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# Designing for Self-Management: Reframing Health & Well-being

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www.dubberly.com/presentations/self-management.pdf

### A talk in three parts

- 1 Reframing health as more than healthcare recognizing the importance of self-management
- 2 Three technology trends that support reframing
- **3** Building tools to support self-management

### Part 1

# **Reframing Health**

- Wicked problem
- A goal-means tree
- Asymmetric relations
- Era analysis

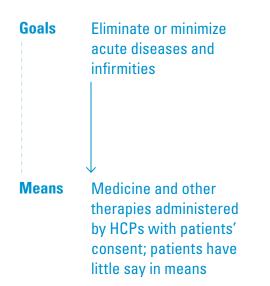
# Most people agree that healthcare is a 'wicked problem'.

# Healthcare's many stakeholders can't agree on a solution, because they don't agree on the problem.

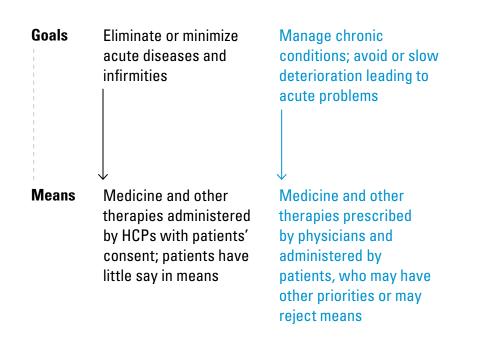
# Wicked problems can only be resolved by reframing by finding shared views, values, and goals.

# From the point of view of today's healthcare system, health is largely about minimizing illness.

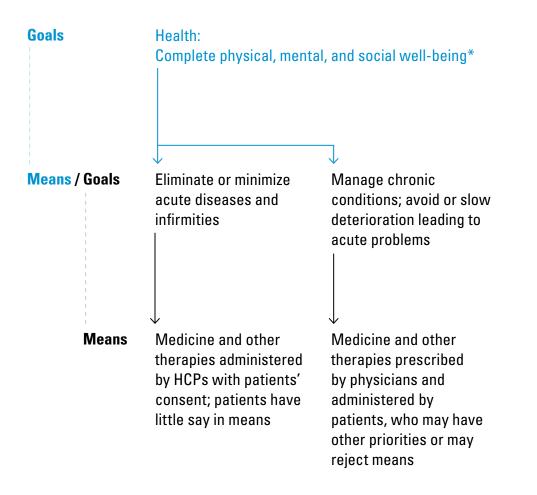
### **Traditional healthcare focuses on treating acute problems.**



# Traditional health management applies the tools of acute care to stabilizing chronic conditions.



# But health is more than eliminating or managing disease.



### Health is a means to higher goals— 'a resource for everyday life'

Goals	Quality of everyday living		
	<b>V</b>		$\rightarrow$
Means / Goals	Health: Complete physical, menta	al, and social well-being*	Other goal/means, such as: – Love of family + friends – Work valued by self + others – Physical and financial security – Fun + joy
	<b>V</b>	$\neg$	
Means / Goals	Eliminate or minimize acute diseases and infirmities	Manage chronic conditions; avoid or slow deterioration leading to acute problems	
Means	Medicine and other therapies administered by HCPs with patients' consent; patients have little say in means	Medicine and other therapies prescribed by physicians and administered by patients, who may have other priorities or may reject means	

# The requirements of health extend beyond traditional healthcare

Goals Means / Goals	Quality of everyday living Health: Complete physical, menta	<ul> <li>Other goal/means, such as:</li> <li>– Love of family + friends</li> <li>– Work valued by self + others</li> <li>– Physical and financial security</li> </ul>		
Means / Goals	Eliminate or minimize acute diseases and infirmities	Manage chronic conditions; avoid or slow deterioration leading to acute problems	Self-management supported by HCPs, family, friends, and peers	<ul> <li>Fun + joy</li> <li>Other means, such as:</li> <li>Employer practices</li> <li>Social policies</li> <li>Providing essentials: clean air + water, food + shelter, education + stability</li> </ul>
Means	✓ Medicine and other therapies administered by HCPs with patients' consent; patients have little say in means	✓ Medicine and other therapies prescribed by physicians and administered by patients, who may have other priorities or may reject means	<ul> <li>People actively involved</li> <li>Monitoring</li> <li>Goal-setting</li> <li>Experimenting</li> <li>Understanding</li> <li>Reflecting</li> <li>in relation to their:</li> <li>Bodies</li> <li>Diet</li> <li>Activities</li> <li>Relationships</li> <li>Environment</li> </ul>	l in their own:

# The way we usually think about health today is bound up in the language of our healthcare system.

- Individuals are patients
- Doctors and nurses are professionals
- Professionals care for patients
- Patients receive treatment
- Not following a physician's orders means a patient is not in compliance

### The language of acute care is ill-suited to managing chronic conditions or preventing disease (often framed as behavior change).

