

Rethinking the composition of computer science

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CS Assistant Professor

jonf@cs.umd.edu



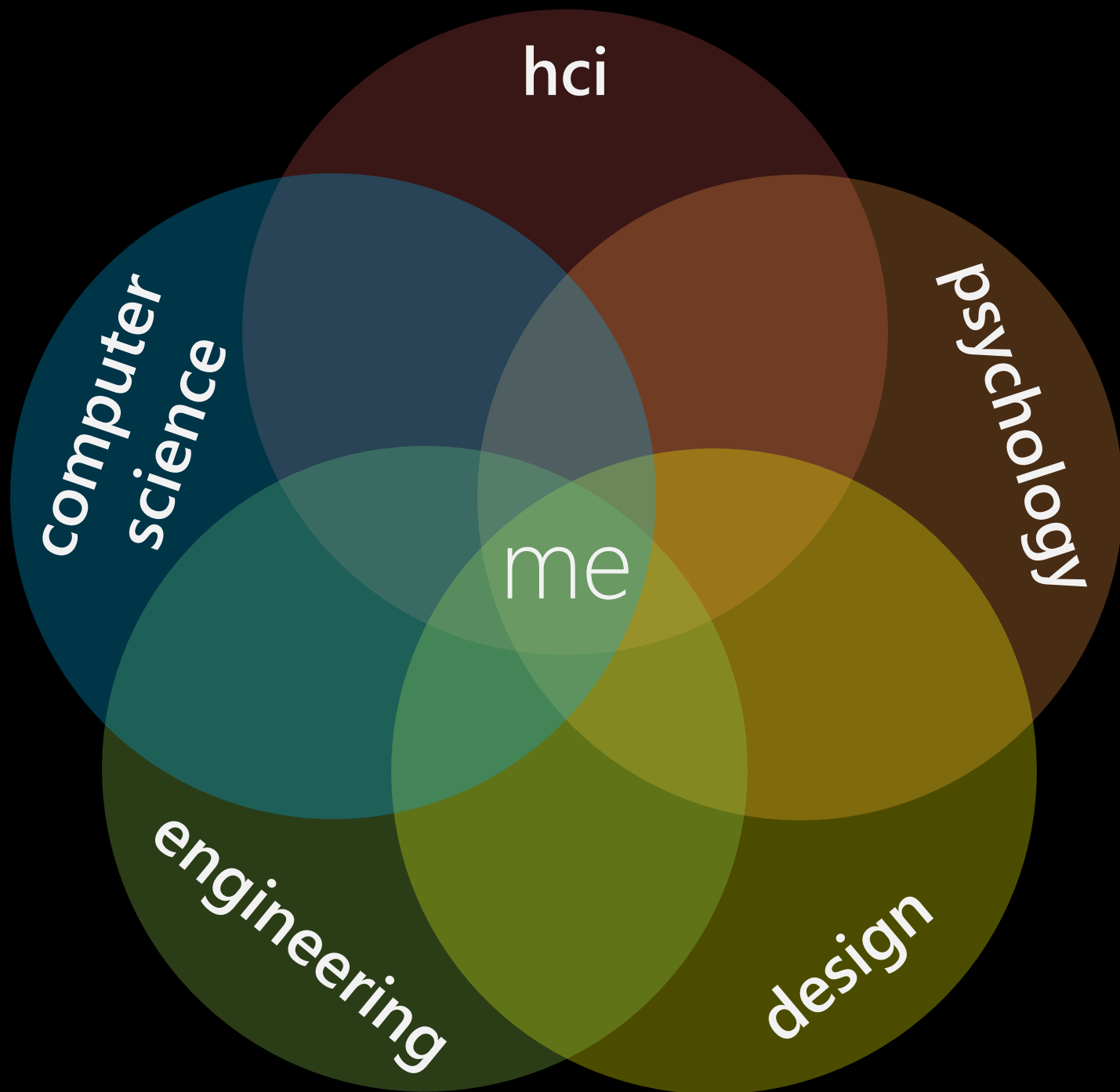
Human-Computer
Interaction Laboratory

University of Maryland
Department of Computer Science





me





Seattle, WA

Minneapolis, MN

Portland, OR

Ames, IA

Maryland!

Orange County, CA

Denver, CO

Machu Picchu
Nov 15, 2011

South America



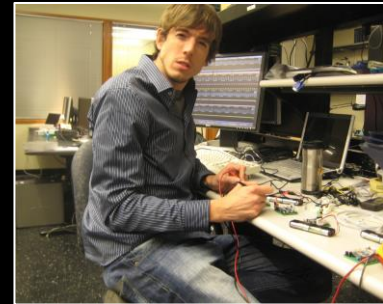




How does one go from



to



?



early exposure to computing



commodore 128
PERSONAL COMPUTER

POWER





my **computer class** in high school





Dell Dimension

Pentium I, 133MHz, 1GB hard drive, 32MB Ram



This Talk

1

Rethinking
CS

2

Reapplying
CS

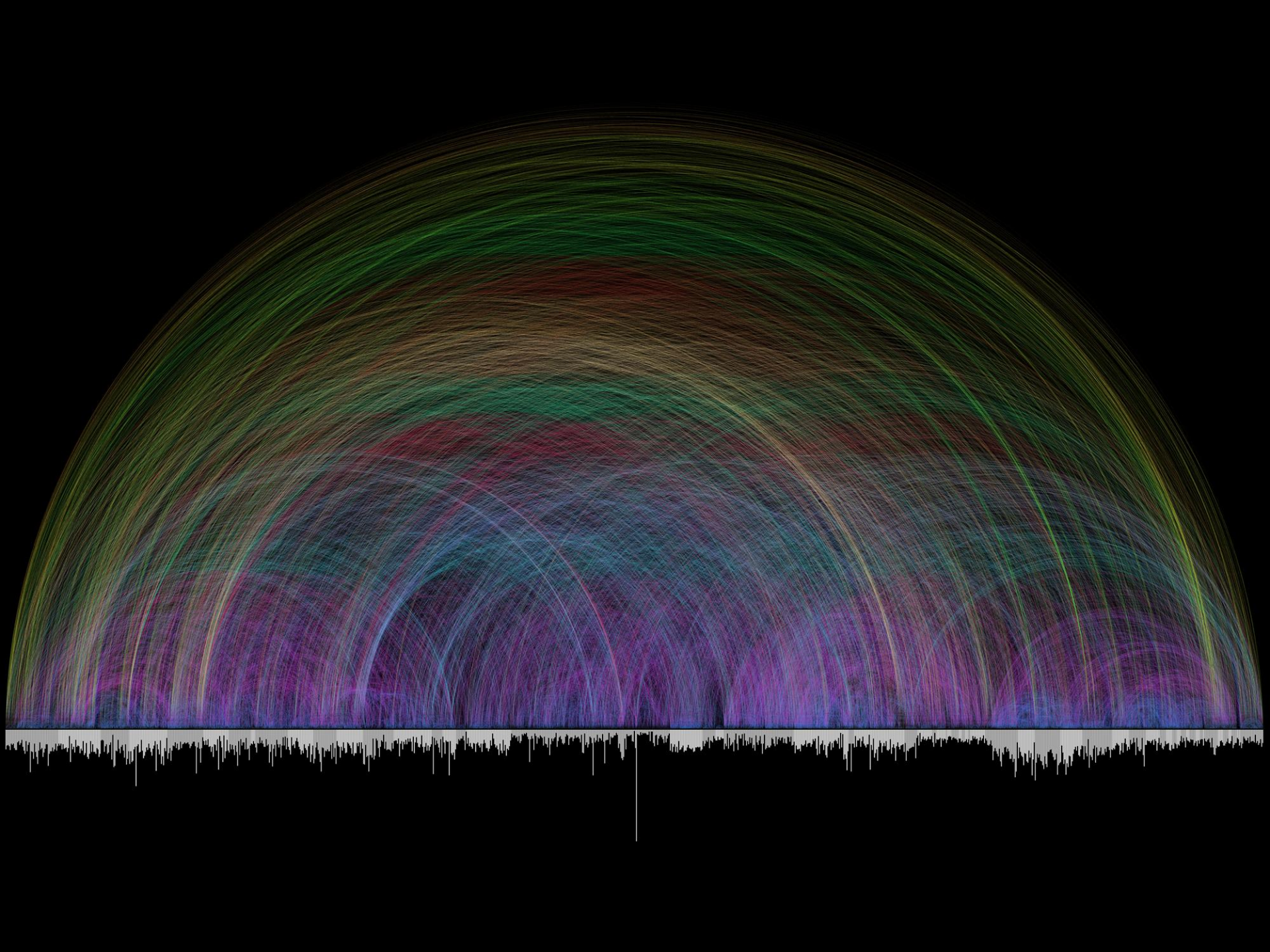
This Talk

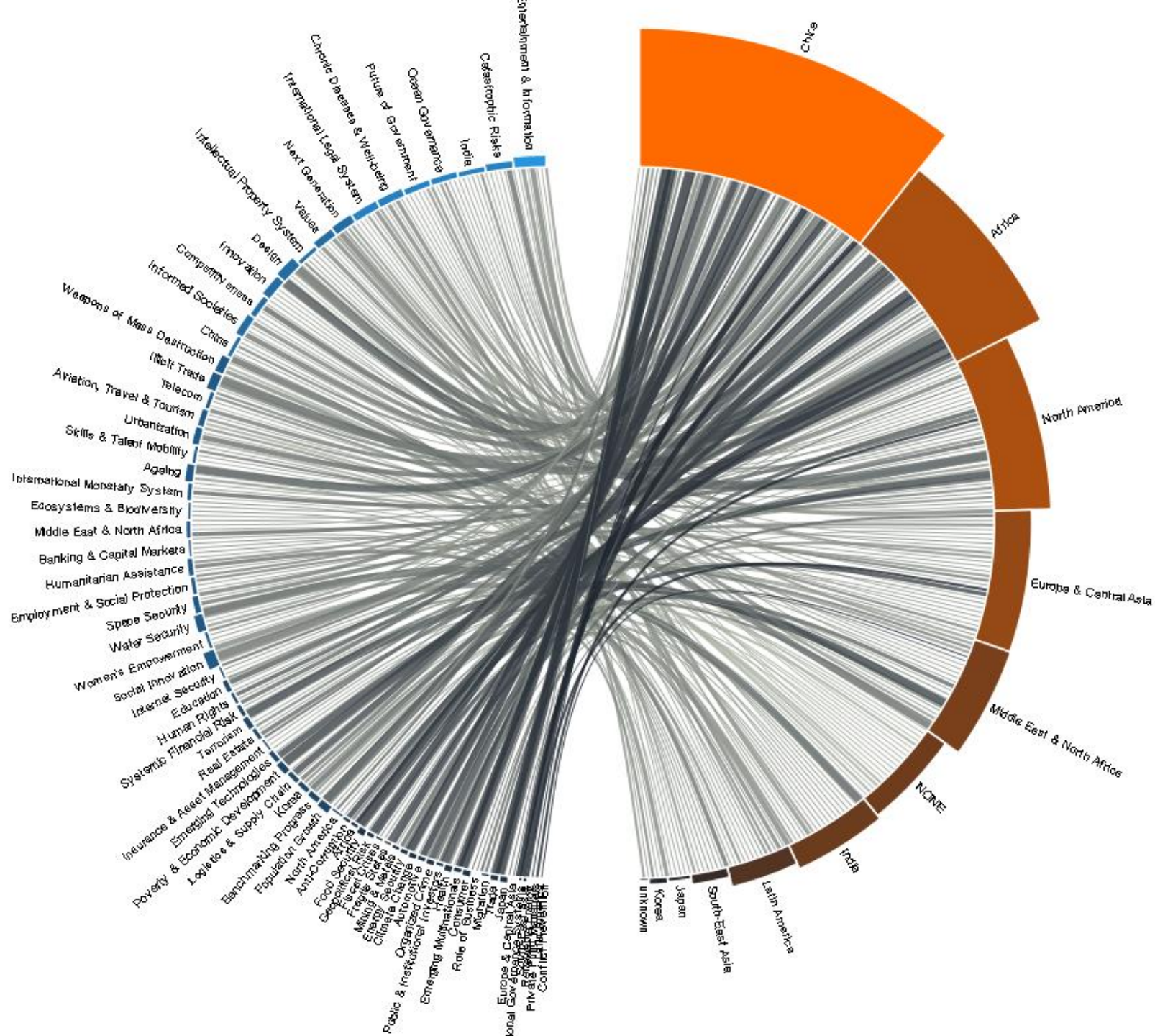
1

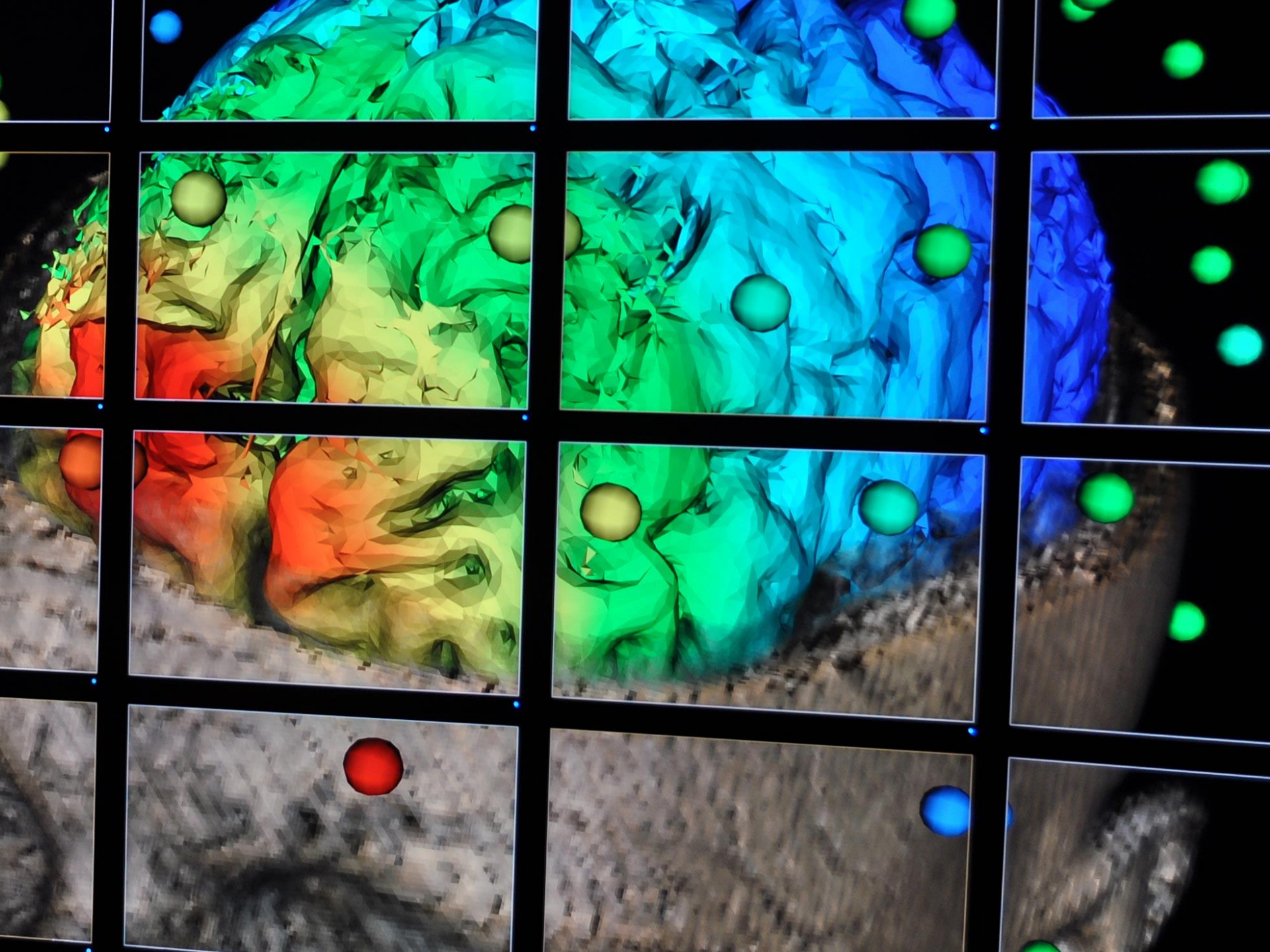
Rethinking
CS

2

Reapplying
CS









imagine • program • share

[home](#)
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[forums](#)
[about](#)
[Language](#) ▼

[Login](#) or [Signup](#) for an account

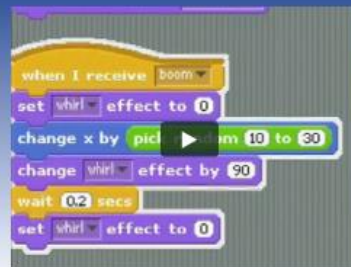
 search

Create and share your own interactive stories, games, music, and art

[Check out](#) the 2,476,796 projects from around the world!



To create your own projects:


[Download Scratch](#)


Featured Projects

[See more](#) ▶


[French Verb Con...](#)
by [trinary](#)



[A Day In the Li...](#)
by [TigerStripes](#)



[alphabet game](#)
by [ocobinner3](#)

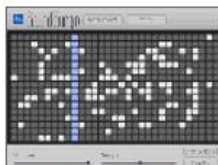
Collab Camp



Check out all the music mashups created by Scratchers in Collab Camp.

[Learn more](#) ▶

Projects Selected by Collab-Camp

[See more](#) ▶


[SoundSurge-Beta 1.0](#)
by [kavybee](#)



[Fandango](#)
by [ffred](#)



[xlyphone hero](#)
by [fireaction2001](#)

Scratch Day



Be a part of Scratch Day - a worldwide network of gatherings, where Scratchers come together to meet, share, and learn.

[Find out more](#) ▶

ScratchEd



Do you help people learn Scratch? Join ScratchEd, our new online community for educators.

[Find out more](#) ▶

Projects from Scratch Design Studio

[See more](#) ▶


Scratch Design Studio

Processing

 Search[Cover](#) \ [Exhibition](#) \ [Reference](#) \ [Learning](#) \ [Download](#) \ [Shop](#) \ [About](#)[»Feed](#) [»Forum](#) [»Wiki](#) [»Code](#)

» Exhibition



[unnamed soundsculpture](#)

by Daniel Franke & Cedric Kiefer



[Soundmachines](#)

by The Product



[Composition No. 1](#)

by Visual Editions



» Download Processing

» Play with Examples

» Browse Tutorials

Processing is an open source programming language and environment for people who want to create images, animations, and interactions. Initially developed to serve as a software sketchbook and to teach fundamentals of computer programming within a visual context, Processing also has evolved into a tool for generating finished professional work. Today, there are tens of thousands of students, artists, designers, researchers, and hobbyists who use Processing for learning, prototyping, and production.

