GE
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A Systems Approach to Product Development

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Continuous innovation is a necessity.

Companies must create value.
Value comes from margins.
Margins come from differentiation.
Differentiation comes from innovation.

Eventually, old innovations become commodities.
New innovations are needed to maintain value.

AXIOM 1

The primary purpose of a publicly traded company is to increase shareholder value.

High value comes from high margins—
from charging substantially more for something
than it costs to make and deliver.

Margin = Revenue – Cost

AXIOM 2

Margins are supported by differentiation—
by offering something no one else offers.

Differentiation comes from innovation—
from creating not just new products and services
but new types of products and services.

AXIOM 3

An important source of innovation is design:

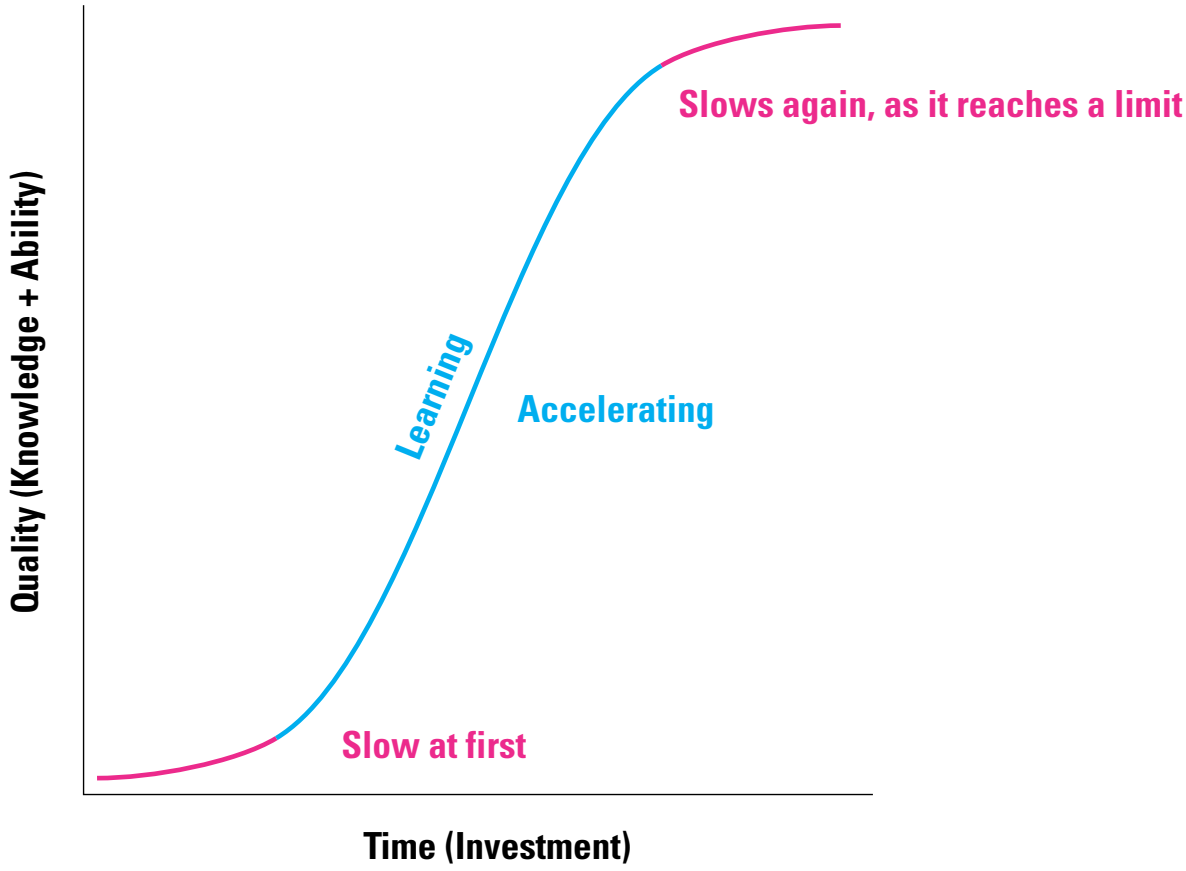
- design research
- design thinking
- design practice

Innovation is a form of learning;
so is design.
Both proceed in a sequence of phases
or learning curves.

PART ONE

Learning Curves

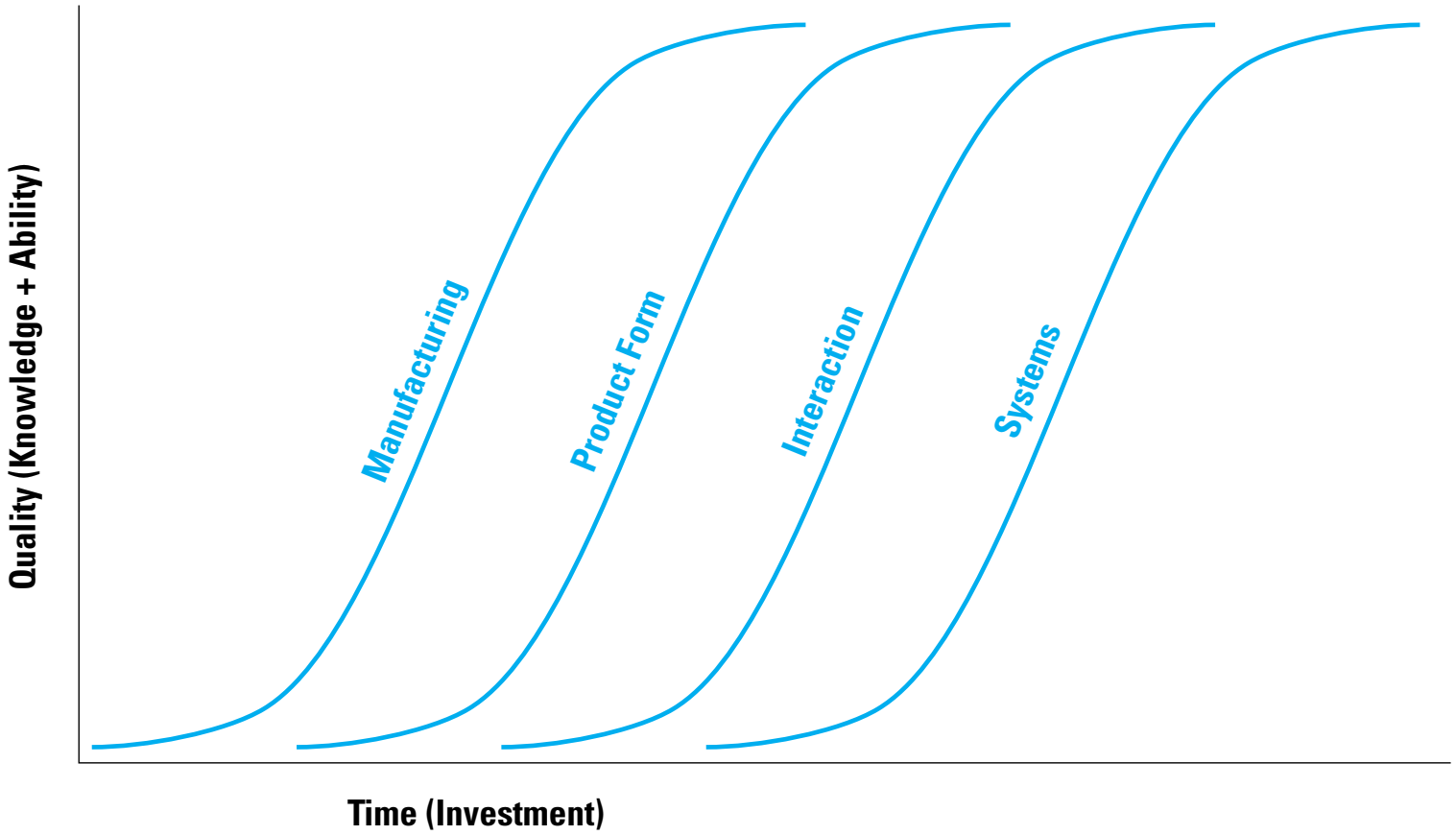
At first, a new wave offers competitive advantage but waves have limits. Eventually, new skills become a competitive necessity—a cost of entry.



Learning happens at different scales—small + large.

- Individuals have insights, which they refine and share with colleagues, building support within an organization or discipline.
- Companies that master new skills first gain a lead over their competitors, but competitors soon copy success and catch up.
- Eventually, knowledge becomes distributed throughout an industry—and innovative practices become standard operating procedure.

Over the last 30 years, product innovation has occurred in 4 waves.

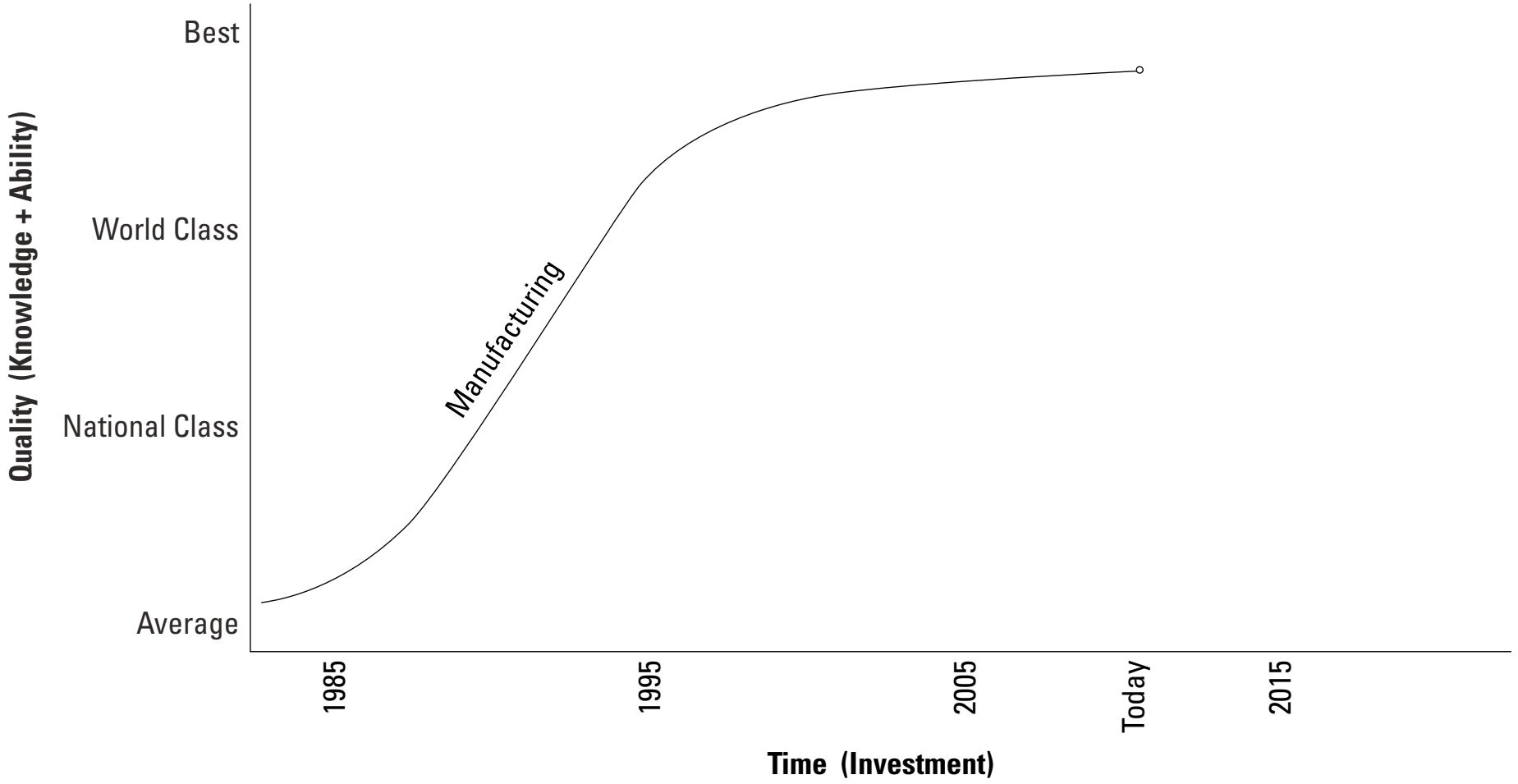


CURVE 1

Improving manufacturing quality.

- Statistical Process Control (SPC)
- Total Quality Management (TQM)
- Six-sigma
- Fit and Finish
- Craftsmanship

In the late 1980s, Samsung focused on improving manufacturing quality; now they make 30nm DRAM.