*'The number 1 problem in treating illness today is patients' failure to take prescription medications.'* 

— American Heart Association

# We can imagine a better world; invent new language; develop new systems; build symmetric relationships

### We can move

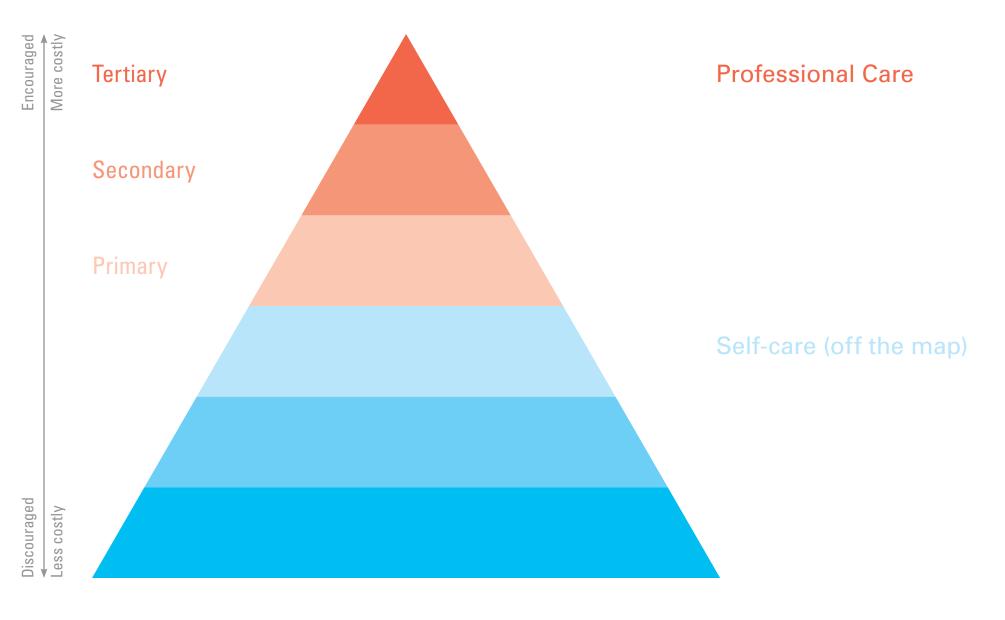
from health — to well-being

from health-care ——— to self-management

'A collaborative co-care model is starting to evolve for healthcare delivery ... the patient's role may become one of active participant, information sharer, peer leader and self-tracker, while the physician's role may become one of care consultant, co-creator and health collaborator.'

#### — Melanie Swan

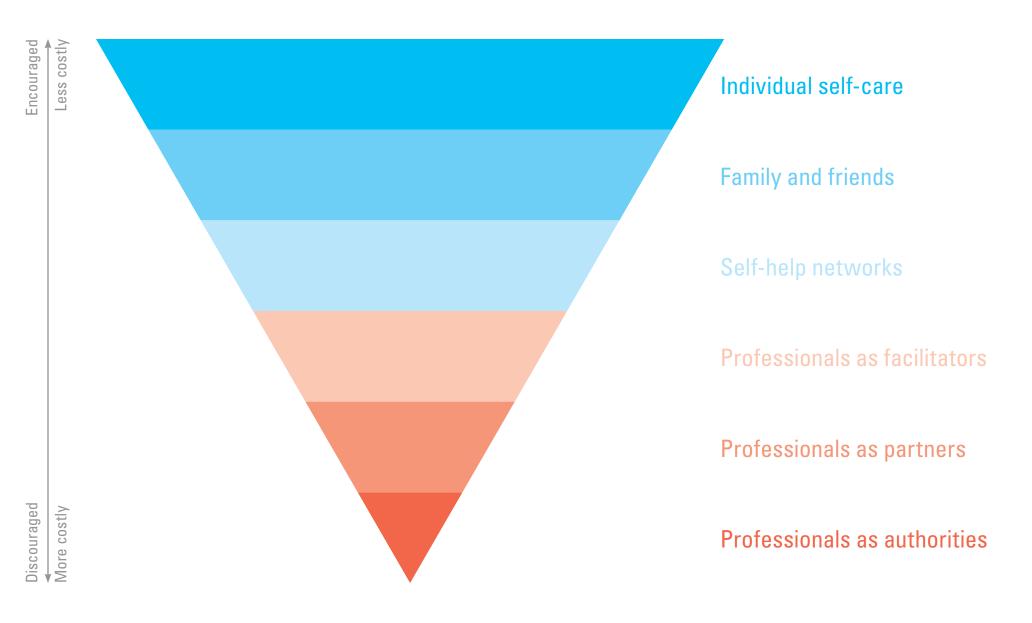
### Industrial-age health systems





Designing for Self-Management

### Information-age health systems





### **Health eras summary**

	Traditional Healthcare frame	Emerging Self-management frame
Scope	Relieve acute condition	Maintain well-being
-	Now	Over a lifetime
Approach	Intervention; treatment	Prevention; healthy living
••	Expert-directed	Self-managed
	Apply standards of care	Measure, assess, & adjust; iterate
	Lengthy regulatory pre-approval	Learn and adapt as you go
Subject	Symptoms and test results	Whole person, seen in context
Response	Prescribe medication	Improve behavior, environment
Relies on	Medical establishment	Individual, family, & friends Social networks, others like me

# Health eras summary (cont.)

	Traditional Healthcare frame	Emerging Self-management frame
HCP as	Authority, expert	Coach, assistant
	Dispensing knowledge	Learning from patients
Patient as	Helpless, childlike	Responsible adult
	Taking orders	Setting goals; testing hunches
Relationship	Asymmetric, one-way	Symmetric, reciprocal
	Command and control	Discussion and collaboration
Records	HCP's notes of visit	Patient's notes, data from sensors
	Sporadic	Continuously collected
	Dispersed between offices	Connected; aggregated
	Managed by HCP	Controlled by patient

