Challenges of spreading innovation- Artificial Intelligence & Robotics in healthcare

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The 21st century landscape of care

- *"What we're experiencing is not simply the acceleration of the pace of change, but the acceleration of acceleration itself. In other words, **change growing at an exponential rate**"*

*from **'The Singularity is near'***

Kurzweil (2006)

ARTIFICIAL INTELLIGENCE

Symbolic AI

Expert
Systems

Machine Learning

Deep
Learning

Defining Artificial Intelligence (AI) & Machine Learning

- **AI -** combines computer science, engineering and related disciplines to build *machines capable of behaviour that would be said to be intelligent if observed in a human*- eg solving problems. So far, AI has not achieved a 'human-like' level.

- **Machine Learning -** A type of AI enabling computers to *learn without being explicitly programmed*. Algorithms use complex statistical methods to recognize patterns in data, learn & make predictions. Able to continuously improve in recognising patterns & predictive ability.

- **Deep Learning -** A branch of machine learning that involves algorithms that *analyse data through multiple layers of complex processing*, with each layer's output becoming the input for the next layer.

- **Expert System -** a computer system that *emulates the decision-making* ability of a human expert, eg in diagnosing a skin condition; or diseases with recognised characteristics.

- **Symbolic AI –** describes AI where all steps are based on **symbolic** human *easily readable* representations of the problem being solved.

BBC Click Video clip –
'The Rise of the Machines'
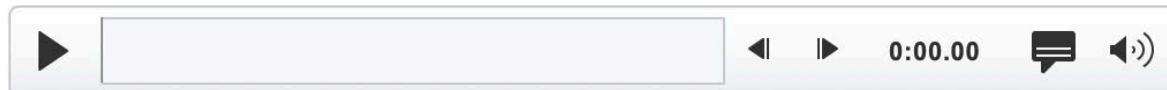
Key Challenges of spreading Innovation in Artificial Intelligence (AI):

*Key **challenges & risks**: –*

- Failure of Organisations to **_adapt_** to the new technologies;

- Governments fail to employ and **_regulate_** these new technologies;

- **_Shifting power_** creates significant new concerns… e.g. for democracy;
                                                       ("a new Power Compass");

- Risk of growing **inequalities**;

- Fragmentation of societies - **_"frustrations & factions"._**

The Fourth Industrial Revolution - 'a time of great promise & great peril'

                                                                    (Klaus Schwab)

Key Challenges of spreading Innovation in Artificial Intelligence (AI):

*Key **elements for success:-***

Five elements of successful AI transformations

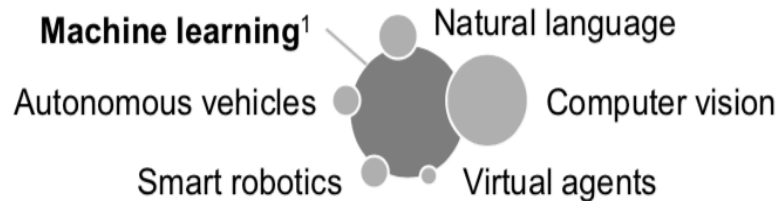- Use cases / sources of value
- Data ecosystems
- Techniques and tools
- Workflow integration
- Open culture and organization

MCKINSEY GLOBAL INSTITUTE (2017)

McKinsey&Company

How is AI predicted to *add 'Value'* within healthcare redesign & delivery?