CURVE 2

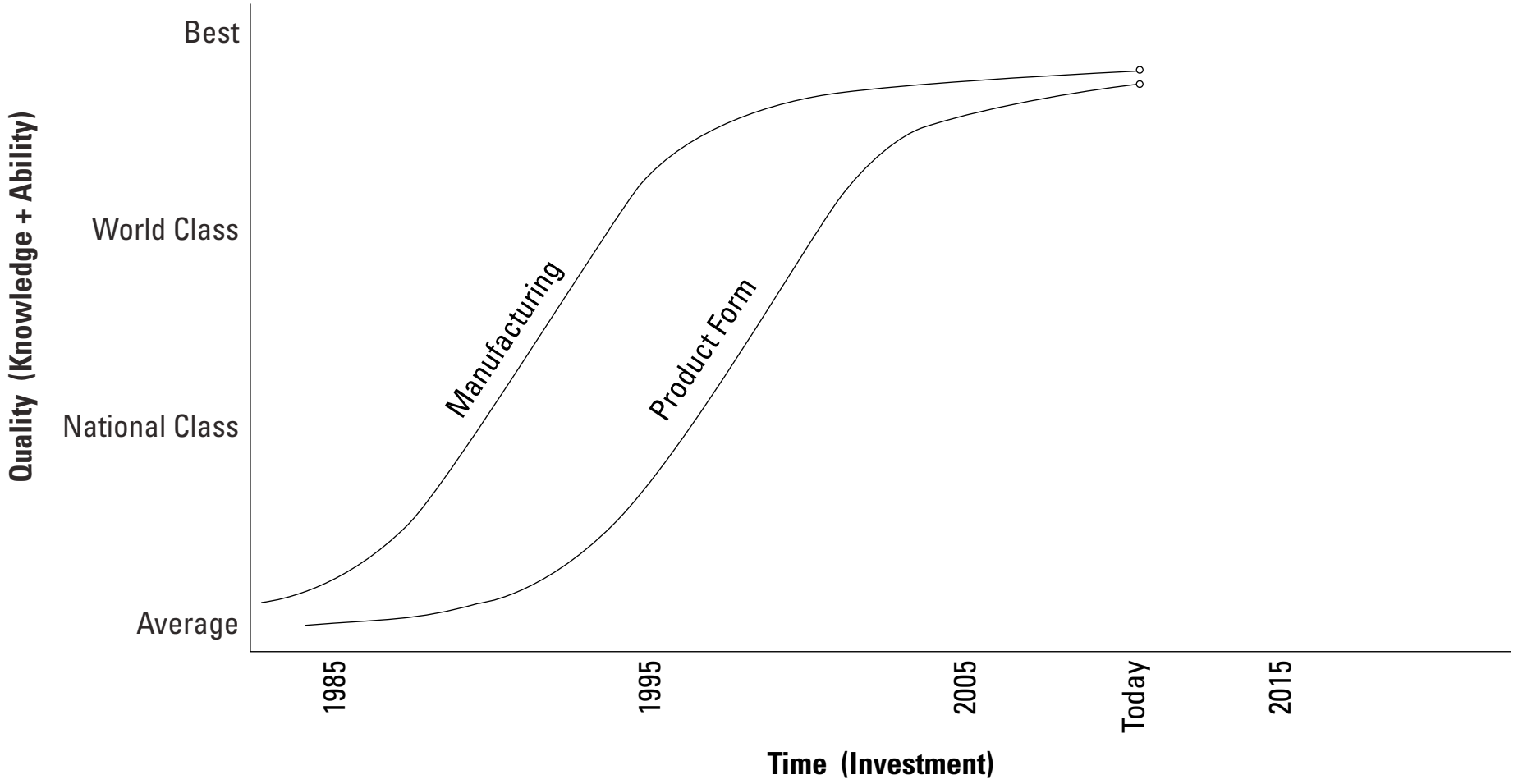
Improving product form.

– **Immediate connection**
"This looks interesting."

– **Clear communication**
"I understand what this does."

– **Emotional resonance**
"This is really great."

In the 1990s, Samsung improved product design; now they win as many design awards as Apple.

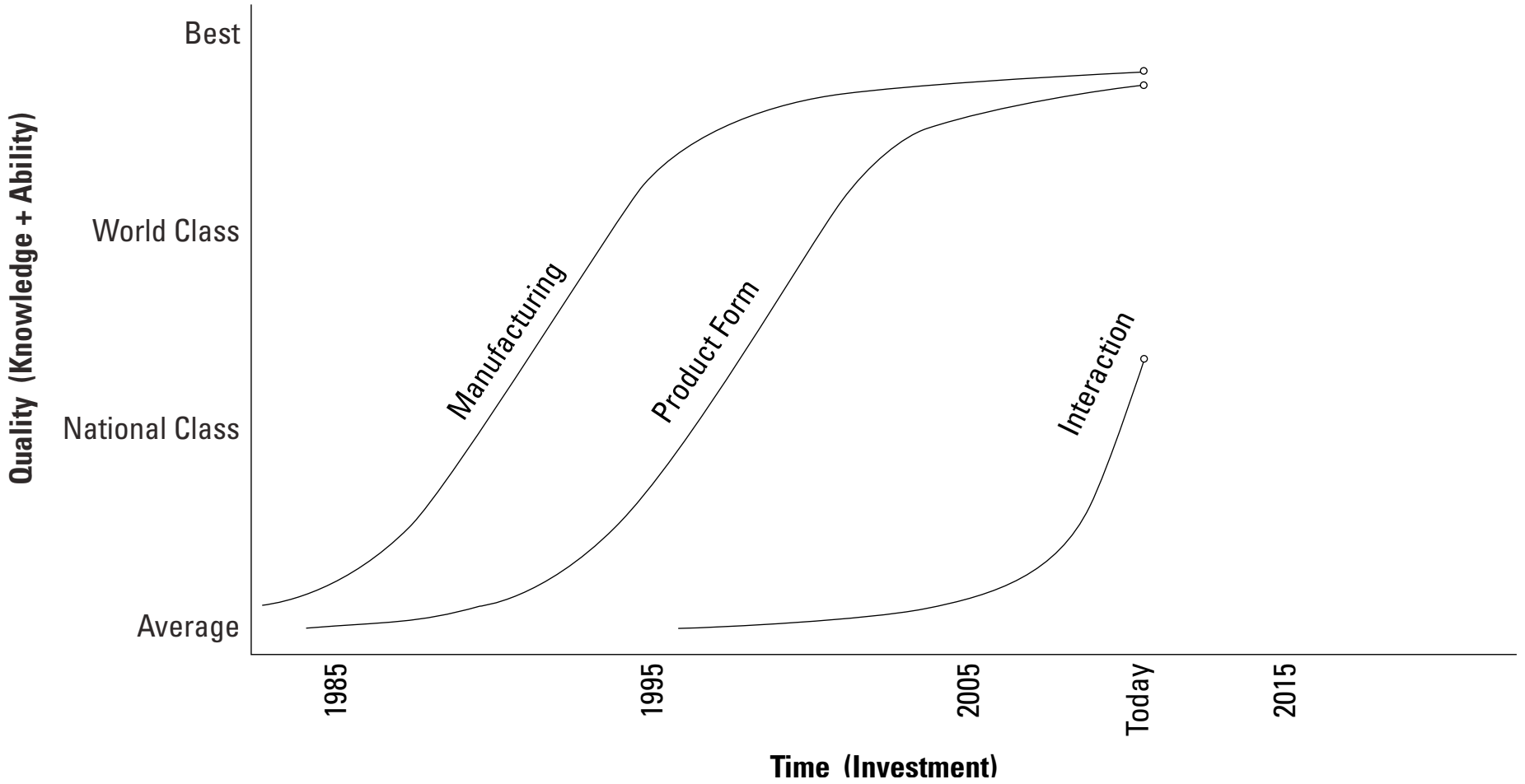


CURVE 3

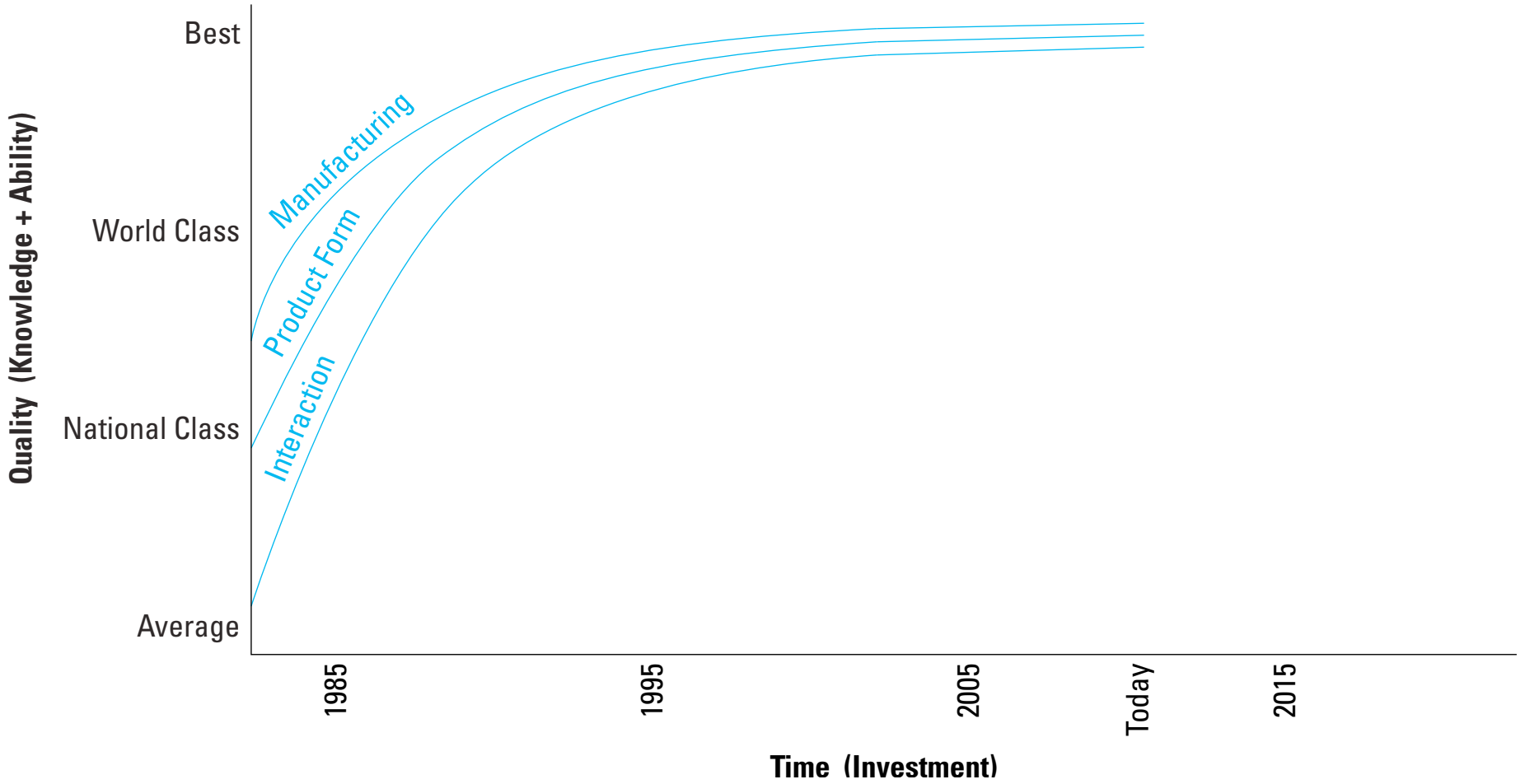
Improving user interaction.

- **Minimizing learning time**
  "This is easy."
- **Efficient, effective, delightful operation**
  "This is fun."
- **Creating unexpected opportunities**
  "Look what I can do now."