# Part 2 Technology Trends

- Sensors
  Big data
- Convergence 2.0

### **Part 2.1**

# **Technology Trends Sensors are proliferating and connecting**

They will be ubiquitous

- at check points
- on line
- all around
- on you
- in you

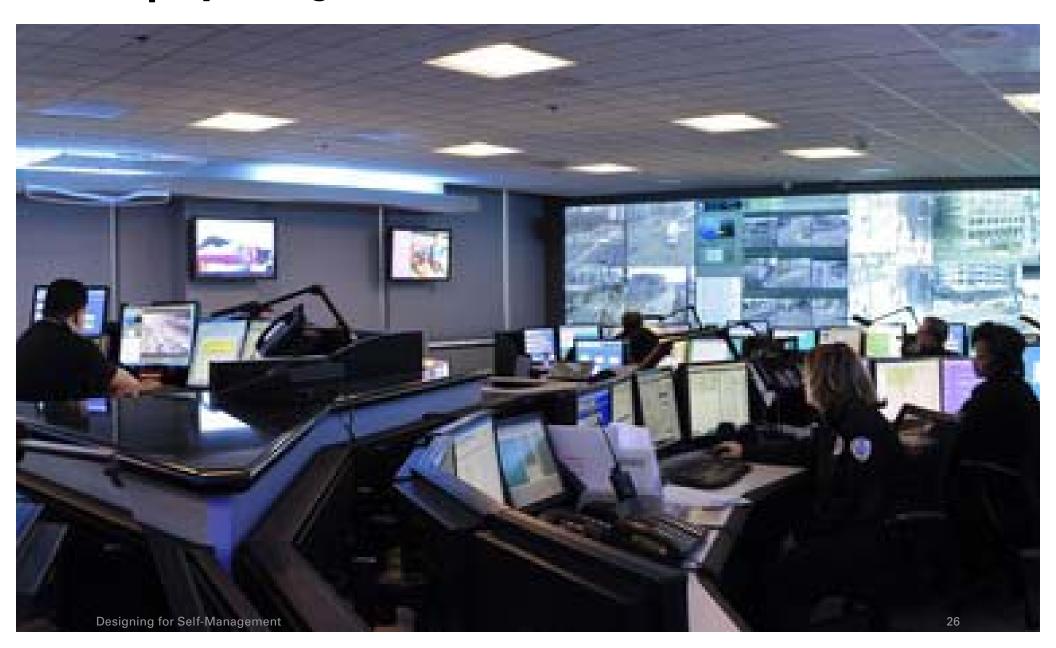
# Wal-Mart has mandated that every package in its stores include an RFID chip.



# London alone already has 500,000 video surveillance cameras.



#### Chicago has about 15,000 cameras, networked so that a 911 call automatically displays images from the nearest camera.



### Intel has chips measuring heat and humidity on each vine in several California vineyards.



### **Pets can have chips implanted so they can be found more easily.**



# Mobile phones are packed with sensors and becoming hubs for body-area networks

- Motion (accelerometer)
- Compass (magnetometer)
- Three-axis gyroscope
- Location (GPS)
- Sound (microphone)
- Light (camera × 2)
- Touch
- Proximity (to face)
- Fingerprint



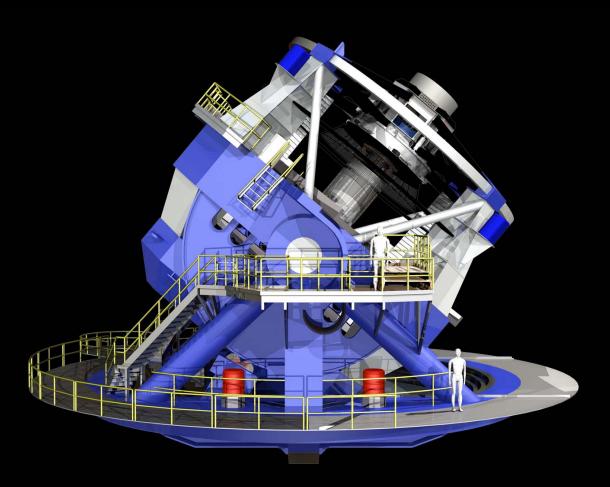
### **Part 2.2**

**Technology Trends Big Data: assembling, managing, & mining huge databases** 

Logging every user action
Measuring every design change
Relying on statistics

The new Large Synoptic Survey Telescope (LSST) will produce 30 terabytes of data each night.

The current largest public database of such images is about 80 terabytes.

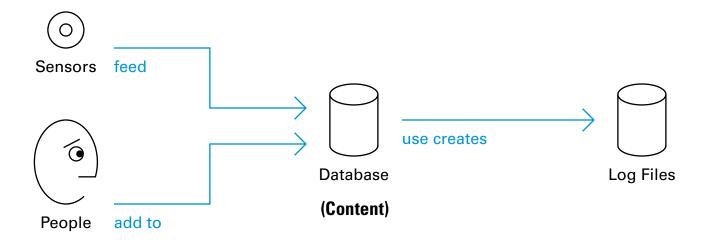


# Google + Amazon have built big businesses collecting huge amounts of data.

#### They are not anomalies, they are signals of the future.

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		Check This Out Holiday Toy List Get great toys and	at Other Customers Are Looking At Right Now	The <u>Bionic Wrench</u> is as easy to use as pliers, with powerful ratheting grigping force. It's 2005 Popular Mechanics Editor's Choice Avard winner.
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		and the second	n and Light Toshiba Laptop with Nine Hour Battery Just \$599.99 Packed with a \$00 GB hard drive, 3 GB of RAM, and Windows 7 Home Premium, this 133-inch (agos offers big time performance in bleck 3-9 pound package. Other features include a stunning Tru-Bright display, multi-touch trackpad, and zippy Intel dual-core processor.	Rave with the Amazon core Vice Card

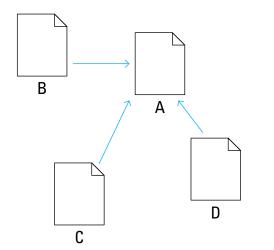
#### **Big data collection has 3 levels.**



### Large data collections are inherently valuable.

#### Links on the web





A	← B, C, D
В	
С	
D	

#### **Google search results**

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Intervent - Infloeen Technologies freexo rifers a variety of digital and analog Sensers for multiple physical parameters, such a magnetic field, temperature, pressure, position, distance, we inflorest controlmalus products thermal Net Infloement Castral CL (11)		www.Feeto.com/USA Sensor Manufacturer Sensors and measuring line Manufacturer and suppler
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### The result? Analytics for everything, everyone, and you.