- » Free to download and open source
- » Interactive programs using 2D, 3D or PDF output
- » OpenGL integration for accelerated 3D
- » For GNU/Linux, Mac OS X, and Windows
- » Projects run online or as double-clickable applications
- » Over 100 libraries extend the software into sound, video, computer vision, and more...
- » Well [documented](#), with many [books](#) available

To see more of what people are doing with Processing, check out these sites:

- » [Processing Wiki](#)
- » [Processing Discussion Forum](#)
- » [OpenProcessing](#)
- » [CreativeApplications.Net](#)



seachange



NEW CONSTRUX. BY FISHER-PRICE.



THE ACTION BUILDING SYSTEM.



Make a helicopter with whirling blades.



Make a Formula 1 racing car that races.



Make a fire engine with turning ladder.



Make a dinosaur with a jaw that bites.



Make a bridge that can raise and lower.



Make anything! It builds imagination.

Construx™ is a terrific, new building system that's really different. With it, kids can play with what they build! Construx comes with lots of moving parts, like wheels, propellers and pulleys. So your kids can make almost anything they can imagine: cars, bridges, even monsters!

It's easy to build with Construx. The pieces snap together and twist apart. No nuts, bolts or tools. There are 11 different Construx sets for kids 5 to 9, each with its own put-together figure. And sets can be combined to build even more! Construx is fun to build with, fun to play with. It's the Action Building System.

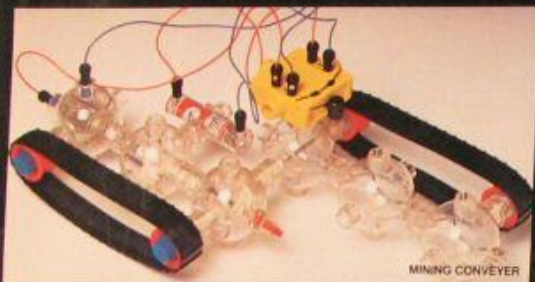


It's simple. Pieces snap together.



THE UNIVERSAL CONSTRUCTION SET **Caprela**[®] 700

MOTORIZED LAND AND WATER MODELS



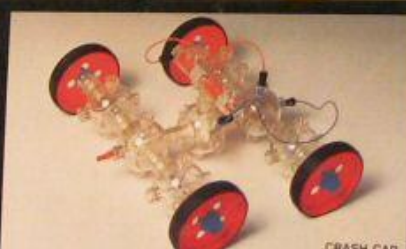
MINING CONVEYER



HOIST



STAR SCANNER



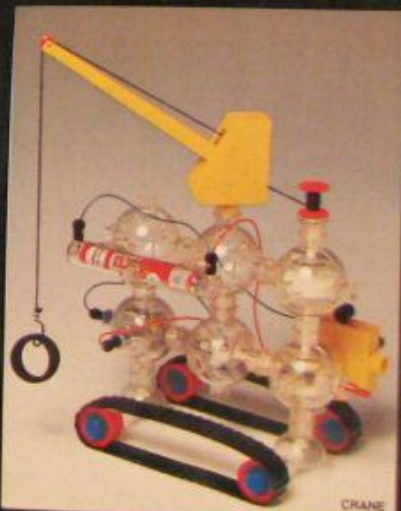
CRASH CAR



FIRE BOAT



SONAR STATION



CRANE



VACUUM CLEANER



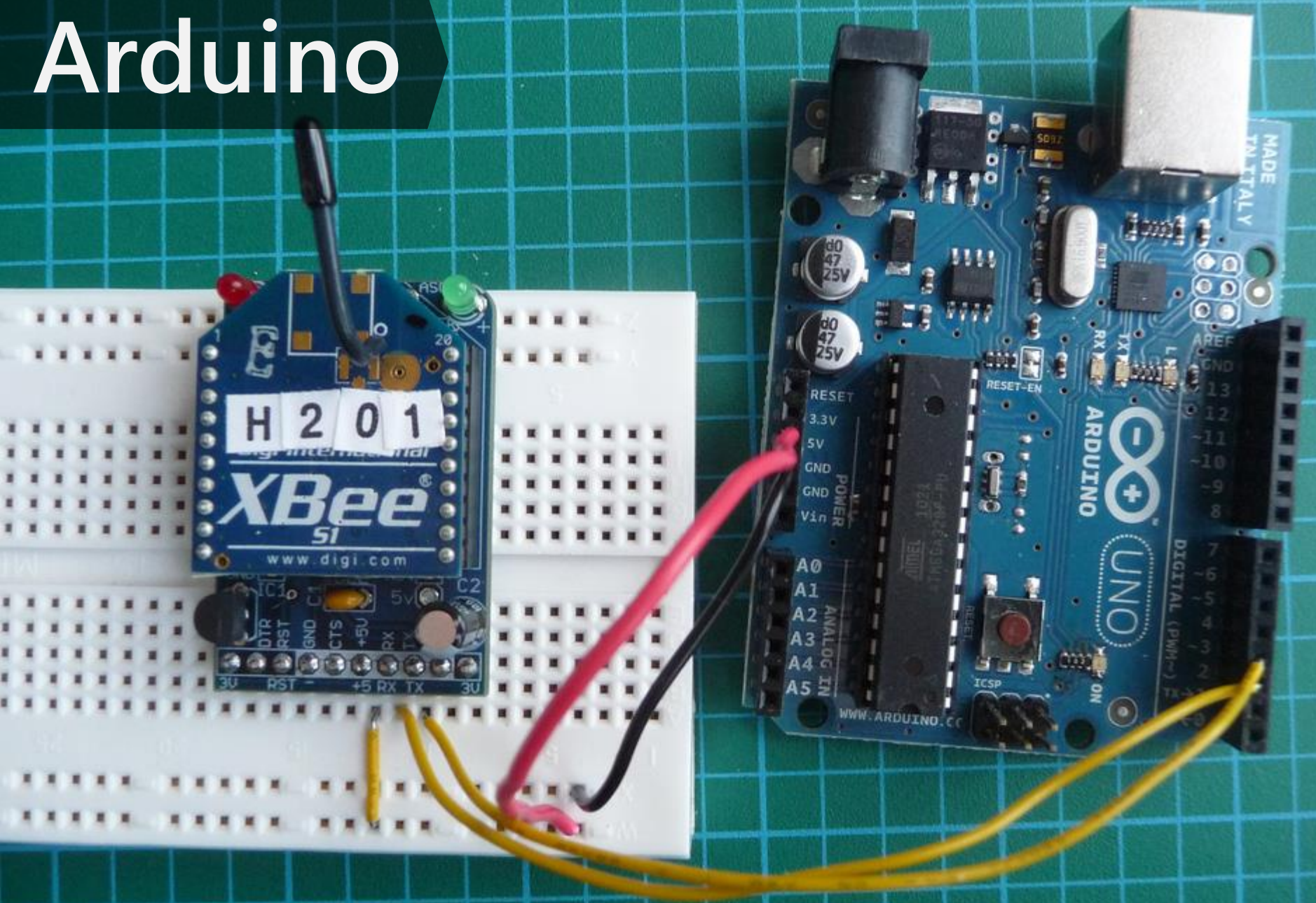
- Construct **47** MOTORIZED models
- See the moving gears in action
- **85** interlocking parts
- No adhesive or tools needed
- Safe and durable highest quality materials
- Three AA batteries required (not included)
- 7 years and older

CONSTRUCT 47 MOTORIZED ACTION MODELS create many more

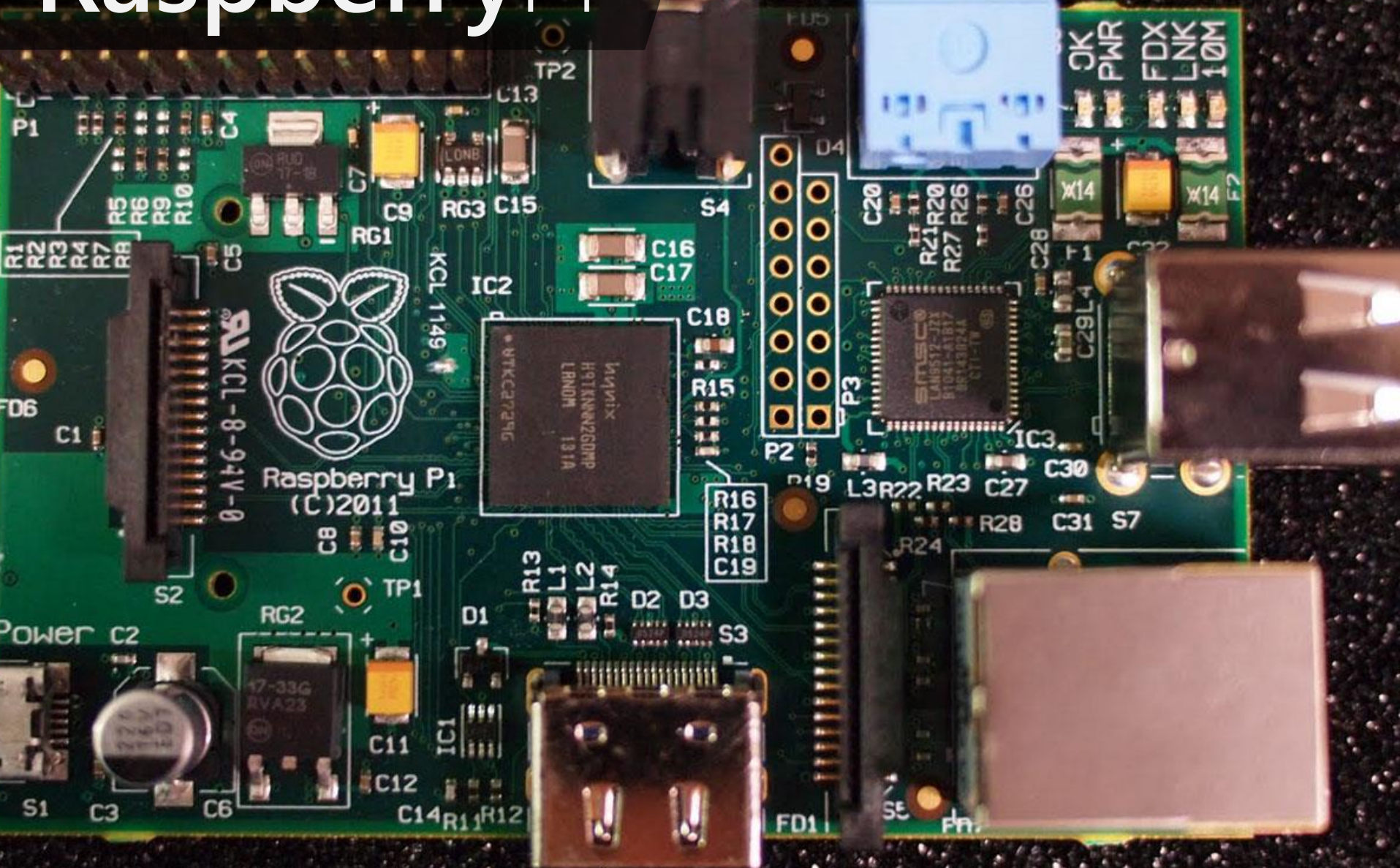
SEE REVERSE SIDE FOR CONTENTS



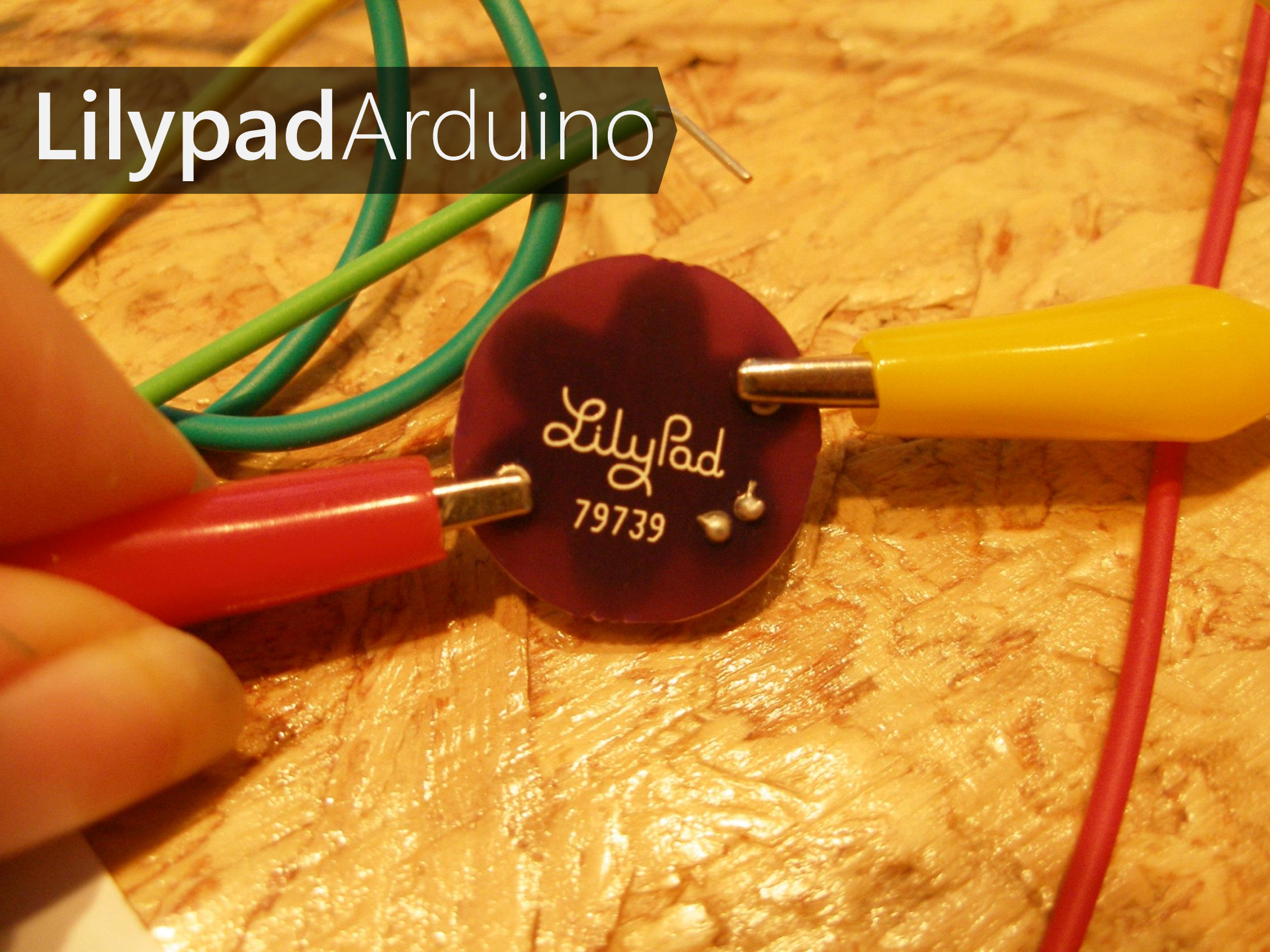
Arduino



Raspberry Pi

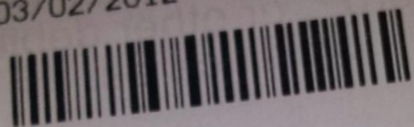


LilypadArduino





WHEATON - 630-510-1590
03/02/2012 06:32 PM



RETURN

ORIG RCPT ID# 2-2059-0838-0077-8253-2
063000128 SEXY T \$17.99-

T = IL TAX 8.2500% on \$17.99-
SUBTOTAL \$17.99-
TOTAL REFUND \$1.48-
\$19.47-

*3910 DEBIT CARD CREDIT \$19.47-

RECEIPT ID# 2-2062-0838-0122-9164-8

Bringing
Sexy Back



#inspiration



Leah Buechley
Assistant Professor
MIT Media Lab

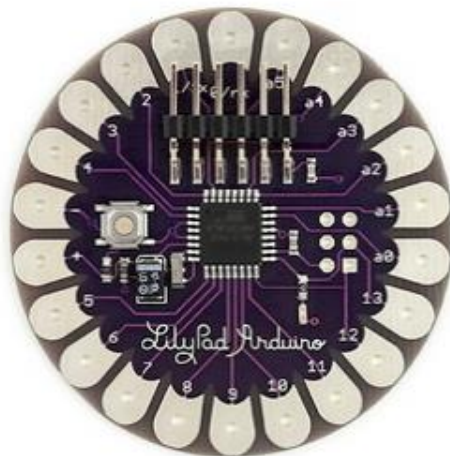




LilyPad home

help!

1. setup
2. software install
3. introduction to Arduino
4. light (LEDs)
5. sensing (switches)
6. color (RGB LEDs)
7. sound
8. sensing (sensors)
9. build something!
10. share it



welcome to LilyPad Arduino!

The LilyPad Arduino is a set of sewable electronic components that let you build your own soft, interactive fashion. To get started, snag this [LilyPad starter kit](#) that I put together. Or, browse through the [LilyPad category](#) on SparkFun to get just the pieces you need.

Work through the tutorials here to learn how to build all sorts of soft interactive stuff...perhaps fortune telling shirts, jackets that sing when you're squeezed or turn signal equipped cycling wear? Enjoy!

Note: for a more general introduction to electronics, programming, and the regular (non-LilyPad) Arduino, see [ladyada's excellent tutorials](#).