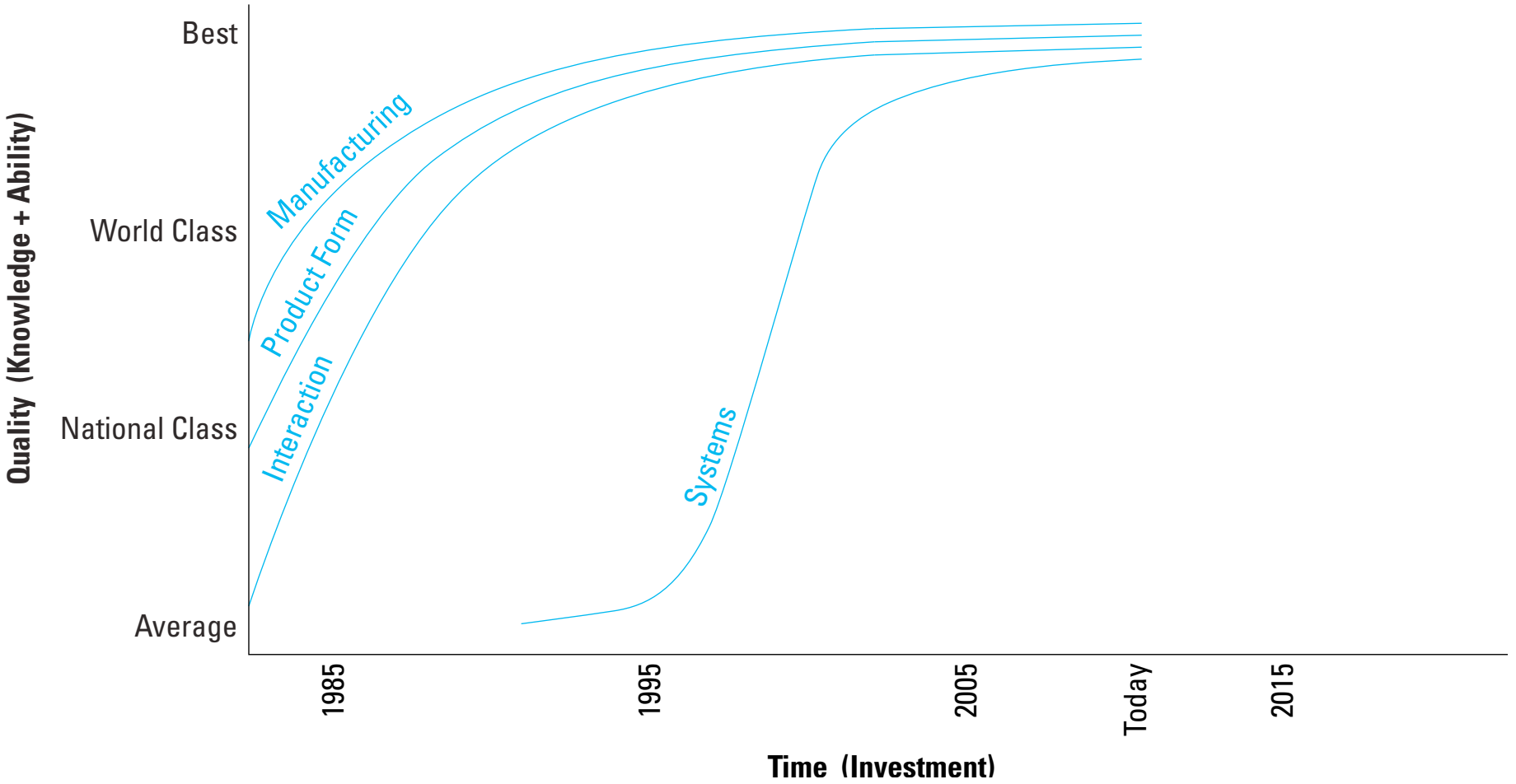
Recently, Samsung began to climb a third curve, improving the quality of its user interfaces.



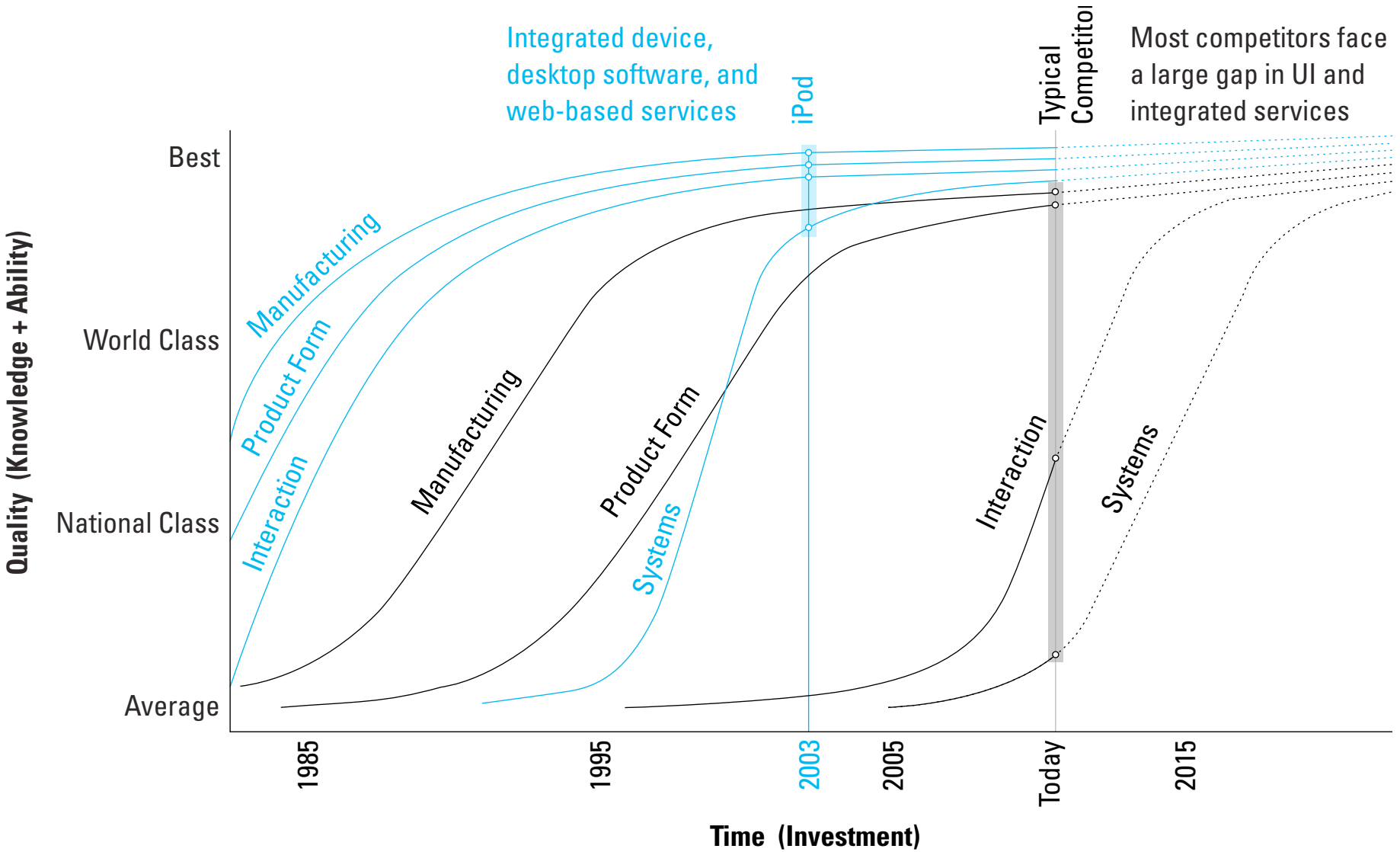
But Apple achieved world-class manufacturing, product design, and user-interfaces, years ago.



More recently, Apple has focused on integrating its products into sophisticated services.



The success of iPod is more than product design; it depends on all four measures of product quality.



CURVE 4

Thinking in terms of systems.

– **Looking at whole systems, not individual products**
roadmaps, product lines, platforms, APIs

– **Enabling feedback**
goal-action-measure-compare loops

– **Adopting metaphors from nature**
ecology, evolution, conversation, bio-cost

Systems affect many dimensions of design.

- Creating and managing (networked) services
- Connecting products + services
- Integrating across products
- Building a seamless brand experience
- Communicating with consistency
- Creating a sustainable business (green design)

PART TWO

Space of Design

Design education focuses on the form of objects; much of practice does likewise.

How are we making it?
Form/Grammar
Syntactic

Object
Component

Form is governed by meaning and structure, though they are also affected by form.

What are we making?
Meaning/Definition
Semantic

How are we making it?
Form/Grammar
Syntactic

Object
Component

Meaning + structure are governed by context; context is also affected by meaning + structure.

Why are we making this?
Context/Need
Pragmatic

What are we making?
Meaning/Definition
Semantic

How are we making it?
Form/Grammar
Syntactic

Object
Component

Objects are often embedded in systems.

Why are we making this?
Context/Need
Pragmatic

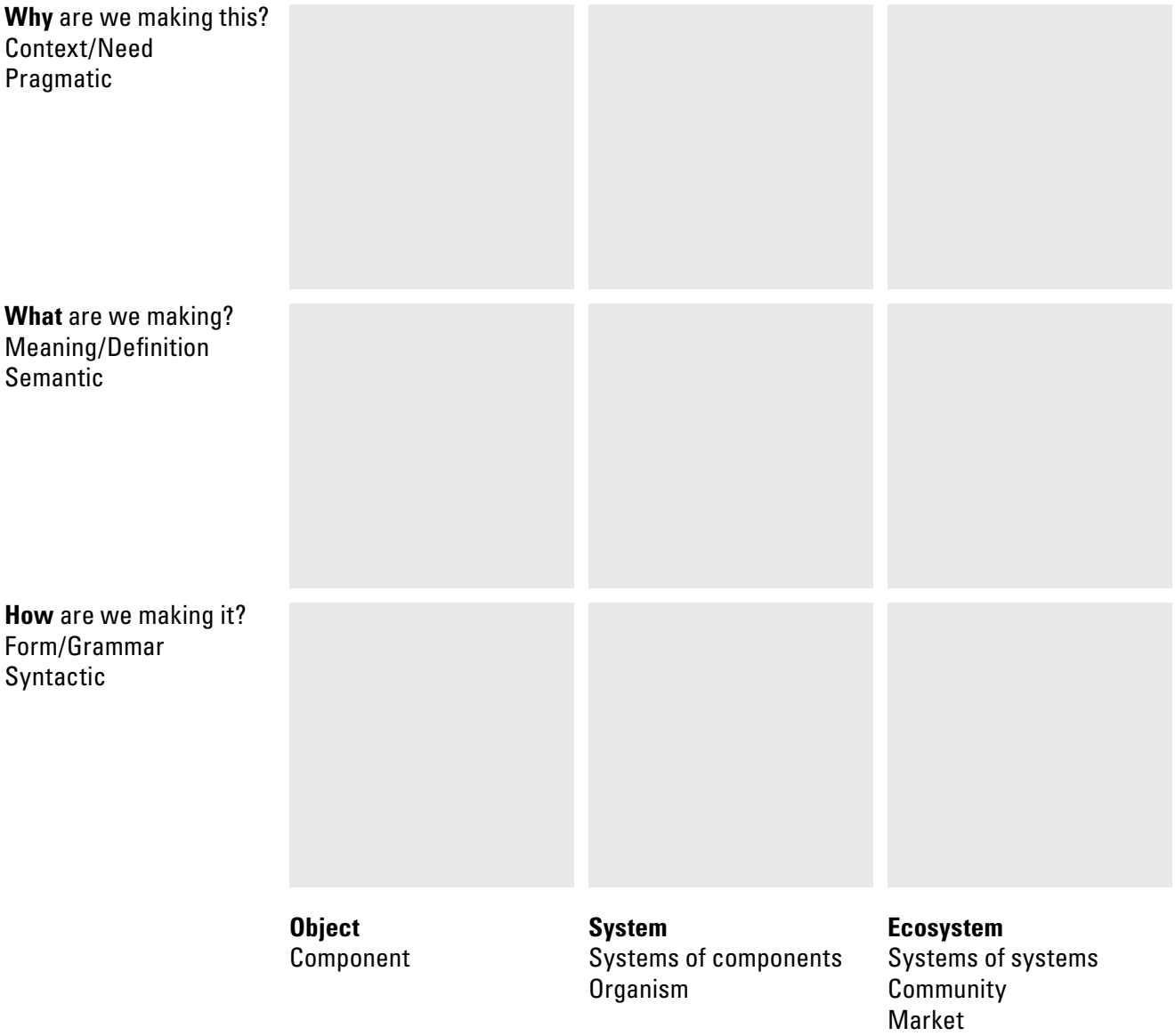
What are we making?
Meaning/Definition
Semantic

How are we making it?
Form/Grammar
Syntactic

Object
Component

System
Systems of components
Organism

Systems are often embedded in ecologies—communities of systems.

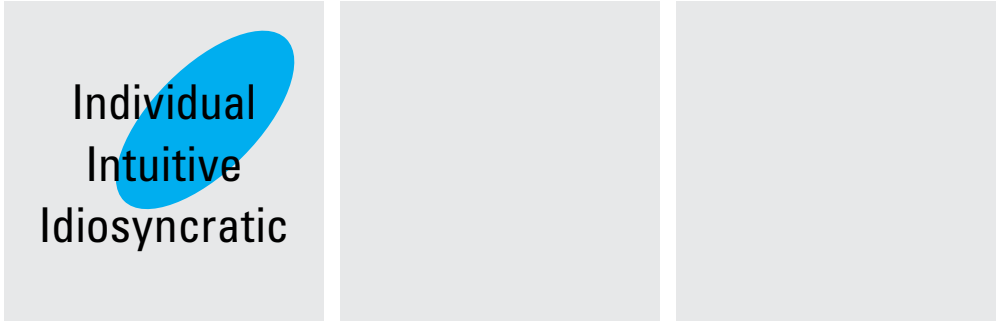


Practice focused on the form of objects can be direct and unmediated.