Machine learning[1]   Natural language

Autonomous vehicles   Computer vision

Smart robotics   Virtual agents

Applicability

● High   ● Medium   ● Low

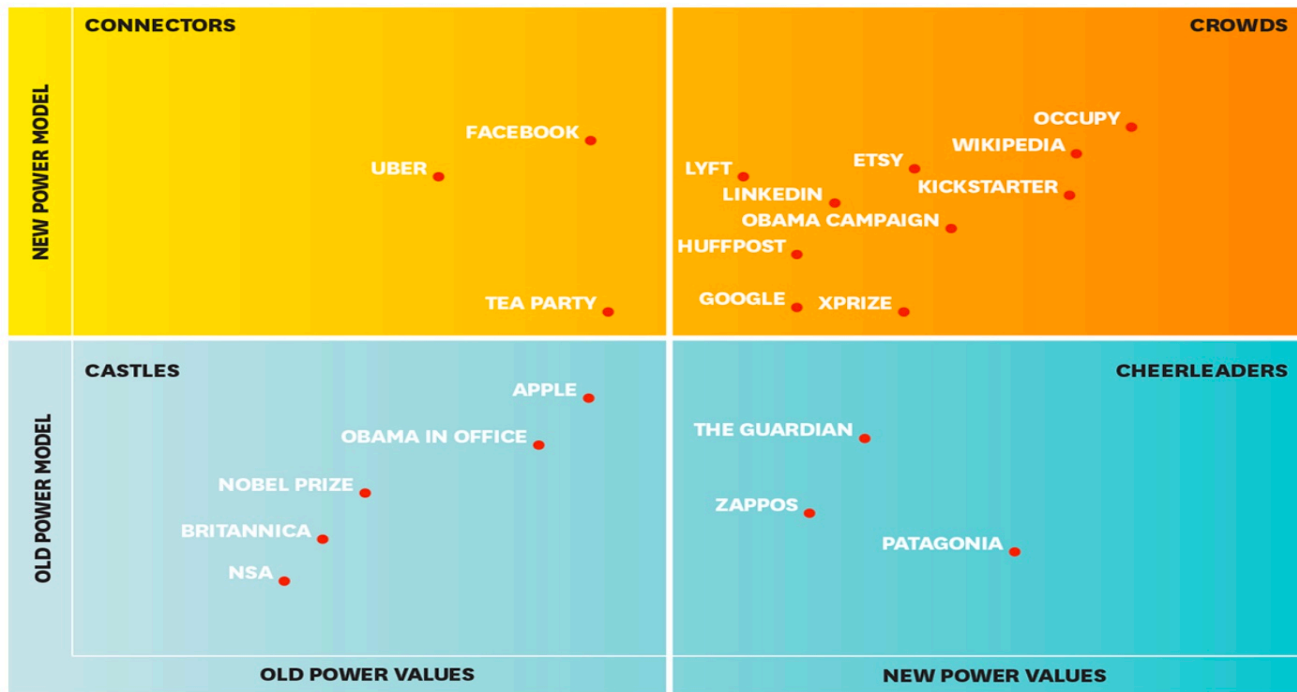|	Project	Produce	Promote	Provide
Applicable technologies	Enlightened R&D, real-time forecasting, and smart sourcing	Operations with higher productivity, lower cost, and better efficiency	Products and services at the right price, with the right message, and to the right targets	Enriched, tailored, and convenient user experience
Health care	Predict disease, identify high-risk patient groups, and launch prevention therapies	Automate and optimize hospital operations; automate diagnostic tests and make them faster and more accurate	Predict cost more accurately, focus on patients' risk reduction	Adapt therapies and drug formulations to patients, use virtual agents to help patients navigate their hospital journey

AI as classic 'disruptive innovation' –

Recent controversy over the 'misuse of social media':
its' algorithms, 'deep learning' & use of 'big data' to predict human behaviour – eg 'bots'