[Click here to return to my home page.](#)

[LilyPad home](#)[help!](#)[1. setup](#)[2. software install](#)[3. introduction to Arduino](#)[4. light \(LEDs\)](#)[5. sensing \(switches\)](#)[6. color \(RGB LEDs\)](#)[7. sound](#)[8. sensing \(sensors\)](#)[9. build something!](#)[10. share it](#)

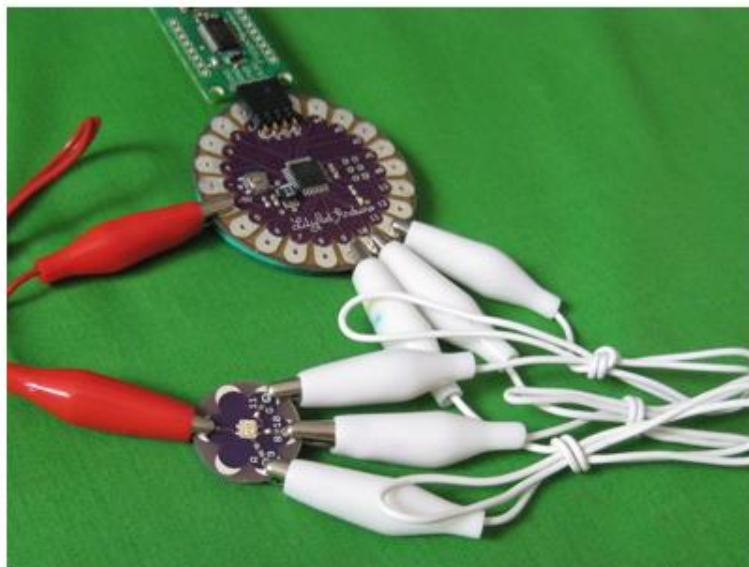
programming the LilyPad Arduino: color (RGB LEDs)

1. If you haven't yet, make a coaster for your LilyPad and RGB LED module.

See this tutorial for instructions. This will prevent the alligator clips that we'll be using from sliding around on the LilyPad. Trust me, it's worth it to do this!

2. Use alligator clips to attach an RGB LED module to your LilyPad

Use a red alligator clip to attach the + petal of the RGB LED module to the +5V petal on the LilyPad. With three more clips, attach the R/9 petal of the RGB LED to petal 9 on the LilyPad, the B/10 to 10 and the G/11 to 11. Your final connection should look something like this:



3. Attach the LilyPad to your computer and start the Arduino software

4. Copy this sample code into an Arduino window

[LilyPad home](#)[help!](#)[1. setup](#)[2. software install](#)[3. introduction to Arduino](#)[4. light \(LEDs\)](#)[5. sensing \(switches\)](#)[6. color \(RGB LEDs\)](#)[7. sound](#)[8. sensing \(sensors\)](#)[9. build something!](#)[10. share it](#)

build something!



turn signal biking jacket

This tutorial will show you how to build a jacket with turn signals that lets people know where you're headed when you're on your bike. [Click here](#) or on the heading above to get to the tutorial.

movement controlled RGB LED example

This tutorial will show you how to build a shirt with a flower lapel that changes color in response to movement. [Click](#)

art, craft, and technology

Leah Buechley and Jie Qi
• Jennifer Jacobs, Sam Jacoby, Emily Lovell,
David Mellis, and Kanjun Qiu
High-Low Tech Group
MIT Media Lab

high-low tech

#cyberlearning

Leah Buechley

Blending Art, Craft, and Technology

@ the Cyberlearning Research Summit

January 18th, 2012

paper, craft and embedded computing



paper, drawing, and embedded computing





THE REDISCOVERY OF WONDER

TED 2011

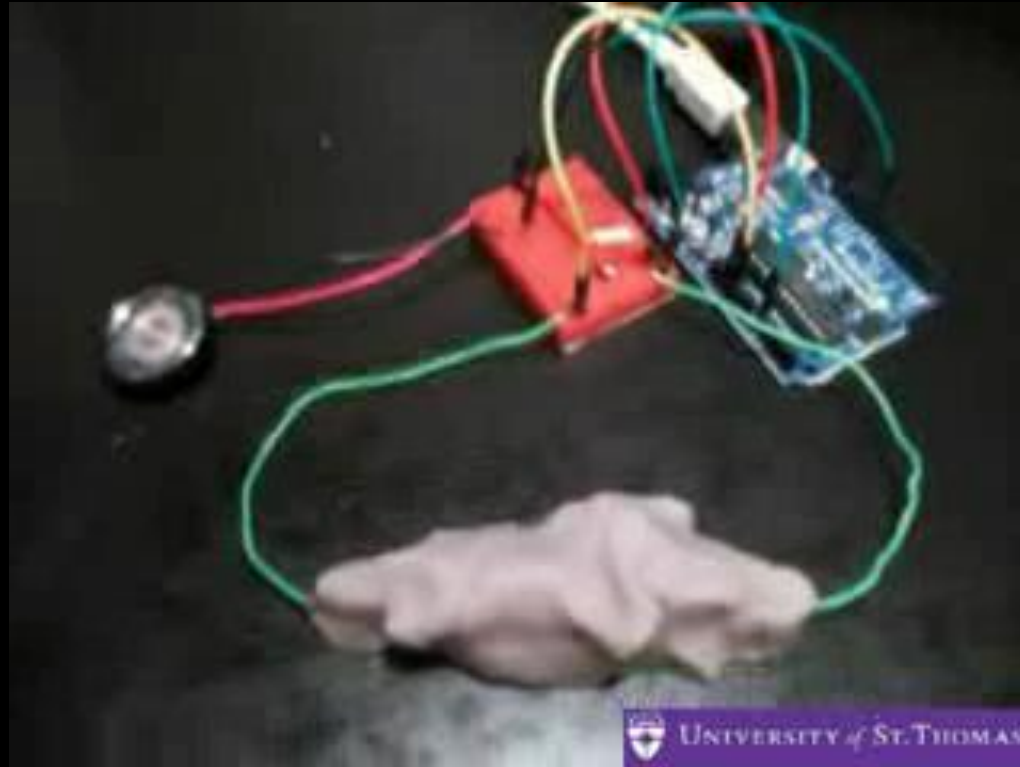
TED

#inspiration2

Ann Marie Thomas
Assistant Professor
University of St. Thomas

play dough and embedded computing

SquishySpeaker



Squishy Circuits

How To

Conductive Dough

Insulating Dough

Building Circuits

Videos

Contact us

Publications

Making Conductive Dough



Materials:

1 cup Water

1 1/2 cups Flour

(A gluten free version of this dough can be made by replacing the flour with gluten-free flour.)

1/4 cup Salt

3 Tbsp. Cream of Tartar*

1 Tbsp. Vegetable Oil

Food Coloring (optional)

*9Tbsp. of Lemon Juice may be Substituted



Procedure:

1. Mix water, 1 cup of flour, salt, cream of tartar, vegetable oil, and food coloring in a medium sized pot.



2. Cook over medium heat and stir continuously.

3. The mixture will begin to boil and start to get chunky.



Squishy Circuits

How To

Conductive Dough

Insulating Dough

Building Circuits

Videos

Contact us

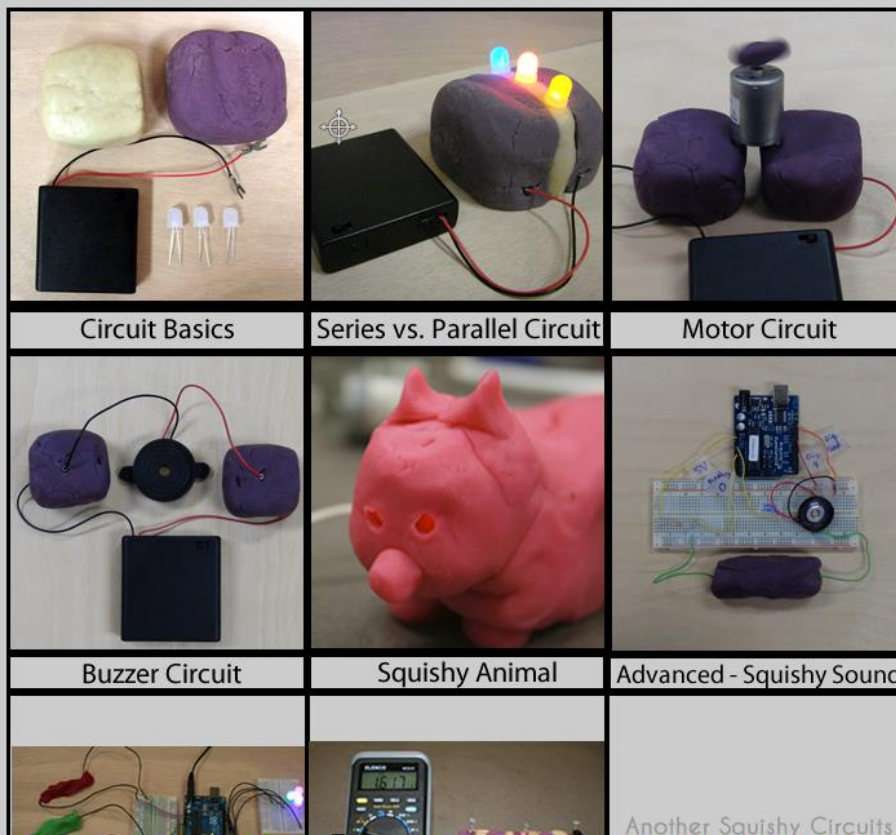
Publications

Building Squishy Circuits

Safety:

These activities are designed such that the dough is used to connect components. Never connect components, such as LEDs, directly to the battery pack, as running too much current through components can damage them, possibly causing them to overheat or pop. Follow standard electricity safety considerations. (Our youngest participants are fans of [these](#) brightly colored safety glasses!)

Click on the picture for a how-to guide specific to each activity.



This Talk

1

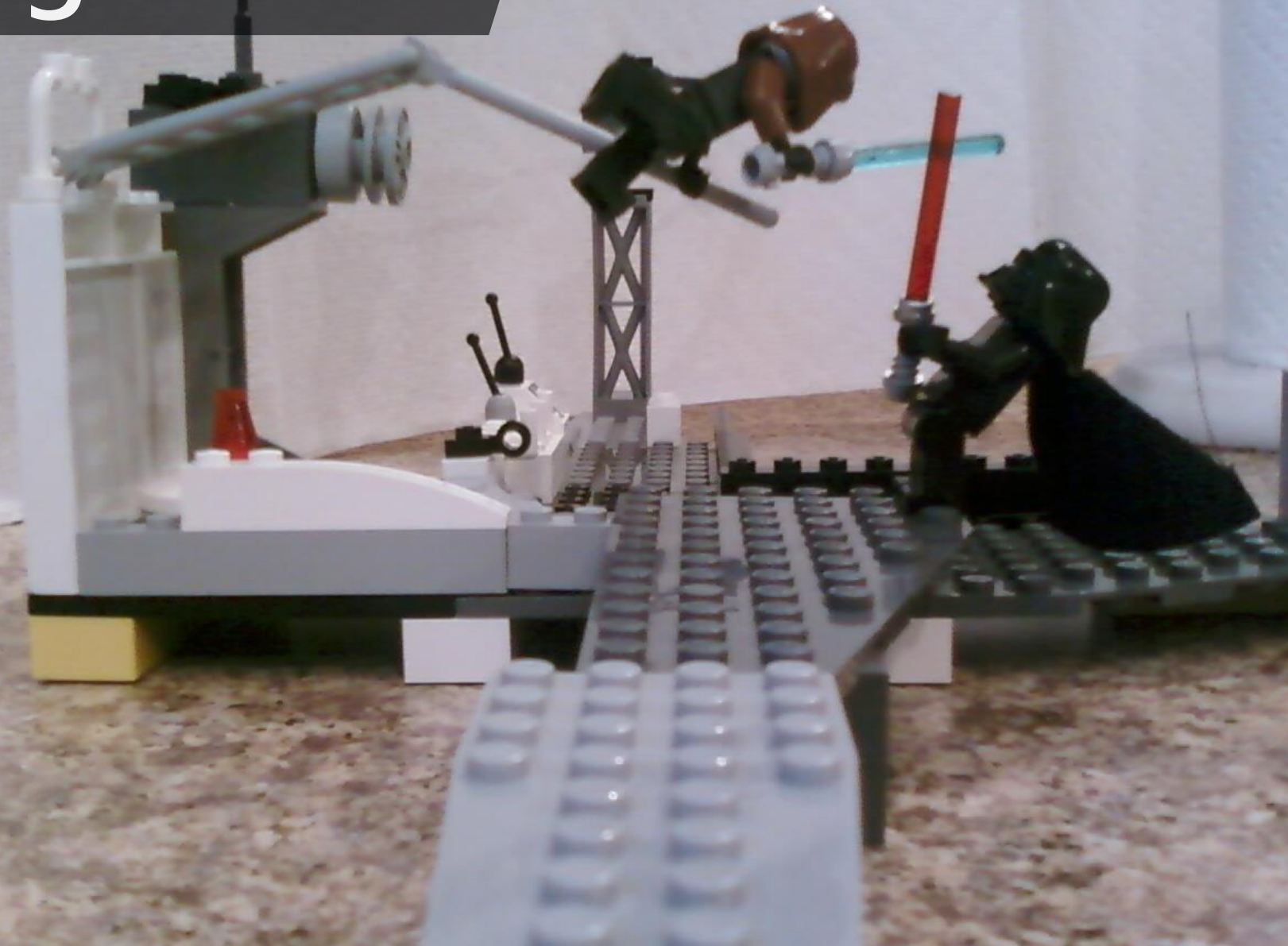
Rethinking
CS

2

Reapplying
CS



Design4Good



Topic1

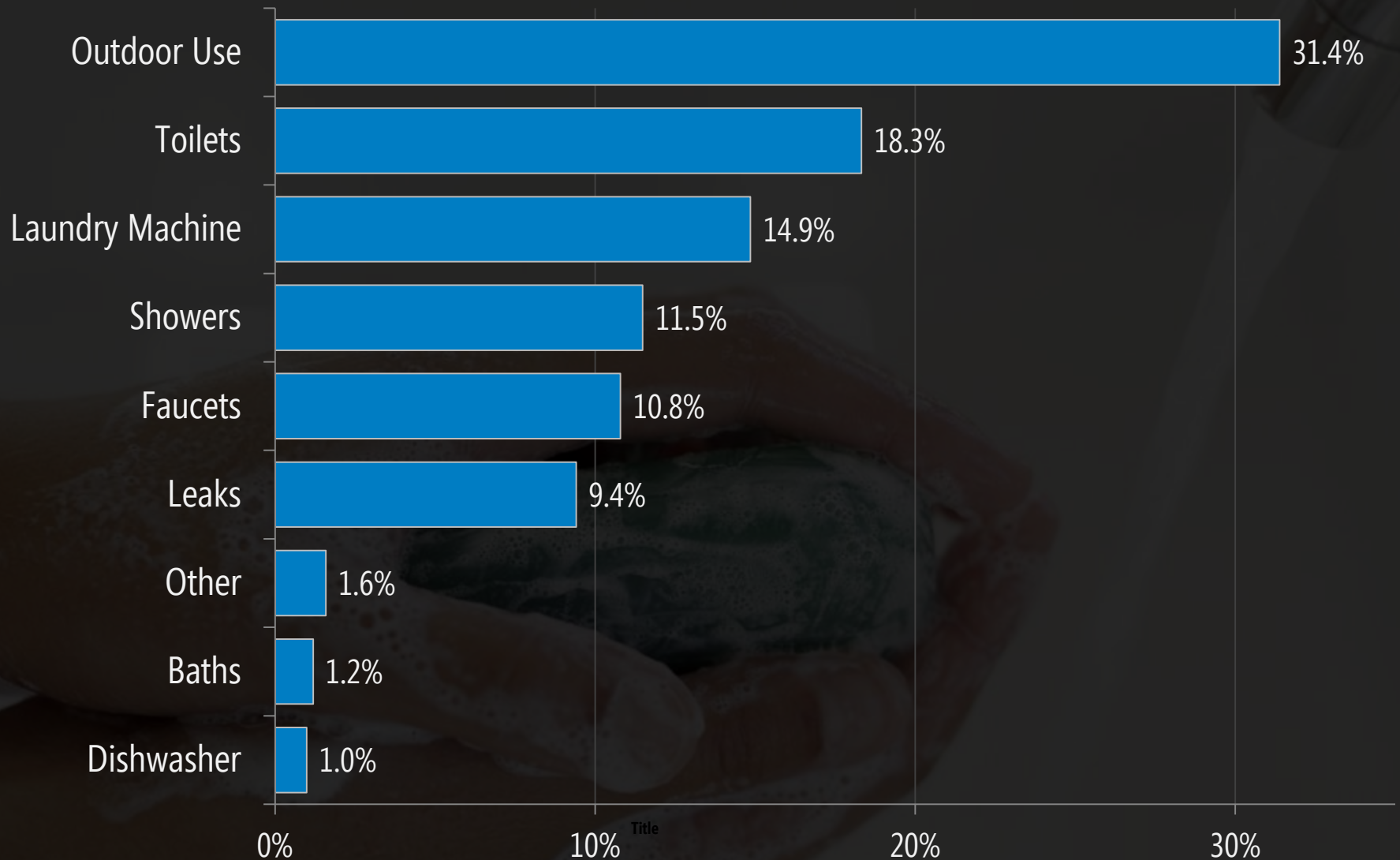
Sustainability

A dark, moody background image showing a hand holding a bar of soap, with a pen resting on the soap. The lighting is soft, highlighting the textures of the soap and the hand.

What

are the most **water** consuming
activities in the average North
American home?