Why are we making this?
Context/Need
Pragmatic

What are we making?
Meaning/Definition
Semantic

How are we making it?
Form/Grammar
Syntactic



Object
Component

System
Systems of components
Organism

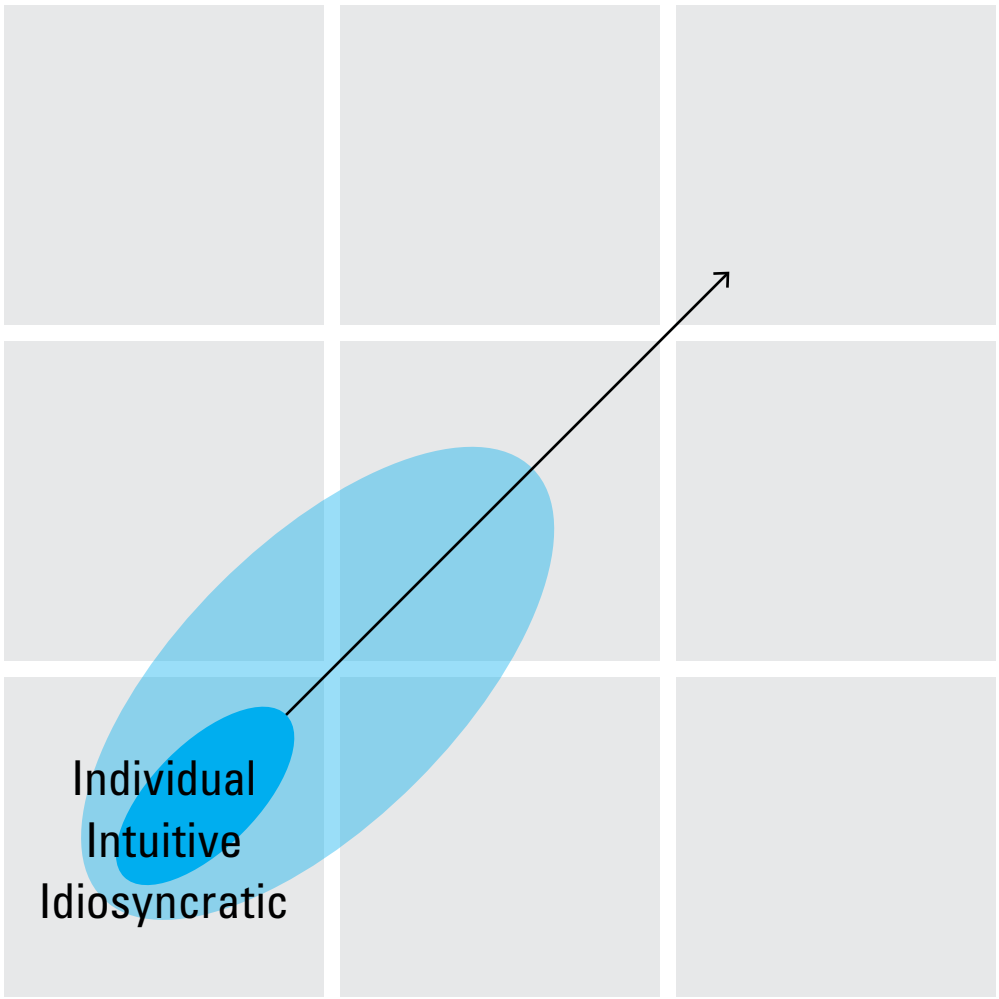
Ecosystem
Systems of systems
Community
Market

As practice expands, it becomes more complex.

Why are we making this?
Context/Need
Pragmatic

What are we making?
Meaning/Definition
Semantic

How are we making it?
Form/Grammar
Syntactic



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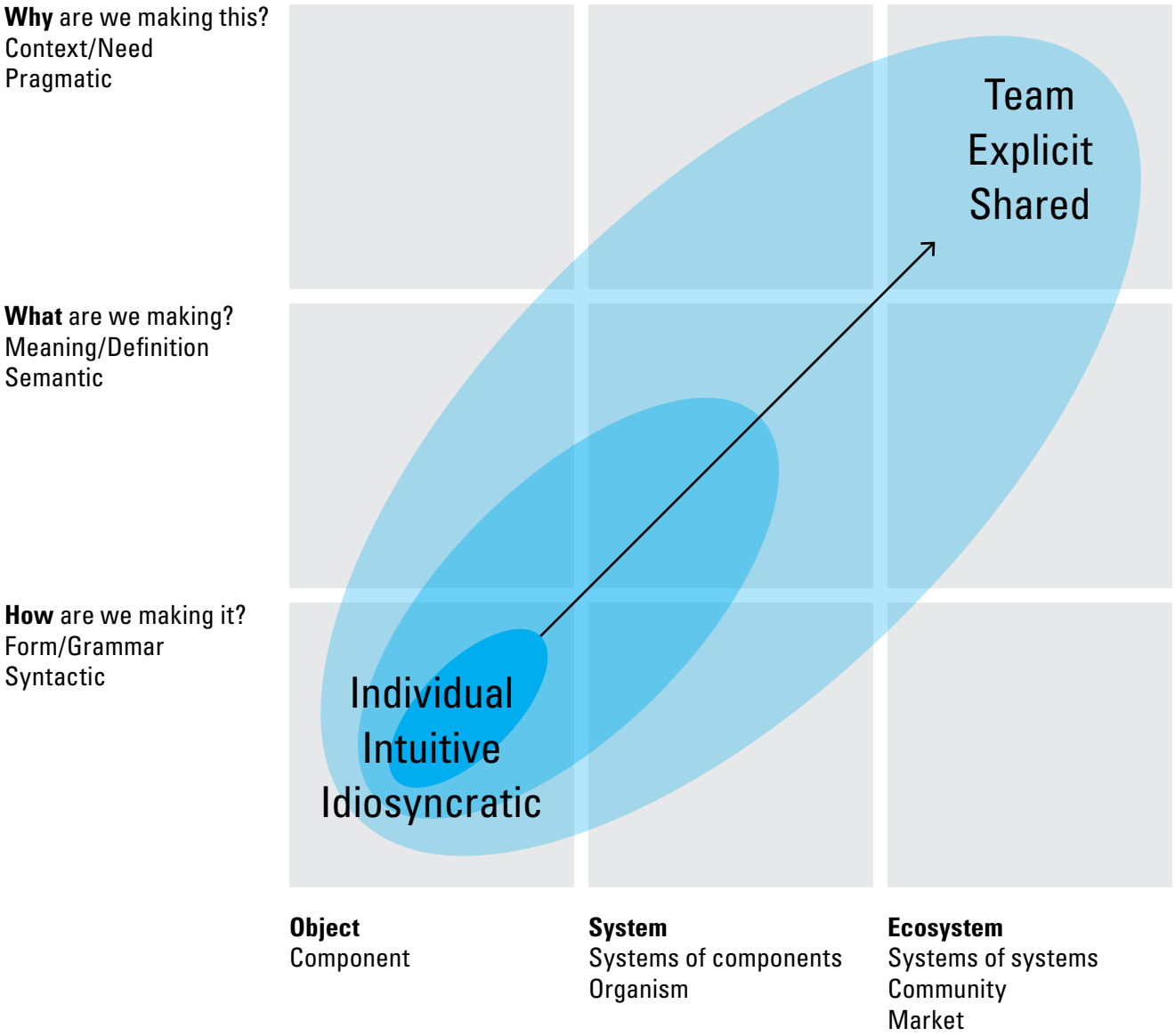
When practice also concerns context + ecologies, it requires shared methods.



"...commercial products are best treated as though they were services.

It's not what you sell a customer,
it's what you do for them.

It's not what something is,
it's what it's connected to, what it does.

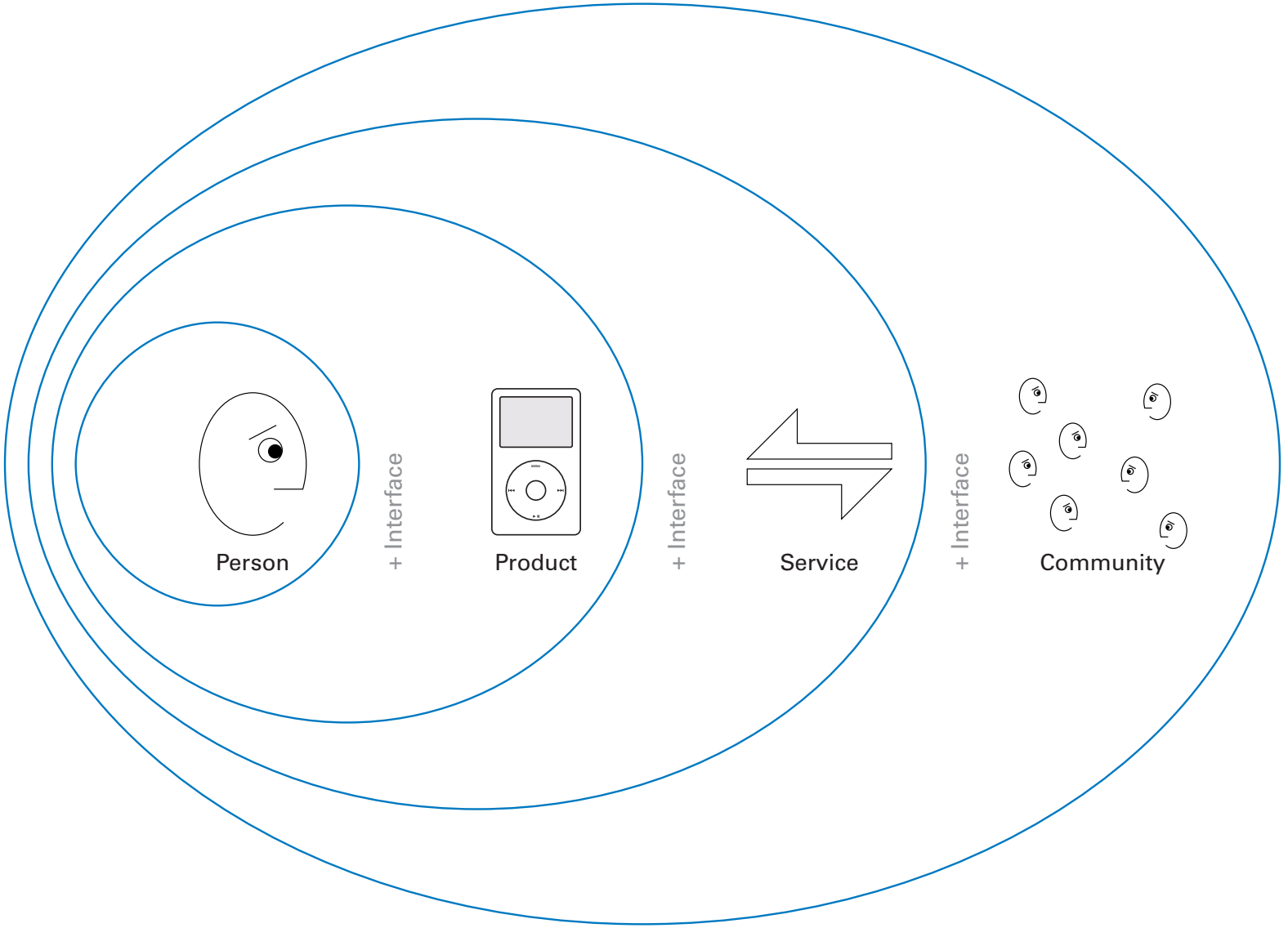
Flows become more important than resources.
Behavior counts."

