



## UPCOMING EVENTS

**Kick-Off:** September 28, 2015, Smilow Center for Translational Research.  
**Register here.**

**Tech Briefing:** October 12

**Creating Your Proposal Q&A:** October 28

**Submissions Due:**  
November 6,

**Finalists Announced:**  
November 20

## PENN TECHNOLOGIES, YOUR IDEAS



**Penn Engineers** are working to tackle some of medicine's most fundamental challenges, and they've invented amazing technologies along the way. Now it's your turn to figure out how to

## FIND YOUR TEAM

Can't make it to one of our events? **Find potential teammates online here.**

## PAST WINNERS





























# Technology Strategy (MGMT 731)

Karl T. Ulrich

Definition of technology

Roles relative to technology

What is a technology strategy?

Incremental vs. radical innovations / H1, H2, H3 innovation

S-curves

Technology push and market pull

Drivers of diffusion rates

Rogers' categories of adoption / "crossing the chasm"

Industry patterns of entry/exit and the "dominant design"

Competence-enhancing vs. competence-destroying technologies

Disruption of incumbents - disruption from below and the "innovator's dilemma"

Drivers of value capture - appropriability and complementary assets

Patents as mechanism for appropriation

Standards as mechanism for appropriation

Timing of entry, first mover "advantage"

Open innovation, open tournaments

Make-buy decisions in innovation, establishing an innovation frontier

Technology ecosystems

Technology and society

## Session 2:

Diffusion and Adoption Dynamics





*\$80 mm investment by Kleiner-Perkins, CSFB*

*Specifications:*

- *12.5 mph*
- *80 lbs*
- *11 miles range*
- *\$9000*  
*(consumer version \$4950)*

*Original volume projections:*

*40,000 units/month by end of 2002.*

*"I would stake my reputation, my money and my time on the fact that 10 years from now, this will be the way many people in many places get around. If all we end up with are a few billion-dollar niche markets, that would be a disappointment. It's not like our goal was just to put the golf-cart industry out of business"*

