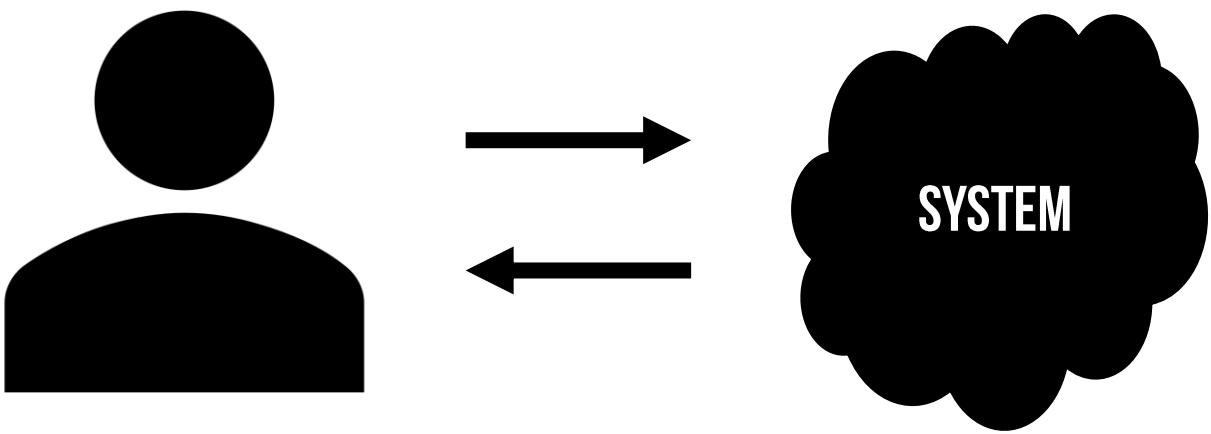


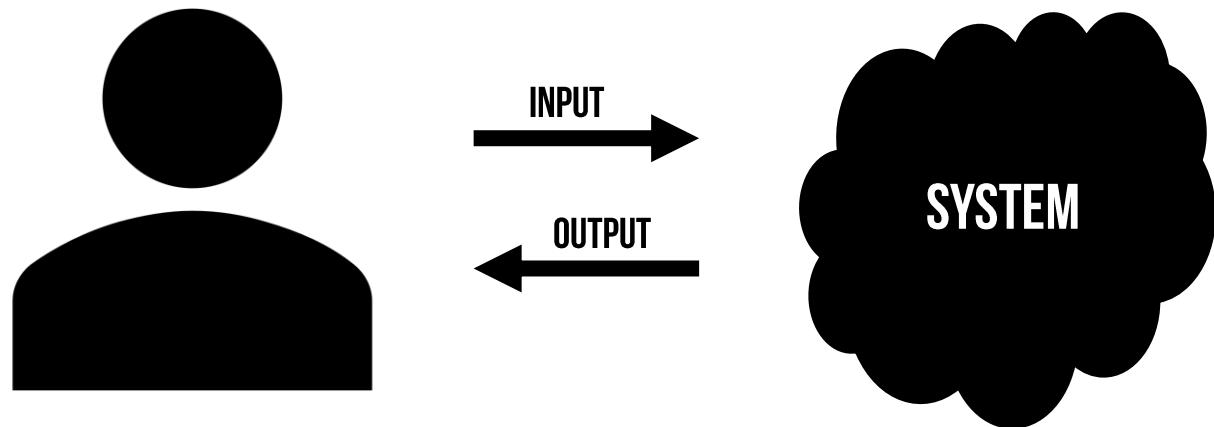
PROTOTYPING INTERACTIVE SYSTEMS

CSE 599 Prototyping Interactive Systems | Lecture 1 | Sept 26

Jon Froehlich • Liang He (TA)