— Kevin Kelley

Hardware products are increasingly tied to:

- embedded software
- the internet and web-based applications
- human services
- the organizations which develop and deliver the products and services
- communities for which they provide infrastructure
- the ecologies in which they cooperate and compete

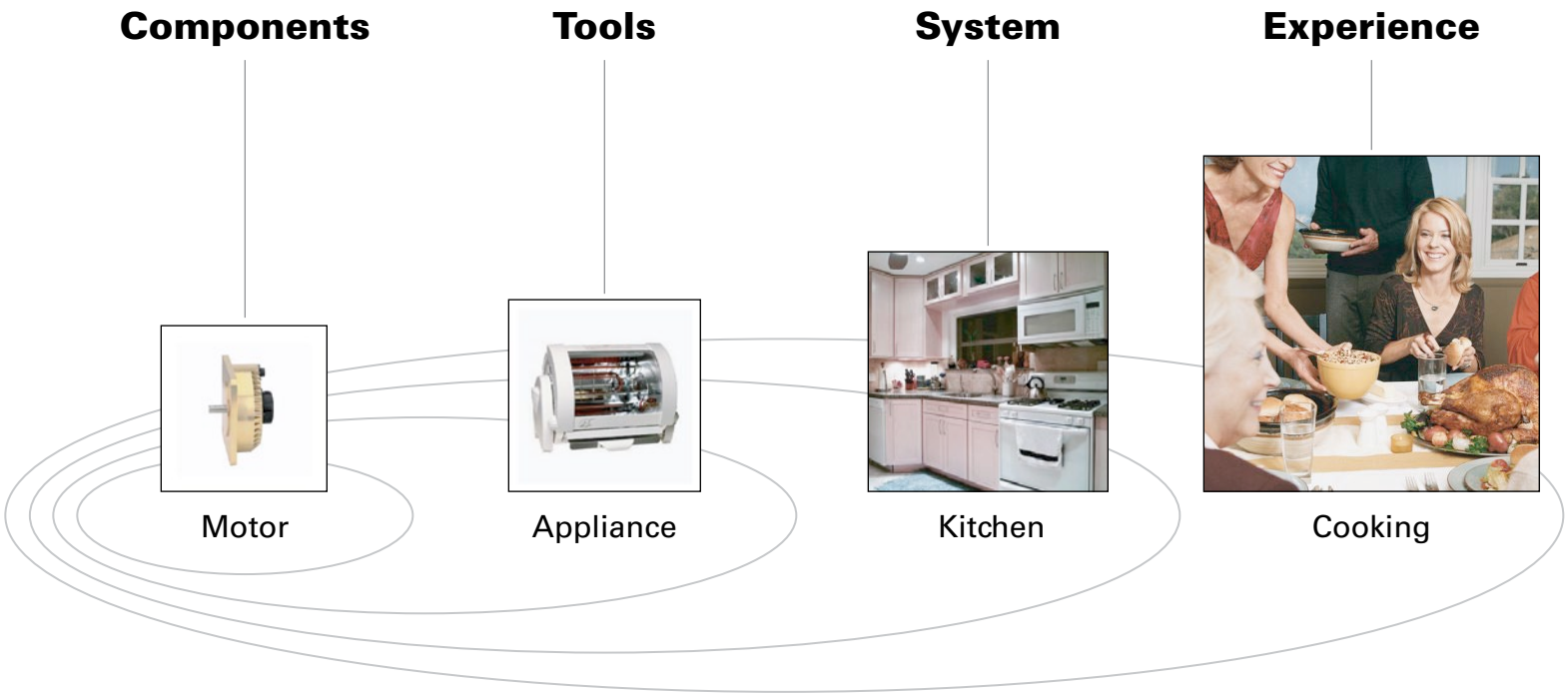
Value comes from interacting with larger systems—enabling an ecology.



Stages of Experience—Pine & Gilmore

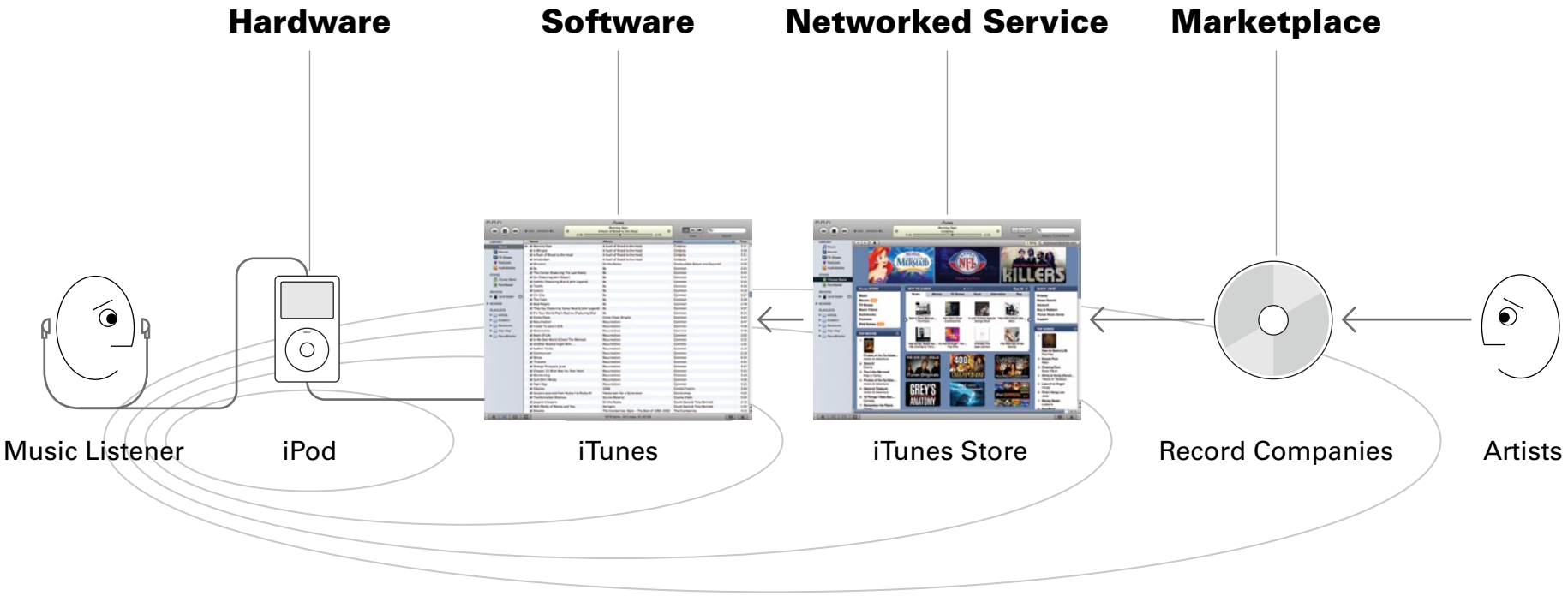
Commodity	Goods	Service	Experience
			
1¢–2¢ Per Cup	**5¢–25¢** Per Cup	**75¢–$1.50** Per Cup	**$2–$5.00** Per Cup
Beans	Roasted and ground	Brewed and served	Treating yourself to something special

Market-spaces—Rheinfrank & Murrell



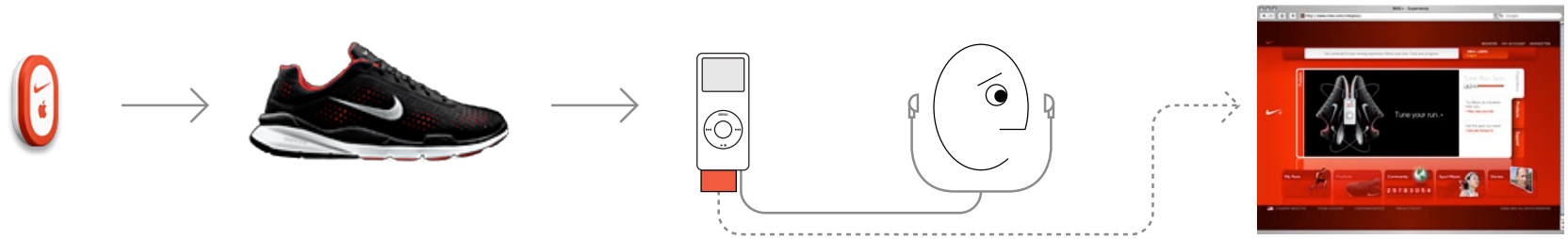
iPod is an integrated system.

DRAM > mp3 player > music sharing service > my music



Apple is a systems company—teamed up with Nike to extend the iPod systems.

Pressure Sensor | Shoe | iPod Nano (with Receiver) | User | Nikeplus.com



Place the sensor in your left Nike+ shoe, in the built-in pocket beneath the insole.

The sensor uses a sensitive accelerometer to measure your activity: the number of steps, the rate at which they are happening, and the time between them.

The sensor then wirelessly transfers this data to the receiver on your iPod nano.

As the user runs, iPod nano tells them their time, distance, pace, and calories burned (According to your choice of workout) via voice feedback that adjusts music volume as it plays.

In addition to progress reports, voice feedback congratulates users when they've reached a personal best—fastest pace, longest distance and time, or most calories burned.

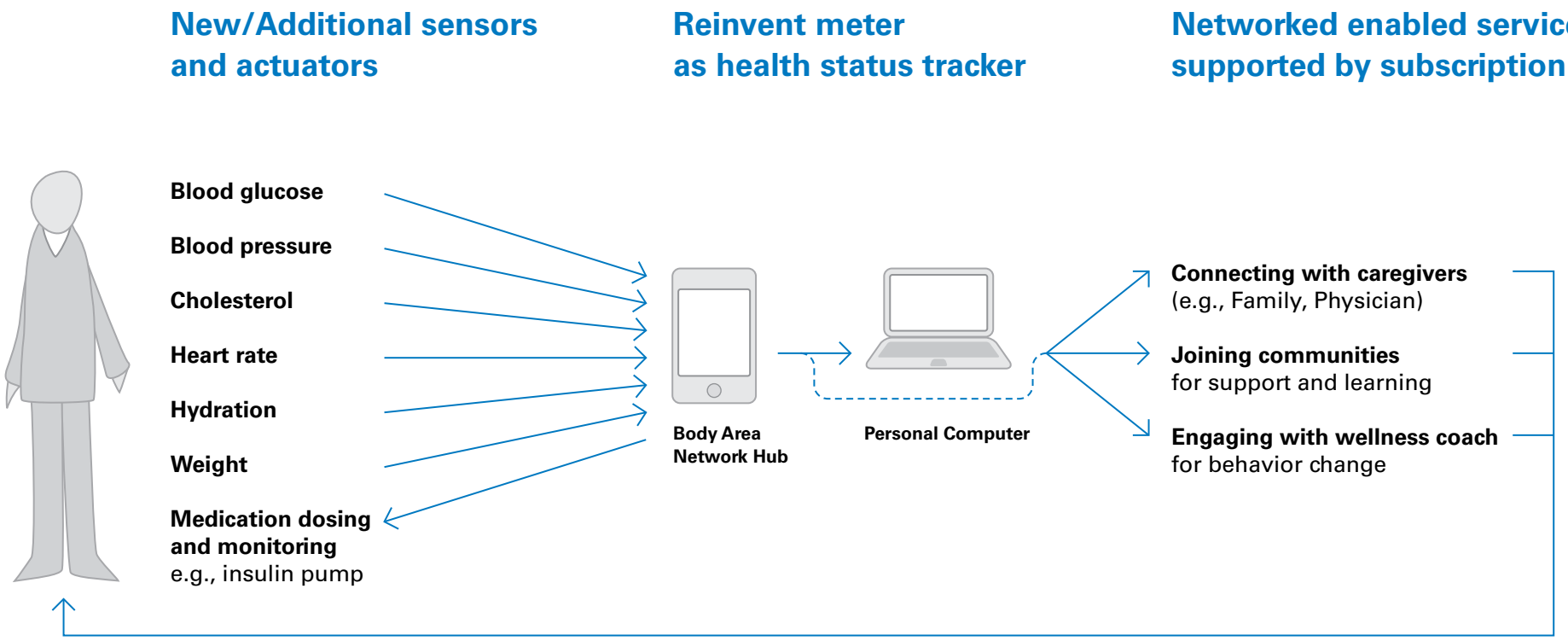
Users can also set a PowerSong for when they need help with the home stretch. Press and hold the center button at any time hear the preselected PowerSong.

After the run, the user may connect the iPod to their computer. iTunes takes over from there, automatically syncing all the run data and sending it to nikeplus.com.