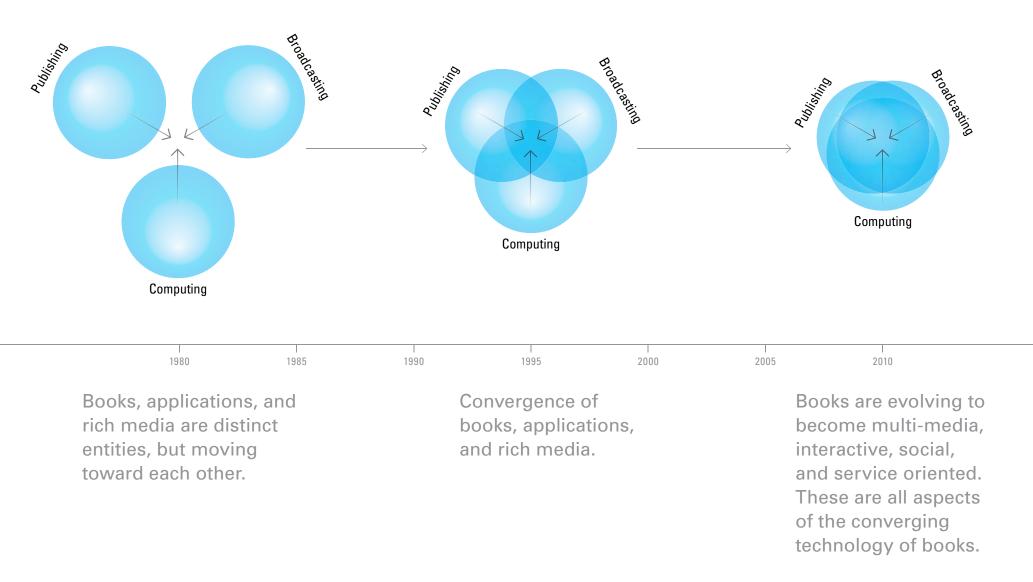


### **Part 2.3**

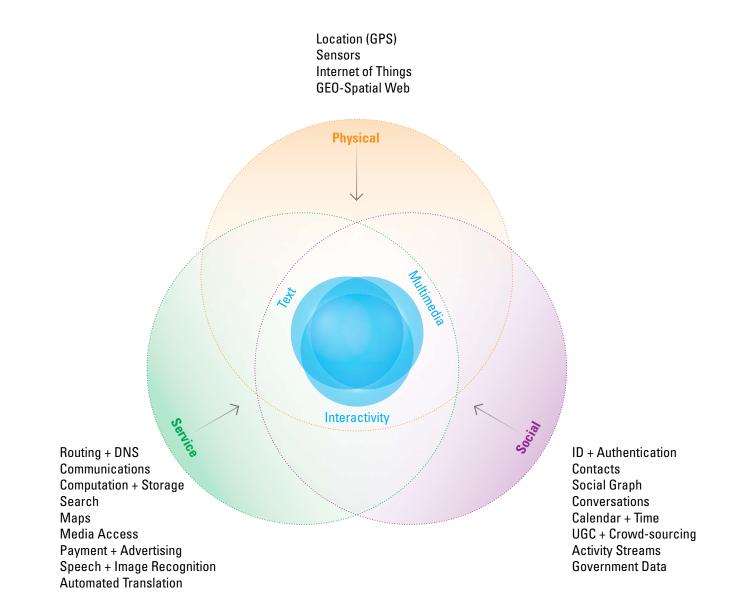
# **Technology Trends A larger trend is at work: Convergence**

- All media becoming digital
- Networks becoming services
- Healthcare becoming digital & networked
- The rise of personal archives

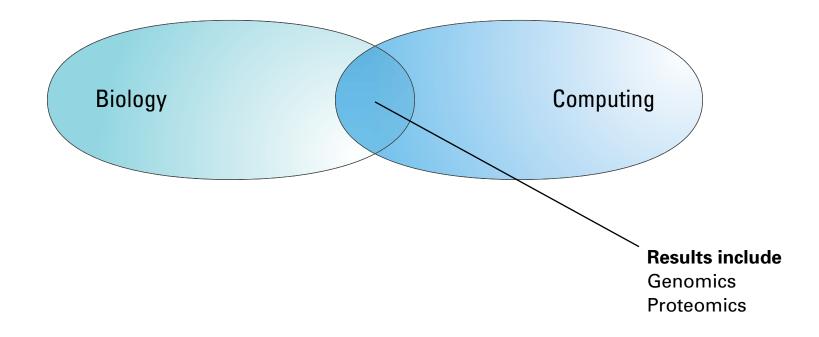
#### **Convergence 1.0: Publishing + broadcasting + computing**