*– Dean Kamen*



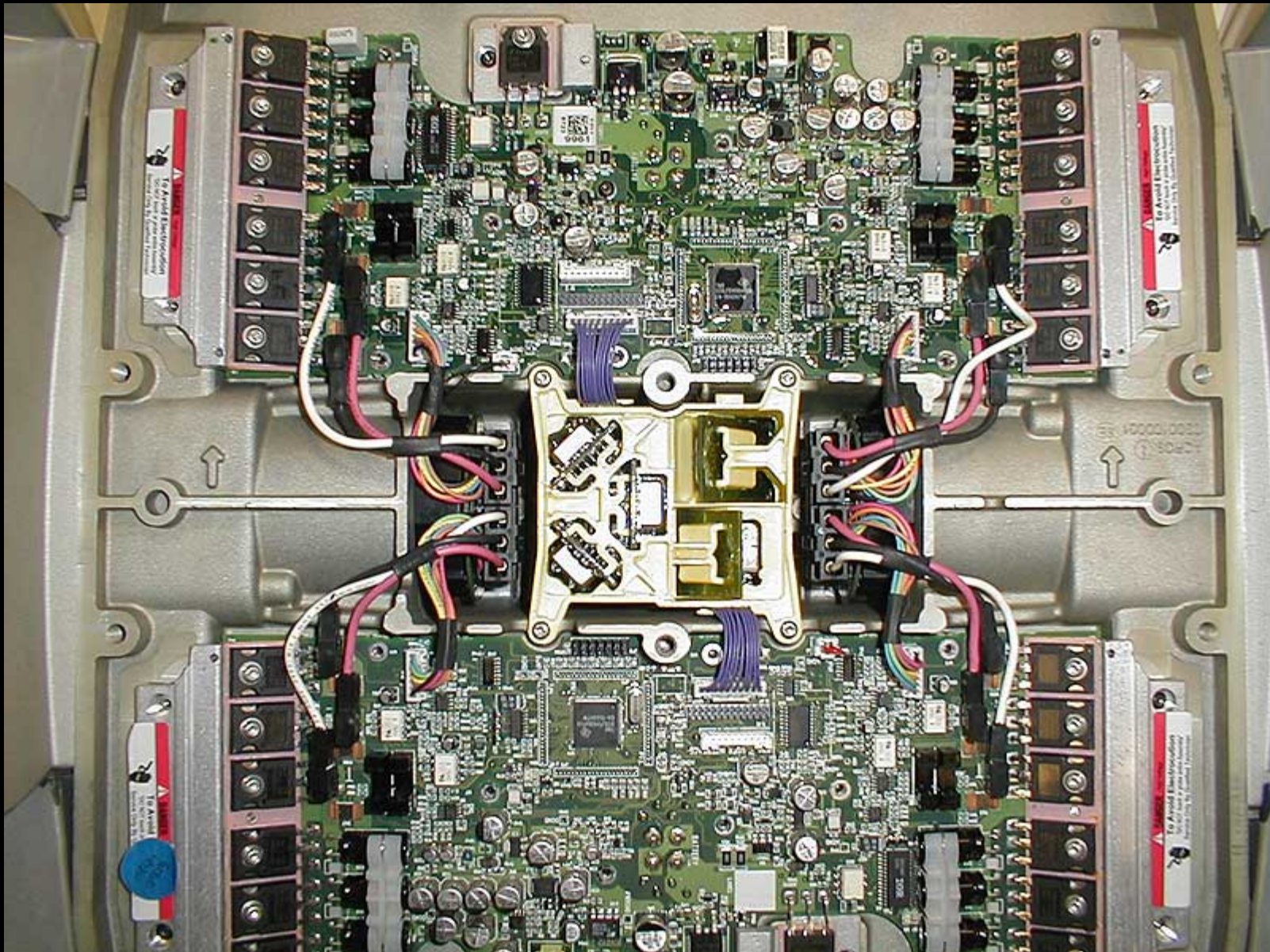




## iBot Self-Balancing Wheelchair

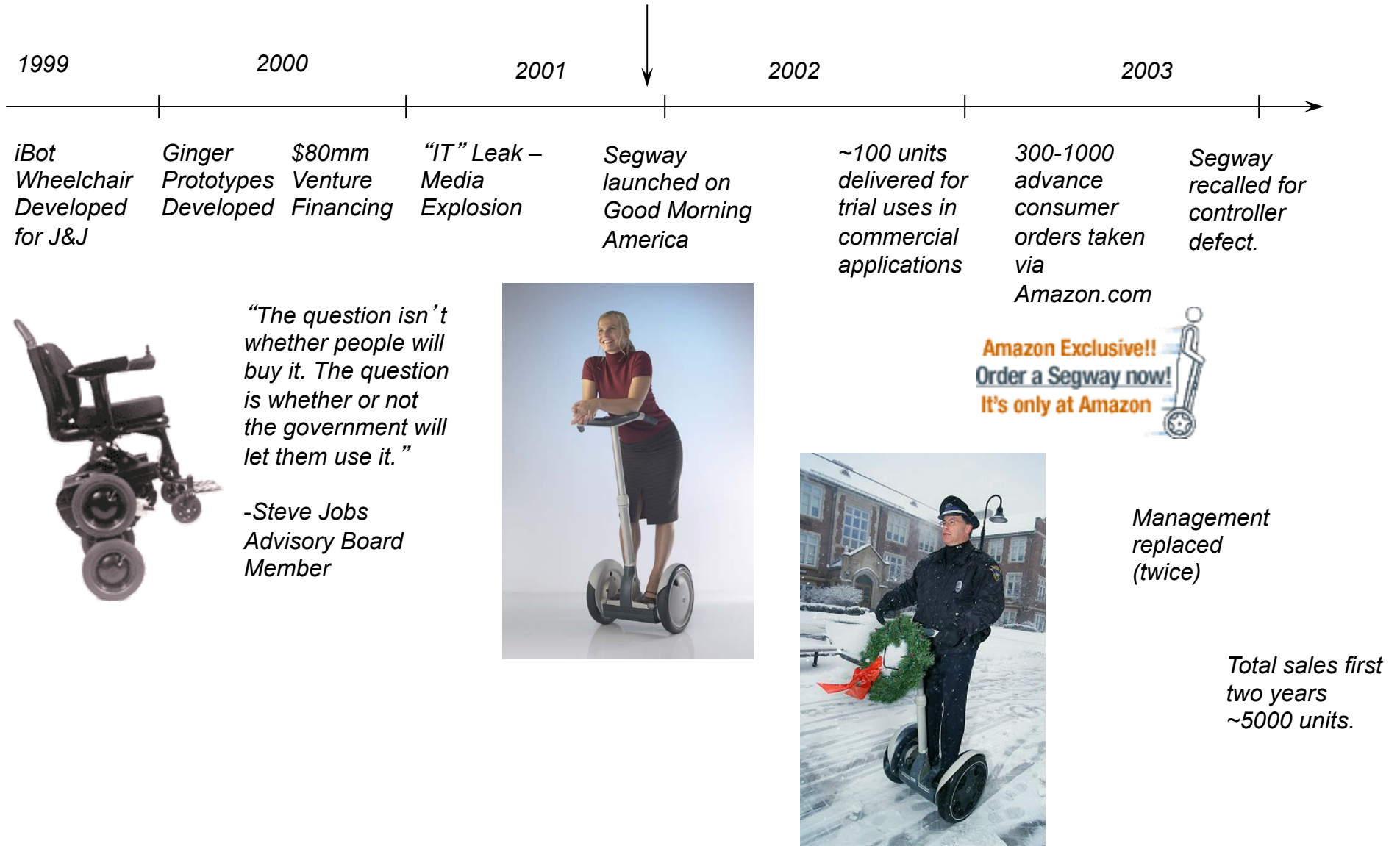








# Segway Timeline



For a fascinating narrative, see “Machine of Dreams,” Vanity Fair, May 2002.

HOW THE SEGWAY SCOOTER STALLED • INSIDE THE MATRIX GAME

# WIRED

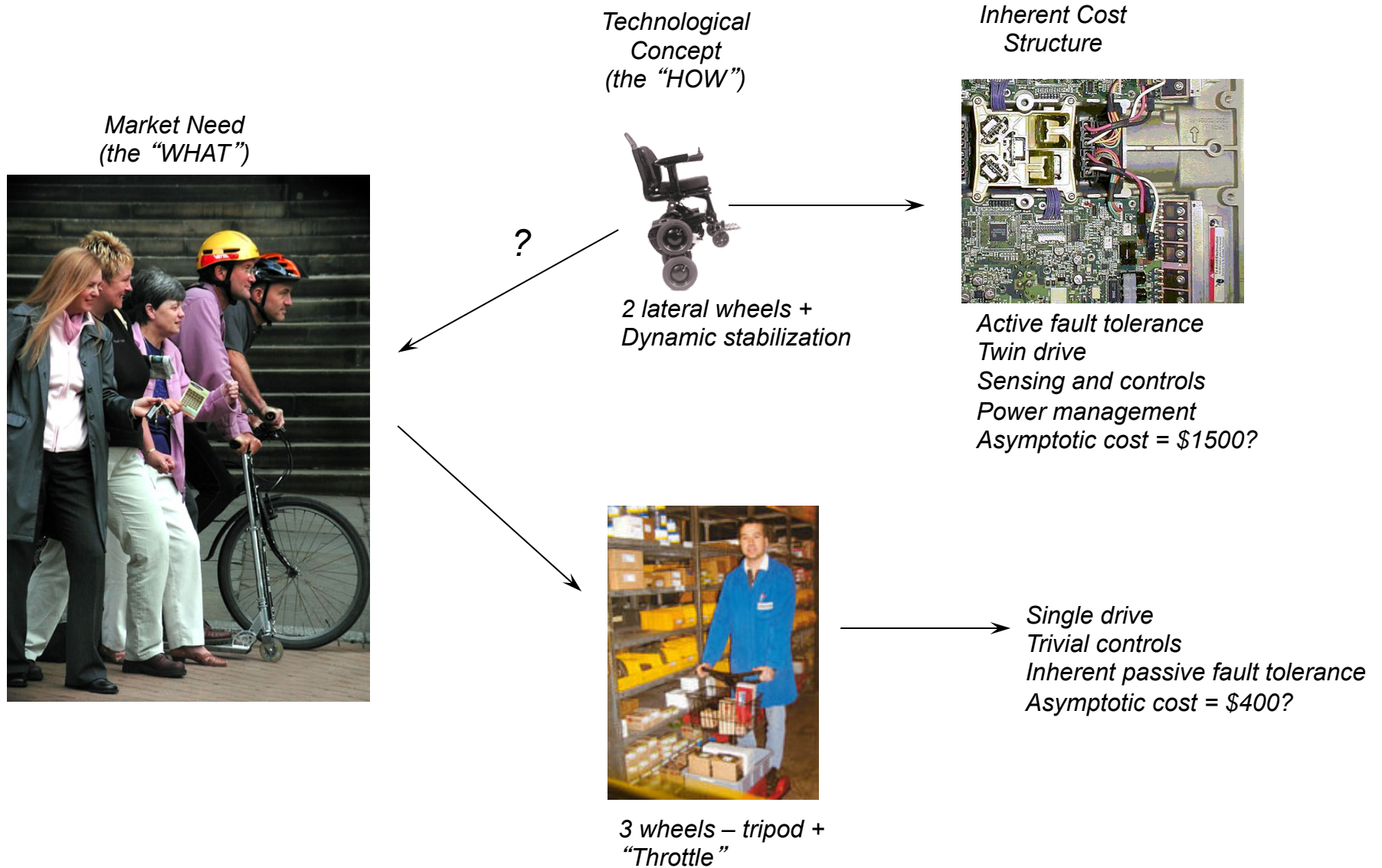
MARCH 2003 GO! GO! GO!