The New Power Compass

New and old power values and models intersect in revealing ways. Plotting organizations along these dimensions sheds light on how companies are accumulating and wielding power. Occupy's position in the Crowds quadrant, for instance, reflects its strong commitment to new power (though not necessarily its ability to compel change).
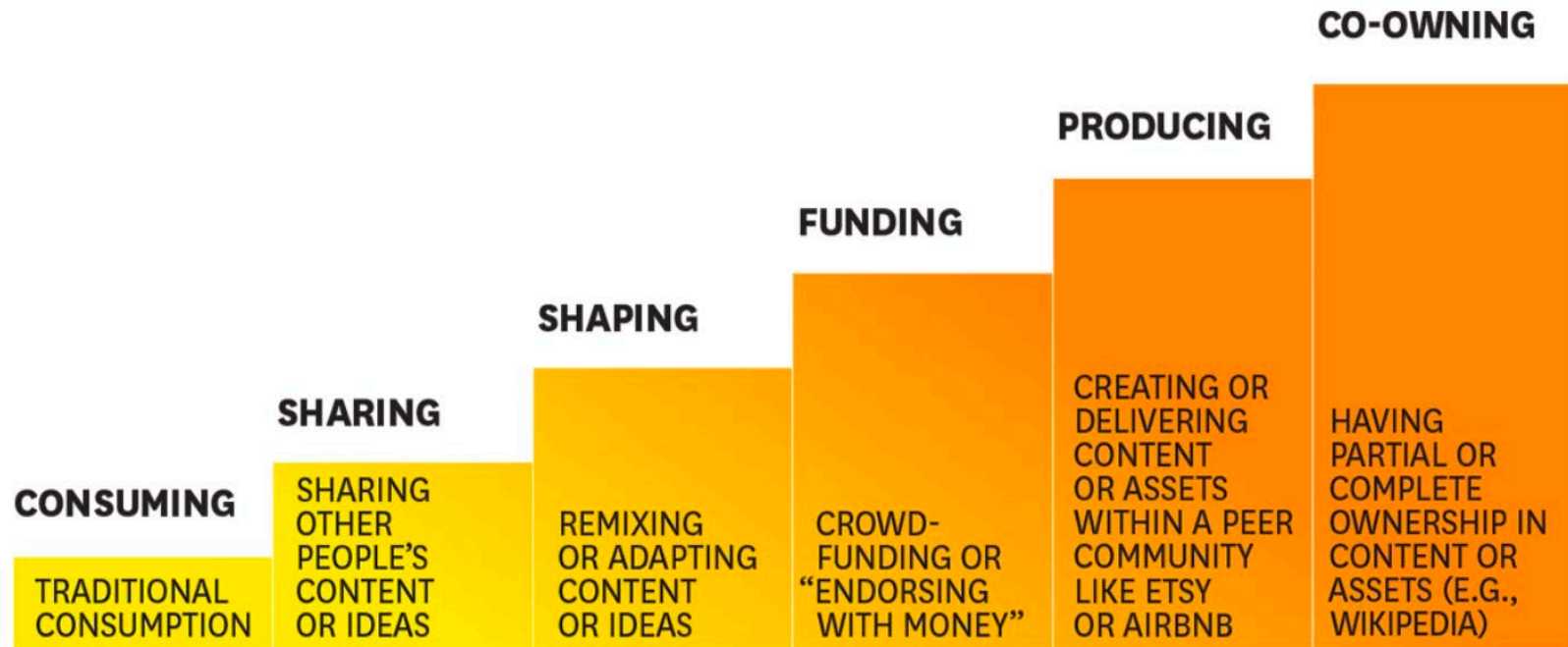
CONNECTORS	**CROWDS**
FACEBOOK •	OCCUPY •
UBER •	WIKIPEDIA •
	LYFT • ETSY •
	LINKEDIN • KICKSTARTER •
	OBAMA CAMPAIGN •
	HUFFPOST •
TEA PARTY •	GOOGLE • XPRIZE •
CASTLES	**CHEERLEADERS**
APPLE •	
OBAMA IN OFFICE •	THE GUARDIAN •
NOBEL PRIZE •	ZAPPOS •
BRITANNICA •	PATAGONIA •
NSA •	
OLD POWER VALUES	**NEW POWER VALUES**

(vertical axis left: NEW POWER MODEL / OLD POWER MODEL)

SOURCE JEREMY HEIMANS AND HENRY TIMMS

HBR.ORG

*Greater **Co-production** & openness in how healthcare is planned & our health data used -*

Patient & Public involvement (PPI) in evaluation to *regain **trust*** of patients/carers *is **essential***

The Participation Scale

New power gains its force from people's growing capacity—and desire—to go far beyond passive consumption of ideas and goods.

CO-OWNING

PRODUCING

FUNDING

SHAPING

SHARING

CONSUMING

TRADITIONAL CONSUMPTION

SHARING OTHER PEOPLE'S CONTENT OR IDEAS

REMIXING OR ADAPTING CONTENT OR IDEAS

CROWD-FUNDING OR "ENDORSING WITH MONEY"

CREATING OR DELIVERING CONTENT OR ASSETS WITHIN A PEER COMMUNITY LIKE ETSY OR AIRBNB

HAVING PARTIAL OR COMPLETE OWNERSHIP IN CONTENT OR ASSETS (E.G., WIKIPEDIA)