Top Water Usage Activities

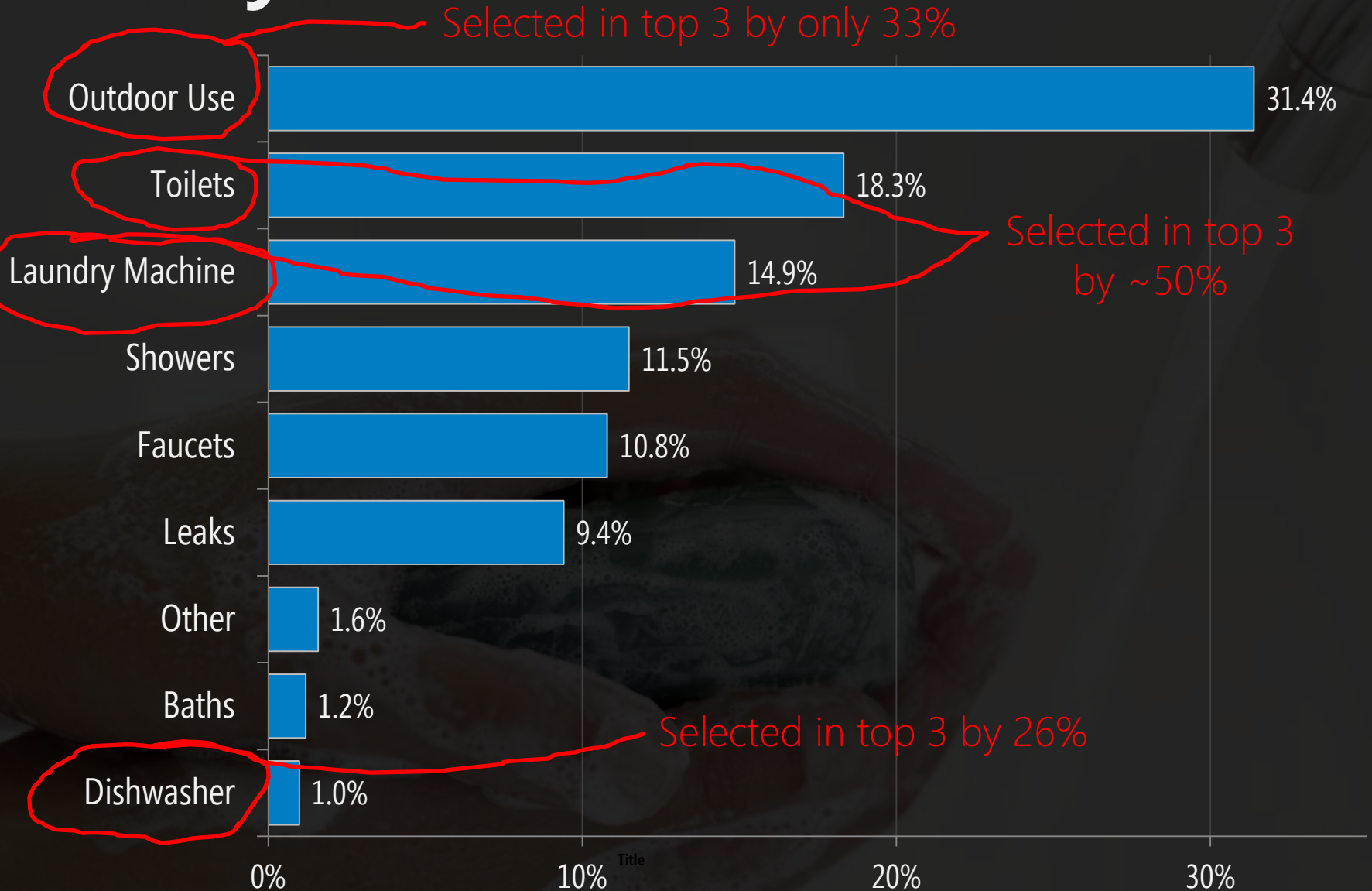


[Vickers, Handbook of Water Use and Conservation, 2001]

we asked **656 people** the same thing

select the top 3 most water consuming
activities in an average home

survey results



[Vickers, Handbook of Water Use and Conservation, 2001]

Traditional water meters measure aggregate consumption

Requires cutting into pipe to install

SERVICES	BILLING PERIOD		DAYS	METER READING			USAGE	USAGE HISTORY	
	From	To		Previous		Present		Last Month	Last Year
Water	2/9/11	3/9/11	31	238400	Actual	238900	500 CF	400 CF	400 CF
Sewer	2/9/11	3/9/11	31	238400	Actual	238900	500 CF	400 CF	400 CF
Sewer Deduct	2/9/11	3/9/11	31	95700	Actual	95700	0 CF	0 CF	0 CF

today's usage

refrigerator
0.3 gallons

dishwasher
6.5 gallons

kitchen sink
28 gallons



today's usage

shower
62.4 gallons

bath
6.5 gallons

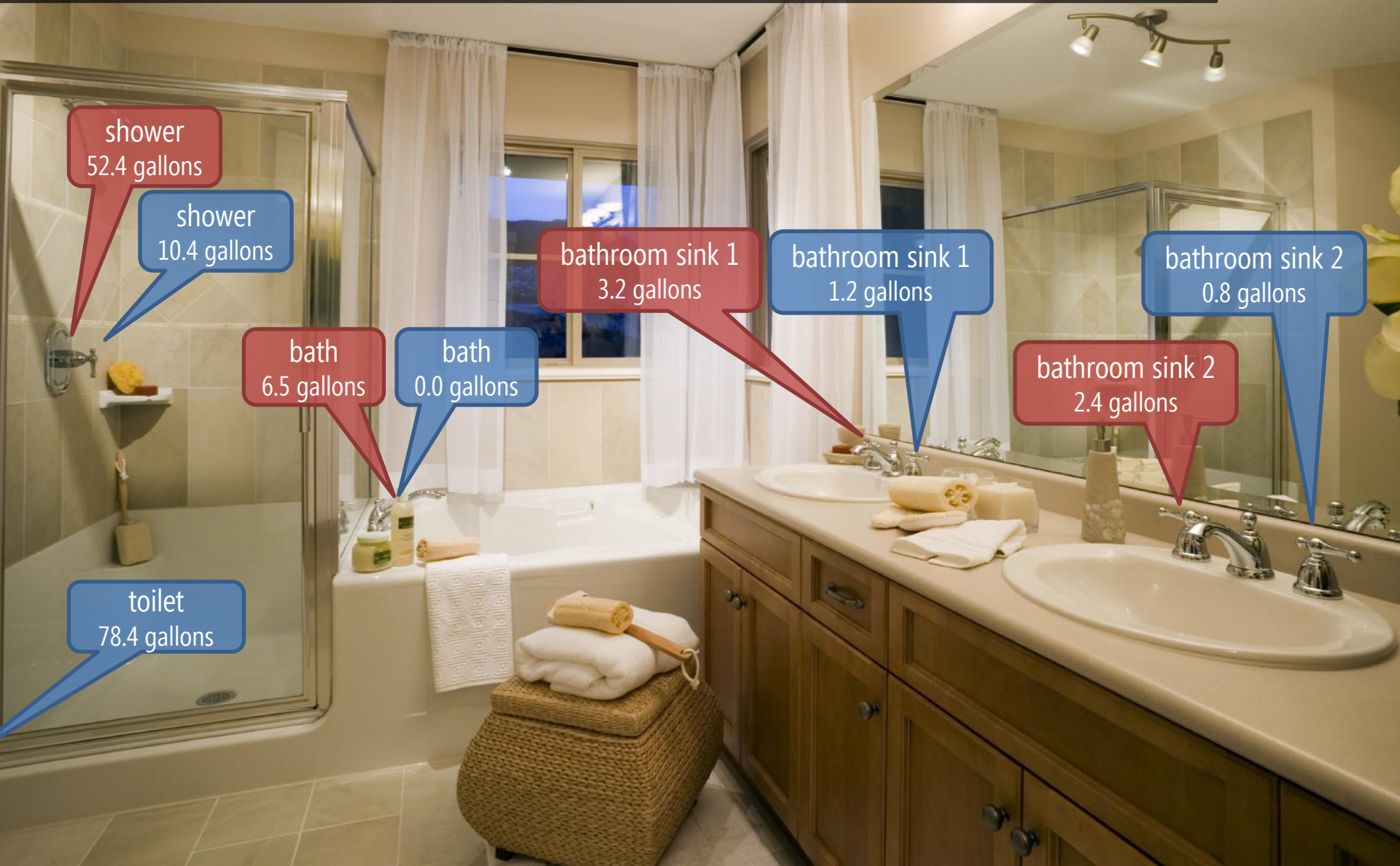
toilet
78.4 gallons

bathroom sink 1
4.2 gallons

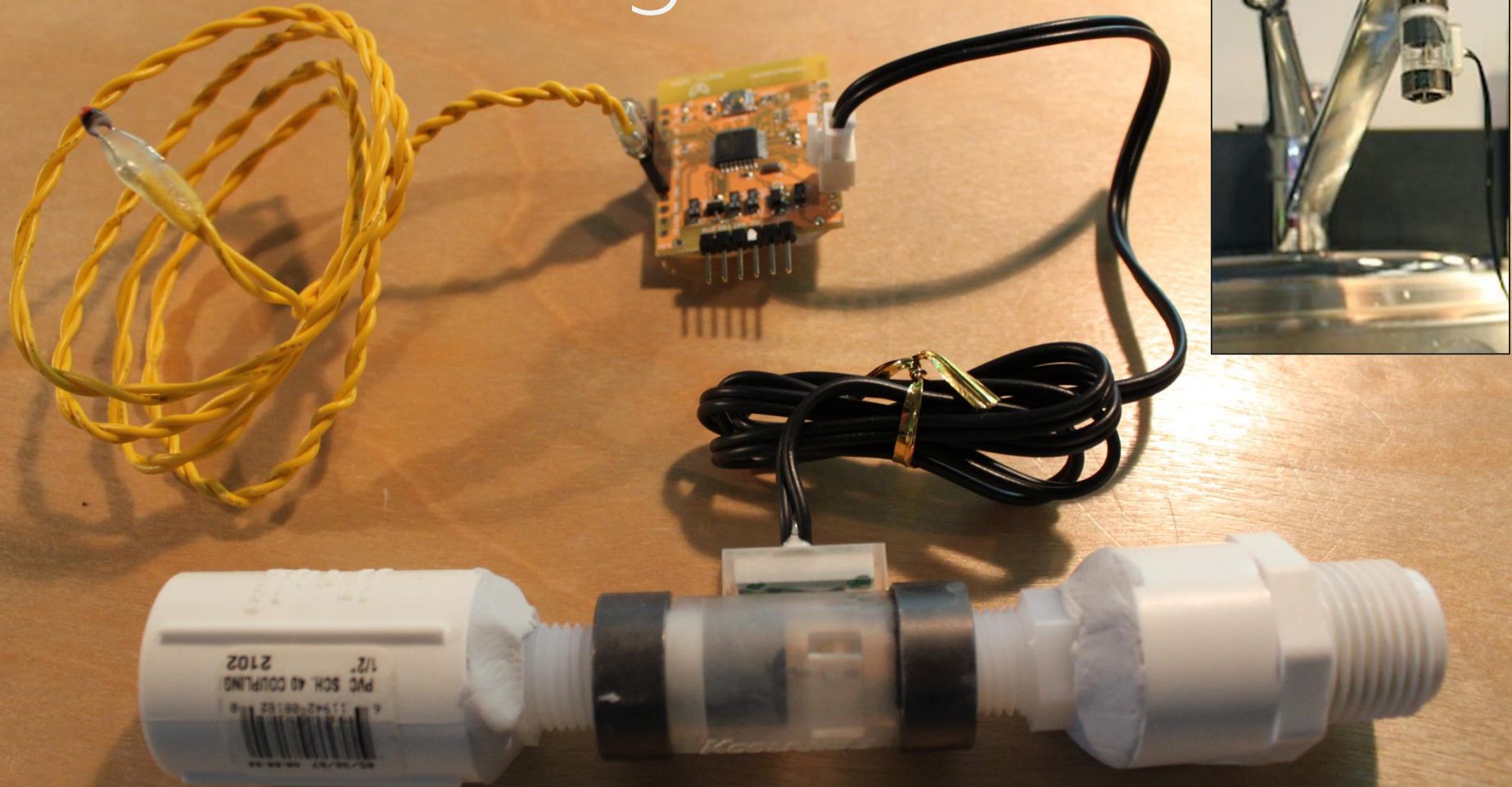
bathroom sink 2
0.8 gallons



today's usage: hot vs. cold



direct sensing



[Teague Labs, Arduino Water Meter, <http://labs.teague.com/?p=722>]

direct sensing

shower
62.4 gallons

bath
6.5 gallons

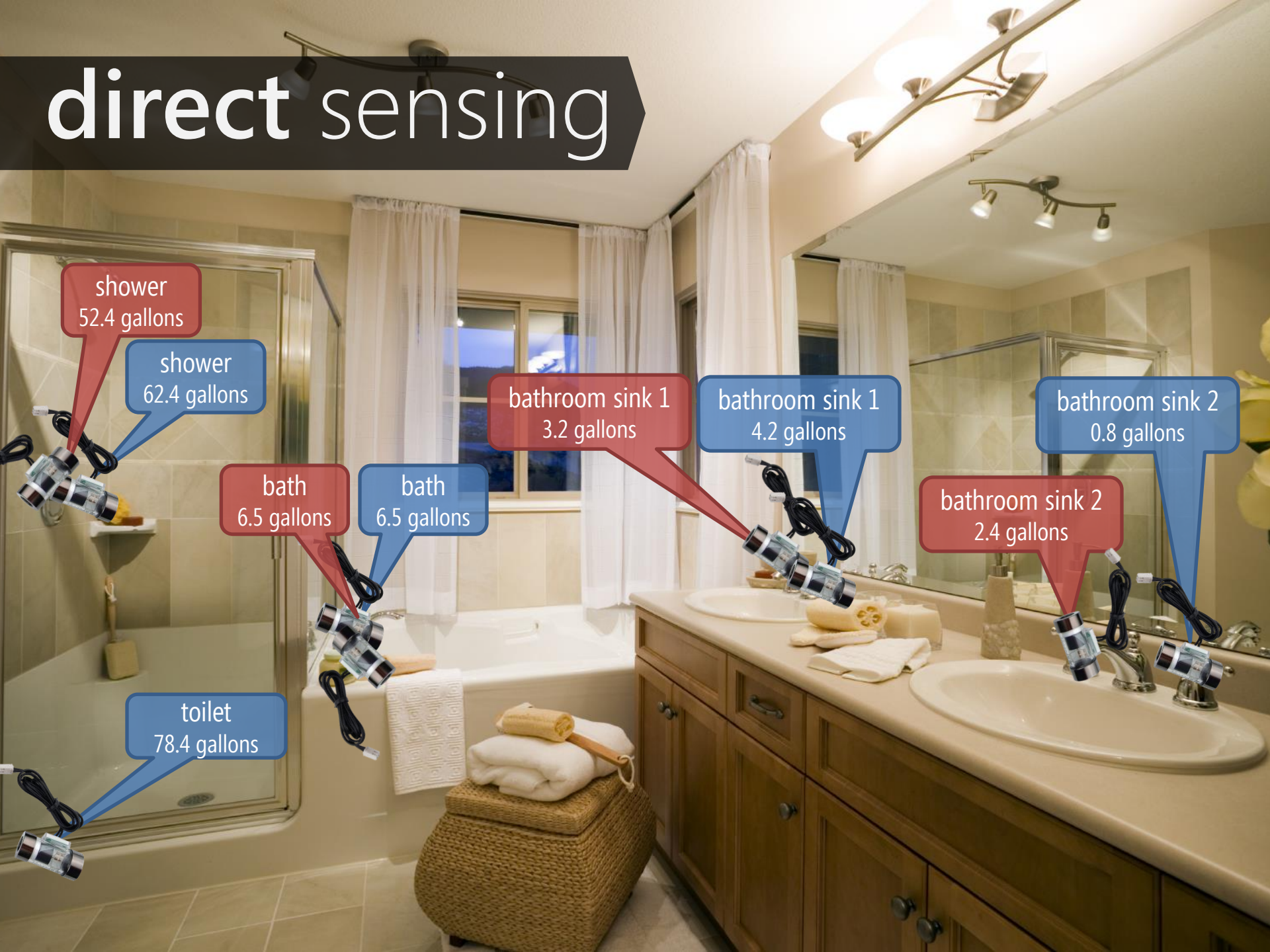
toilet
78.4 gallons

bathroom sink 1
4.2 gallons

bathroom sink 2
0.8 gallons



direct sensing



shower
52.4 gallons

shower
62.4 gallons

bath
6.5 gallons

bath
6.5 gallons

toilet
78.4 gallons

bathroom sink 1
3.2 gallons

bathroom sink 1
4.2 gallons

bathroom sink 2
2.4 gallons

bathroom sink 2
0.8 gallons

scalable
fixture-level sensing
easy-to-install
easy-to-maintain
low-cost

hydrosense

single, screw-on sensor
identifies fixture usage
estimates flow

P1600-100
Range: 0 to 100 psi
Black = Cold Red = Hot
White = Off
Serial # 8037 630928
Slope = 25.0 Q/Wall = 1