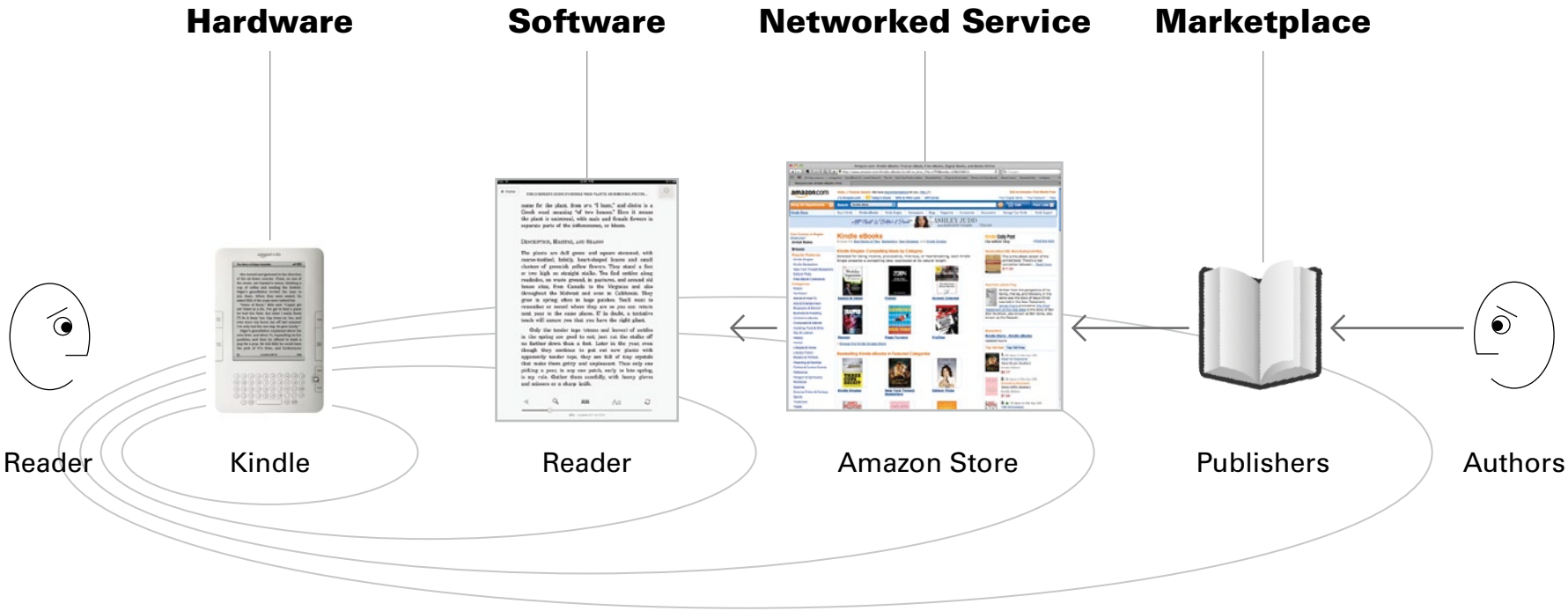
Nikeplus.com keeps stats on every step. Check the users speed, distance, and calories burned—by run, by week, or by month.

Nikeplus.com also keeps users connected with runners from every corner of the web. Users are encouraged to compete with other runners and compare stats on the site.

In just a few years, iPhone and other smartphones will become hubs of body-area networks.



Amazon's Kindle-Reader-WisperNet-Store system is another networked-services ecology.



**“I think of [the Kindle] as a service.
Part of [it] is of course the hardware,
but really, it’s the software, the content,
it’s the seamless integration of those things.”**

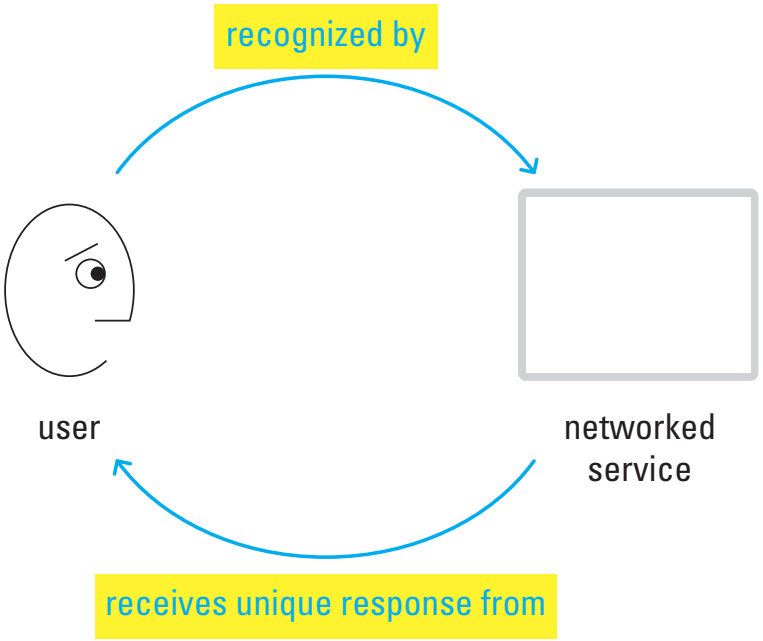
—Jeff Bezos

PART THREE

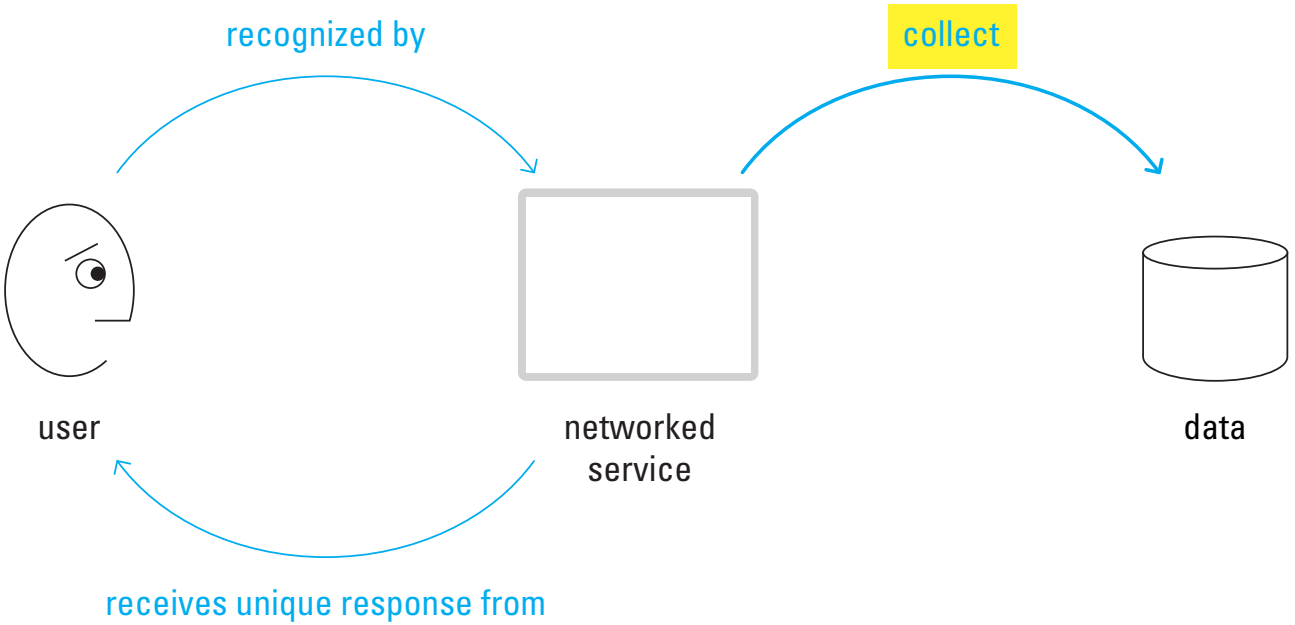
“All hardware products want to be web sites.”

—Tim Misner

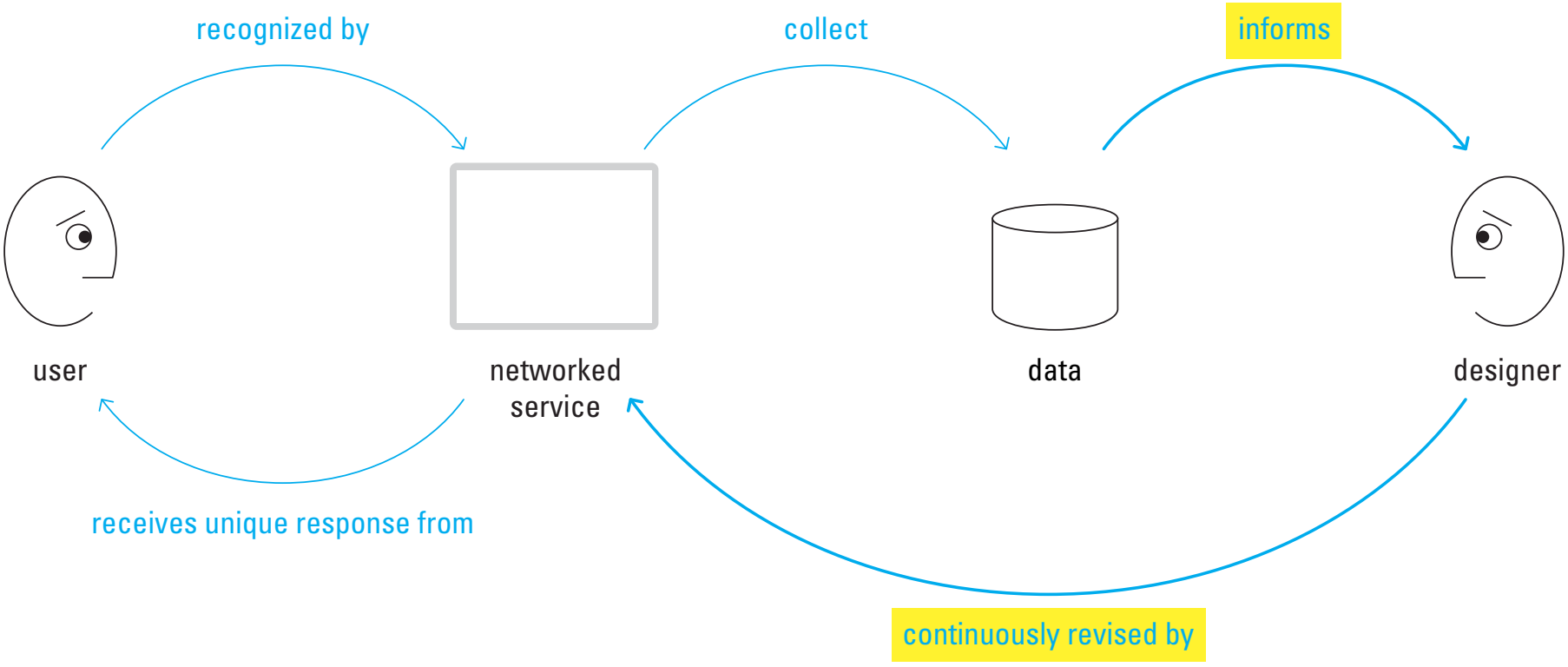
Networked services can recognize their users and respond uniquely.



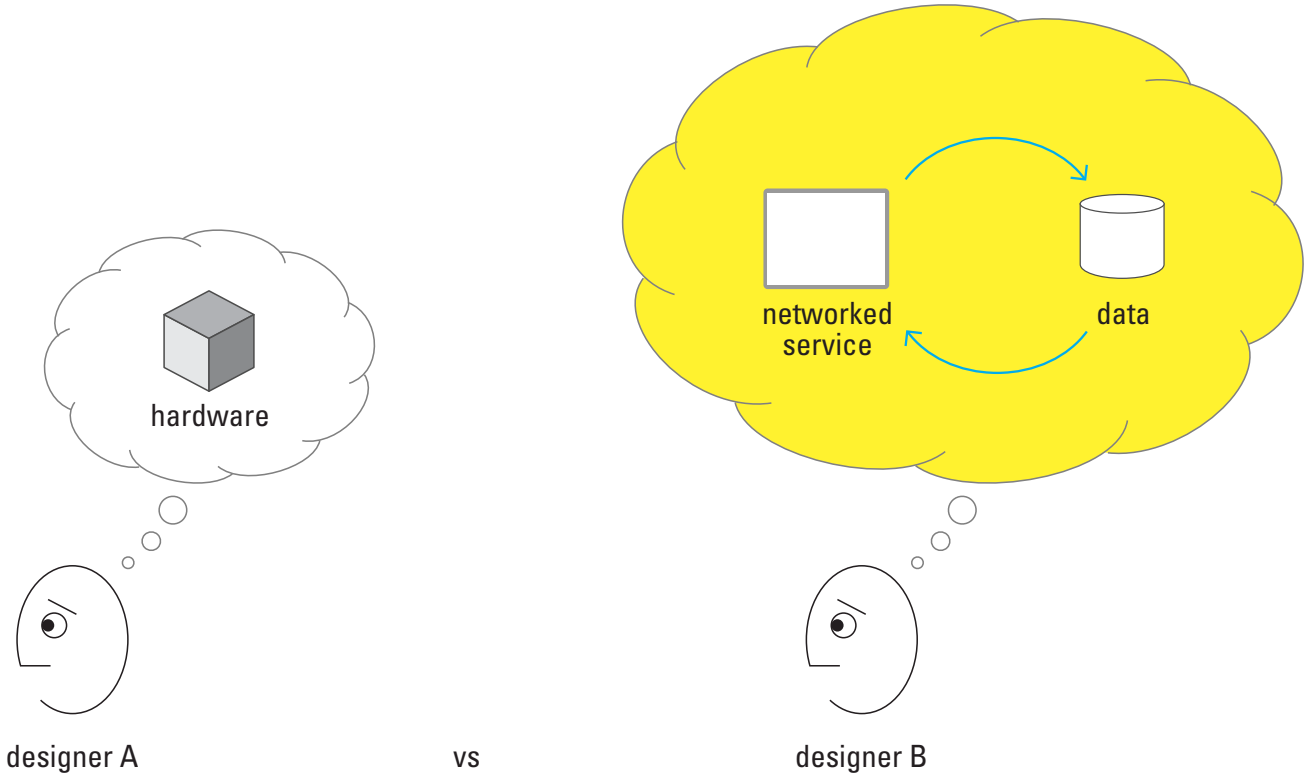
Networked services collect information as a natural part of operating.