Point of Care Foundation Video –
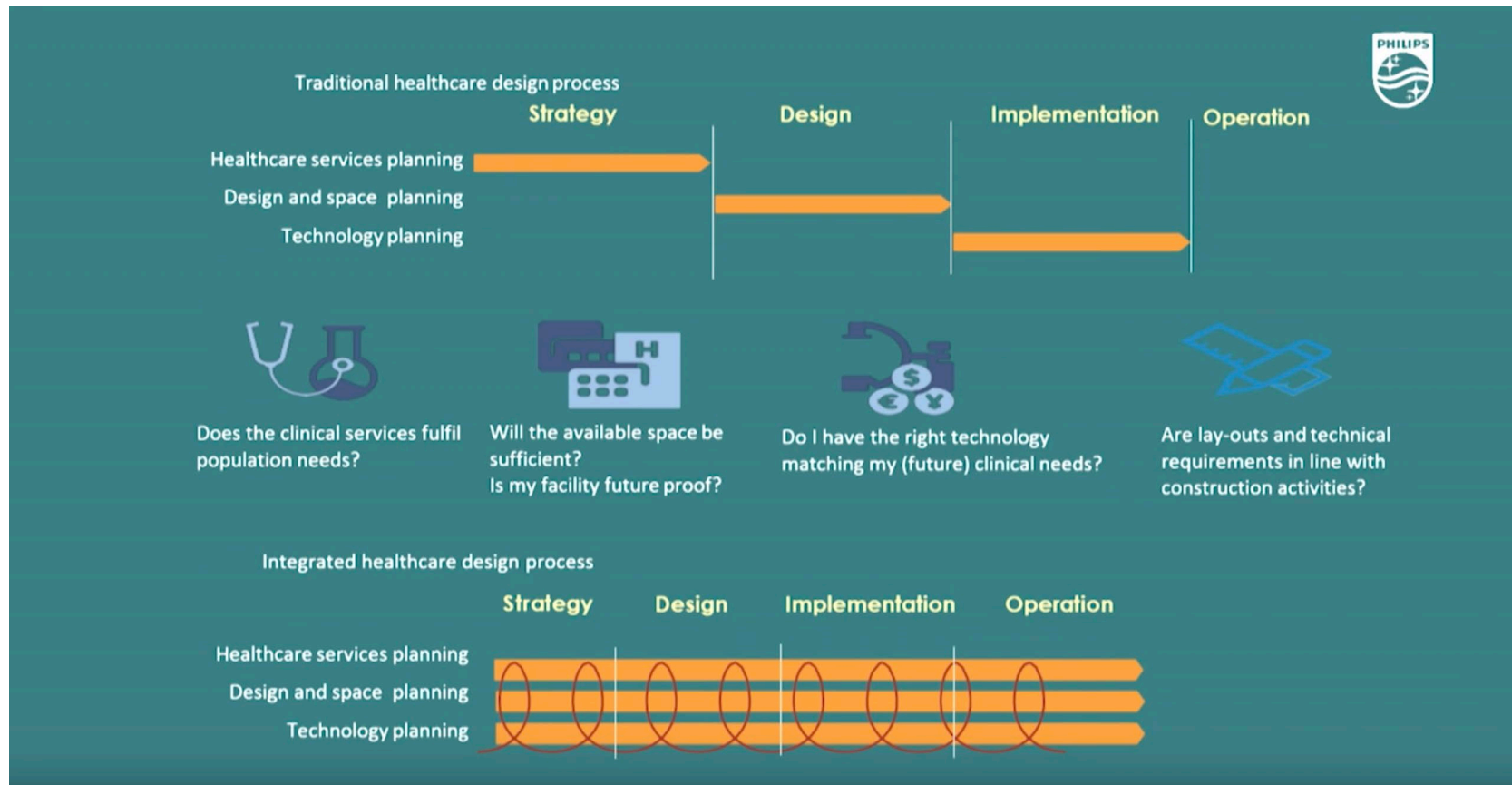## *Experience Based Co-design for Healthcare (EBCD)*