brief plumbing primer





water tower

plumbing primer



water tower

plumbing primer

incoming cold
water from
supply line





water tower

pressure regulator

incoming cold
water from
supply line



utility water
meter



pressure
regulator



water tower

plumbing layout

incoming cold
water from
supply line



utility water
meter

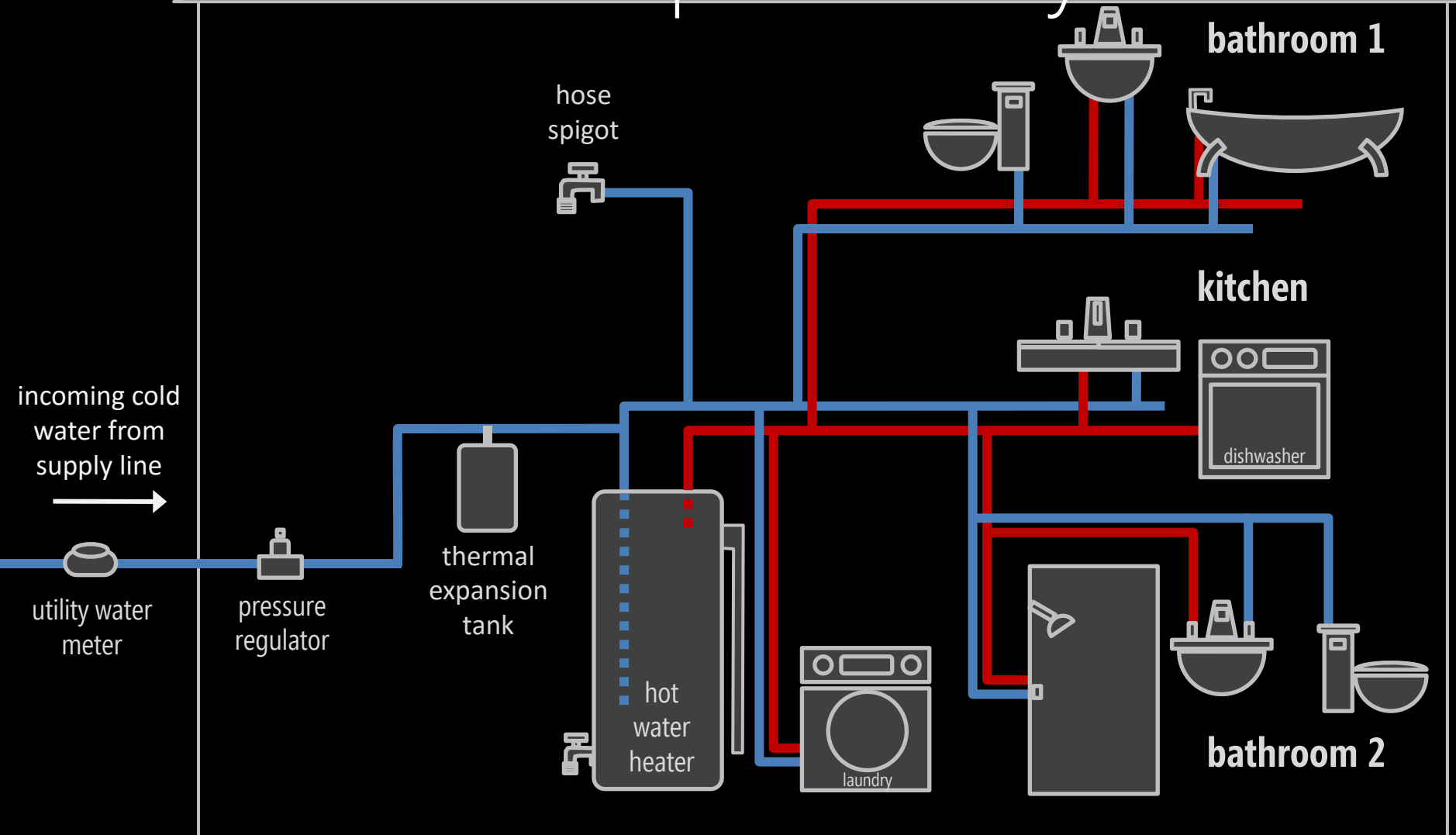


pressure
regulator



water tower

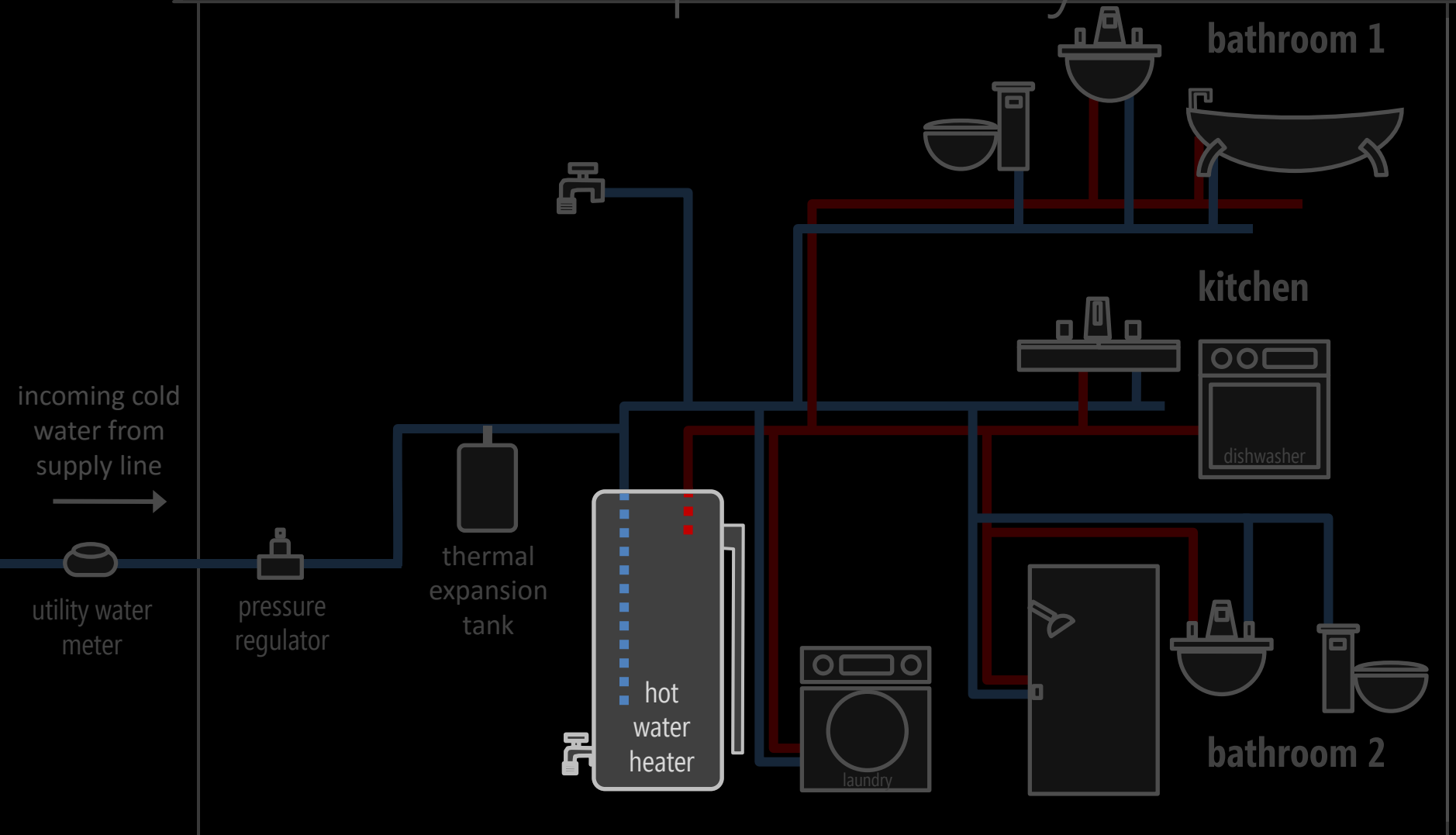
closed pressure system





water tower

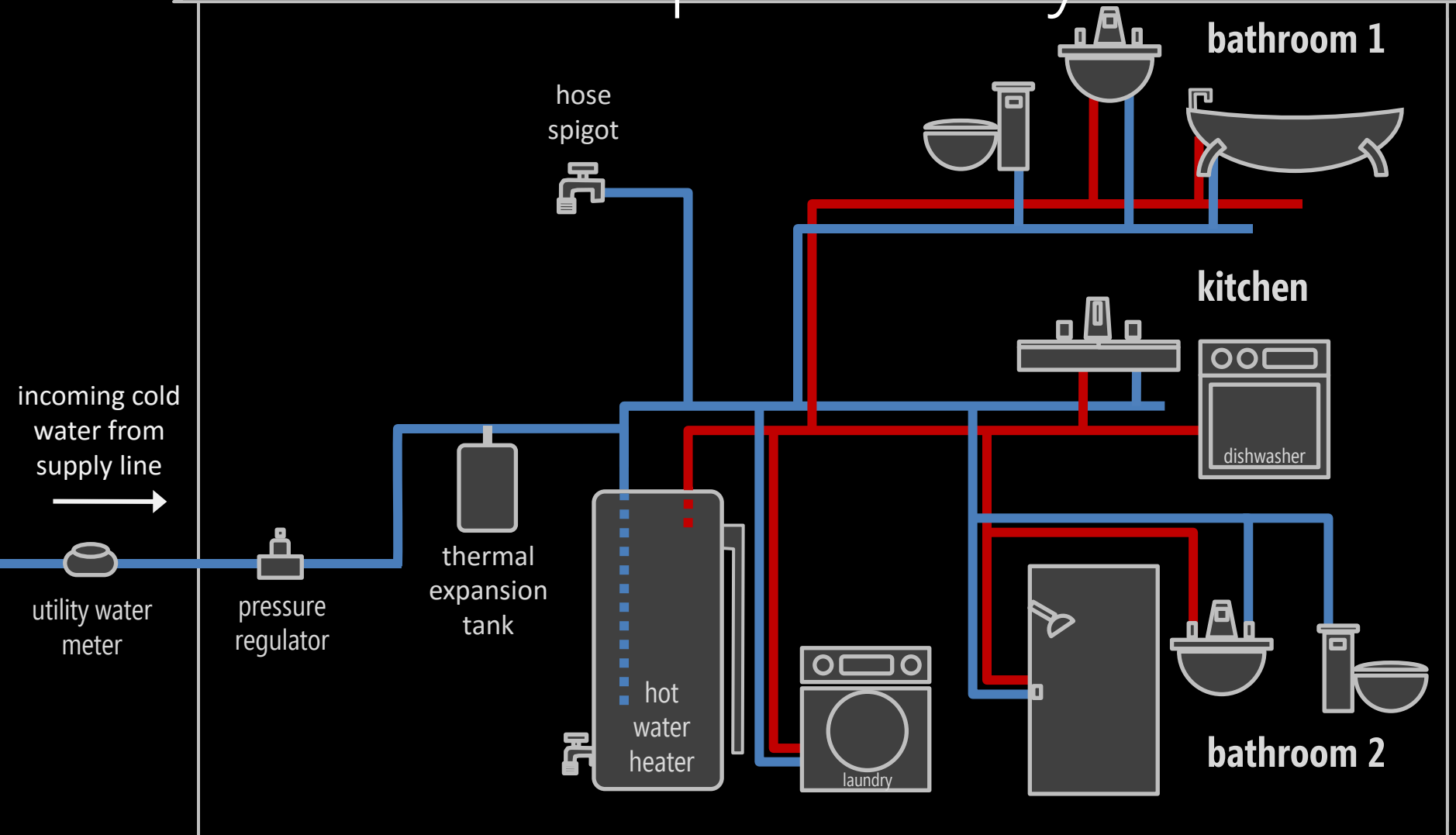
closed pressure system

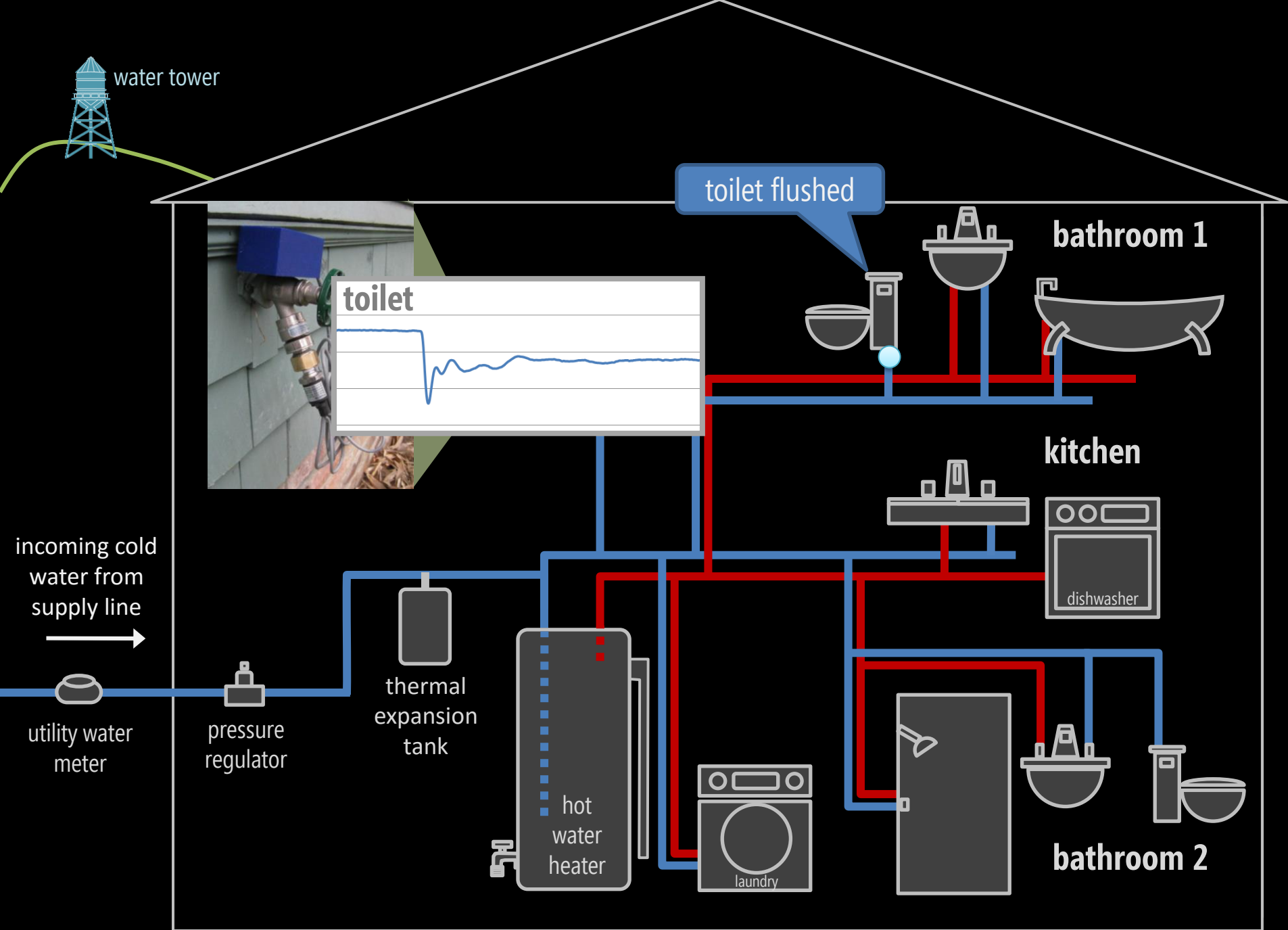


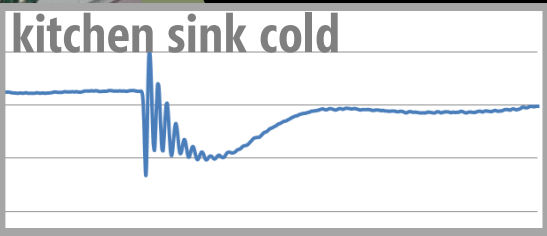
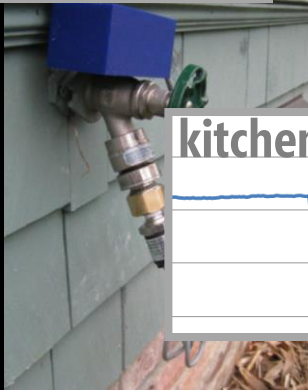
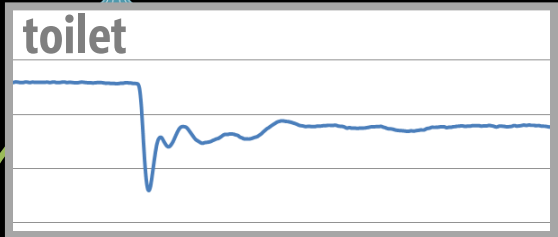