Networked services change continuously.



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

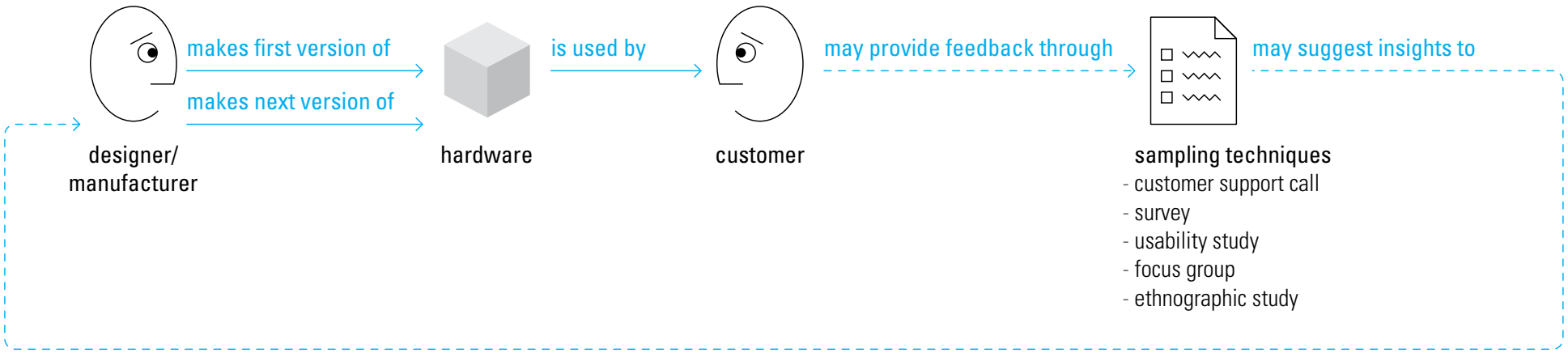


“...internal discussion changes

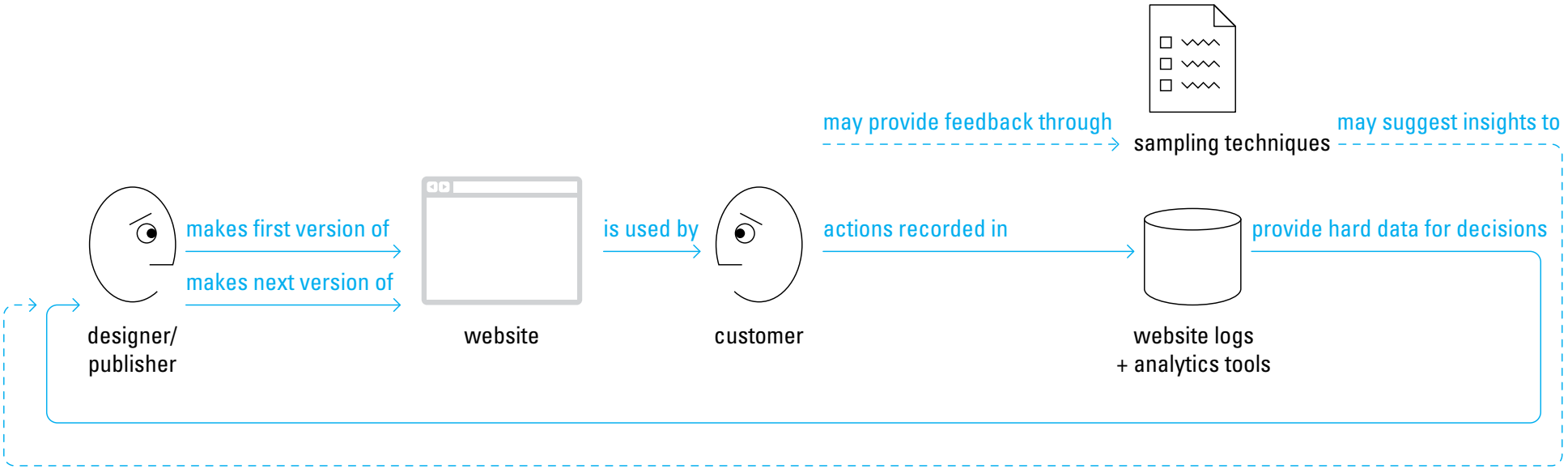
from **‘what features or quality level do we think our products need?’**

to **‘what data can we collect about our features and quality?’”**

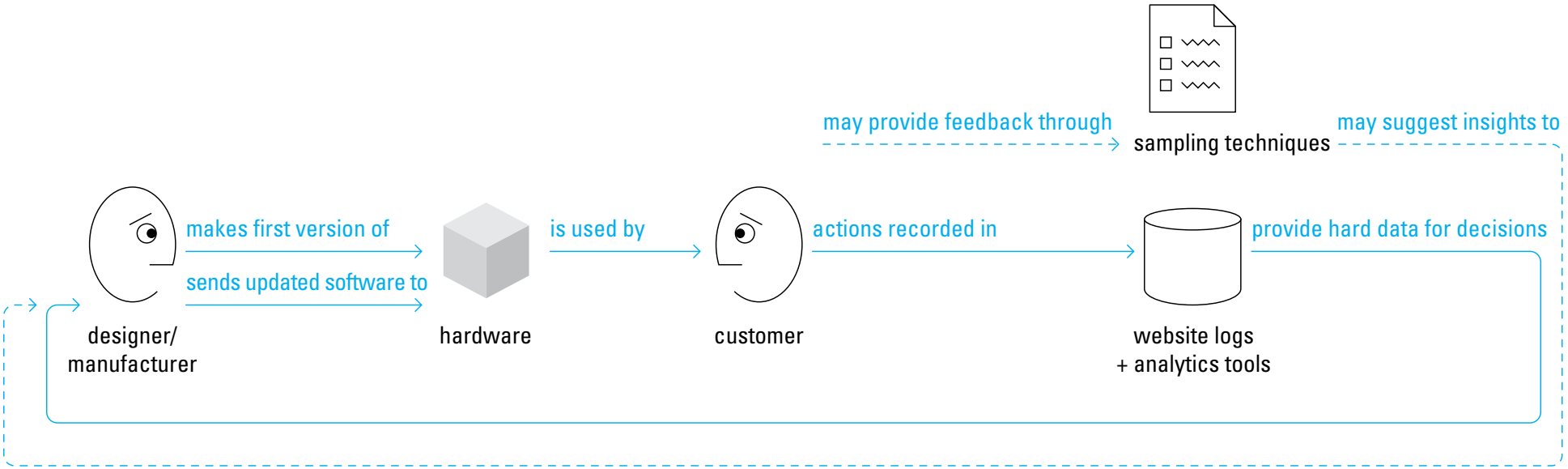
With traditional hardware products, designers have limited knowledge of customer use patterns.



With web-based services, designers can have almost complete knowledge of customers behavior.



As hardware products become part of networked services, they become more like web sites.



PART FOUR

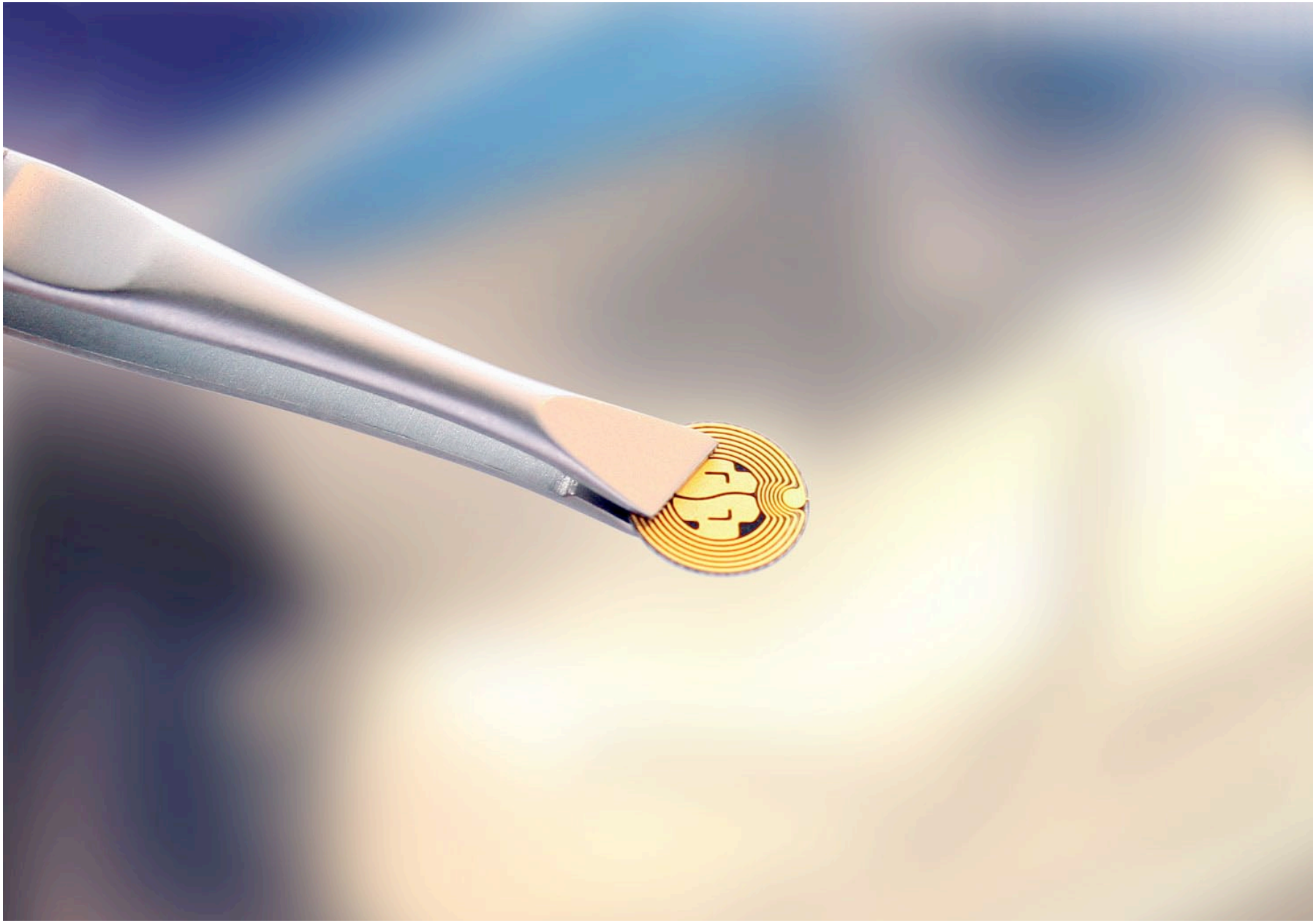
Three trends supporting networked services:

#1 **Sensors**

#2 **Big Data**

#3 **Conversations**

#1 The sensor revolution



London alone already has
500,000 video surveillance cameras

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

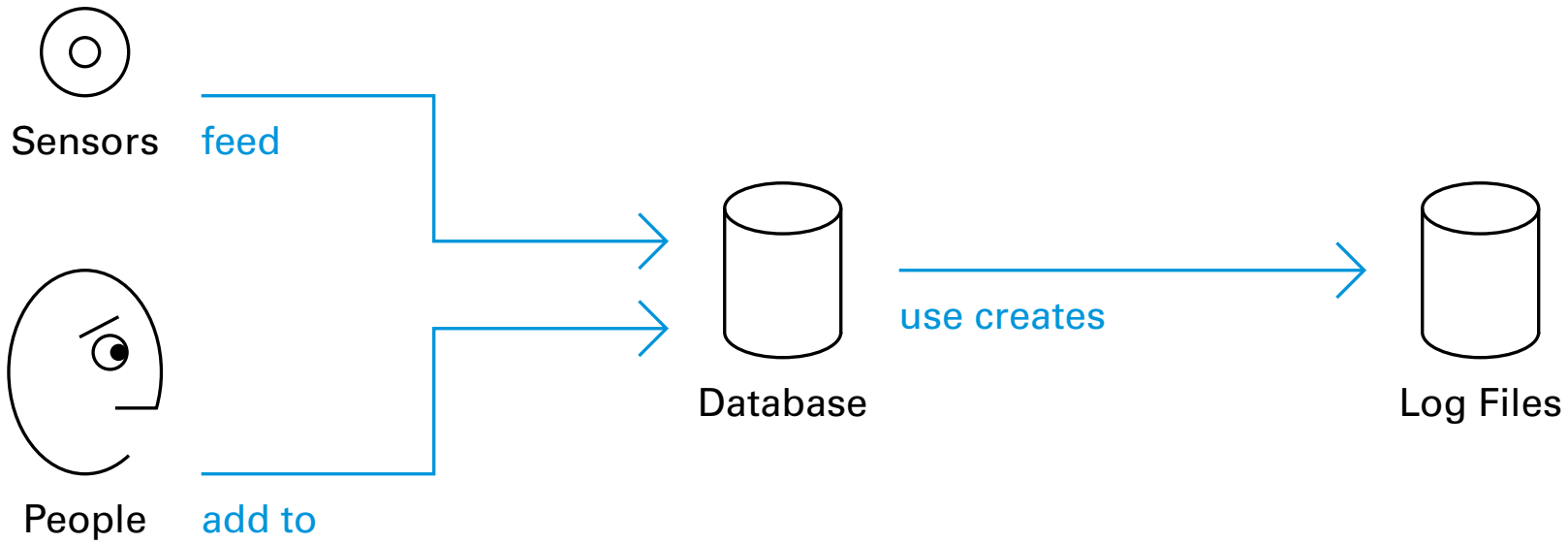
Wal-mart has mandated that every package in its stores include an RFID chip.