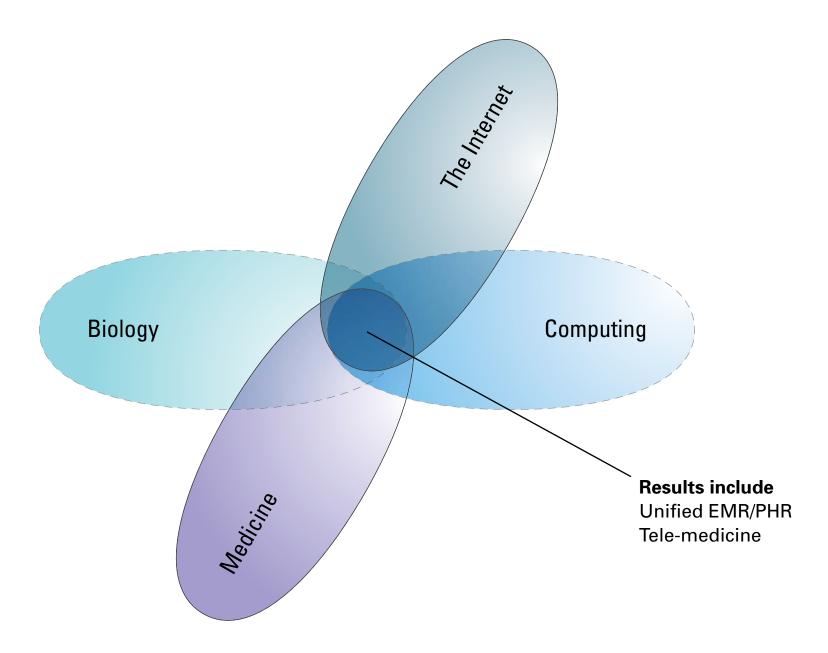
#### **Convergence 2.0: Service + social + physical**



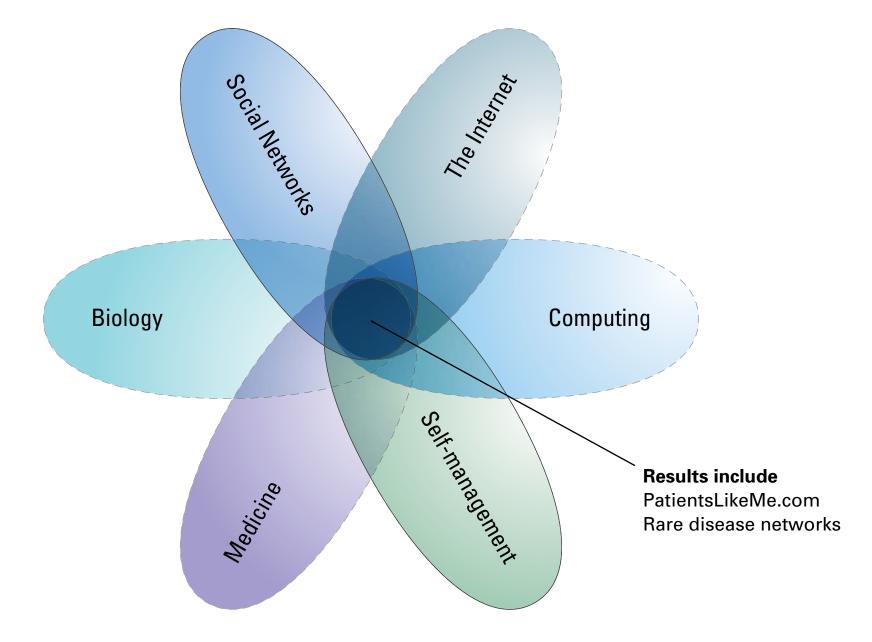
#### **Convergence is even larger. Biology is becoming a computational science.**



## The Internet is beginning to transform the practice of medicine.



## Social networks will merge with dashboards to enable self-management.

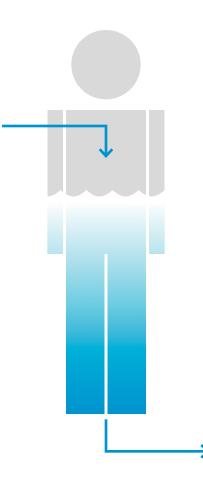


## **Convergence will hasten the growth of personal archives**—and their integration.

		<b>Health</b> Wellness Physical Data	<b>Finance</b> Assets Transactions	<b>Education</b> Experience Media Consumed	<b>Social</b> Contacts Calendar Communications Travel
Future	Goals – Opportunities – Threats			Amazon Wishlist	
Present	Status – Strengths – Weaknesses		Mint Online Wallets		Facebook Single Sign-on
Past	Records – Successes – Failures	EMR/PHR		Evernote Amazon Purchase I	History