# The Peril of Technology Push





# The What-Not-How Principle

Frame new-category product development problems in terms of **WHAT** need the product should address and not in terms of a technology (**HOW**) you hope to solve a problem.

Pose problem as:

- *improve the efficiency of mail carriers*
- *extend the range and mobility of police officers*
- *provide a fun transportation sensation to consumers*

NOT

- *What can we do with a two-wheel dynamically stabilized mobility technology?*

Thought experiment:

- What can you do with a Segway that can not be done with a simple, statically stabilized three-wheel design?



## Value Creation in Innovation

1. Is the need real?



2. Does the solution meet the need?



3. Is the “customer” willing to pay more for the solution than it costs to deliver it?



$$Price - Cost \gg 0$$

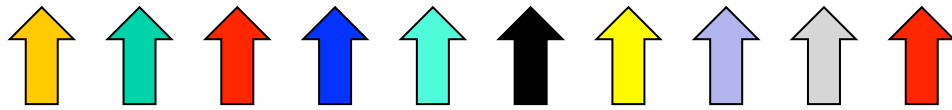


## Pull

How can we solve this particular problem?

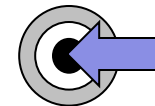
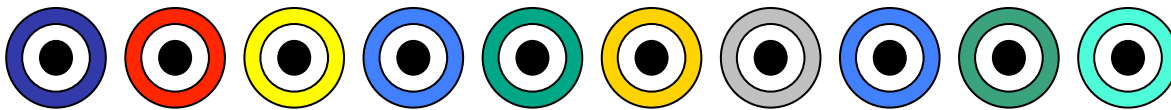
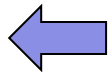


Which solution best meets the needs at attractive cost?

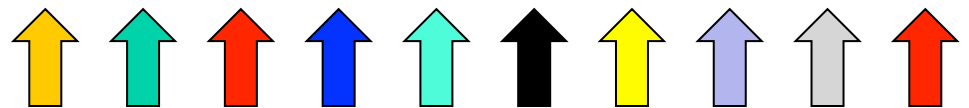


## Push

What else can we do with our solution?



*(and... is our solution the best possible solution?)*



3. Is the customer willing to pay more for the solution than it costs to deliver it?<sup>9</sup>

You are here: [Home Page](#) > [Toys](#) > [Bikes & Scooters](#) > [Electric Scooters](#)

## Rad2Go: The Q Personal Transporter



**\$994.00**

Preorder this item today and it should arrive on or just after 12/29/2003

**Shipping Cost:** To see the shipping cost for this item, add it to your cart.

[Preorder](#)

Save gas money and travel time with The Q, a Quick, Quiet and Quite affordable personal transporter by Rad2Go. Great for college campuses, warehouses and short commutes, this lightweight vehicle allows you to step on and go! With a maximum speed of 10 mph and the ability to fold up for portability and storage, you can ride it to the train station or subway, fold it up and travel with ease. It's like having your own personal moving sidewalk, at a price that can't be beat.

**Learn even more about The Q in our**

[See larger photo](#)

Click on an image to enlarge it:













# SEGWAY<sup>®</sup> BLOG

A Blog About Business, Technology, Being Green and All Things Segway

## Segway Announces Development of a Three-Wheel Personal Transportation Device for the Public Safety Market

**Segway Quality, Value Priced Product will be Available in Q4 2013**

Bedford, New Hampshire – March 6, 2013 – Segway Inc. (Segway) is pleased to announce the development of a new three-wheel personal transportation product targeted at the public safety market.

"Our customers are demanding a We are going to meet their needs Roger Brown, President and Chief

Brown added, "Segway is a greener from point a to point b in a safe and aggressive business plan is to go launching new and affordable product offerings."

The new three-wheel transportation security customers will appreciate competitive price of \$7,500\*. The network.

### Availability

This product will be available in Q Segway will begin accepting orders [www.segway.com](http://www.segway.com) soon.

*\*This is a projected price point at*



priced.  
said

people  
d  
g and  
'ent

and  
ntly, its  
service

dealers.

ZERO DOWN LEASING AVAILABLE\*



\*For well-qualified businesses and municipalities

[Visit the official Segway website](http://www.segway.com)

**Search**

Search

Find

**Subscribe to our blog**



Enter your email address to subscribe:

[Subscribe](#)

Delivered by [FeedBurner](#)

# Segway, meet the Toyota Winglet

Compact scooter has a body the size of an A3 sheet of paper that houses an electric motor, two wheels, and internal sensors that constantly monitor the rider's position.



by [Leslie Katz](#) | August 1, 2008 12:23 PM PDT



0



0



0



1

[More +](#)

[Comment](#) 1

Toyota Motor on Friday showed off a new stand-up scooter that could one day be seen zipping alongside the [Segway](#) on the personal-transporter superhighway.

The "Winglet" has a body the size of an A3 sheet of paper that houses an electric motor, two wheels, and internal sensors that constantly monitor the rider's position and make adjustments in power to ensure stability.

A parallel link mechanism lets riders go forward, backward, and turn by shifting body weight, making the Winglet potentially useful for maneuvering in tight spaces or crowded urban environments.

Riders can cruise around at a leisurely 3.7 mph--not ideal for rushing to a meeting, but nice for scooting around a shopping mall, perhaps. (The Segway, by comparison, can hit 12.5 mph.)

The Winglet comes in small, medium, and large sizes ranging in height from 18 inches to 3 feet 8



A Toyota employee displays a Winglet prototype at the company's showroom in Tokyo. She is riding the medium-size scooter.