water tower

closed pressure system







incoming cold
water from
supply line



utility water
meter

pressure
regulator

thermal
expansion
tank

hot
water
heater

laundry

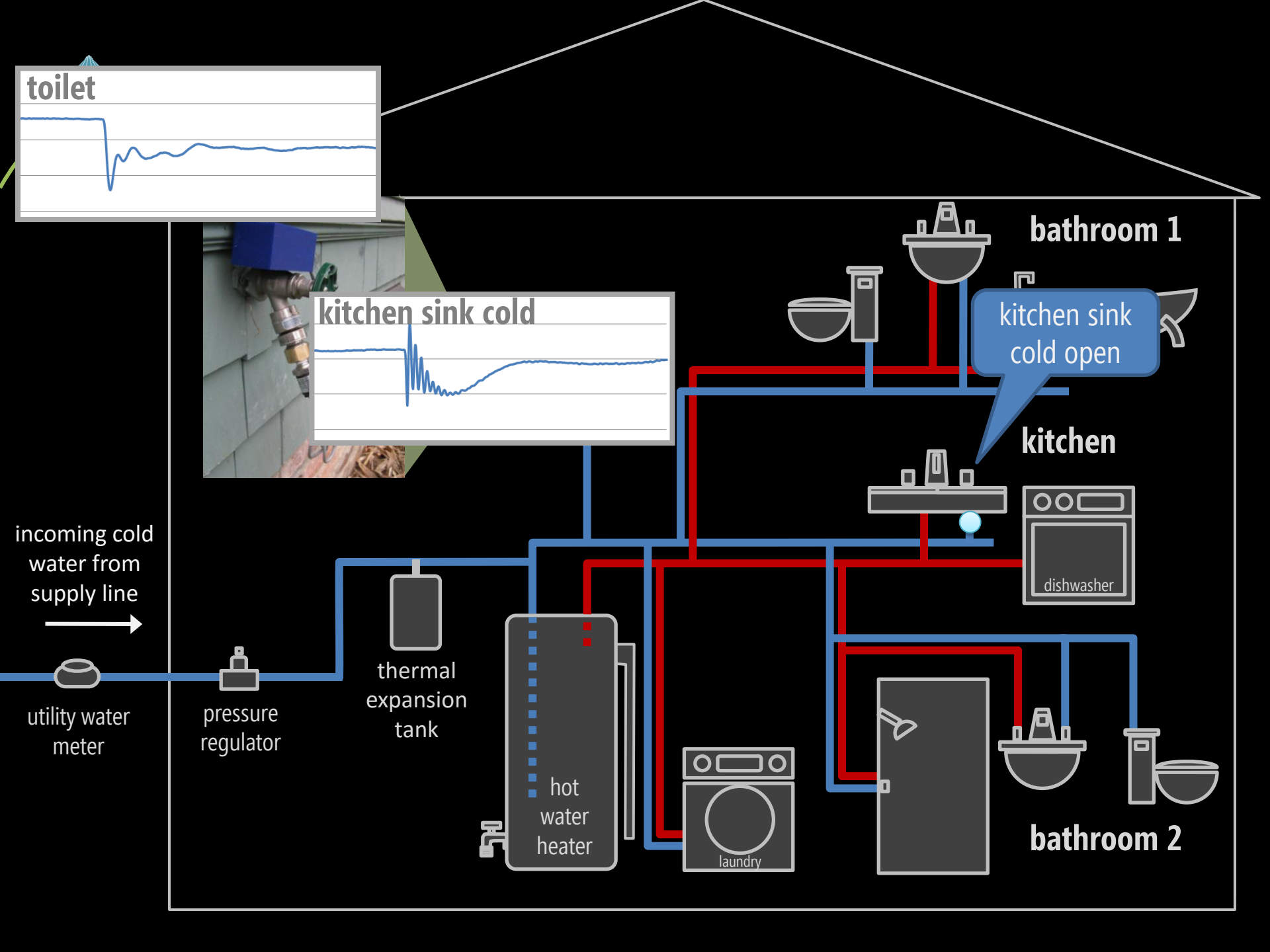
kitchen

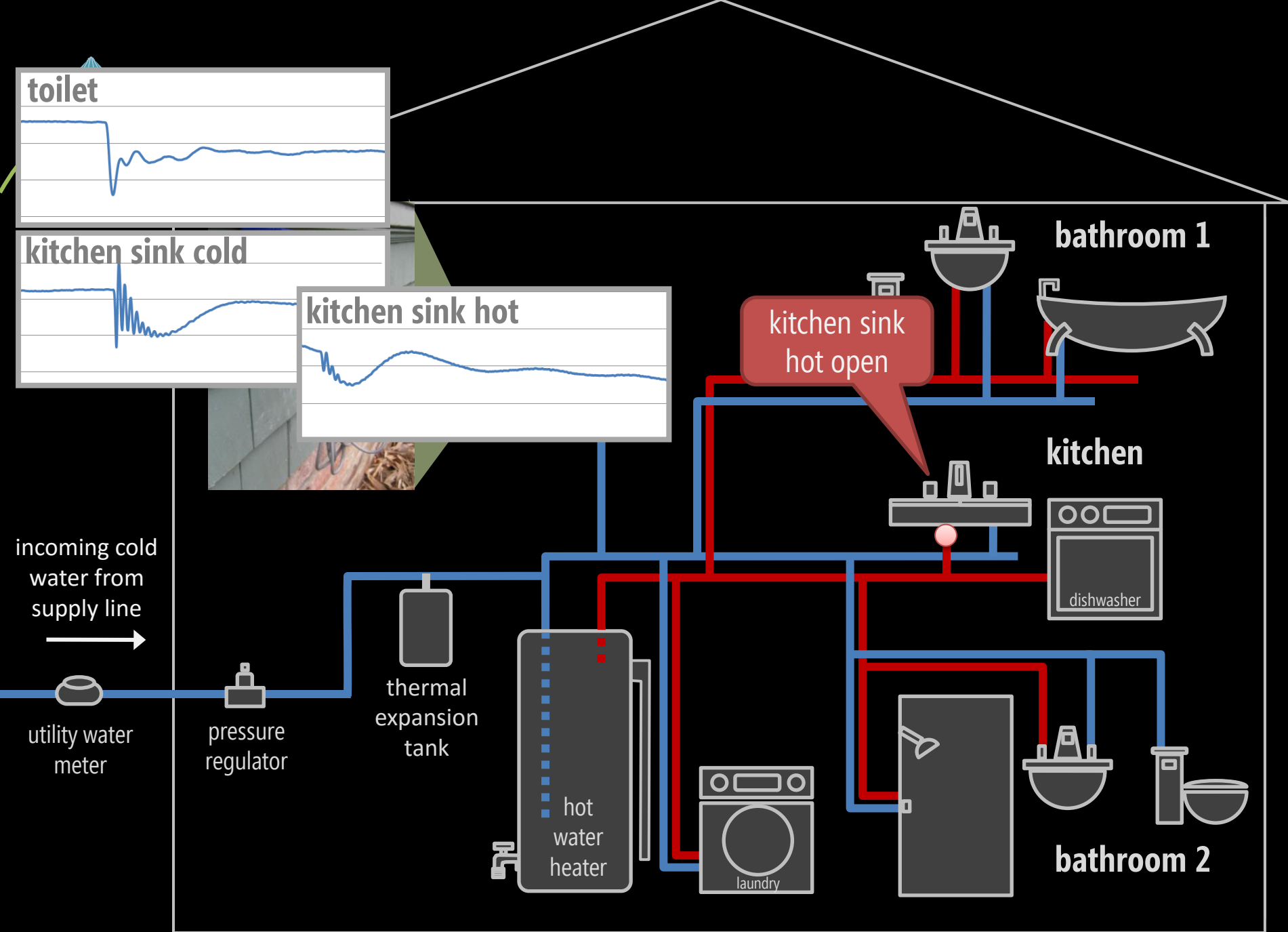
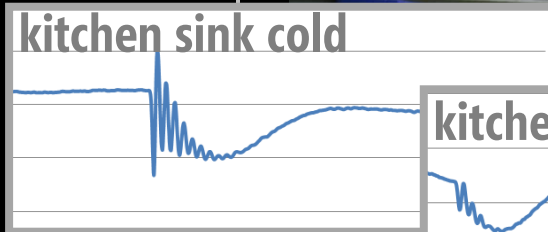
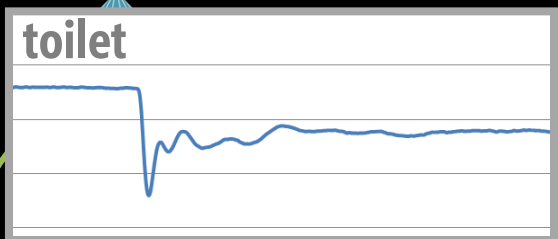
dishwasher

kitchen sink
cold open

bathroom 1

bathroom 2





what do you do with that data?

Real-time Water Feedback





time-series day view

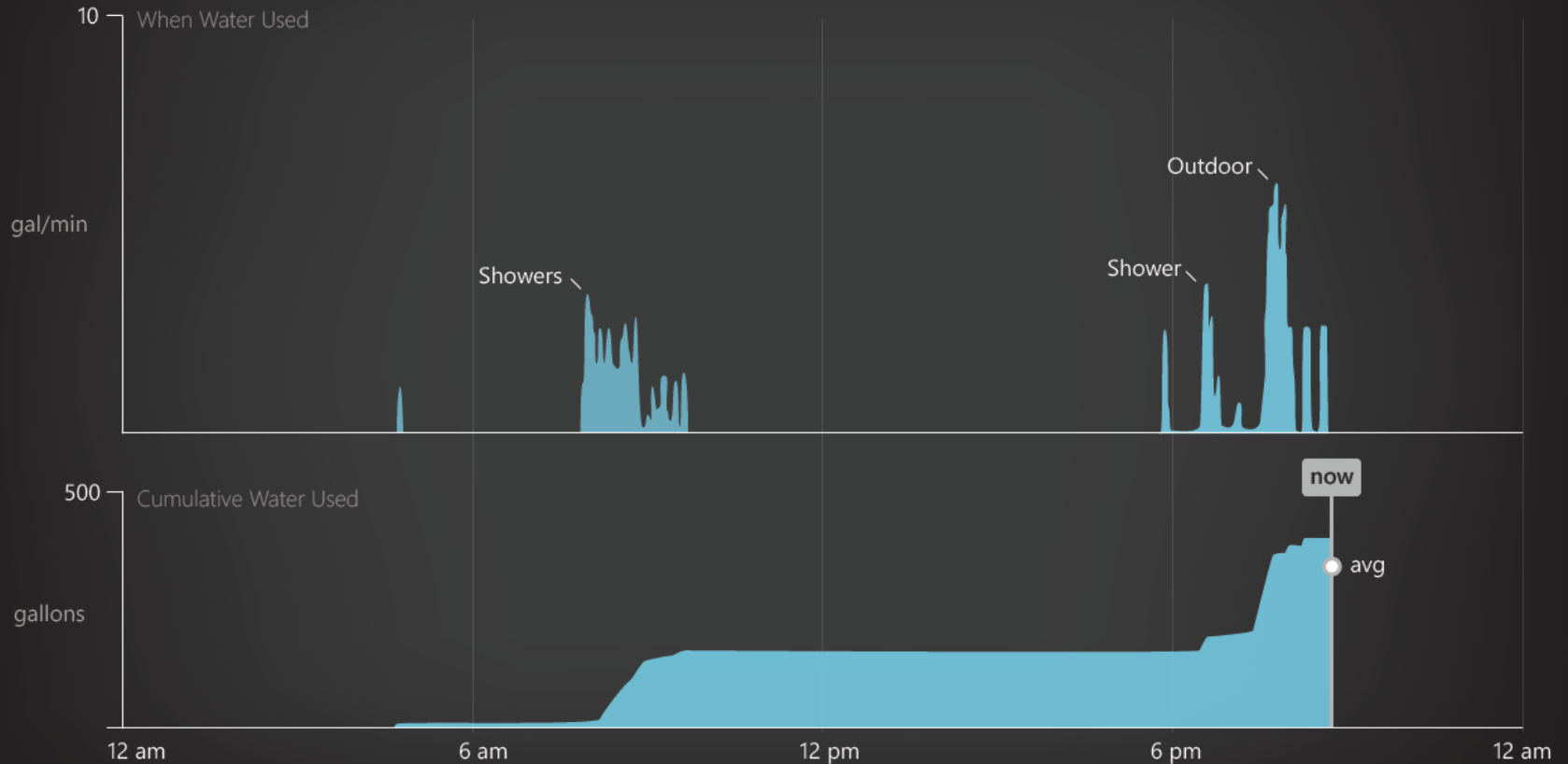
63° 

Friday June 15th | 9:30 PM

352 | 440 gal

Water Usage in Gallons

Today's Usage



spatial view

Today's Water Usage in Gallons

Room View

Friday June 15th | 9:30 PM

Bathroom Total: 81.2 gal



Shower



Toilet



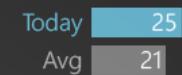
Bathroom Sink



Bath



Kitchen Total: 25 gal



Kitchen Sink



Dishwasher



Laundry Total: 40.6 gal



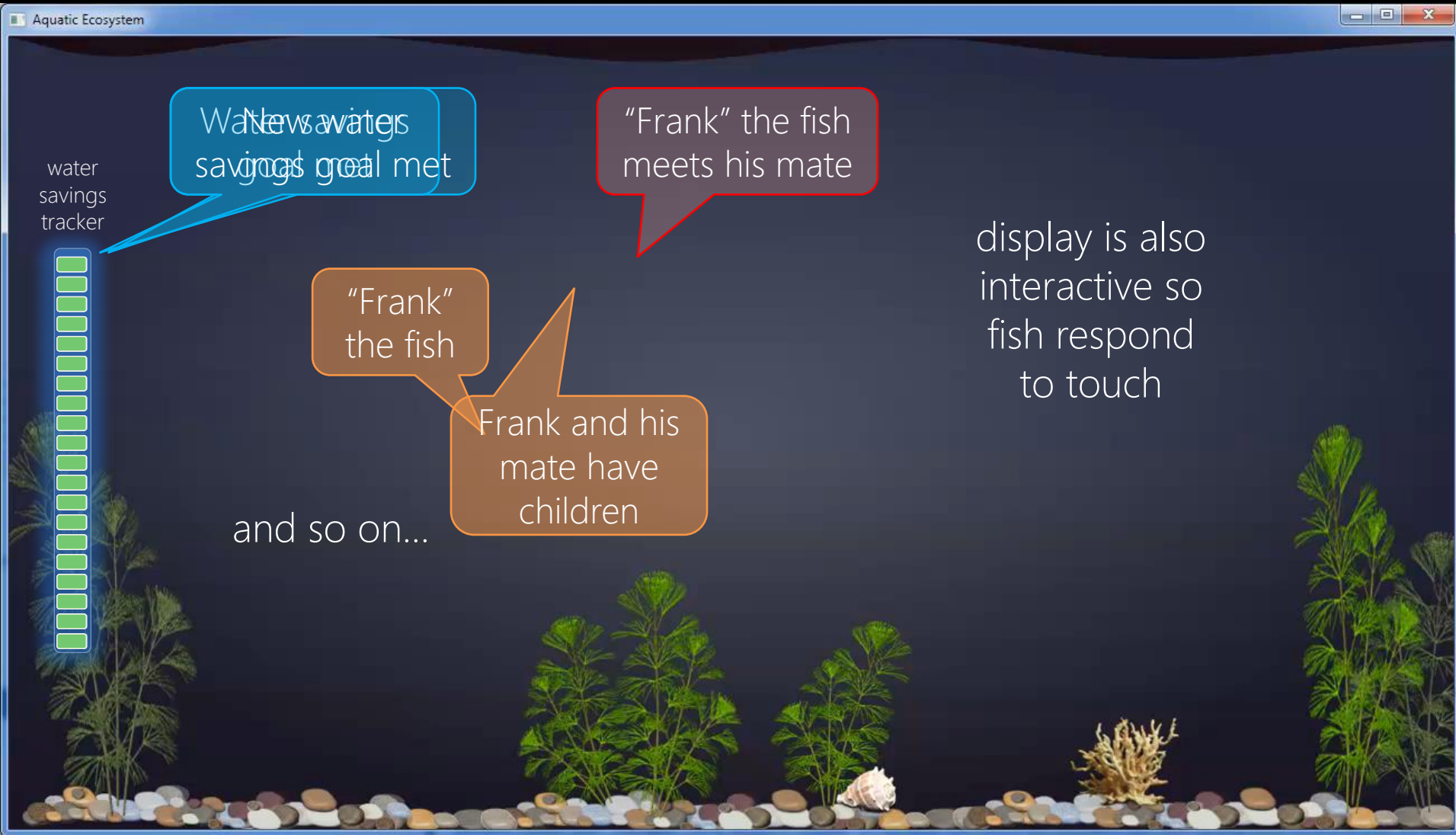
Laundry Machine



Laundry Sink



Aquatic Ecosystem: Gamifying Water Savings



time-series day view

Today's Real-Time Water Usage

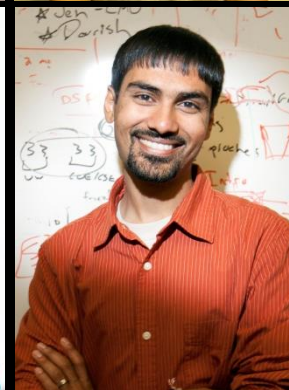
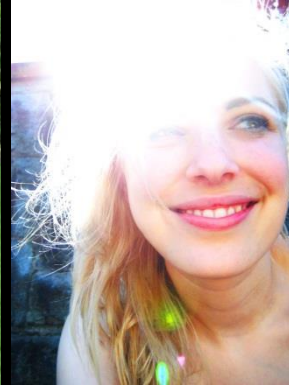
Fixture Category View

Friday June 15th | 9:30 PM



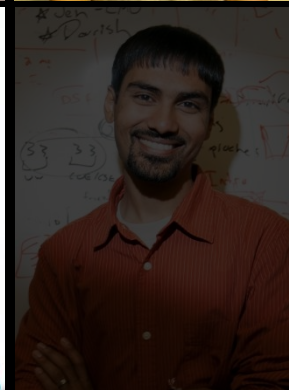
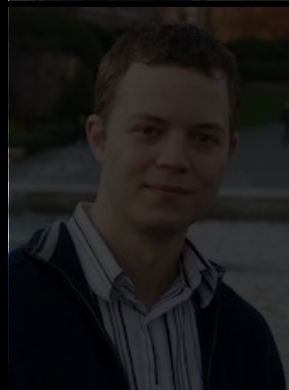
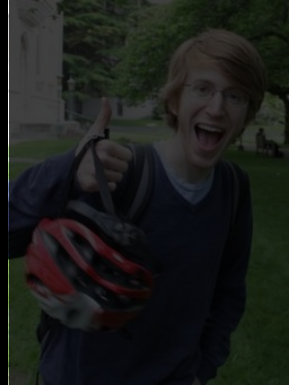
my collaborators