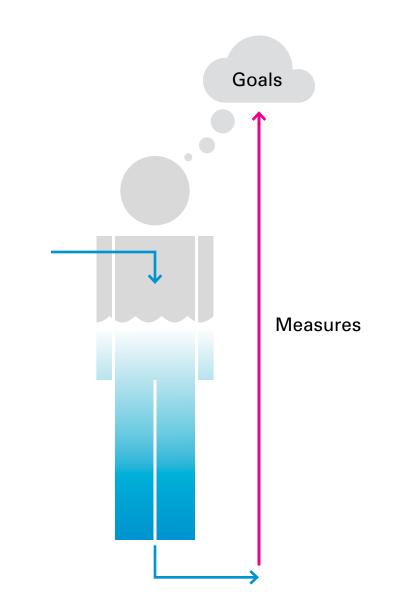
## Part 3 Building Tools

#### Living systems must maintain dynamic equilibrium (homeostasis) to survive

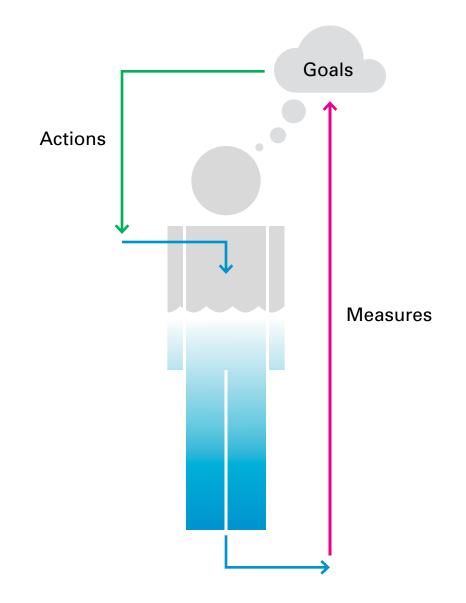


# A patient's vital signs measure important elements of homeostasis

Variable	Goal range
Body temperature	97.25°F – 99.5°F
Heart rate	60 – 80 bpm
Blood pressure	< 120 / < 80 mm Hg
Respiratory rate	10 – 14 bpm



## Maintaining homeostasis requires 'closing the loop' on many variables simultaneously



#### Common lab tests measure other elements of homeostasis and may indicate therapies

Variable	Goal range	Therapy
Weight	150 – 170 lbs	Diet, exercise
BG (fasting)	70 – 99 mg/dL	Diet, insulin
INR	0.8 – 1.2	Diet, warfarin
Cholesterol	< 200 mg/dL	Diet, statins

### A quick survey turned up more than 150 analytes that can be measured in lab tests today.

Pulse regularity Respiratory rate Bone density **Cross-linked N-telopeptides** Vitamin D Uric acid Blood vessel dilation Muscle mass Sodium Potassium Calcium Magnesium Chloride Hydrogen phosphate Hydrogen carbonate Total serum iron Total iron-binding capacity Transferrin Transferrin saturation Ferritin Ammonia Copper Zinc Magnesium Selenium Ceruloplasmin Blood vessel supply Dopaminergic neuron quantity Glucose Protein Red blood cells White blood cells Blood pressure Refractive error Pressure Clarity Hearing sensitivity Thyroid stimulating hormone Free thyroxine Self-Management Free triiodothyronine Total thuravina

Body mass index Epinephrine Cortisol 17 hydroxyprogesterone Angiotensin-converting enzyme Growth hormone Follicle-stimulating hormone Luteinizing hormone Adrenocorticotropic hormone (ACTH) Prolactin Pulse Pressure Blood Glucose Insulin absorption Plasma osmolality Total cholesterol High density lipoprotein (HDL) Low density lipoprotein (LDL) Triglycerides pН H+ Base excess Oxygen pressure Oxygen saturation Carbon dioxide Standard bicarbonate Hemoglobin Hemoglobin in plasma Glycosylated hemoglobin Haptoglobin Hematocrit Mean cell volume Red blood cell distribution width Mean corpuscular hemoglobin concentration Erythrocytes/Red blood cells Reticulocytes Thrombocyte / platelet count Prothrombin time Coogulate production

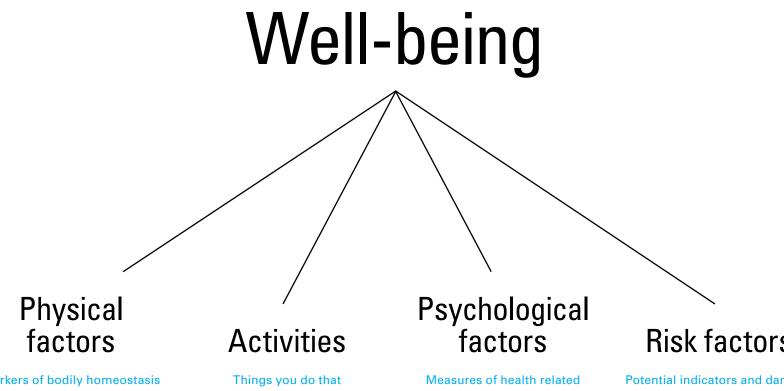
Bleeding time Viscositv D-dimer Creatine kinase CPK-MB Brain natriuretic peptide NT-proBNP Myoglobin Troponin-I Troponin-T Lung volume Oxygen absorption Hypopneas Neutrophil granulocytes Neutrophilic band forms Lymphocytes Monocytes Mononuclear leukocytes CD4+ cells Eosinophil granulocytes **Basophil granulocytes** Erythrocyte sedimentation rate C-reactive protein Alpha 1-antitrypsin Immunoglobulin A Immunoglobulin D Immunoglobulin E Immunoglobulin G Immunoglobulin M Anti-SS-A (Ro) Anti-SS-B (La) Anti ds-DNA Anti-histone antibodies Cytoplasmic/classical antineutrophil cytoplasmic antibodies Perinuclear anti-neutrophil cytoplasmic antibodies Anti-mitochondrial Antibodies Rheumatoid factor Antietrontolygin O titro

Albumin Globulin **Total Bilirubin** Direct/conjugated bilirubin Lipase Plaque regulation Amylase H.pylori Lumen obstruction Gastrin Fecal occult blood Serum creatinine Urine specific gravity Osmolality Uribilinogen **RBC** casts Ketone bodies Nitrite NMP22 protein Sperm Testosterone Dihydrotestosterone Estradiol Progesterone Prostate specific antigen Human chorionic gonadotropin Alpha-fetoprotein Human chorionic gonadotropin CA19-9 CA-125 Carcinoembryonic antigen Homocysteine Herpes simplex 1&2 Hepatitis A Hepatitis B Hepatitis C Cytomegalovirus HIV Inluenza Measles Human papillomavirue