"The masters of life know the way, for they listen to the voice within them, the voice of wisdom and simplicity, the voice that reasons beyond cleverness and knows beyond knowledge."
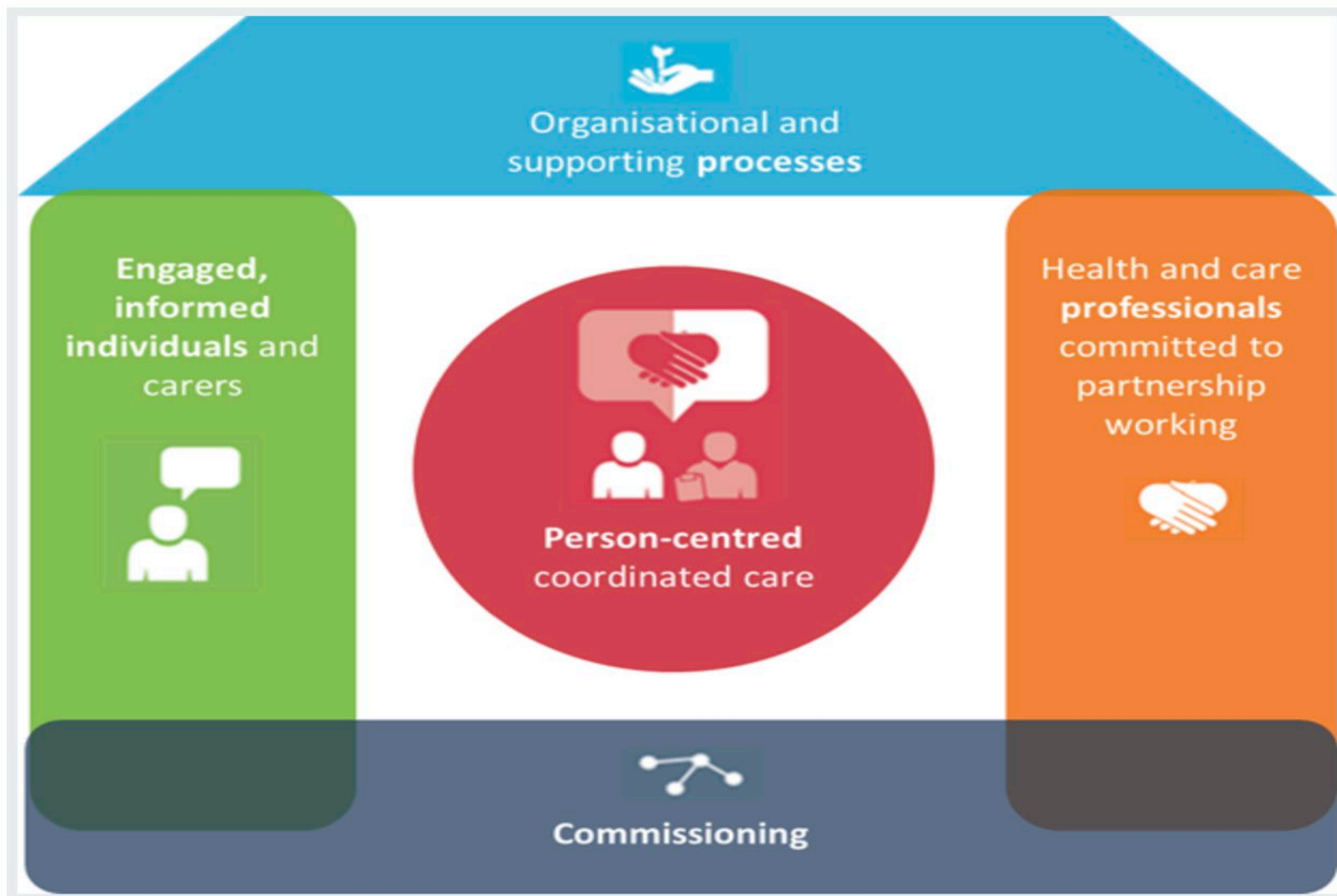
— Benjamin Hoff, ' The Tao of Pooh'
(Methuen Books – 1982)

Future healthcare Business & Estates Planning will require more 'cyclical' process to integrate technological change
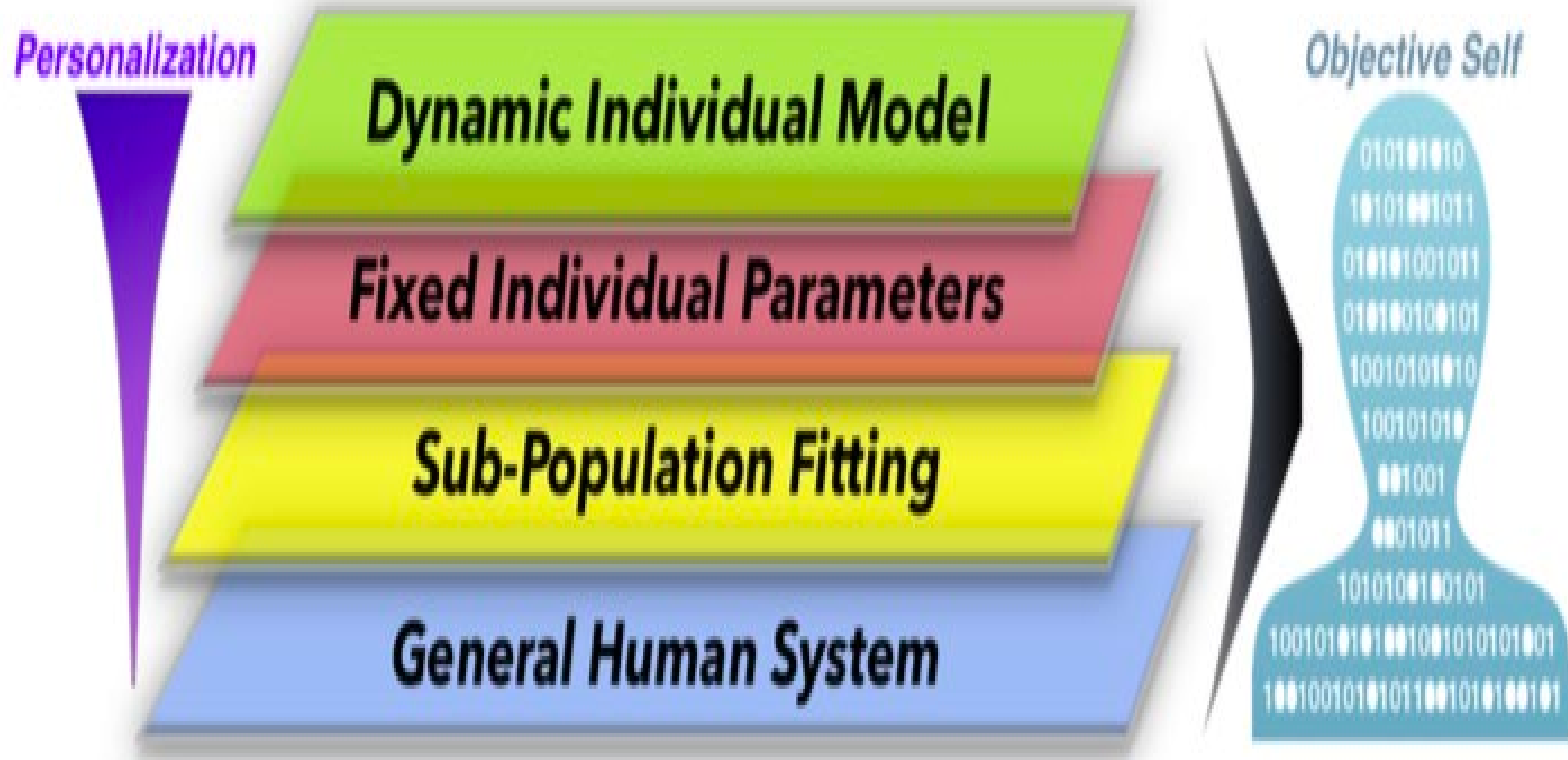
House of Care –
a framework for managing long term conditions