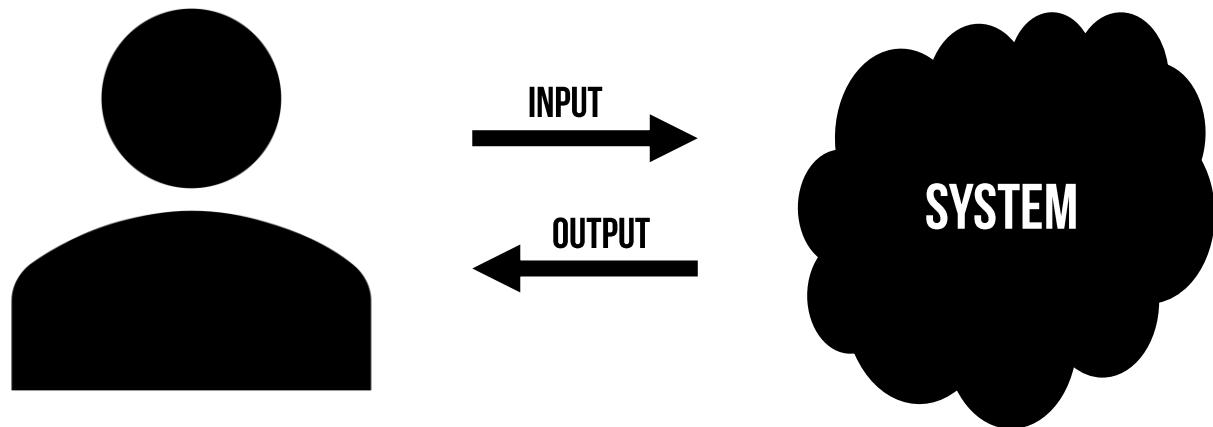


AN INTERACTIVE SYSTEM IS MEASURED BY?



**HOW WELL IT SUPPORTS THE USER IN
ACCOMPLISHING KEY TASKS**

AN INTERACTIVE SYSTEM IS MEASURED BY?

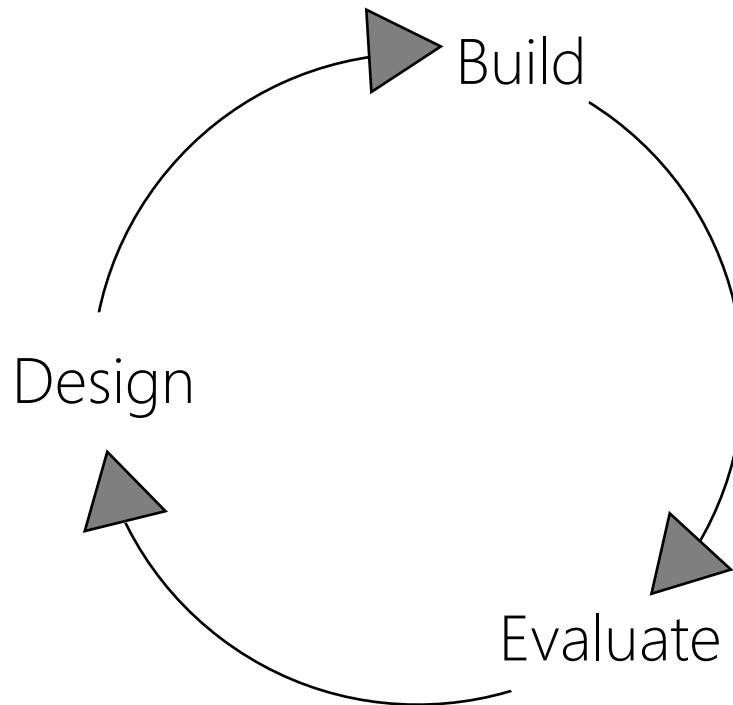


**HOW WELL IT SUPPORTS THE USER IN
ACCOMPLISHING KEY TASKS**

Efficiency
Accuracy
User satisfaction

Aesthetics?
Engagement?
Fun?
Safety?
Accessibility?
...

ITERATIVE DESIGN PROCESS



••••• AT&T ⌘

9:44 PM

57% ⚡



↻ John Maeda Retweeted



Design .Co @designdotco 18m

“The most appropriate design for an interactive system cannot typically be achieved without iteration.” — ISO9241-210 userfocus.co.uk/articles/iso-1...

