Hello
Westinghouse Science Honors Institute: February 2014

Field research:
The nitty gritty of the real world

@paulkgould

Photos: Paul Gould
Knowledgeable pursuit

Junior bookworm

Bryan Elementary School sixth grader Paul Gould, son of Ken and Ingrid Gould, recently picked up five school trophies for reading 378 books during the past school year. Paul said he does not know exactly how fast he reads but an average size book will take him less than two hours to complete. This summer, he expects to read 250 books in one of his favorite reading spots — a comfortable tree limb just outside his house.
Most people start out as designers . . . before unlearning that awesomeness.
“Everyone designs who devises courses of action aimed at changing existing situations into preferred ones.”

HERB SIMON
Survival of the Fittest

How the Science of Design Can Save Your Neck

@paulkgould
Evolution
Connected
Social media network connections among Twitter users

Created with NodeXL (http://nodexl.codeplex.com) from the Social Media Research Foundation (http://www.smrfoundation.org)

Diagram: Marc Smith (CC by 2.0)
Open APIs: Growth is accelerating

Total APIs over time
Data Scientist: The Sexiest Job of the 21st Century

Abstract

Key to the effective use of big data are the analytical professionals known as “data scientists,” who can both manipulate large and unstructured data sources and create insights from them. Data scientists are difficult to hire and retain, but their skills will be necessary to any organization wishing to profit from big data.

Keywords: big data; data scientists; business analytics; Data and Data Sets; Mathematical Methods; Jobs and Positions

Format: Print

Citation:

Shanghai

1990

2010
New Transatlantic Cable Built to Shave 5 Milliseconds off Stock Trades

Hibernian Atlantic is building an undersea fiber optic cable that will stretch from New York to London. The purpose of this engineering feat? To allow computers to complete financial transactions 5 milliseconds faster than their competitors. Finance is now increasingly dominated by automated trading, and to a computer 5 milliseconds is an eternity.
FAST COMPANY

HOW ONE SECOND COULD COST AMAZON $1.6 BILLION IN SALES

RESEARCH ON U.S. NET HABITS SUGGESTS THAT IF THIS SENTENCE TAKES LONGER THAN A SECOND TO LOAD, MANY CITIZENS WILL HAVE CLICKED ELSEWHERE. ALREADY, IF YOU'VE GOT THE PATIENCE (OR ARE EUROPEAN) READING FOR MORE SHOCKING DATA ON NOT DAWDLING.

BY KIT EATON

The data comes from an infographic compiled by OnlineGraduatePrograms.com, with the specific goal of finding out about tolerance of slow webpage speeds for the average U.S. web user. Then they extended the data to cover other habits that take time, like waiting in line or being served in a restaurant. It turns out that Americans are an astonishingly impatient lot. In fact, odds are they've probably all given up reading this by now. Holla, rest of the world!
Massive
According to Applied Materials, Inc., in 2009...

10 quintillion transistors were produced, which was...

250x the grains of rice consumed in the world.

1 grain or 125,000 transistors cost the same!
2007
“There is no chance that the iPhone is going to get any significant market share. No chance.”
— Steve Ballmer, CEO: Microsoft
2012
iPhone sales exceeded all revenue of Coca-Cola and McDonalds—combined.

Source: Bloomberg Businessweek, 9 September 2013
THE WORLD'S CAPACITY TO STORE INFORMATION
This chart shows the world's growth in storage capacity for both analog data (books, newspapers, videotapes, etc.) and digital (CDs, DVDs, computer hard drives, smartphone drives, etc.)

In gigabytes or estimated equivalent

1986
ANALOG
2.62 billion

1990
ANALOG STORAGE

2000
DIGITAL

2007
18.86 billion gigabytes

Paper, film, audiotape and vinyl: 5.2%
Analog videotapes: 53.8%
Other digital media: 0.8%
Portable media players, flash drives: 2%
Portable hard disks: 2.4%
CDs and minidiscs: 6.8%
Computer servers and mainframe hard disks: 8.9%
Digital tape: 11.8%
DV/DVD: 22.6%

COMPUTING POWER
In 1986, pocket calculators accounted for much of the world's data processing power.