Organisational and supporting **processes**

Engaged, informed **individuals** and carers

Person-centred coordinated care

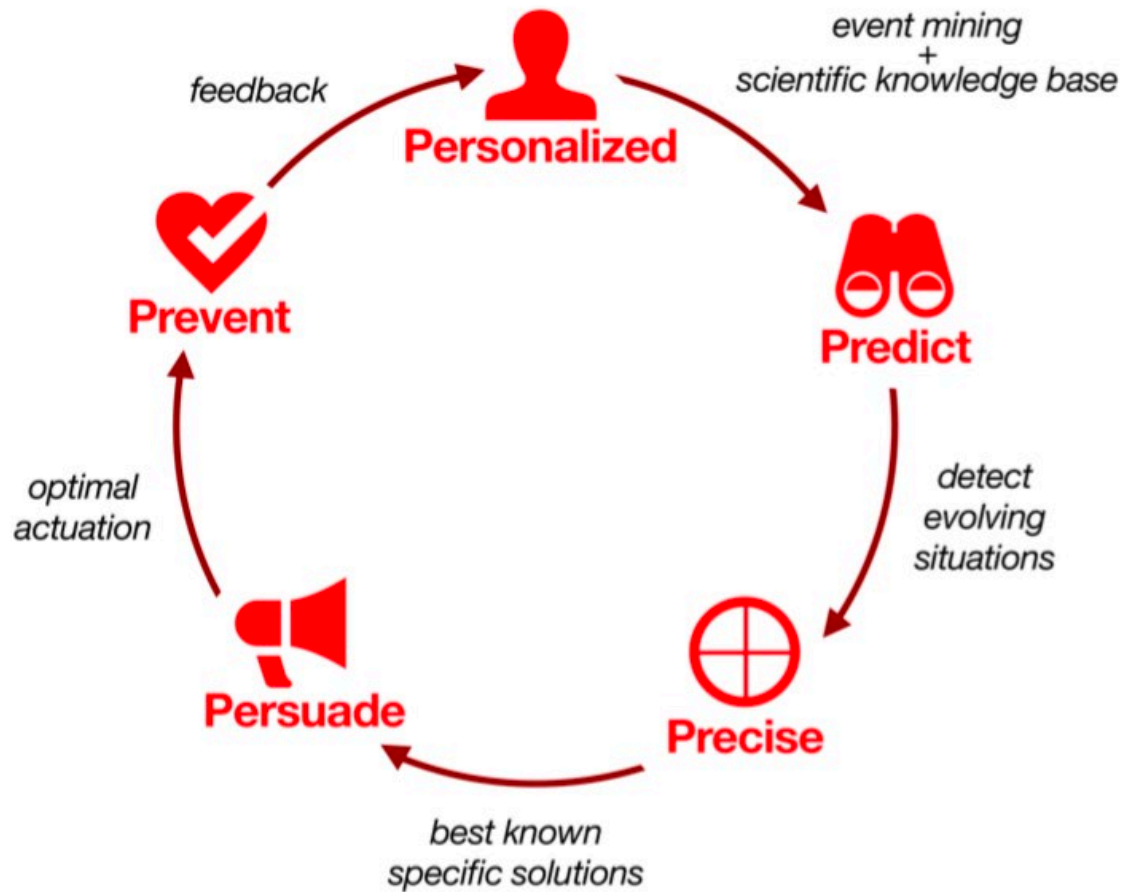Health and care **professionals** committed to partnership working