(Credit: AFP Photo/Yoshikazu Tsuno)



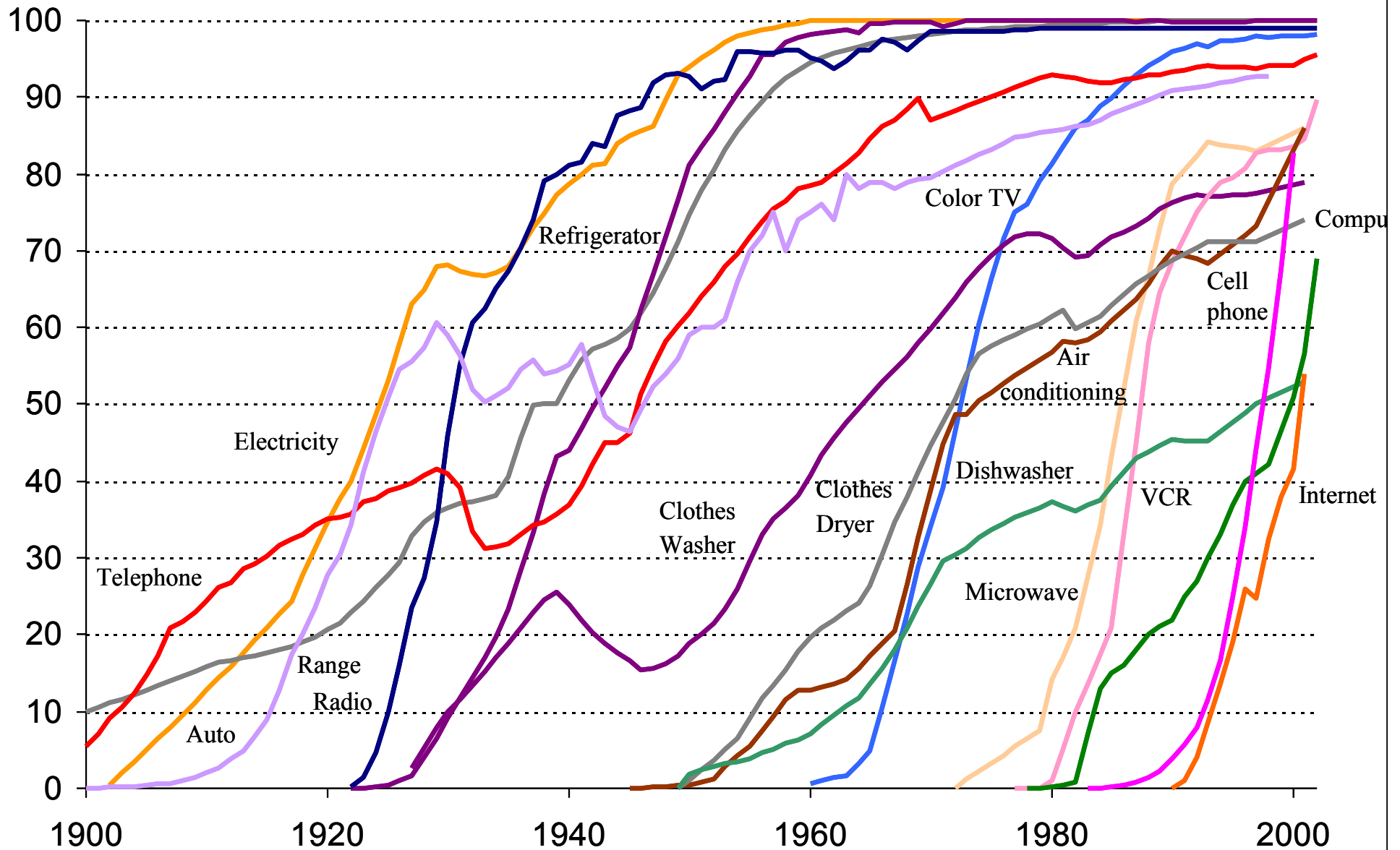
## The Push Paradox

- Radical innovation tends to be pushed into the market by technology enthusiasts.
- Yet, those enthusiasts will rarely (a) get it right, (b) have the relevant capabilities to exploit the innovation, and/or (c ) have the patience/resources to survive the adoption process.