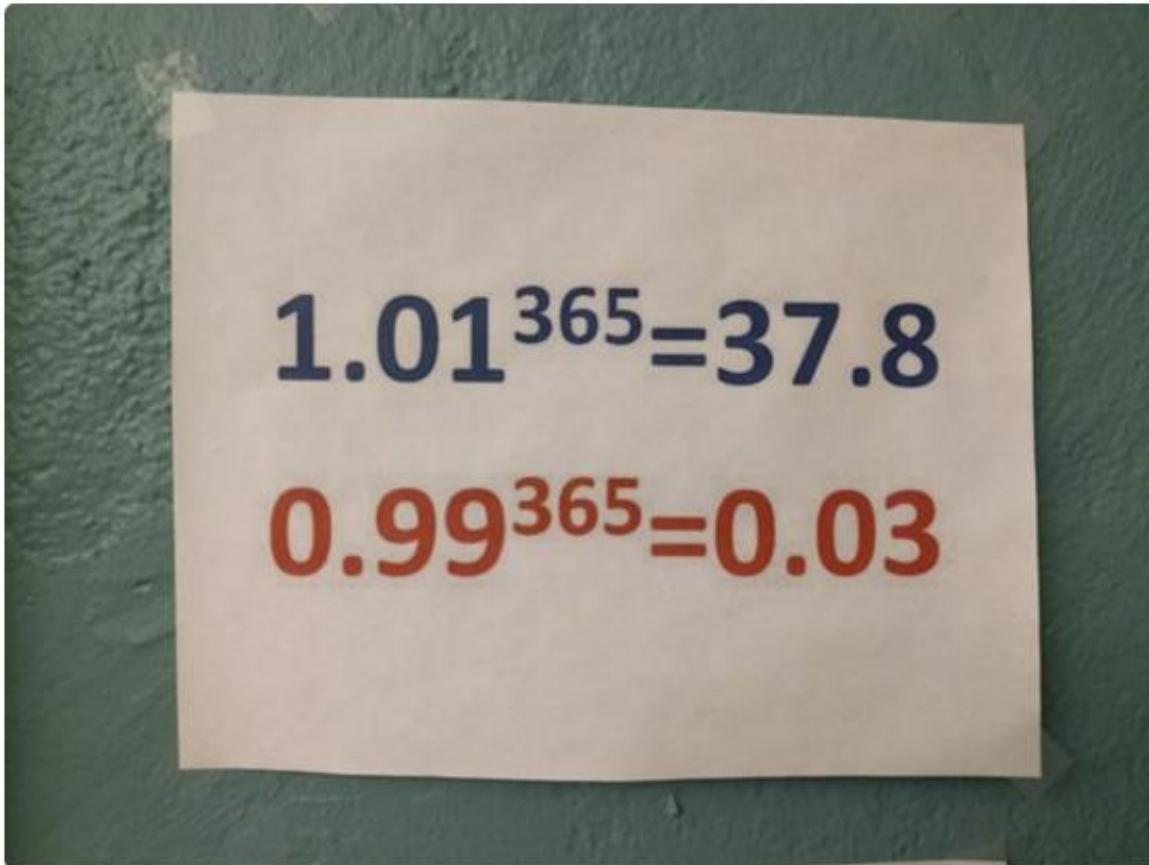




Jed Christiansen @jedc · 19 Nov 2015

Perhaps the most important startup equation? (Constant improvement trumps all)

As spotted at [@homebrew HQ](#).



