Design in Plastics Conference Providence June 22, 2016

How the Internet of Things will shape future product design

Hugh Dubberly, Dubberly Design Office Stephen B. Wilcox, Design Science

presentations.dubberly.com/IoT_product.pdf

"...software is eating the world.

...we are in the middle of a dramatic and broad technological and economic shift in which software companies are poised to take over large swathes of the economy...

— Marc Andreessen, founder, Netscape and Andreessen-Horowitz

Wall Street Journal OpEd www.wsj.com/articles/SB10001424053111903480904576512250915629460



"If you went to bed last night thinking you're an industrial company, you're going to wake up this morning as a software and analytics company."

— Jeff Immelt, Chairman and CEO, General Electric

Minds + Machines 2014 www.ge.com/stories/industrial-internet



Technological change comes in waves, which interact to create "combinatorial innovation." [1]

- Work has *gone digital*.
- People *have connected*.
- Now, *things* are connecting, too.





2016 is like 1981 and 1995 all over again. You can see the next wave coming.

It goes by many names: Internet of Things (IoT) Internet of Everything, Cisco – Industrial Internet, GE – Smarter Planet, IBM - Living Services, Accenture - Platform World, Sapient. Publicis - Social CRM or Social Business **Digital Engagement Digital Transformation**

The change has already begun, for example

Amazon announced AWS IoT, also testing pop-up stores in malls featuring IoT devices and Echo.

GE hired 2,000 engineers in San Ramon, builds **Predix platform**,

GE Digital now has 30,000 employees.











Sears opens a series of **"Connected Home"** showcase stores.

Target launches **"Open House"** IoT showcase store in San Francisco.

By 2020, ~50 billion devices will be connected to the Internet; today, ~7 billion computers and tablets are connected.



Sources: The Economist and Cisco

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Automotive

Industrial devices (military and aerospace)

Consumer electronics and medical devices

Computers

Mobile communications

Fixed communications

"Design has also evolved from the design of objects both physical and immaterial, to the design of systems, to the design of complex adaptive systems. This evolution is shifting the role of designers; they are no longer the central planner, but rather participants within the systems..."

— Joi Ito, Director, MIT Media Lab

"Design and Science", January 11, 2016

Traditionally, **"products"** has meant not just hard goods but also information and **services**.

In the last 20–30 years, "services" have become a way to deliver "products."

More recently, **services** are connecting to **integrated systems**, forming product service ecologies—networks of products, services, people, and their interaction.

Harvard Business School professor Michael Porter writes about systems of systems.

— Michael Porter and James Heppelmann, How Smart, Connected Products Are Transforming Competition Harvard Business Review, November 2014 https://hbr.org/2014/11/how-smart-connected-products-are-transforming-competition

Products are becoming "smart." Product

- + Sensor
- + Computer
- = Smart Product

The average vehicle includes 60–100 sensors; that figure may grow to 200 by 2020.

Source: Automotive Sensors and Electronics Expo 2015—http://www.automotivesensors2015.com/

In 2010, basic cars included 30 microprocessors; luxury cars had as many as 100.

Source: The New York Times—http://www.nytimes.com/2010/02/05/technology/05electronics.html

Sets of smart products are connecting. Smart Product

- + Network
- + Cloud Service
- = Smart, Connected Product

Sets of connected products form product systems. Smart, Connected Product + other Smart, Connected Products = Product System

Systems connect to other systems, forming ecologies. **Product Systems**

- + other Product Systems
- = Product-Services Ecology

Farms are becoming automated factories. Plants are attached to sensors, connected to networks, generating data.

Macro view: processed satellite images of crop growth over time, e.g., central lowa, March 29 to October 23, in 8 day increments.

Algorithms automatically align images, remove clouds, and detect vegetation.

Daily weather data can augment machine learning.

Precipitation, temperature, wind direction and speed, snow cover, and cloud cover can aid forecasting.

Last year, Descartes Labs used satellite and weather data and machine learning to make the first entirely automated forecasts of crop production.

iPod was the proto-loT device—an integrated system of hardware, software, and networked services.

VCs are no longer funding stand-alone apps; Uber isn't just an app; it's an IoT platform for logistics.

Last fall, Mattel relaunched Barbie, as a smart, connected product.

Barbie + sensor + computer + network + cloud services = Eliza 2016

- Recognizes you and what you say
- Learns about you
- Converses with you, using 8,000 pre-recorded phrases
- Extends up to 120 exchanges

Now imagine Barbie's AI connected to a CRM system. "Have you told Grandma what you'd like for your birthday?"

from outsourced service...

...to core business function. You have to recognize your customers in real-time.

Catalia Health is developing Mabu, a personal healthcare companion.

Robot + touch-screen + network + cloud services = Mabu

- Recognizes you and what you say
- Learns about you
- Imports data from health trackers
- Converses with you about your condition
- Reminds you to take medications
- **Connects with HCPs**

Many companies are working on robots almost all are networked systems connected to the cloud.

Sony Qrio

Asus Zenbo

Boston Dynamics Atlas

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VGo Telepresence

Medical devices are connecting to the cloud, too, including pacemaker-defibrillators, auto-injectors, and glucometers.

In the future, medical products will no longer stand alone. Increasingly, they will exist in complex networked service webs.

Glucometer + processor = computer that can run apps; e.g., bolus calculator, calorie estimator and tracker. When a glucometer connects to a smart-phone, cost can come down, because the meter can build on the phone's processor and display. Plus data can be shared with family and HCPs. A near continuous glucose monitor can be coupled with an insulin pump, forming a glucose management system. The glucose management system can connect with many other systems, such as EMRs, remote alerting, patient population management, drug interaction monitoring, pharmacy order management, and billing.

Unified patient and device data will afford useful views to many constituents.

Patients can know much more about what's happening and can share information with family, friends, and HCPs.

HCPs can receive a more holistic view of each patient and can manage groups of patients more efficiently.

Bio-med engineers can better manage equipment, improve service, and reduce support costs.

Researchers can learn from aggregate data, to improve procedures and care-facility operations.

Designers can get detailed usage data, to improve next generation products.

What does this mean for designers, developers, and product managers?

Networked services can recognize their users and respond uniquely.

Networked services collect information as a natural part of operating.

Networked services change continuously.

"...designing networked services requires a new way of thinking about a product and its development."

— Tim Misner, Oracle Software Architect

"...internal discussion changes

from

'what features or quality level do we think our products need?'

to 'what data can we collect about our features and quality?'"

he nternet of hings, signals a larger cultural shift...

from

Industrial age

nformation

ao

...and a corresponding shift in the nature of products.

from the design of Objects

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to adaptive systems orchestrating

Special thanks to Bob Grace Ryan Reposar

hugh@dubberly.com sbw@dscience.com

Presentation posted at presentations.dubberly.com/loT_product.pdf