Percentage of available processing power by device:

<table>
<thead>
<tr>
<th>1986</th>
<th>Pocket calculators</th>
<th>Personal computers</th>
<th>Video game consoles</th>
<th>Servers, mainframes</th>
</tr>
</thead>
<tbody>
<tr>
<td>41%</td>
<td>33%</td>
<td>9%</td>
<td>17%</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>66%</td>
<td>25%</td>
<td>31</td>
<td></td>
</tr>
</tbody>
</table>

Mobile phones, PDAs, supercomputers: 0.3%

PC hard disks: 44.5%

123 billion gigabytes

276.12 billion gigabytes

*Other includes chip cards, memory cards, floppy disks, mobile phones, PDAs, cameras/camcorders, video games
Complex
Technology used to be:

- Expensive
- Rare
- For experts

When you moved
TUESDAY, SEPTEMBER 10

You have 8 active hours
Move often throughout the day to earn more active hours

Source: Apple

@paulkgould
Try it yourself. Click on the arrows below.

**Calories Burned**

- **Target**: 2170 calories
- **Actual**: 2372 calories

**Calories Burned Per Minute**

- From: 6:20 AM to 12:00 AM

**Calories Consumed**

- 1920 calories
- 1152 calories

**Calorie Balance**

- 250 calories burned
- 1220 calories burned

**Physical Activity**

- 0:45 minutes
- 3:15 minutes

**Steps Taken**

- 8000 steps
- 7795 steps

**Sleep Duration**

- 8:00 hours
- 6:57 hours

**Weight**

- Current Weight: 128 lbs
- I have lost 11 lbs

- Need to change your weight for this day?
- Change Weight Measurement

Know your body, Change your life.

The four sensors in our little Armband pull data off of your body at a clip of 5,000 data points per minute. All of that data gets categorized and analyzed and delivered to you in an easy-to-understand way. With this info you can unlock secrets of your body and determine what you should do (or stop doing) to lead a healthier life.

Learn More
Family Communications®

Founded by Fred Rogers, the Family Communications is a non-profit company that supports projects for children, their families, and those who support them. It is our privilege to continue Fred Rogers' work and expand it to reach new audiences.

Photo: Paul Gould

@paulkgould
Humans cope by putting things in boxes (and by hoping for magic bullets)
Westinghouse Science Honors Institute: February 2014

@paulkgould

Images: Ed Massery, used with permission.
Interdisciplinary teams bring fresh perspectives and break down barriers

- Information Design
- Interaction Design
- Animation/Filmmaking
- Architecture
- Human/Computer Interaction
- Ethnography
- Anthropology
- Cognitive Psychology
- Software Engineering
- Electrical/Mechanical Engineering
- Computer Science
- Mathematics
Taming complexity

- Hammer
- Apollo Landing

@paulkgould
Taming complexity

- Hammer
- Human Vision
- Apollo Landing

@paulkgould
$3 billion
Applying Human-Centered Design

Innovating for People

© LUMA Institute and its licensors
CHARACTERISTICS OF INNOVATIVE PEOPLE
(KEY BEHAVIOR TRAITS)

- Empathetic
- Persistent
- Curious
- Experimental
- Humble
- Risk Enthusiast
- Imaginative
- Problem Framer
- Collaborative
- Pattern Finder
- Networker

A-ha!

SKILLSSET OF INNOVATIVE PEOPLE
(THE DISCIPLINE OF HUMAN-CENTERED DESIGN)

- Looking
  OBSERVING HUMAN EXPERIENCE
- Understanding
  ANALYZING CHALLENGES & OPPORTUNITIES
- Making
  ENVISIONING FUTURE POSSIBILITIES

@paulkgould
PAUL’S THREE KEYS TO DOING AWESOME THINGS:

GET ENGAGED
DON’T BE AN IDIOT
PLACE MANY SMALL BETS
YOU DON’T KNOW EVERYTHING
GET ENGAGED

(INVOLVE AND UNDERSTAND DIVERSE PEOPLE)
Look around you and look for hacking and adaptation
Understanding users in context helps identify user needs—even if unspoken
What’s going through their minds?
Prototypes evolve through testing with users
We create information-centric interfaces that allow for direct-manipulation of information, polymorphic presentation of information, and fluid collaboration.

"...the greatest advance in technology for command and control in the past 30 years."—Gen. Paul F. Gorman, US Army (Ret.)
Helped the US Army deploy a new digital command system that increased mission efficiency by 300% and reduced training time from 14 days to 1 day—12 months ahead of schedule.

Defense Advanced Research Projects Agency (DARPA)
SILOS AND ONE-OFF PRODUCTS ARE BRITTLE
DON’T BE AN IDIOT
(WORK ARCHITECTURALLY)
The system should not be what you’re delivering
The system should not be what you’re delivering

Stuff

System Architecture

Information Architecture

User Interface Architecture

Oooo!
The system should not be what you’re delivering

How To Think

System Architecture

Information Architecture

User Interface Architecture

@paulkgould
Here’s the interface

![Interface Image]
Prioritize features based on what users want to accomplish
Make rough and ready prototyping to test concepts
Use progressive disclosure to reveal complexity

If the knob is not pushed in, then the next clockwise turn highlights:
- 260 V, then 101 A, then 60 Hz, then A, and so forth.