# Diffusion Rate of New-Category Products

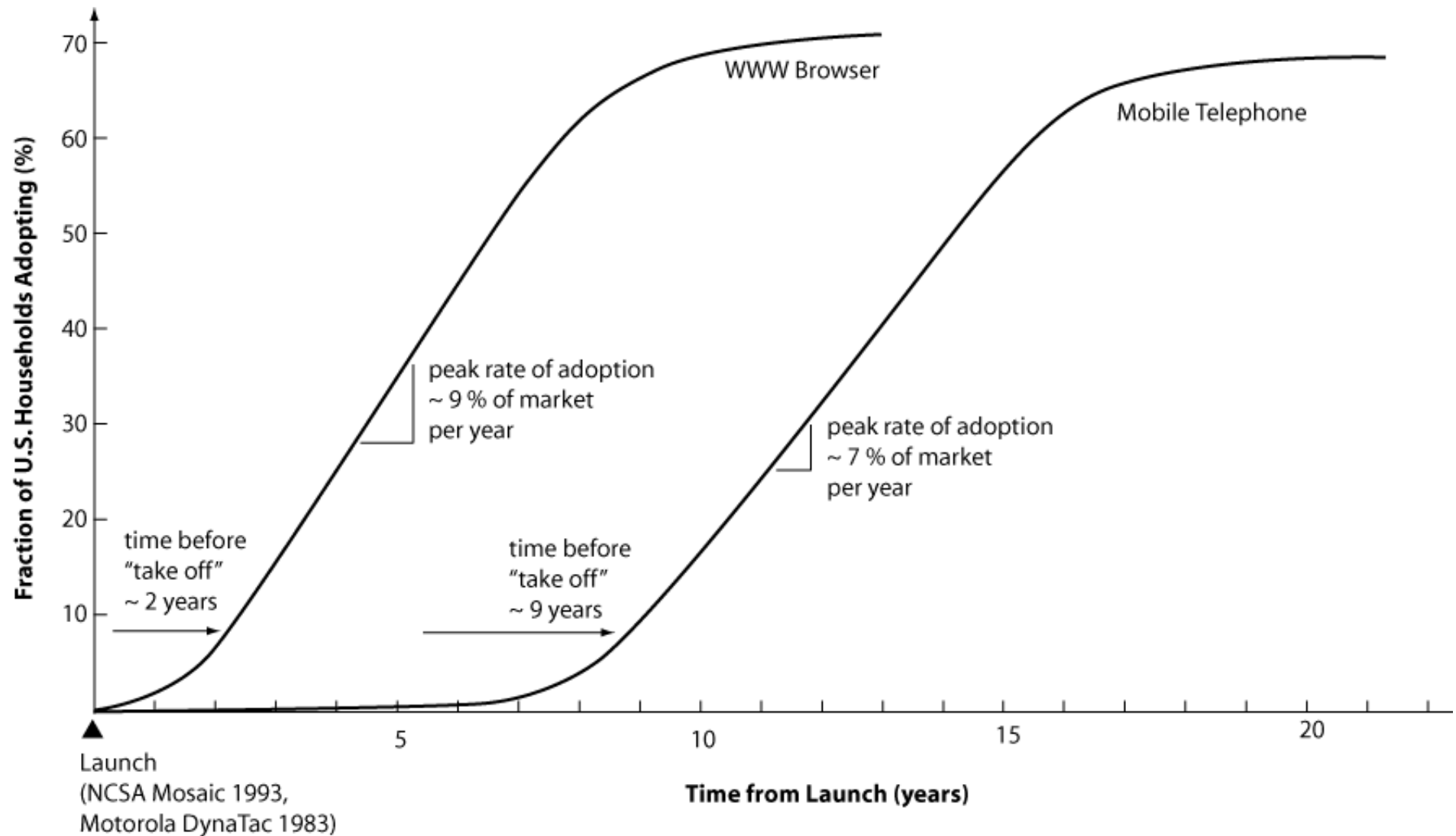
Percent of U.S. Households



Source: W. Michael Cox, Federal Reserve Bank of Dallas

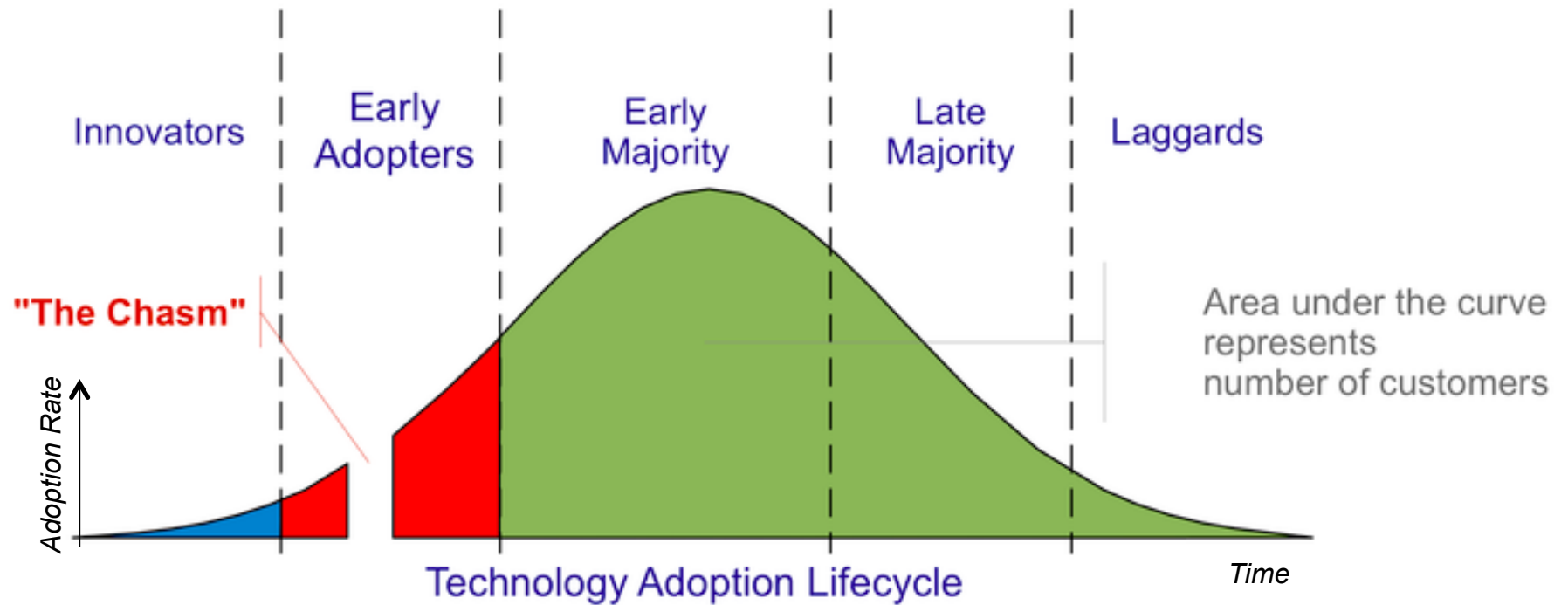


# Adoption Dynamics: Diffusion



**Source:** Terwiesch and Ulrich, *Innovation Tournaments*, Chapter 8.

## Rogers and Moore Adopter Categories



Are *S-Curves* and *Diffusion Curves/Adoption Categories* related?

**Source:** Image from Wikipedia, based on categories of Everett Rogers, with addition of "chasm" by Geoffrey Moore.



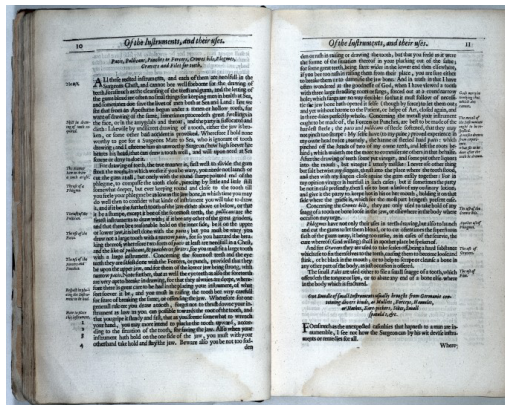
# Scurvy: 255 years to adopt fully the citrus fruit “innovation”

1601

British Navy conducts first experiments showing citrus fruit prevents scurvy.

1617

John Woodall (Surgeon General of East India Company) publishes first edition of *The Surgeon's Mate*, which includes citrus as remedy for scurvy.



Pages 160-176:

We have in our owne country here many excellent remedies generally knowne, as namely, Scurvy-grasse, Horse-Reddish roots, Nasturtia Aquatica, Wormwood, Sorrell, and many other good meanes... to the cure of those which live at home...they also helpe some Sea-men returned from farre who by the only natural disposition of the fresh aire and amendment of diet, nature herselfe in effect doth the Cure without other helps." ... "the Lemmons, Limes, Tamarinds, Oranges, and other choice of good helps in the Indies... do farre exceed any that can be carried thither from England.

1795

Scurvy eliminated in the British navy through use of citrus fruit.