Commissioning

How layers of data modelling *('Big Data')* contributes to *identify high-risk individuals & stratify risk*

'Cyberkinetics': applying the principles of AI into complex healthcare decision-making (1)

P⁵ Cybernetic Health

- feedback
- event mining + scientific knowledge base
- Personalized
- Predict
- detect evolving situations
- Precise
- best known specific solutions
- Persuade
- optimal actuation
- Prevent

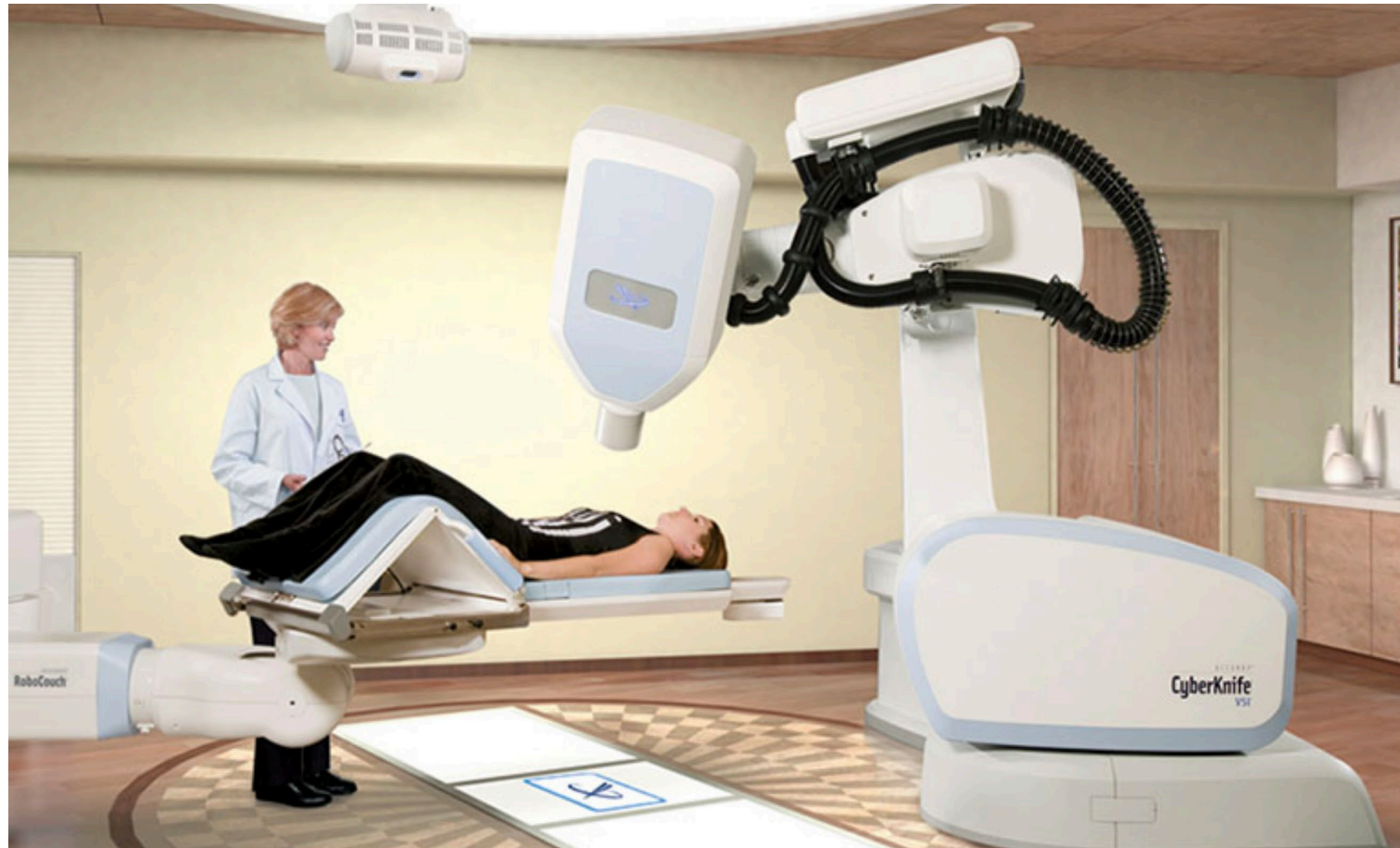# 'Cyberkinetics': applying the principles of AI into complex healthcare decision-making (2)