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#### Health is more than measuring chemicals

A whole-systems view should encompass more than chemical markers and consider how our actions, emotions, perceptions, and histories affect our overall health



Markers of bodily homeostasis primarily measurable through blood, urine, and tissue

> e.g. prothrombin time cholesterol bone density

alter your bodily chemistry in some way

> e.g. eating physical activity hydration

to emotion and self-perception that are not easily quantified

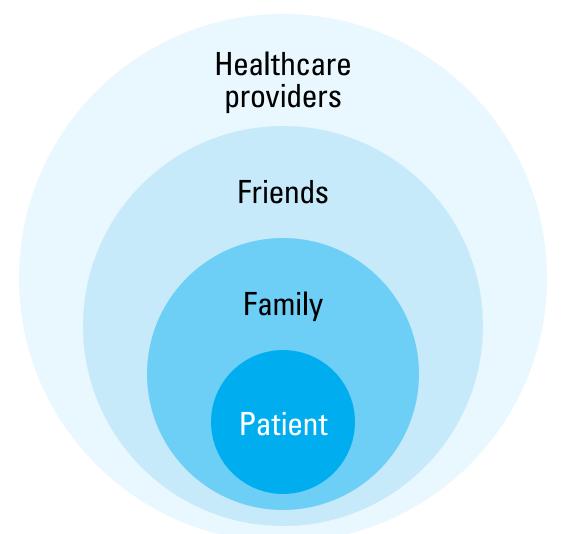
> e.g. sense of energy stress body image

**Risk factors** 

Potential indicators and dangers related to your past and current life situation

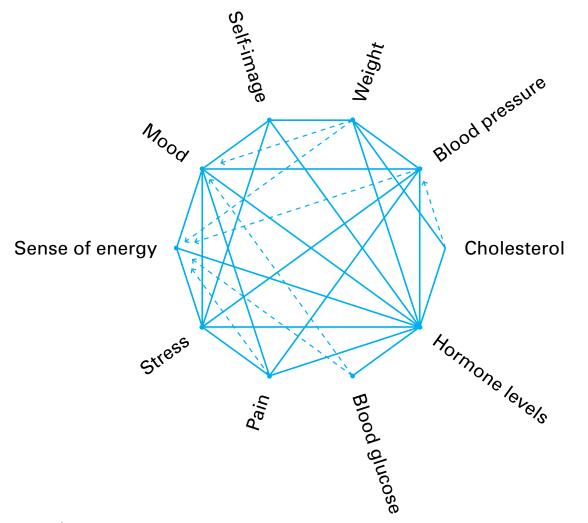
> e.g chronic activity past incident family history

## A whole-systems view should show how an individual's network contributes to their health

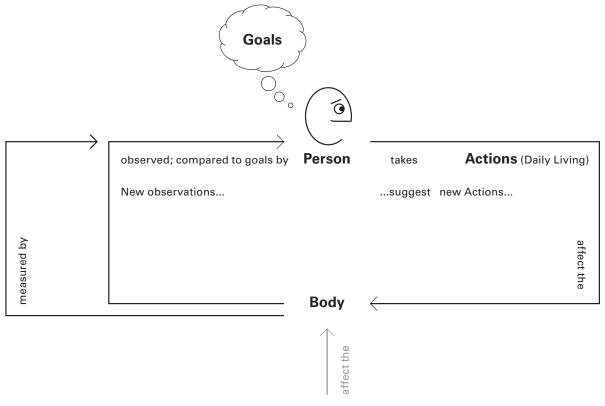


#### A very large number of factors contribute to wellbeing; many of them are richly interconnected.

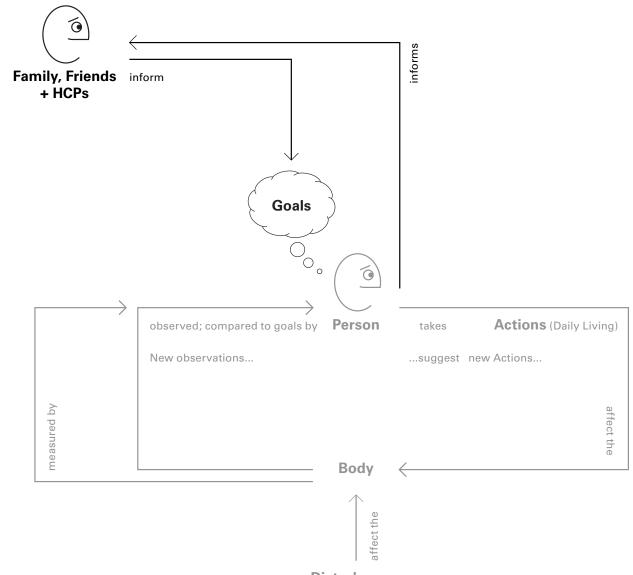
Modelling these relationships is complicated but presents a truly massive opportunity for new understanding



