutralize** Wi-Fi **black spots**

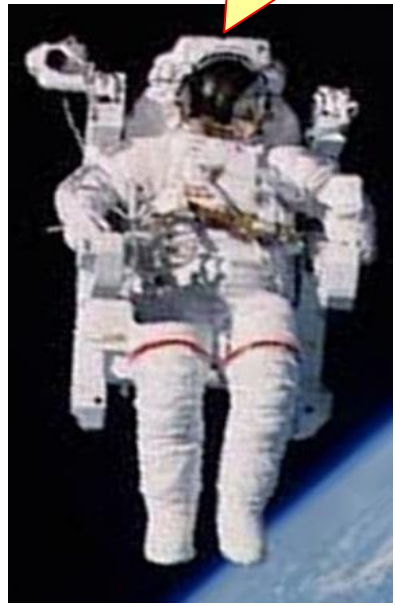


# Pervasive plug & play grid (2P) | the communications grid 4/4

- Leverage IoT open vendor platforms to build **one** (or fewer) **simplified integrated communication** device/s
  - AV, ITC, CCTV, lifts, fire doors, access gates and any other fixed or mobile systems (Modbus language)
  - carer-2-site, carer-2-carer, carer-2-resident, resident-2-resident, internal/external communications
- **Proprietary** systems to be **discouraged** or handicapped at tender selection stage
- Prefer **IP-based open-source** organizations or consortia with open API

1. IP-based smart television, entertainment and video-conferencing unit in each resident room
2. EWIS (Emergency Warning Intercommunication System)
3. Geo-fencing (via RFID) for absconding prevention
4. Sound masking and speech privacy solutions
5. Real Time Locating Systems
6. Electronic White Boards
7. Nurse Rounding Tim
8. Nurse Call Systems
9. Sensor movements
10. Wireless phones
11. Digital Signage
12. Public address
13. Alarm systems
14. CCTV network
15. Fall detectors
16. Bell system
17. Smart beds
18. Duress call
19. RF pagers
20. Email
21. VOIP
22. SMS ... ..

25+ different tools??  
Did anyone get the memo??



**Alarm fatigue** ranks **no 1** health technology **hazard** past 3 years\*

# Pre-fabrication (3P)

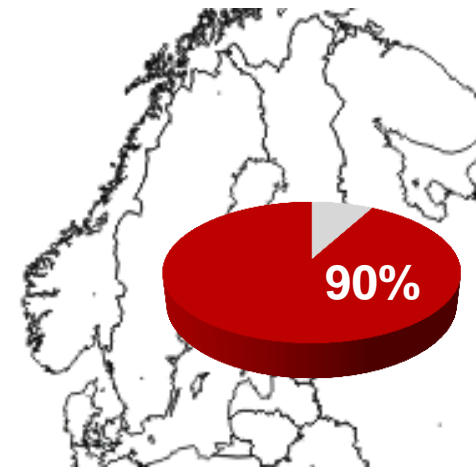
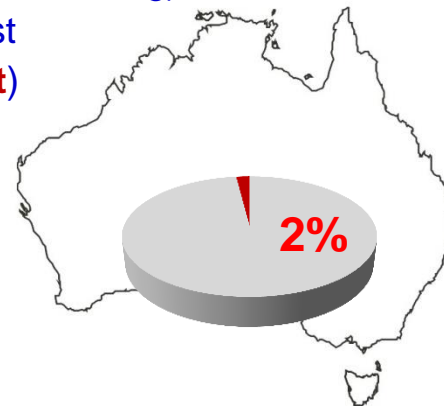


Conventional building construction



High-Tech Factory, Shizuoka, Sekisui House Ltd

- enhanced building **energy efficiency** due to high quality **factory sealing**
- conformity to building code standards and **greater quality assurance**
- enhanced **materials protection** from exposure to the elements
- **enhanced precision** (numerical machines, precision-cutting)
- high degree of **customization** at an affordable cost
- all year-round construction (**weather-independent**)
- significant cost **savings** (due to **faster** production)
- enhanced **worker safety** and comfort level
- theft and vandalism **risks minimization**
- community **disruption minimization**
- **wastage minimization**

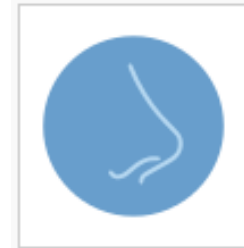


**% of prefabricated buildings  
Australia v Scandinavia**

# Passive design for Active Alive sites (4P)



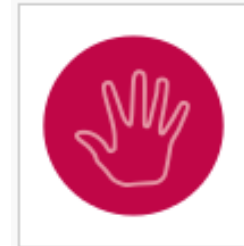
- Site location, **signage** and user-friendly **navigability**
  - seamless integration with surrounding communities
  - indoors / outdoors, rooms / corridors transitions
  - uncontained radial elliptical close-loops paths
  - driverless connections or onsite “*true village*”
  - continuity of care and assistive technologies
  - event focal spaces and social inclusiveness
- **Sensory design** & suitable stimuli framework
  - sight (landscape, internal design & colours, lightning)
  - touch (including pervasive contactless features)
  - scent / olfactory (indoors farm’s eternal spring)
  - thermal | humidity | air flow
  - memory-care
  - soundscape
- Site **anticipation** & awareness of all users
  - inverted information flows routed to users
  - security, access and smart emergencies
  - all users movements (including visitors)
- Passive **prevention** for all site users
  - uplifting, secure, biophilia, smooth curvaceous design, handrails
  - stairless, non-slip no hard surfaces, no sharp angular edges
  - fall risk minimization, intra-site travel minimization (clusters)
- Site **orientation** to minimize energy needs



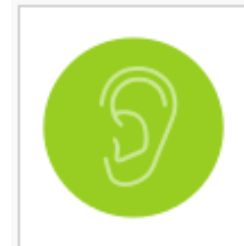
Smell



Sight



touch



Hearing

# Summary | the journey ahead



**Passive & metabolic *immortal*-centred design**

**Pre-fabricated biophilic re-configurable site**

**Pervasive smart grid for any or 0-device**



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