Sensors will be everywhere:

– in you
– on you
– all around you
– at check-points
– and online

#2 Big data

Big data collection has 3 levels.



Suppose you misplace your car keys?
Soon, you'll go to Google to find them.

Google™

Web Images Video News Maps more »

Where are my keys?

Google Search I'm Feeling Lucky

Advanced Search
Preferences
Language Tools

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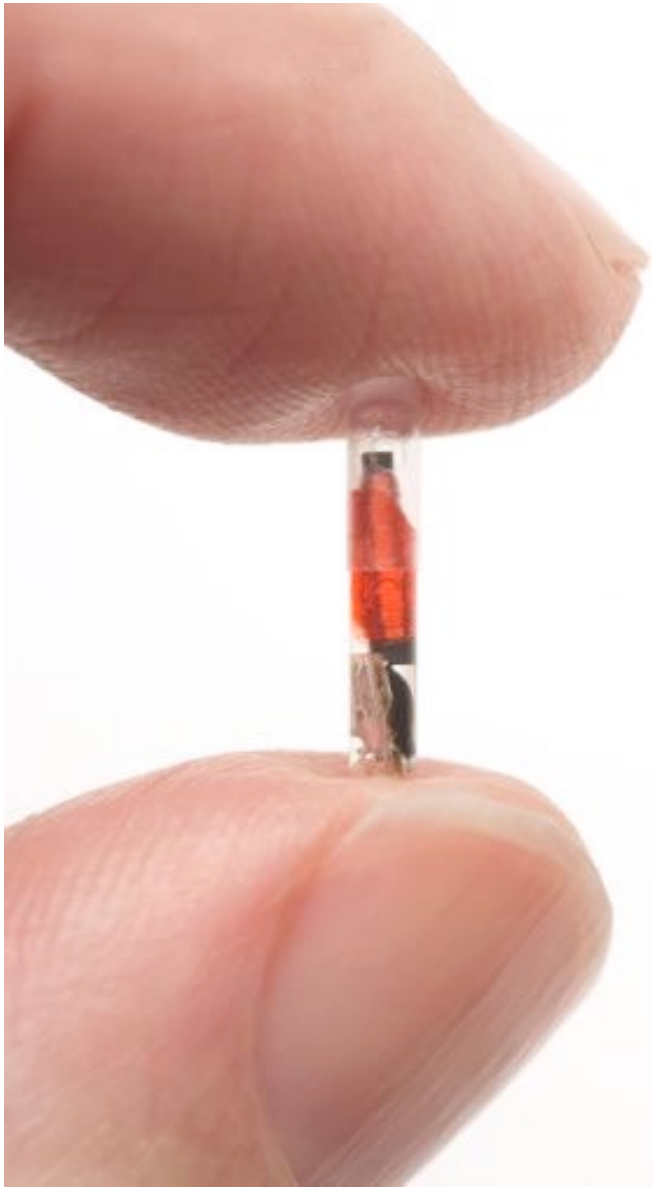
Pets can have chips implanted.



Suppose your puppy wanders away?
Soon, you'll go to Google to find him.

Google™

Web Images Video News Maps more »

Where's Fido?

Google Search I'm Feeling Lucky

Advanced Search
Preferences
Language Tools

Advertising Programs - Business Solutions - About Google

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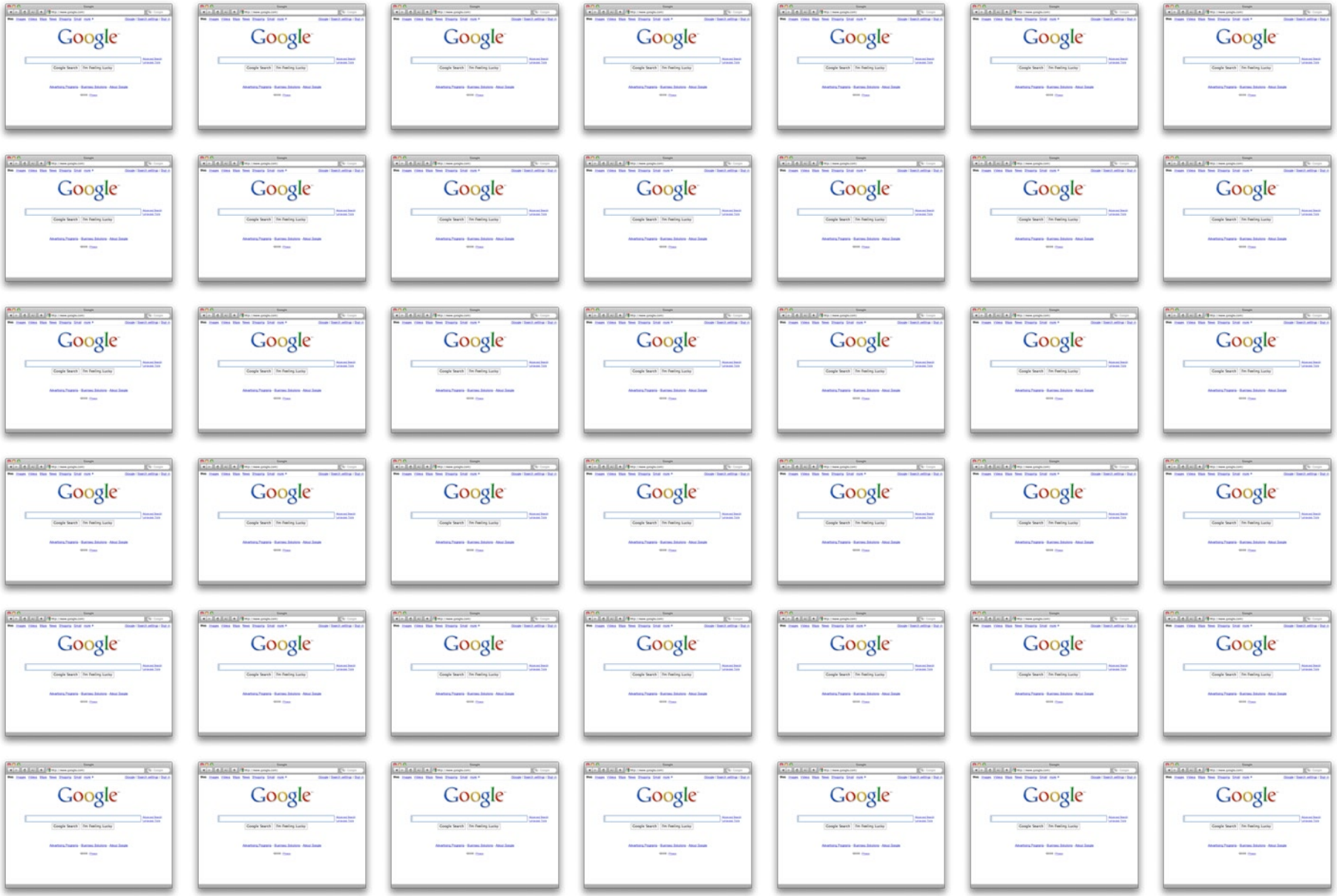
Google has changed the way they think about design—e.g., testing 42 shades of blue.



#3 The shift to conversation

A shift *from*
computers as devices
that help us compute

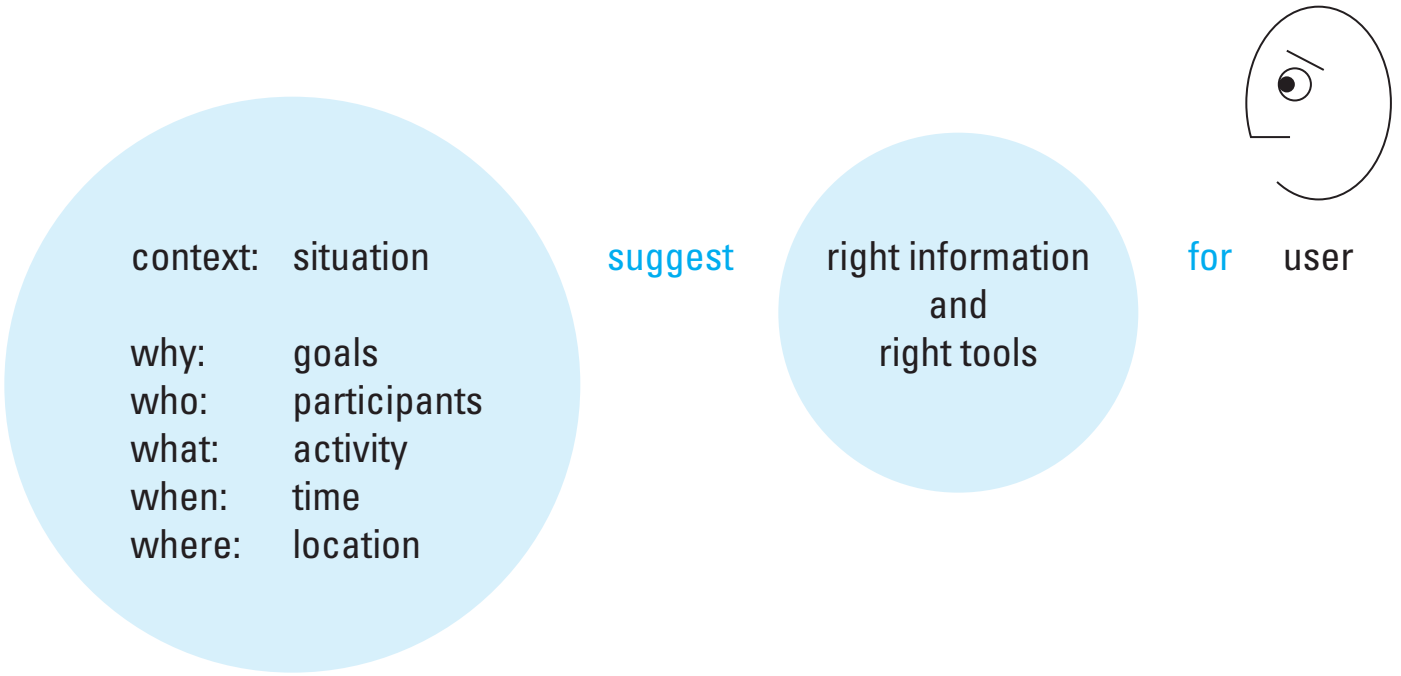
to
computers as devices
that help us communicate.

A shift to
one-on-one conversations with customers:

– customer learning from producer
– producer learning from customer

– customer learning from product
– product itself learning from customer

Products need to provide the right information and tools for the context.



Design—and culture—are in the midst of a huge shift.

	From... escaping the past	To... inventing the future
	Manufacturing Age	**Age of Biology**
Focus	Objects/Things	Systems/Behaviors
Values	Seek simplicity	Embrace complexity
Designer's role	Expert/Deciding	Collaborator/Facilitating
Construction	Direct	Mediated
Stopping condition	Almost perfect	Good enough for now
Result	More deterministic	Less predictable
End-state	Completed	Adapting continuously

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