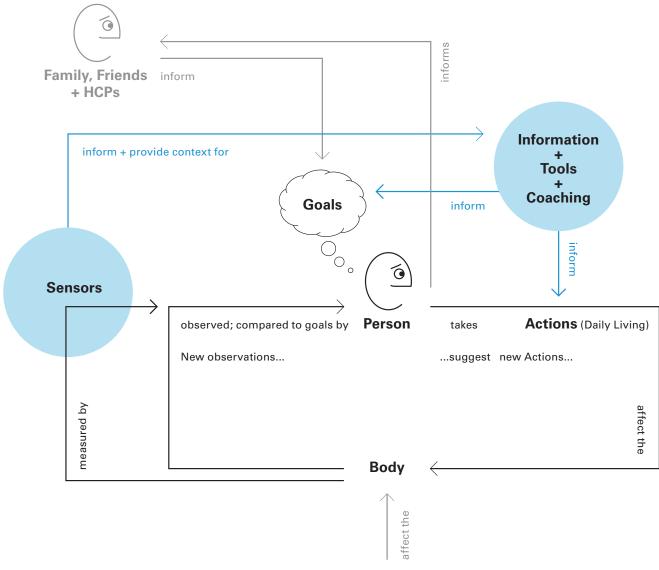
#### The feedback loop provides a conceptual model imagine 'Quantified Self (or diet tracking) for all of homeostasis'



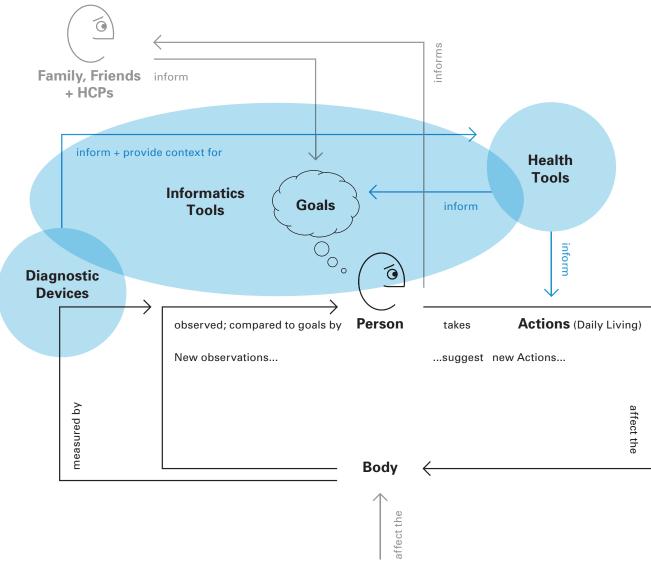
#### Individuals also need to connect to a wider circle, while controlling who sees what imagine 'Facebook for health'



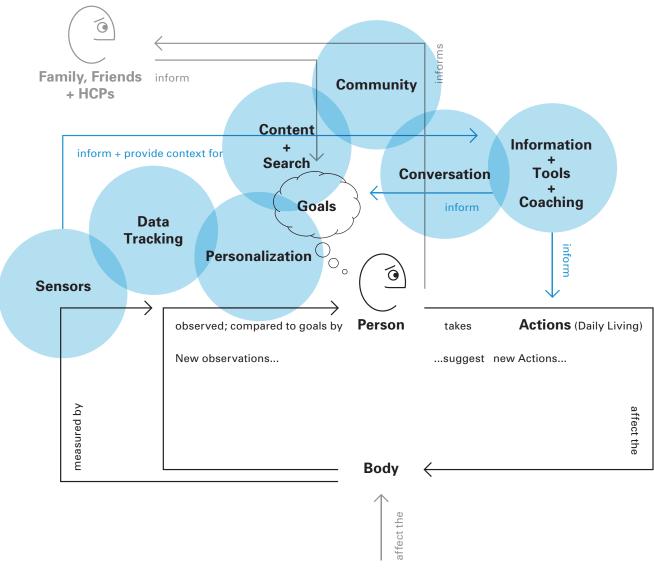
#### Connecting sensors with coaching offers a new blend of self-management or chronic care imagine 'Khan Academy for wellbeing'



## Informatics tools can link devices, services, and people.

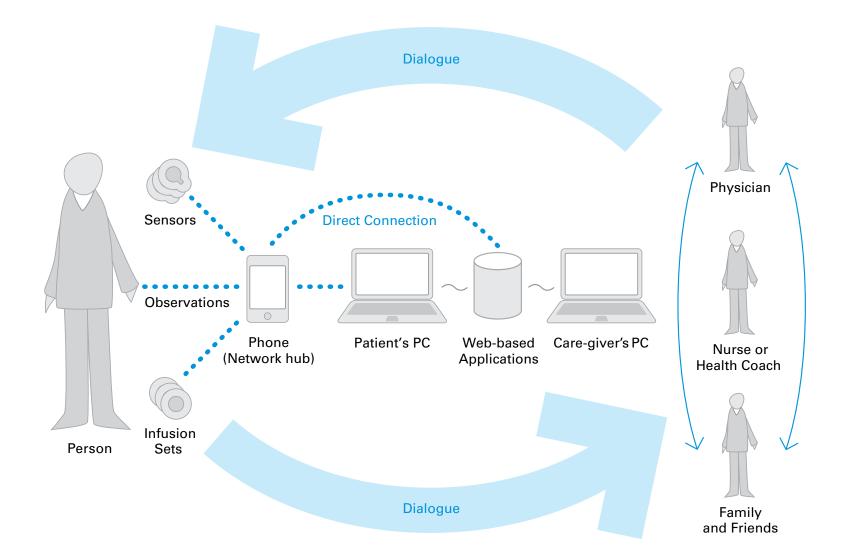


#### Informatics tools include five major areas.



#### Imagine 'QS + Facebook + Khan Academy'

Individuals take a more active role in managing their own health (designing and running their own experiments) while also engaging in more dialogue with others.



### New tools can build a ladder to health + wellbeing.

Health + Wellbeing 1 enable **Better Choices** ↑ yield **Motivation + Validation** î yield **Conversations + Learning** 1 support Data + Stories 1 generate Actions + Events

#### **Special thanks to**

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Presentation posted at www.dubberly.com/presentations/self-management.pdf