1856

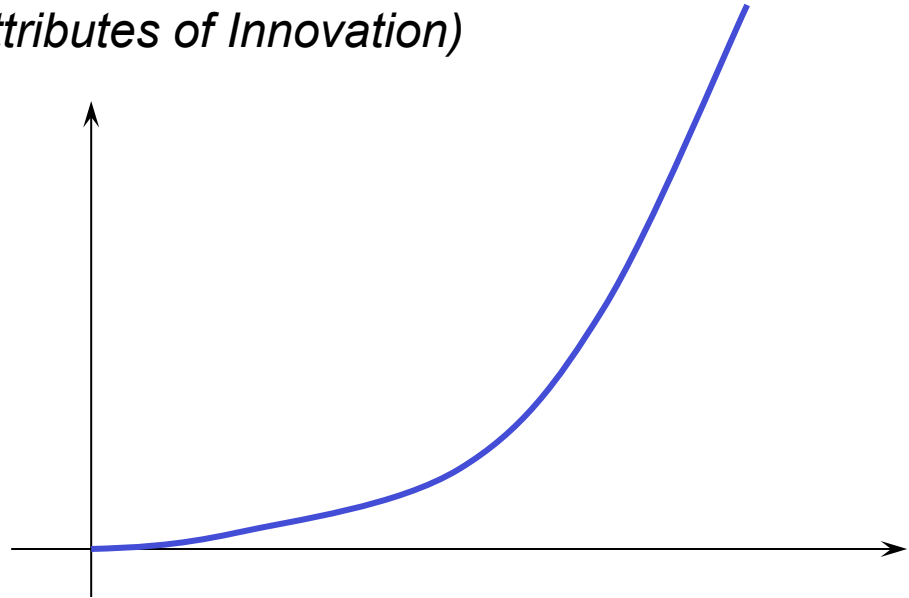
British Board of Trade adopts a policy of using vitamin C to eliminate scurvy in the trading fleet.



# Explaining Diffusion Rates

*Rogers' Five Factors (Intrinsic Attributes of Innovation)*

1. *Relative advantage*
2. *Visibility*
3. *Trialability*
4. *Simplicity*
5. *Compatibility*



*Everett M. Rogers, Diffusion of Innovations, Fourth Edition, Free Press, New York, 1995.*

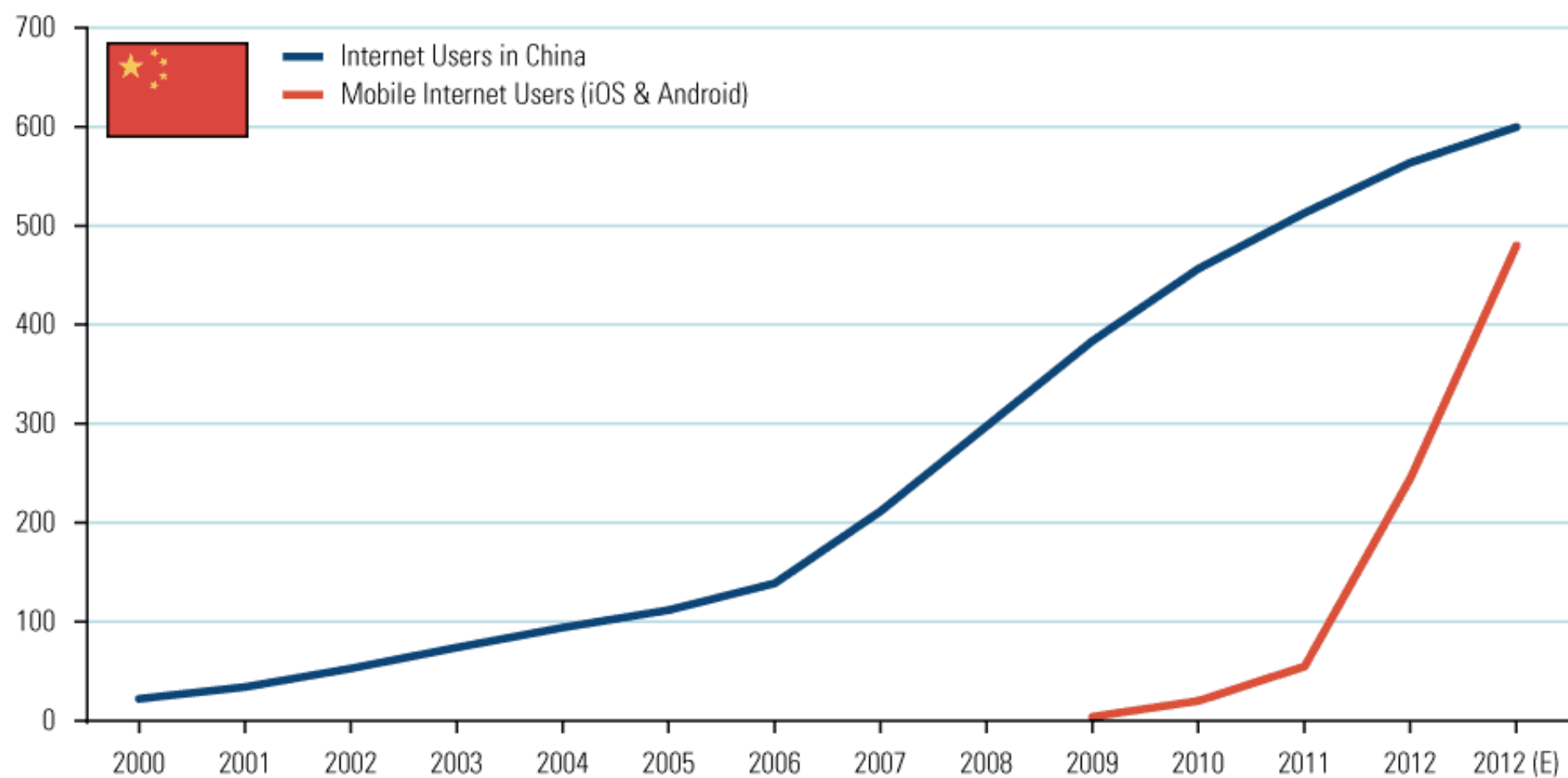


	<b>EZ Pass Auto Toll System</b>	<b>Web Browser</b>	<b>Mobile Phone</b>	<b>Segway Personal Transporter</b>
<b>Relative Advantage</b>	• • • • • no waiting at toll booths	• • • • • free, instant information	• • • • • wireless calling, but initially expensive	• better than walking?
<b>Visibility</b>	• • • • • obvious to all users	• not very visible	• • • • • visible in public	• • • • • highly visible
<b>Trialability</b>	• • must enroll to try	• • • • • free download	• • contract required	• \$10k commitment
<b>Simplicity</b>	• • • How does payment work? Who installs?	• • • • • click and view	• • “send” button? reception, coverage?	• • How does that thing work? What powers it?
<b>Compatibility</b>	• • • • • all vehicles	• • • • • all PCs	• • • • • fits in pocket or bag	• • Storage? Locking? Where to ride? Charging?
<b>Predicted Relative Rate</b>	Fast	very fast	moderate	very slow
<b>Years to “Take Off”</b>	~3	~2	~9	11 and counting...