first row:
all undergrads
↘



female
my collaborators

first row:
all undergrads



6/10 collaborators were female

Topic 2

Accessibility

Target Acquisition Challenges Faced by Motor-Impaired Users

Difficulty gripping

Difficulty holding

Lack of sensation

Tremor

Spasm

Rapid fatigue

Poor coordination

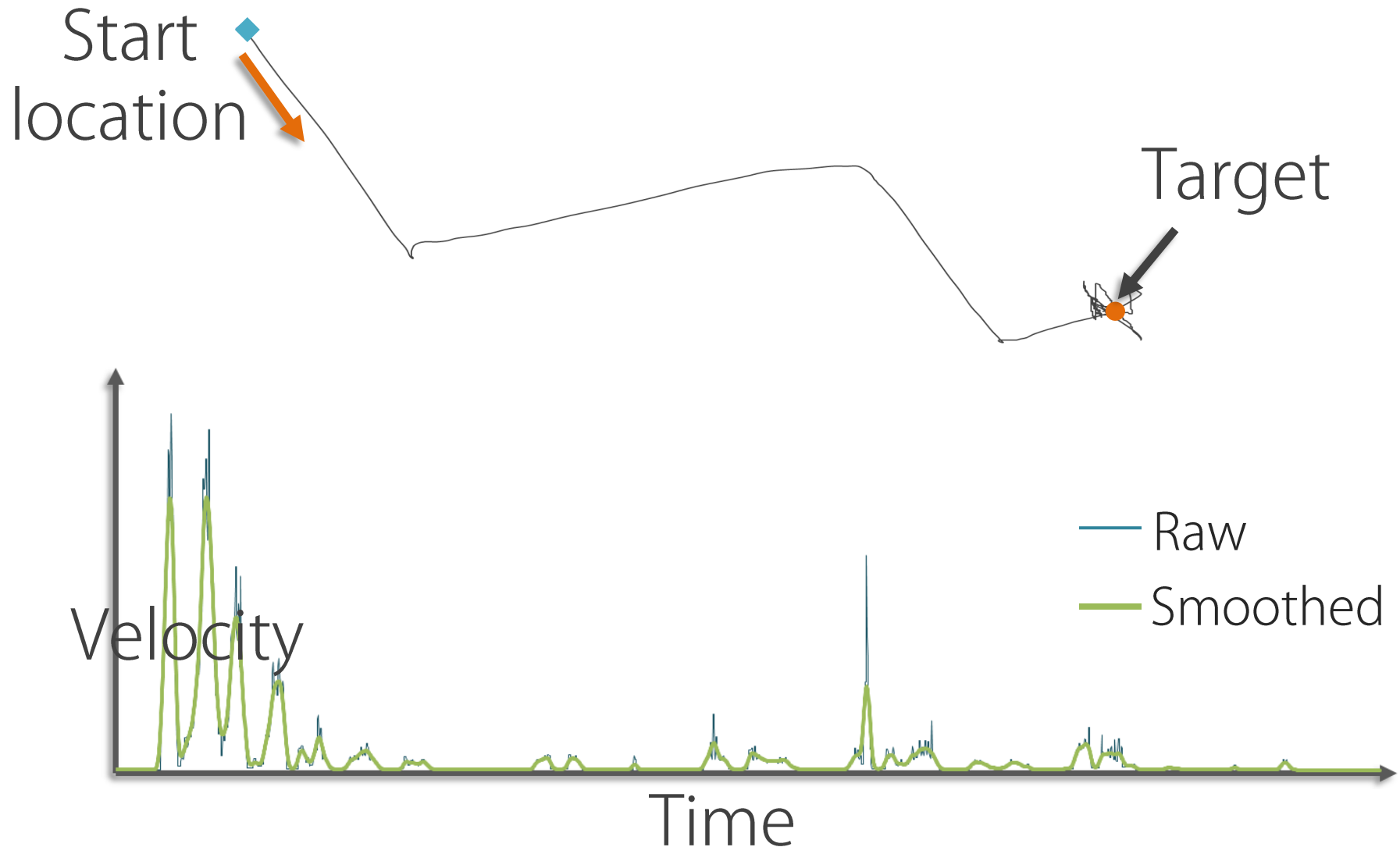
Low strength

Slow movement

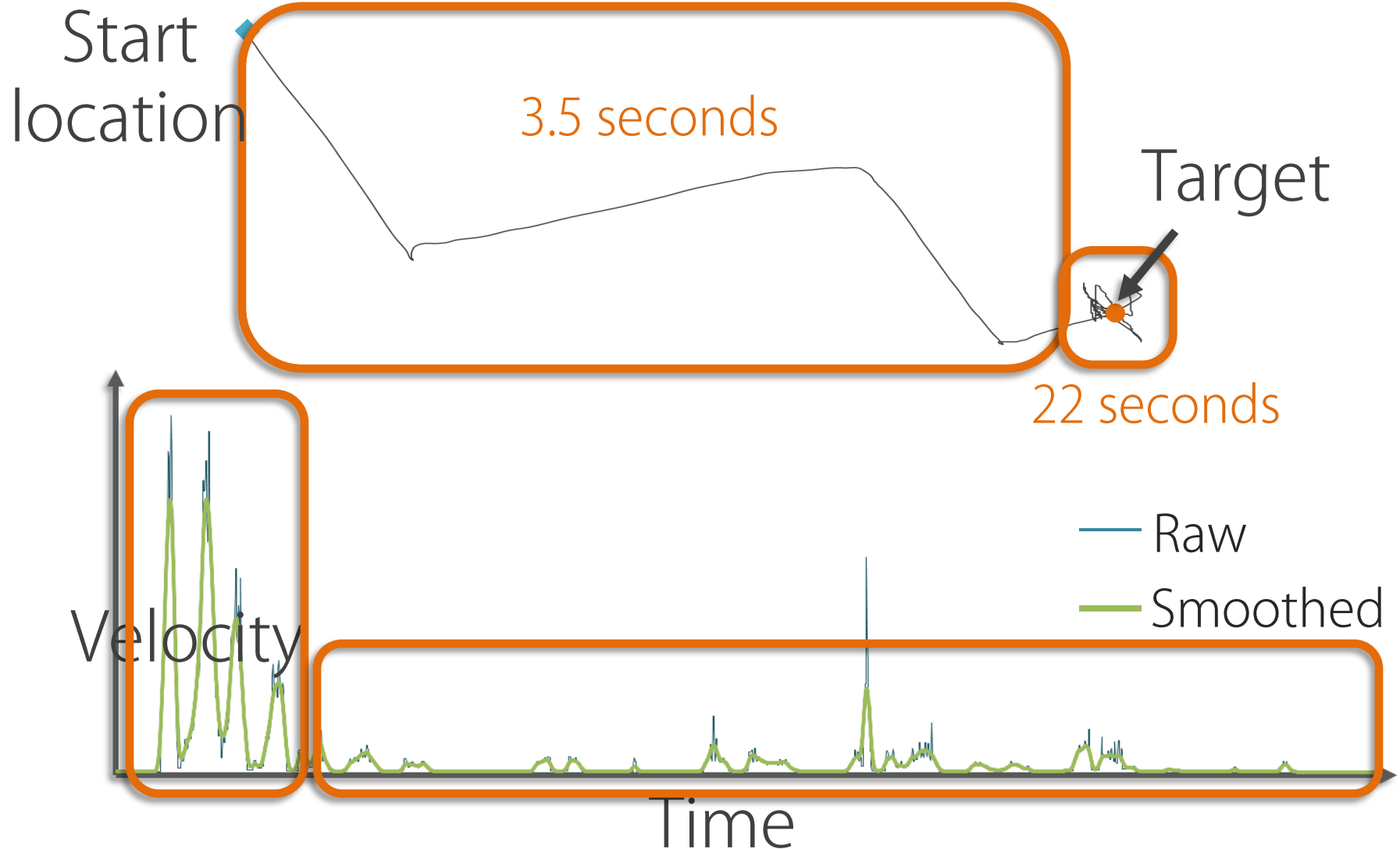




Submovement Analysis

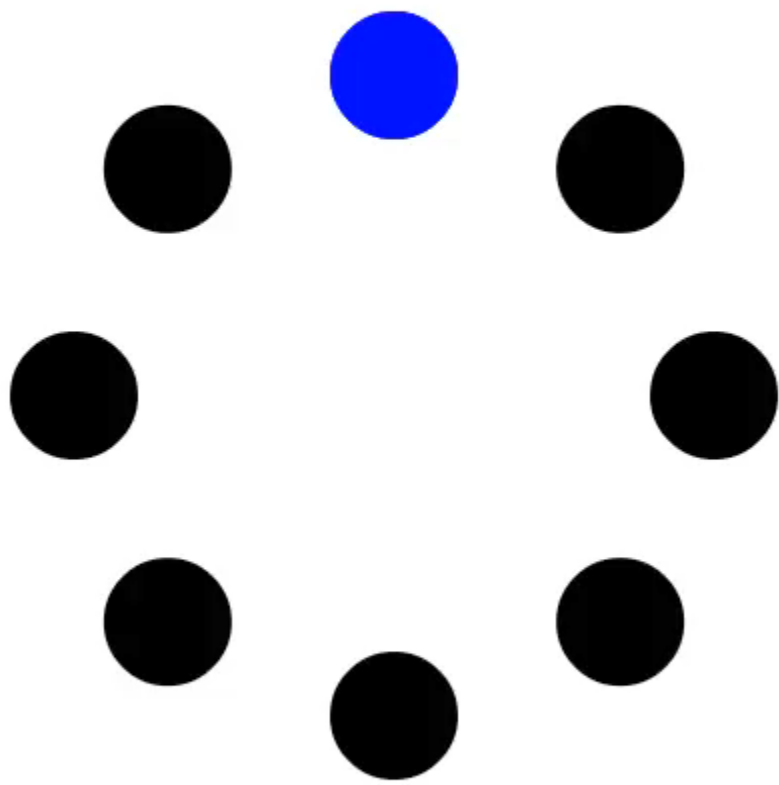


Submovement Analysis



We are currently building an HTML5/Javascript application to scale this research to 100s/1,000s of users across devices (including phones/iPads)

Debugging text on



Current condition = 64 320

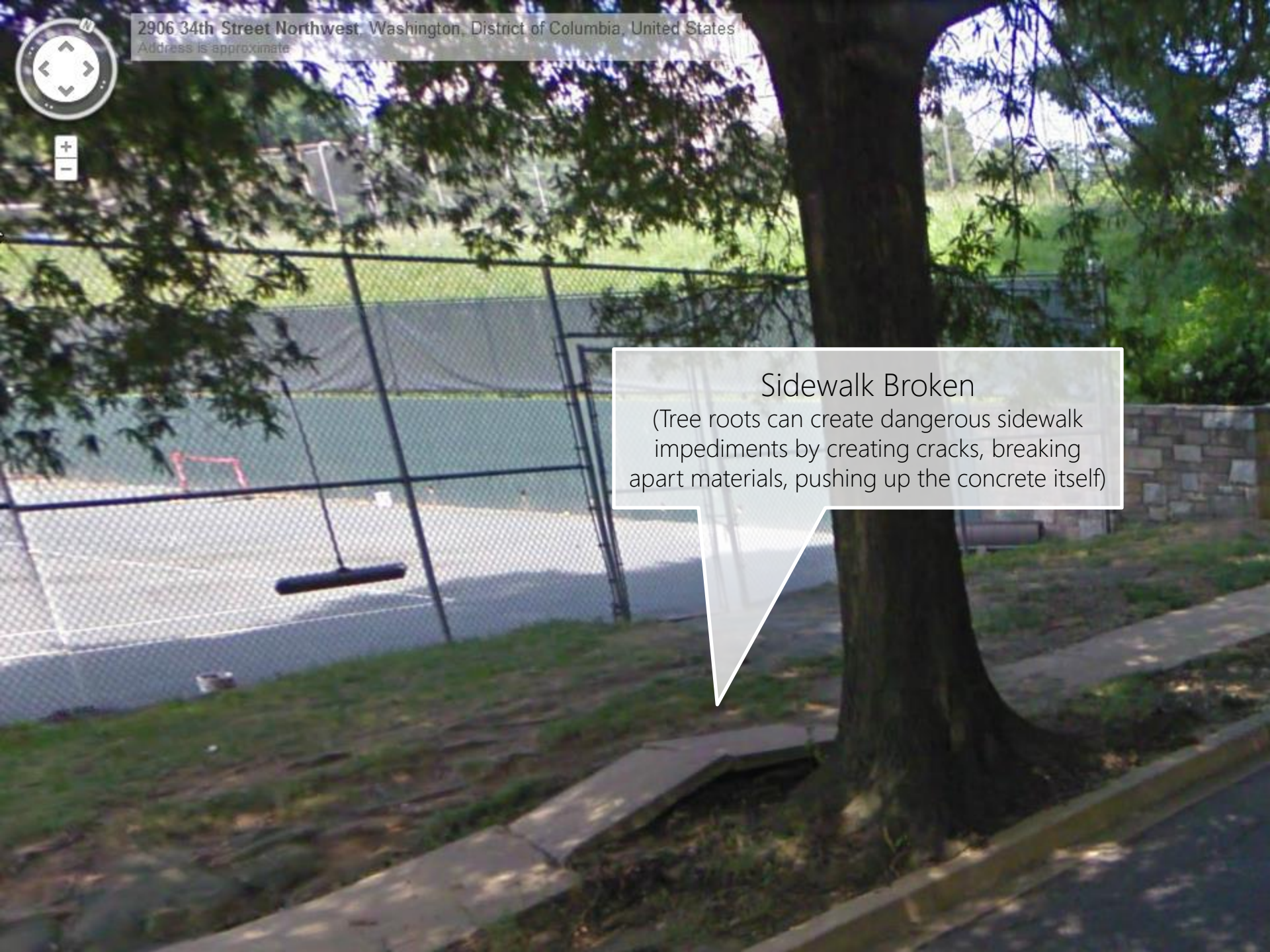
applying computing to solving real-world,
physical accessibility problems





2906 34th Street Northwest Washington, District of Columbia, United States
Address is approximate

Sidewalk Broken
(Tree roots can create dangerous sidewalk impediments by creating cracks, breaking apart materials, pushing up the concrete itself)





No smooth transition
to alleyway



N Woodyear St

Harlem Ave

Temporary
blockage
(garbage in the way)

Overgrown
vegetation



No Curb Cut

Topic 3

Smart Cities





扉にご注意！
かけこみはおやめください





Site search

SEARCH ▶

HOME

DATA ▾

APPS

COMMUNITY

METRICS

OPEN DATA SITES

GALLERY

WHAT'S NEW

FEDERAL DATA CENTER CONSOLIDATION

List of Federal Data Centers shut down by end of 2011 as a result of the Federal Data Center Consolidation Initiative

UPDATED

Latest Datasets

- NSF Graduate Research Fellowship Program...
- NSF Graduate Research Fellowship Program...
- NSF Graduate Research Fellowship Program...
- NSF Graduate Research Fellowship Program...
- Science and Engineering Indicators: 2012
- The 2001 Residential Finance Survey - Owners...
- The 2001 Residential Finance Survey - Rental...
- 2010 Federal STEM Education Inventory Data...
- Livestock and Grain Market News Search
- NSF Graduate Research Fellowship Program...

DATA AND APPS



- 390,831 [raw](#) and [geospatial](#) datasets
- 1,231 government [apps](#)
- 236 citizen-developed [apps](#)
- 85 [mobile apps](#)
- 172 [agencies and subagencies](#)
- [Suggest a dataset or app!](#)
- [2011 Next Generation Data.gov](#) is interactive, explorable, and social.

COMMUNITIES



Come explore, discuss, meet others in the same field, and develop the data and apps in the community that you care about. Join in the discussions by going to communities below that interest you.

OPEN DATA

SEMANTICWEB

HEALTH

LAW

ENERGY

OCEAN

EDUCATION

OPEN GOVERNMENT



First open source code released for the Open Government Platform delivered by the governments of India and the U.S. [Find out more](#) and then [download the code](#).

The 2012 International Open Government Data Conference will be held July 10-12 at the World Bank in Washington DC. We hope to see you [there](#).

What's coming up on Data.gov? Check out [our blog](#).







28 DAYS LATER

THE QUARANTINE

ARTEDGECREATIVE
[HTTP://ARTEDGE.COM.UA](http://artedge.com.ua)

bicing in barcelona, spain



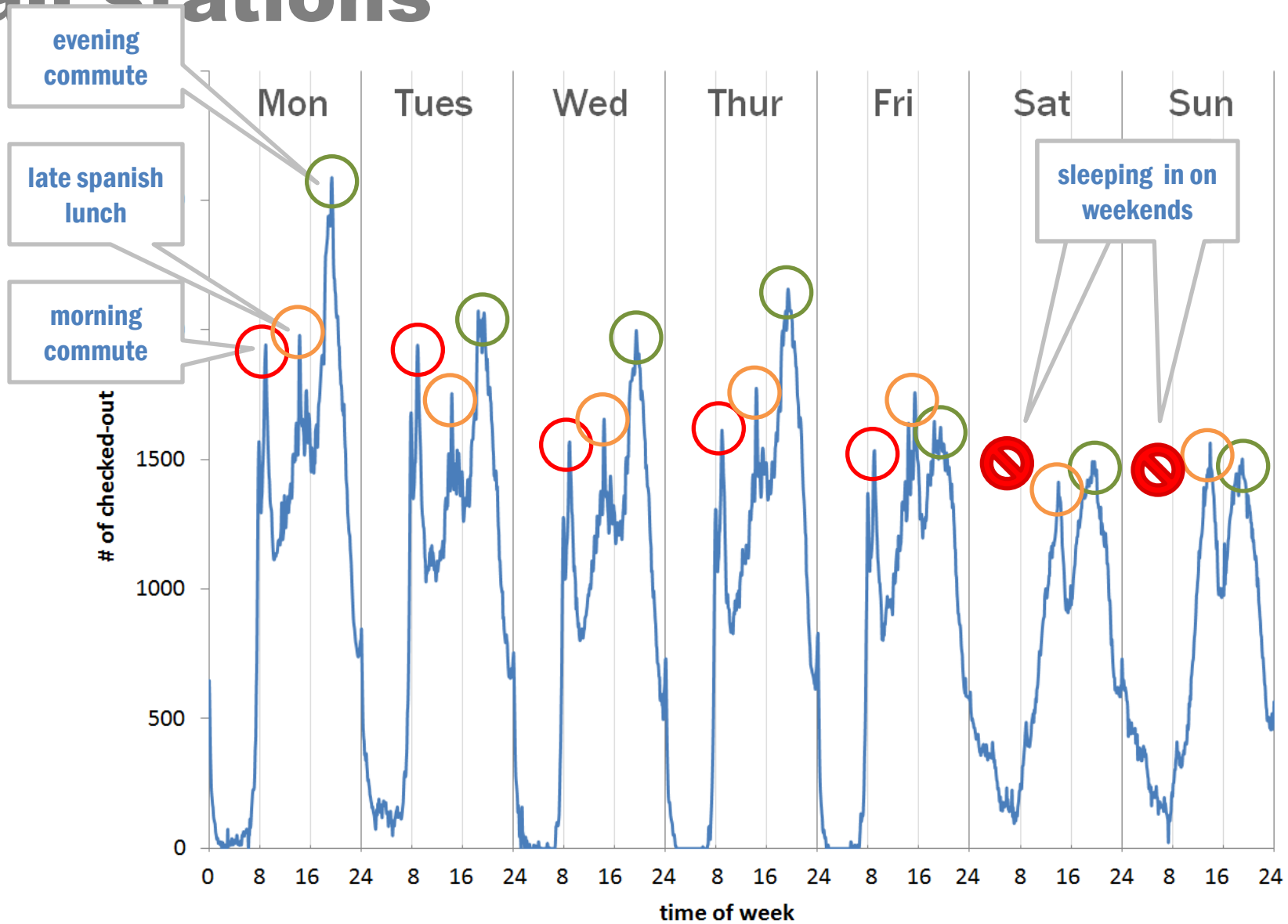
launched march 2007

by summer 2008:

- 373 stations
- 6,000 bicycles
- 150,000 subscribers

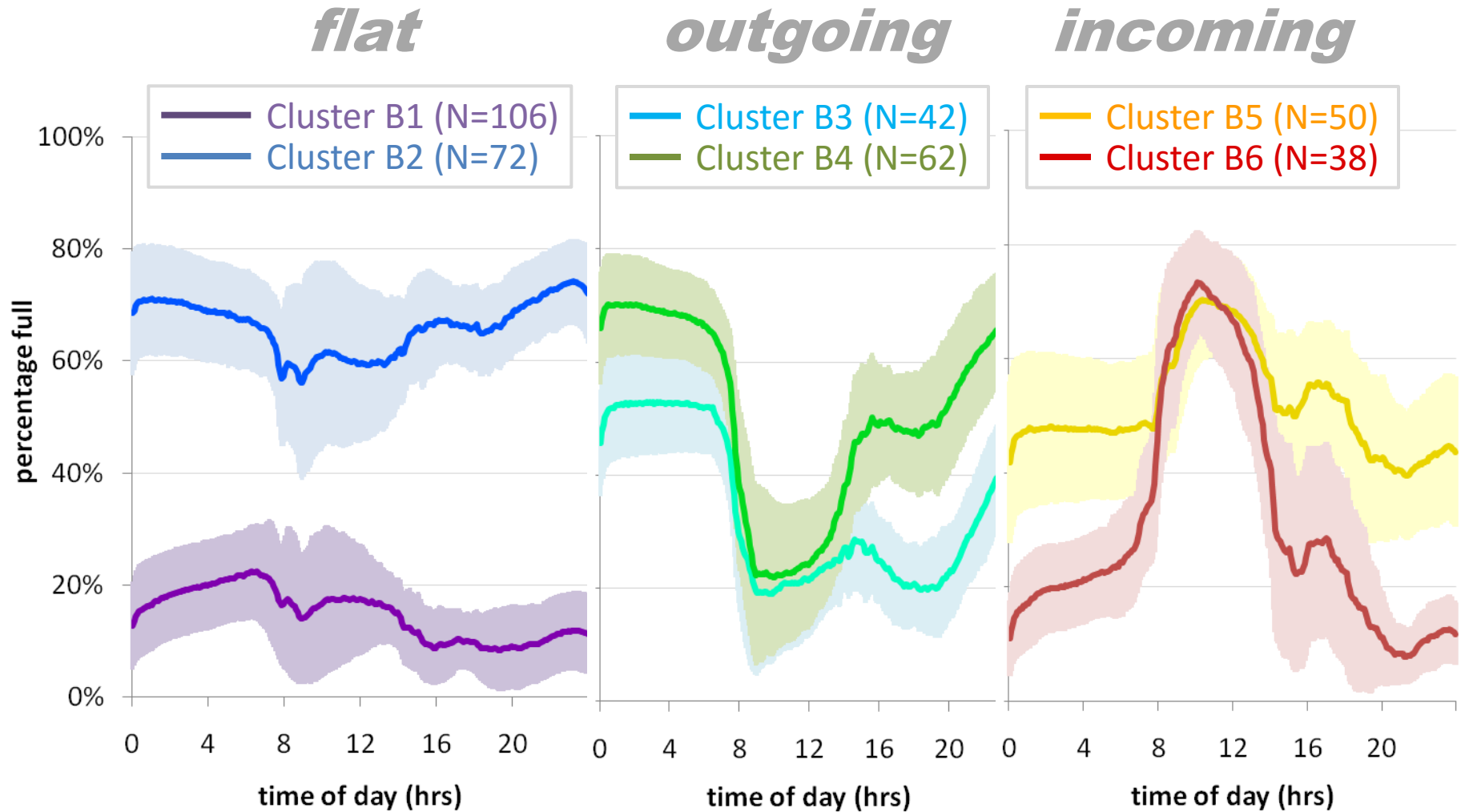


num checked-out bicycles across all stations



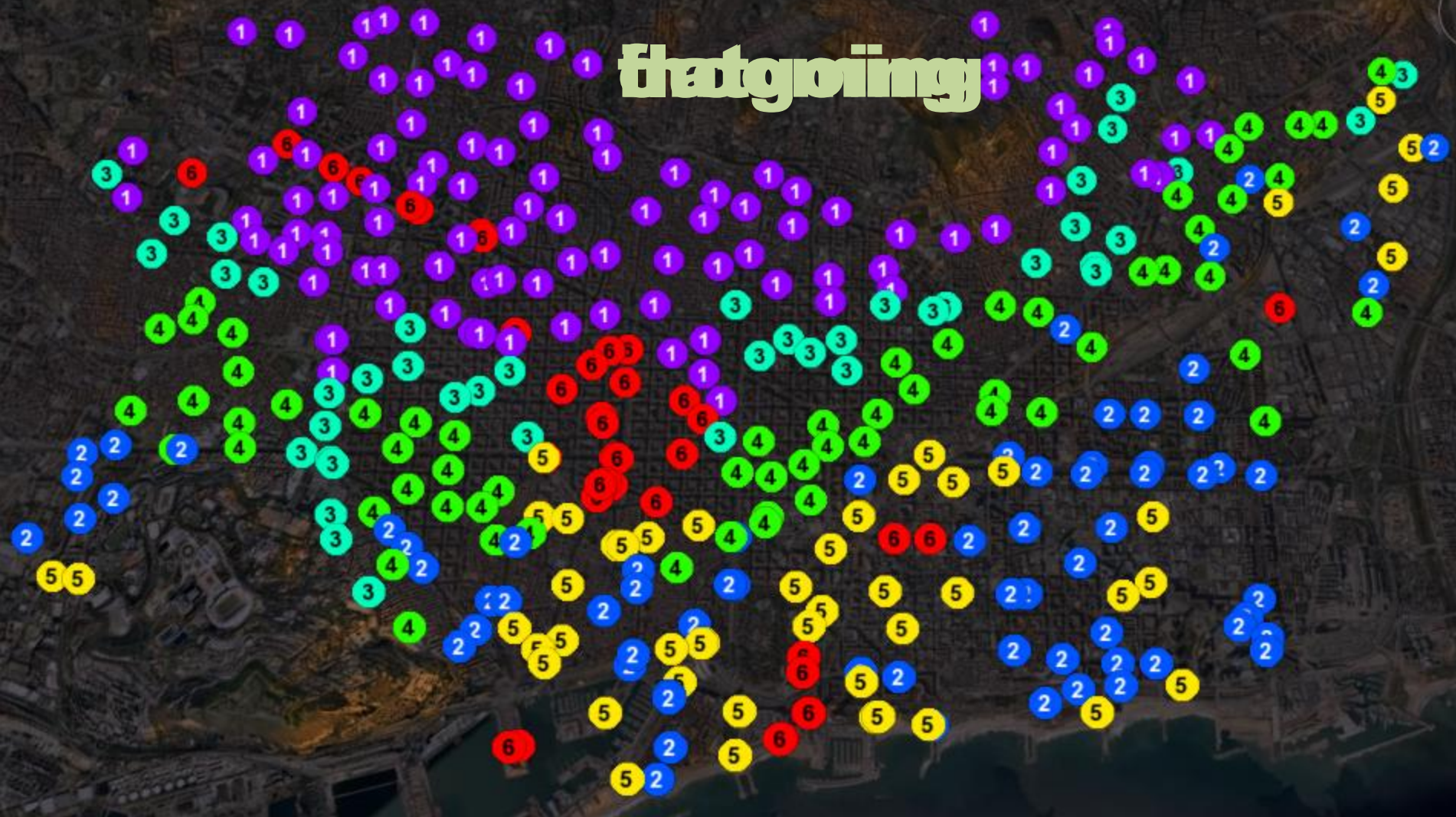
**how are
bicing patterns shared
across stations and
distributed in the city?**

avail. bicycle clusters



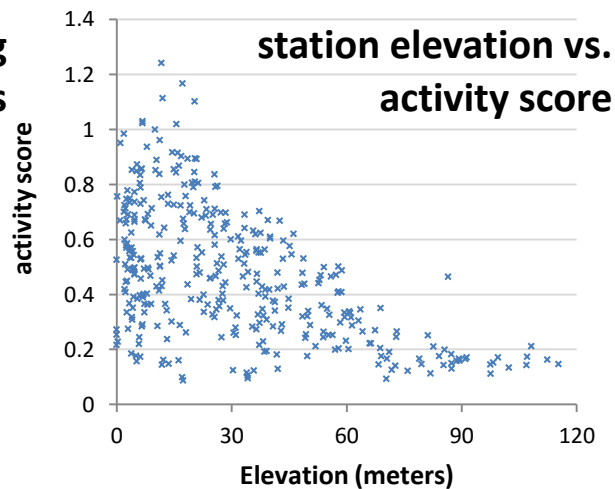
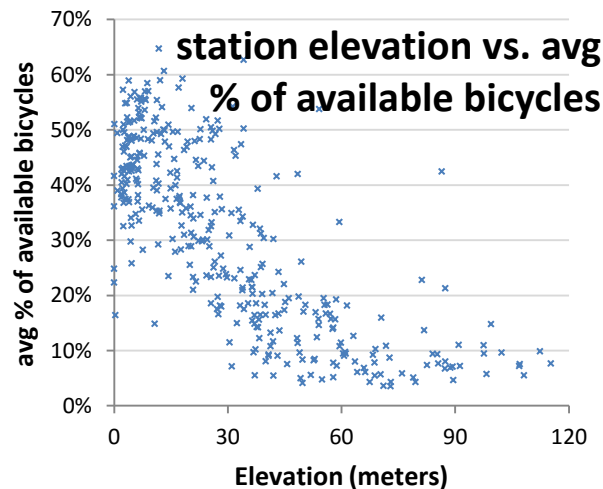
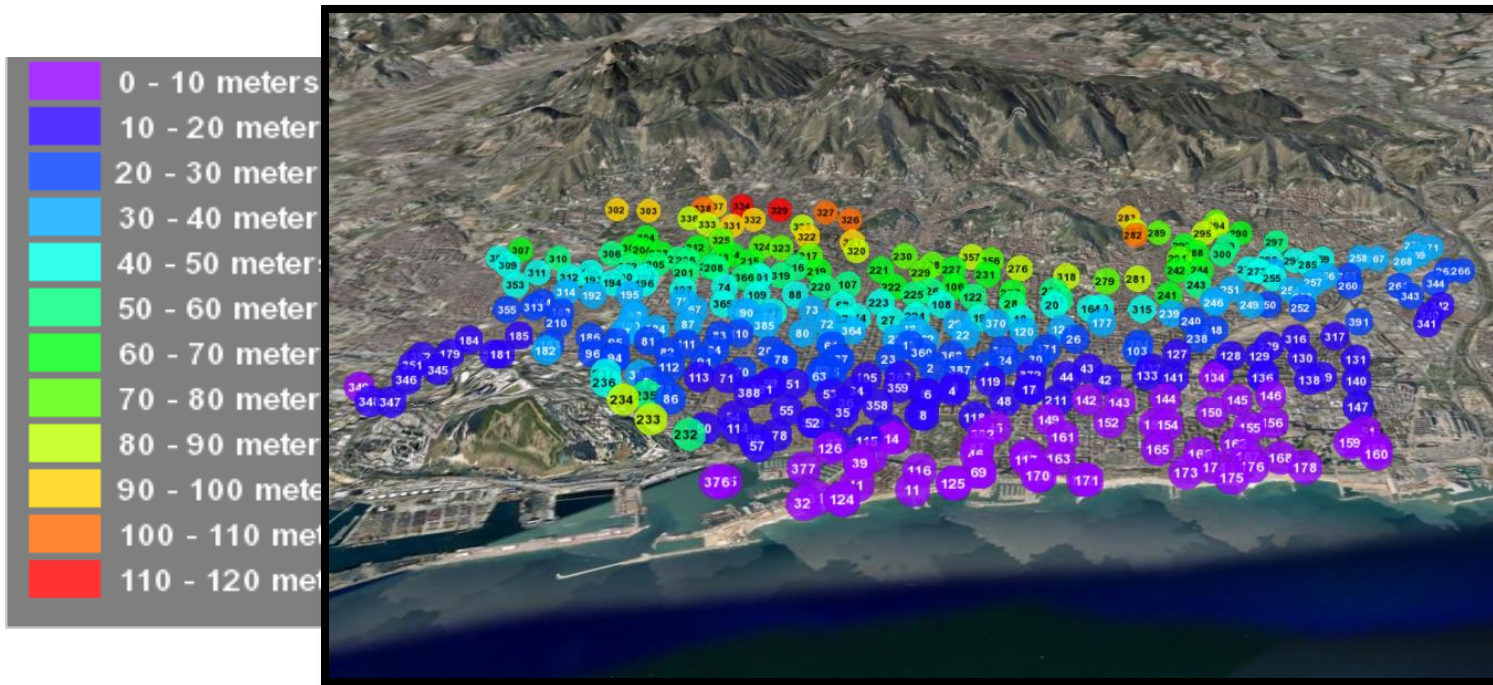


thatology



2683 m

biases of human behavior



other transit sources



currently logging 11 cities across the world including

montreal

London

washington dc

paris

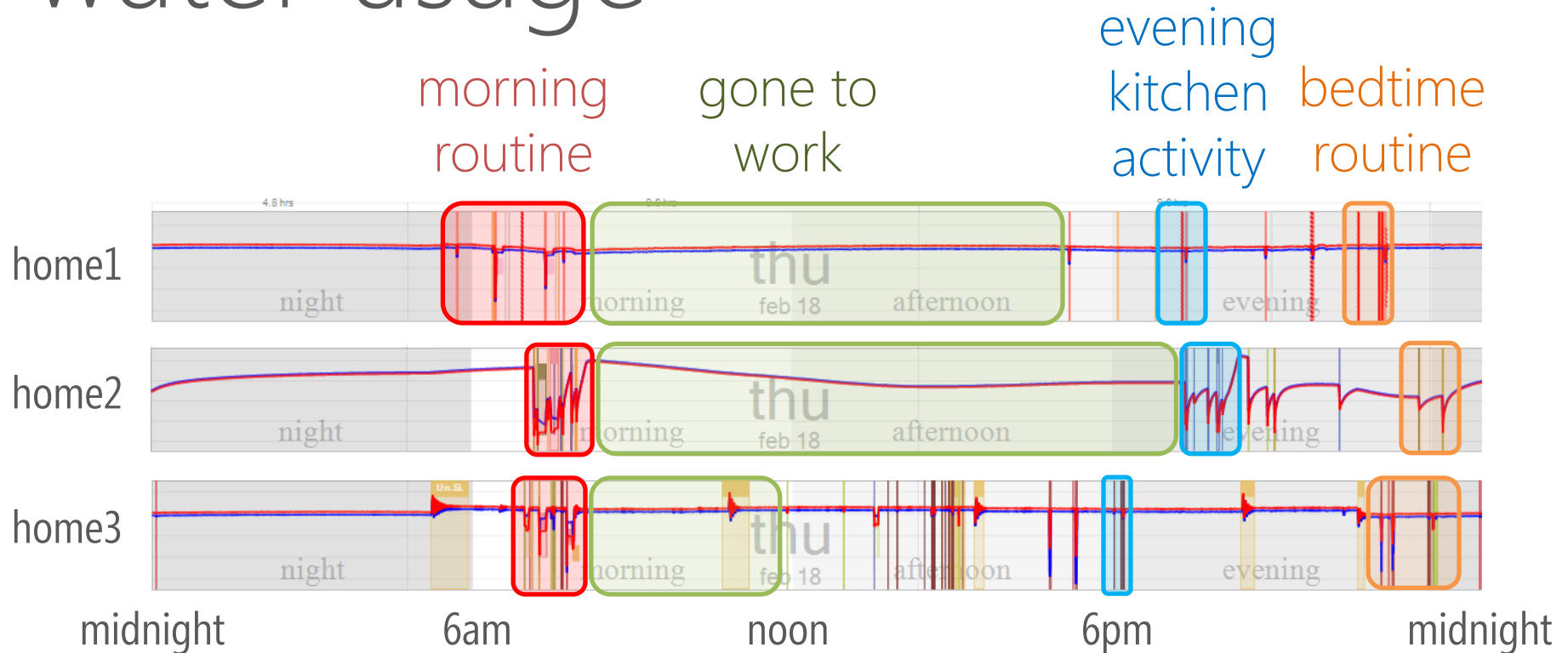
barcelona

taipai

Topic4

Health & Wellness

behavioral patterns of water usage



how predictable are home water usage patterns?

how can
hydrosense be
used to **support**
aging in place
applications?



assisted living applications



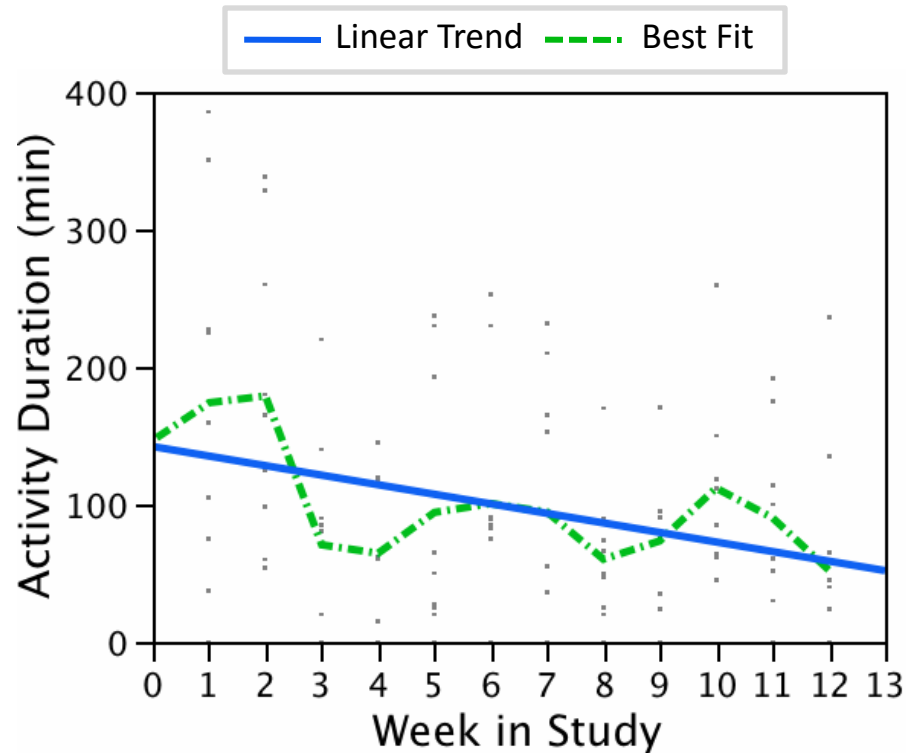
ubifit

- fitness monitoring application
- automatically senses activity
- at-a-glance goal information

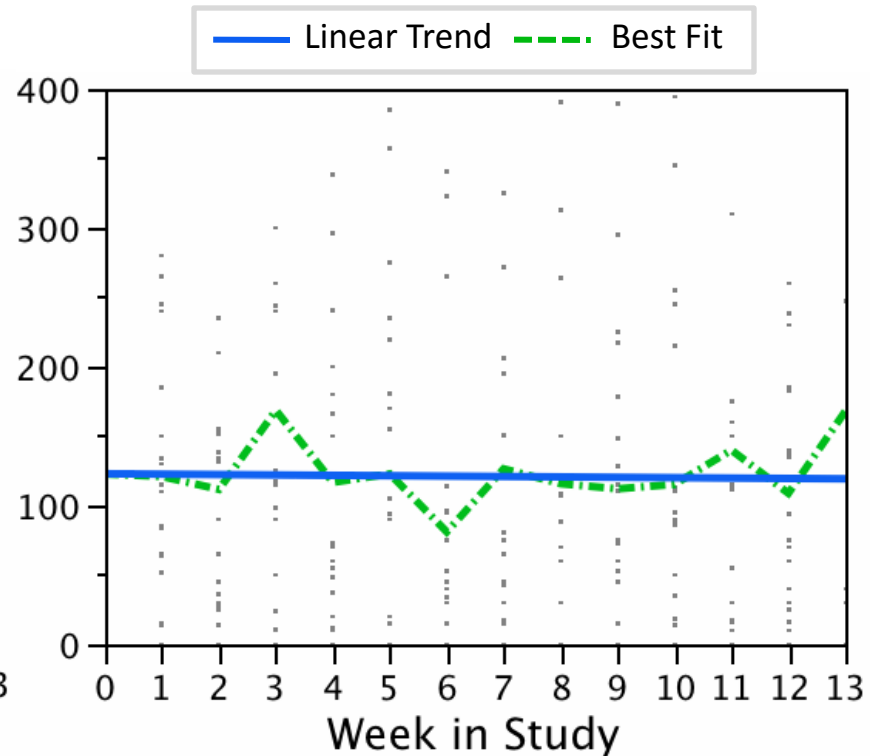


-  **strength**
-  **cardio**
-  **flexibility**
-  **walk**
-  **week's goal met**
-  **recent goal met**

effectiveness of the ubifit glanceable display



no glanceable display



glanceable display

ubifit in a shoe





**Human-Computer
Interaction Laboratory**
Hornbake 2nd Floor

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[@jonfroehlich](#)