If the knob is pushed in, the 'Menu Nav Dot' is selected. The next clockwise turn of the knob moves the dot to the Power home page. Another clockwise turn moves the dot to the Quality home page.

A counterclockwise knob turn moves the dot to the Power home page.

A knob push operation selects the Power home page with 90 kW highlighted.

Rotating the knob highlights the links in sequence (101 A to 60 Hz to A).

If the knob is turned when A is highlighted selects that Phase and displays those values.

Rotating the knob highlights Phase B. Pushing the knob selects Phase B.

Rotating the knob highlights the links in sequence. Pushing the knob when 100 A is highlighted selects Current.

Rotating the knob selects Phase A.

Voltage: 239 V
Current: 103 A
Frequency: 60 Hz
Angle: 0°
Complex and powerful, yet remarkably easy to use.
IT’S NOT GOING TO BE RIGHT THE FIRST TIME
PLACE MANY SMALL BETS
(APPROXIMATE THE EXPERIENCE EARLY)
Early Flight
SILENT FOOTAGE
Name that dude:
IT’S GOING TO COST YOU SOMEWHERE, SOMETIME . . .

RELATIVE COST TO REPAIR

1x

10x

100x

TYPICAL STAKEHOLDER TOUCH-POINTS

IDEAL STAKEHOLDER TOUCH-POINTS

Research
Concept
Spec.
Alpha
Beta
Launch
Support

@paulkgould
QUICK START GUIDE
We build simple prototypes as quickly and as early as possible to test thinking and hypotheses
Usability testing with paper prototypes
Before

After

Photo: General Dynamics. Used with permission.
How about you?
October 28, 2011

Majority of American Workers Not Engaged in Their Jobs

Highly educated and middle-aged employees among the least likely to be engaged

by Nikki Blacksmith and Jim Harter

WASHINGTON, D.C. — Seventy-one percent of American workers are "not engaged" or "actively disengaged" in their work, meaning they are emotionally disconnected from their workplaces and are less likely to be productive. That leaves nearly one-third of American workers who are "engaged," or involved in and enthusiastic about their work and contributing to their organizations in a positive manner. This trend remained relatively stable throughout 2011.

Gallup Employee Engagement Index

<table>
<thead>
<tr>
<th></th>
<th>Quarter 4 2010</th>
<th>Quarter 1 2011</th>
<th>Quarter 2 2011</th>
<th>Quarter 3 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Engaged</td>
<td>28</td>
<td>30</td>
<td>30</td>
<td>29</td>
</tr>
<tr>
<td>% Not engaged</td>
<td>53</td>
<td>52</td>
<td>51</td>
<td>52</td>
</tr>
<tr>
<td>% Actively</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disengaged</td>
<td>19</td>
<td>18</td>
<td>19</td>
<td>19</td>
</tr>
</tbody>
</table>

70 Percent of Americans 'Emotionally Disconnected' at Work: Shocking Poll Reveals Workforce Zombieland

Nearly one in five hate work so much they sabotage their employers.

June 18, 2013 | If you thought that Americans who kept their jobs during the Great Recession were glad to be working, you would be dead wrong. According to a Gallup.com report, 70 percent of American workers are emotionally disengaged at work, with nearly one in five employees actively disengaged.

Americans' levels of engagement at work are generally consistent with Gallup's trends on workplace engagement from various studies since 2000. The current percentage of engaged employees is similar to the historical high of 50% in 2001 to 2002 and 2006 to 2007. The percentage who are actively disengaged is near the high of 20% recorded in 2007 and 2008.

Highly Educated and Middle-Aged Workers Less Likely to Be Engaged
Engaged vs. Competent

@paulkgould
Engaged

 Dropout

 Competent

@paulkgould
Engaged

Dropout

Automaton

Competent

@paulkgould
Entertained

Engaged

Dropout

Automaton

Competent
Engaged

Entertained

Dropout

Competent

Automaton

@paulkgould
THREE KEYS TO DOING AWESOME THINGS:

GET ENGAGED
DON’T BE AN IDIOT
PLACE MANY SMALL BETS
That’s larger than me . . .

That’s me!

Exploratory
Experimental
Expressive
Empathetic
Engaged

@paulkgould
gould@maya.com
@paulkgould