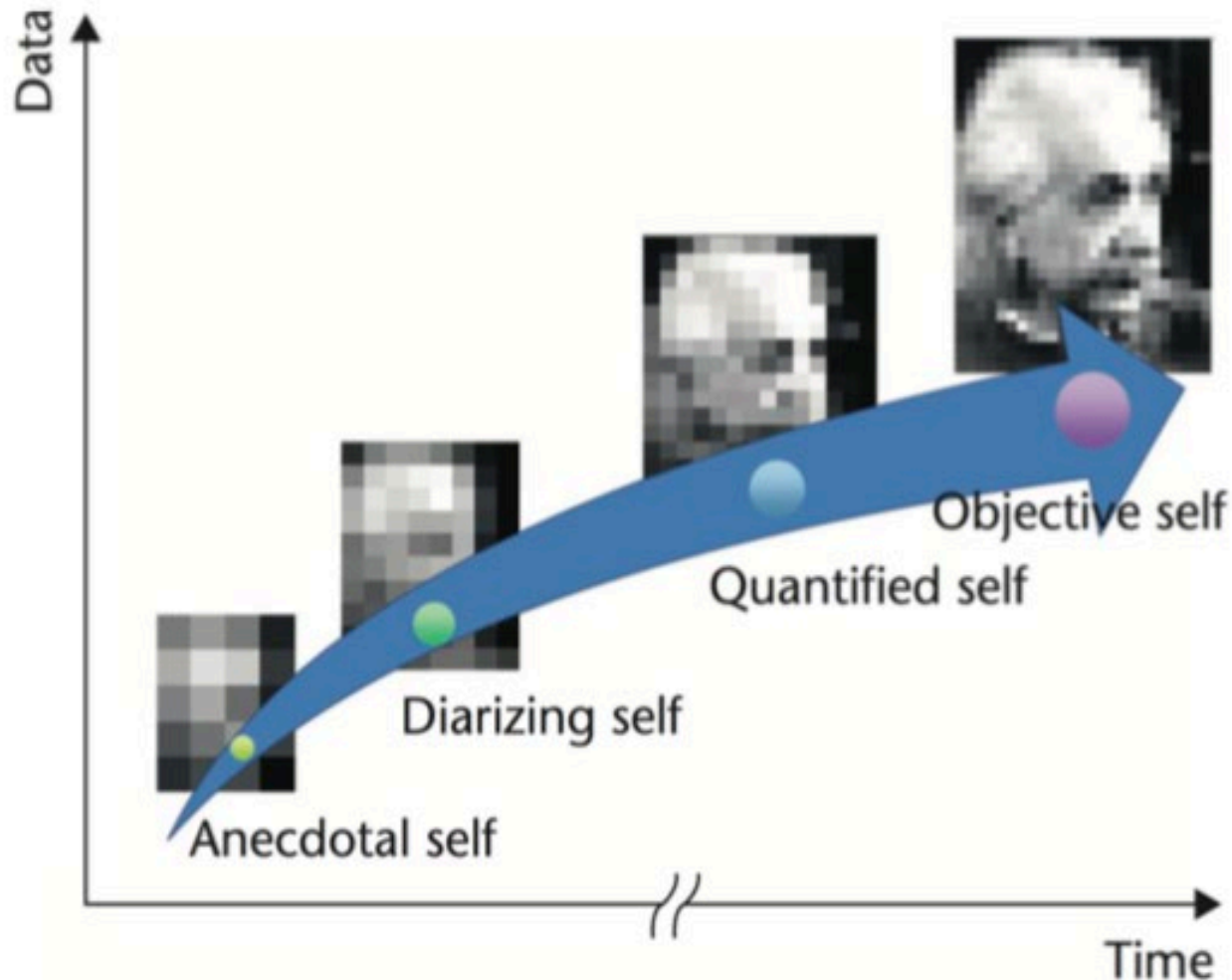
BBC Click Video clip –
'Can Artificial Intelligence beat a Doctor?'

Current treatment developments (1):
Accuray **'Cyberknife' radiotherapy machine** – *robotic control allows for patient movements, claims less exposure of healthy tissue.*

Current treatment developments (2):
Robot Surgical systems – 'da Vinci system'
assisted surgery which is less invasive requiring 'keyhole' incisions & reduced time for recovery.