**Source:** Terwiesch and Ulrich, *Innovation Tournaments*, Chapter 8.

## Mobile Internet Adoption 4.5x Faster than Regular Internet in China

Number of users in millions

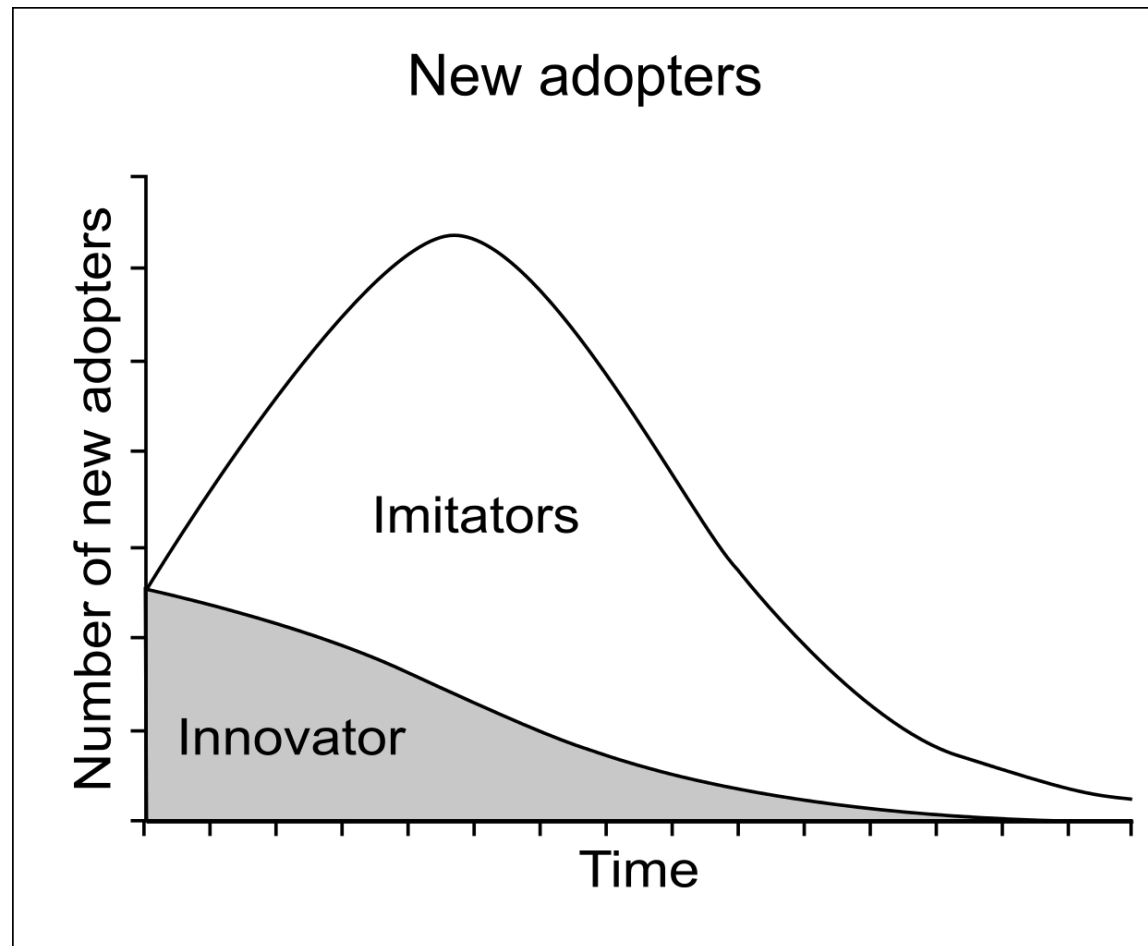


Source: Kai-Fu Lee



# Bass Model

See your marketing notes, or wikipedia  
[https://en.wikipedia.org/wiki/Bass\\_diffusion\\_model](https://en.wikipedia.org/wiki/Bass_diffusion_model)



$$S(t) = m \frac{(p + q)^2}{p} \frac{e^{-(p+q)t}}{(1 + \frac{q}{p}e^{-(p+q)t})^2}$$

$S$  is sales (e.g., units/year),  $m$  is total potential market size (units)

$p$  is coefficient of innovation (ave. is 0.03 and often less than 0.01, for  $t$  in years)

$q$  is coefficient of imitation (ave. is 0.38, with a typical range between 0.3 and 0.5)

# Timing of Key Problems Tackled by Segway LLC

*\$50mm+*  
*2000-2001*

*Technical performance*

*Production capacity*

*Reliability and robustness*

*Legality*

*Patents*

*Staffing a large organization*

*\$??*  
*2002*

*Where to ride*

*Which markets*

*What price point*

*Demand forecast*

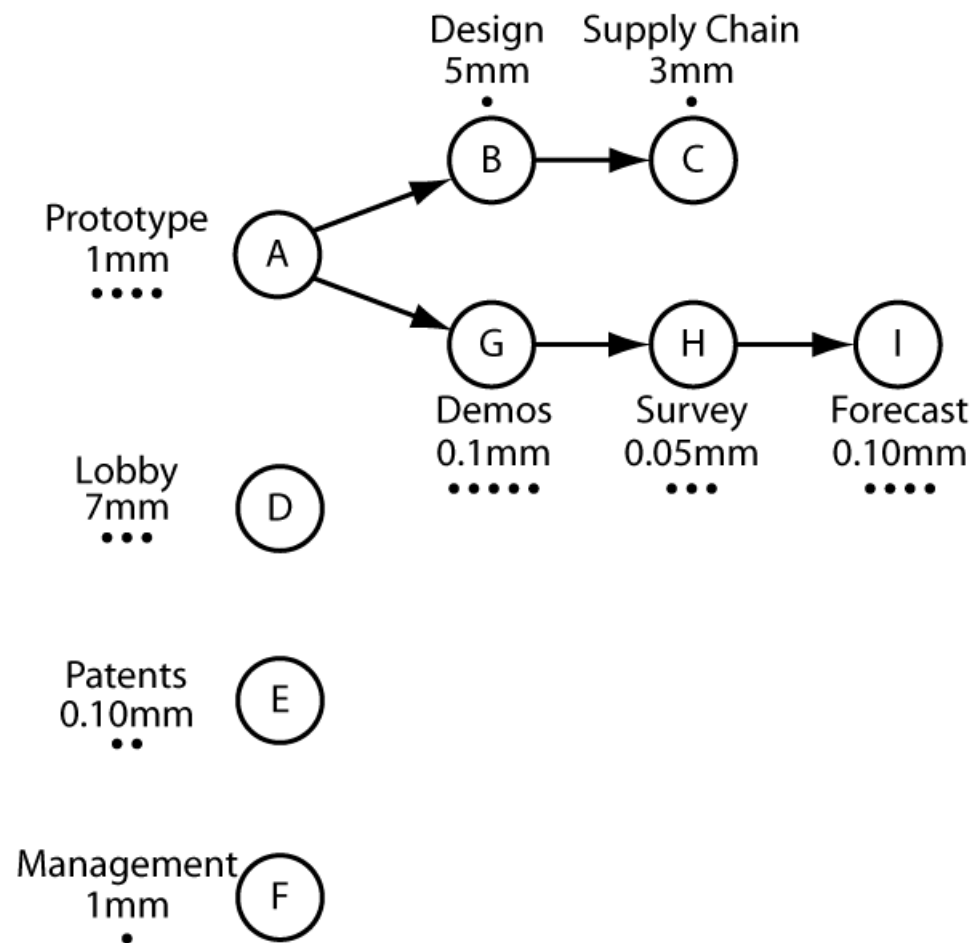
*What benefits*



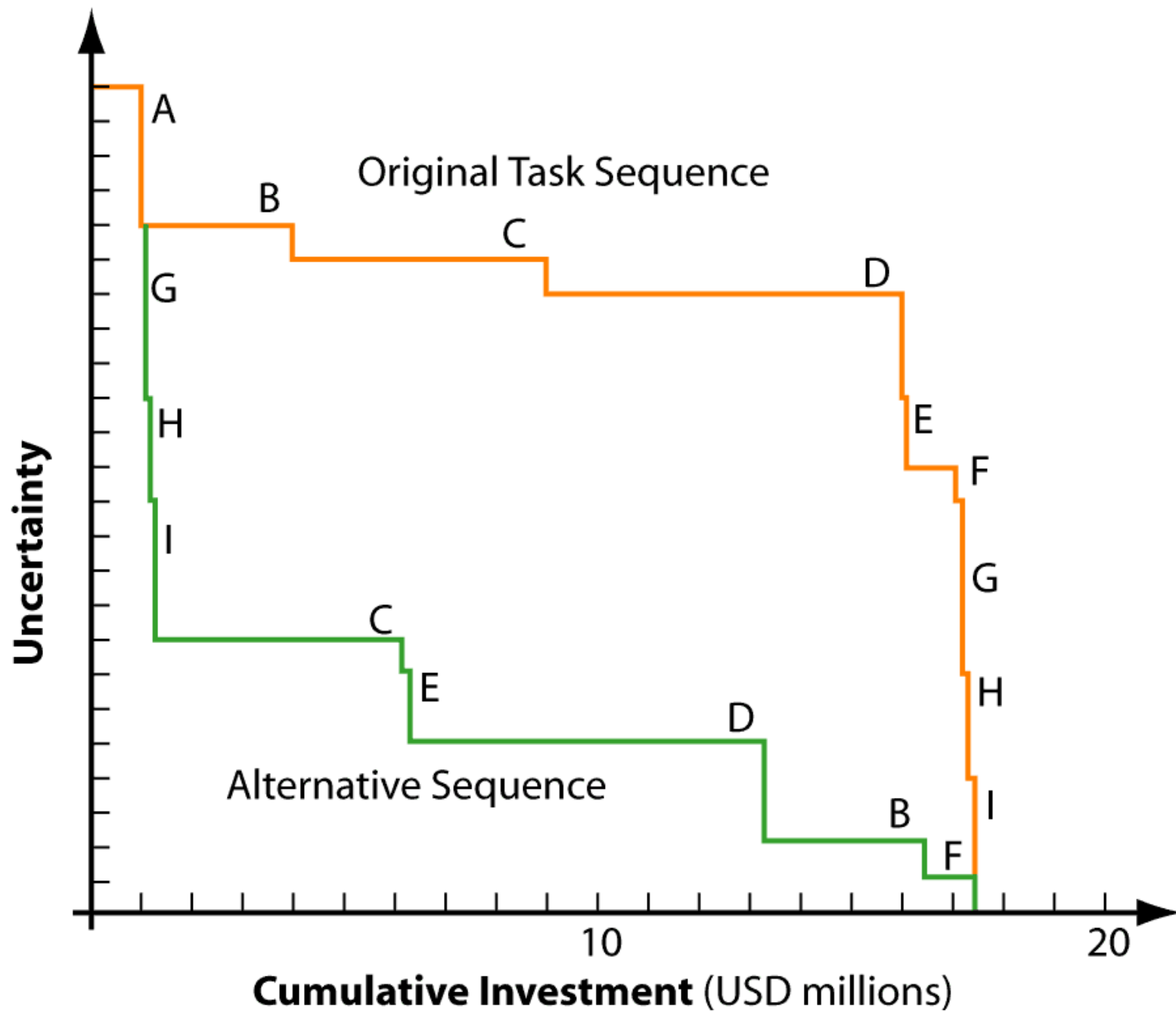
	Task	Questions Addressed	Effect on Uncertainty	Cost of Task (USD)
<b>A</b>	Complete alpha prototype design, fabrication, and testing.	Will the technical performance of the product be acceptable?	• • • •	1 mm
<b>B</b>	Design supply chain and set up production facility.	Can we establish production capacity?	•	3 mm
<b>C</b>	Complete production-intent design, engineering refinement, life testing.	How reliable and robust can we make the product?	•	5 mm
<b>D</b>	Lobby for new legislation in state and local governments.	In how many states will it be legal to ride on the streets and sidewalks?	• • •	7 mm
<b>E</b>	File patents.	What is the extent of the intellectual property barrier?	• •	0.10 mm
<b>F</b>	Recruit full management team of new company.	Can we establish the structure and personnel to support a large enterprise?	•	1 mm (+0.50mm/ month)
<b>G</b>	Conduct customer interviews and demonstrations.	Which market segments will most resonate with the benefits of the product? What is the core benefit proposition for the product? Where will the user ride the product?	• • • • •	0.10 mm
<b>H</b>	Perform competitive product analysis, customer surveys, retailer surveys.	What should be the target price point?	• • •	0.05 mm
<b>I</b>	Complete diffusion modeling, historical comparisons, purchase intent survey.	What is likely to be the sales trajectory?	• • • •	0.10 mm

**Source:** Terwiesch and Ulrich, *Innovation Tournaments*, Chapter 8.

## Tasks and Inherent Dependencies









Ninebot

Ninebot One

Online Store

Ninedroid APP

Choose Region ▼

## Personal Transportation Robot

[Watch the video](#) 



### **April 2015**

Ninebot acquires Segway.

Segway had sued for patent infringement.

Ninebot just closed \$80mm equity investment from Xiaomi and Sequoia.

KU Guess: \$30-40mm price for Segway.



# Segway Revisited



- **Key benefits are:**

- Novelty
- Fun
- High visibility
- Pedestrian-like “footprint”
- Small turning radius

- **Which targets might resonate with these benefits?**

- Ambassadorial positions, e.g., theme park staff, police officers, resort staff.
- Rental operations focused on fun.
- Attention getting activities, e.g., sales, promotions.
- Golf cart market?

- **Potential market?**

- Guess: 10,000 units per year at \$1500/unit (factory price) = \$15MM/yr revenue.
- (Sales after 5 years were 23,000 units.)