2.6K

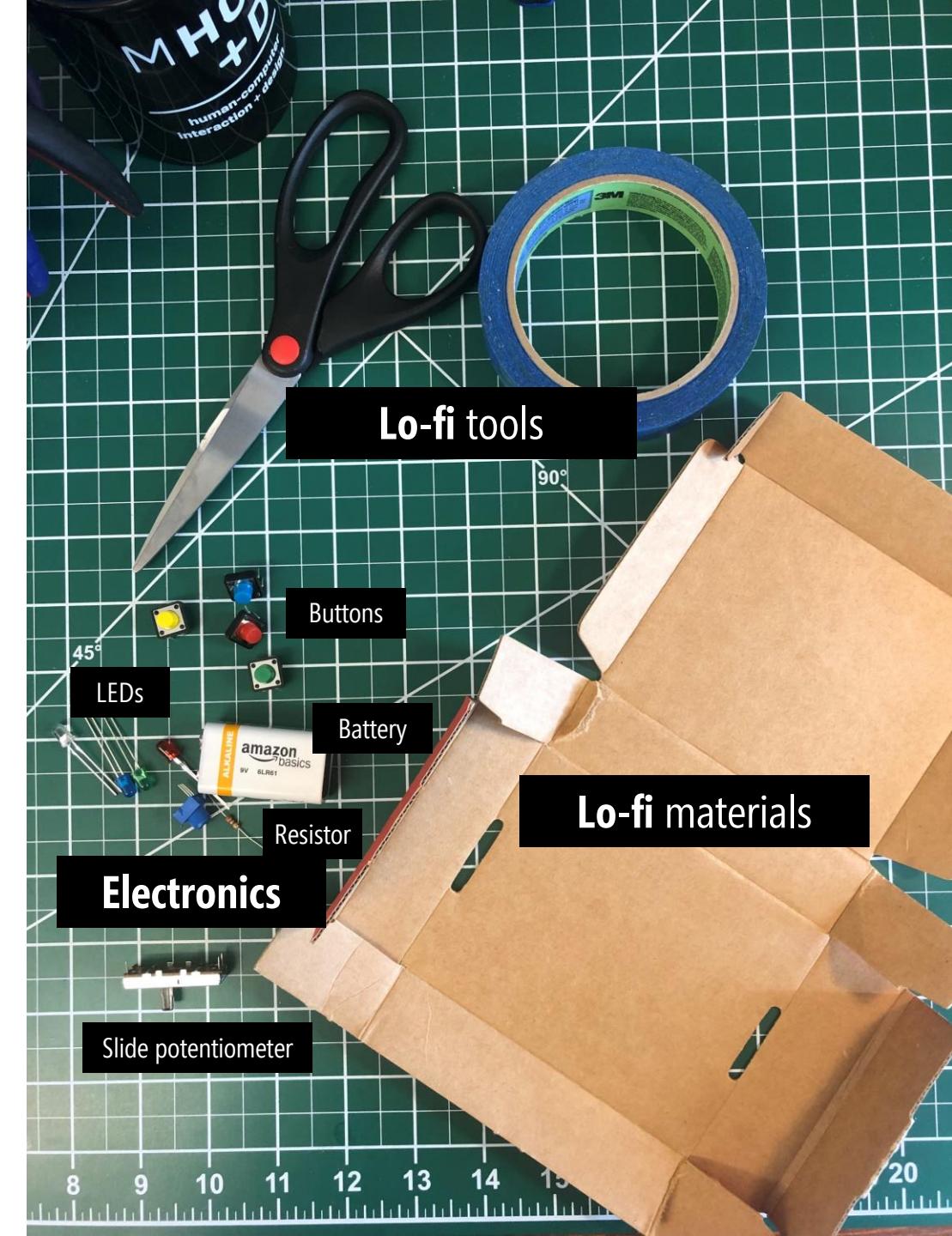
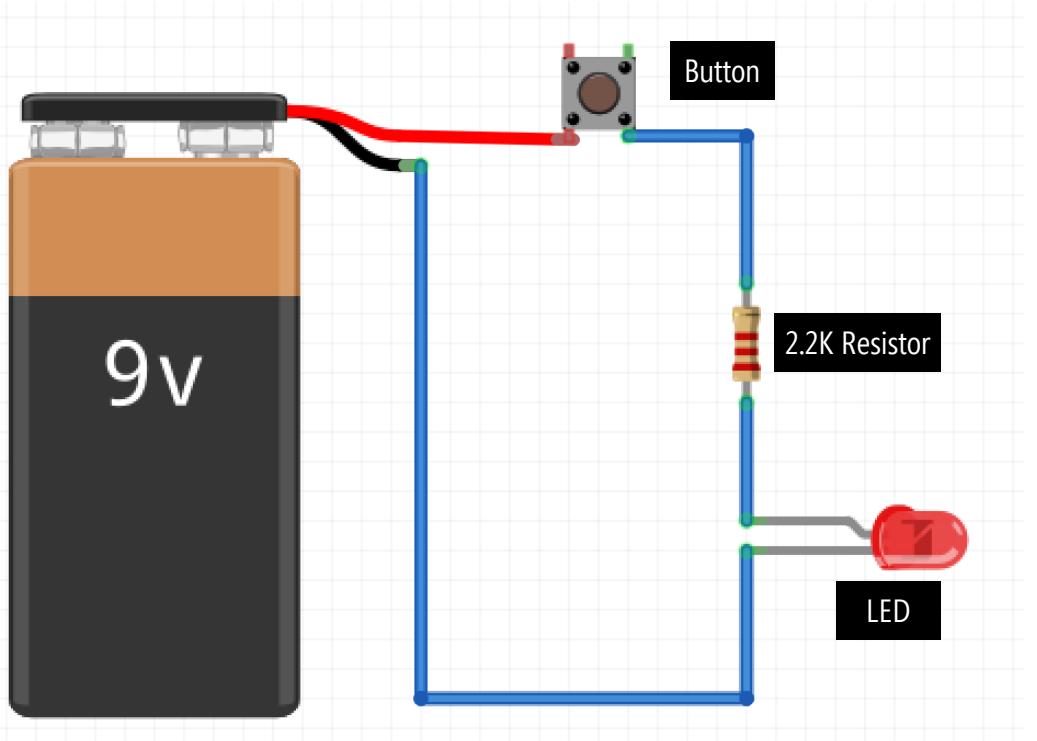
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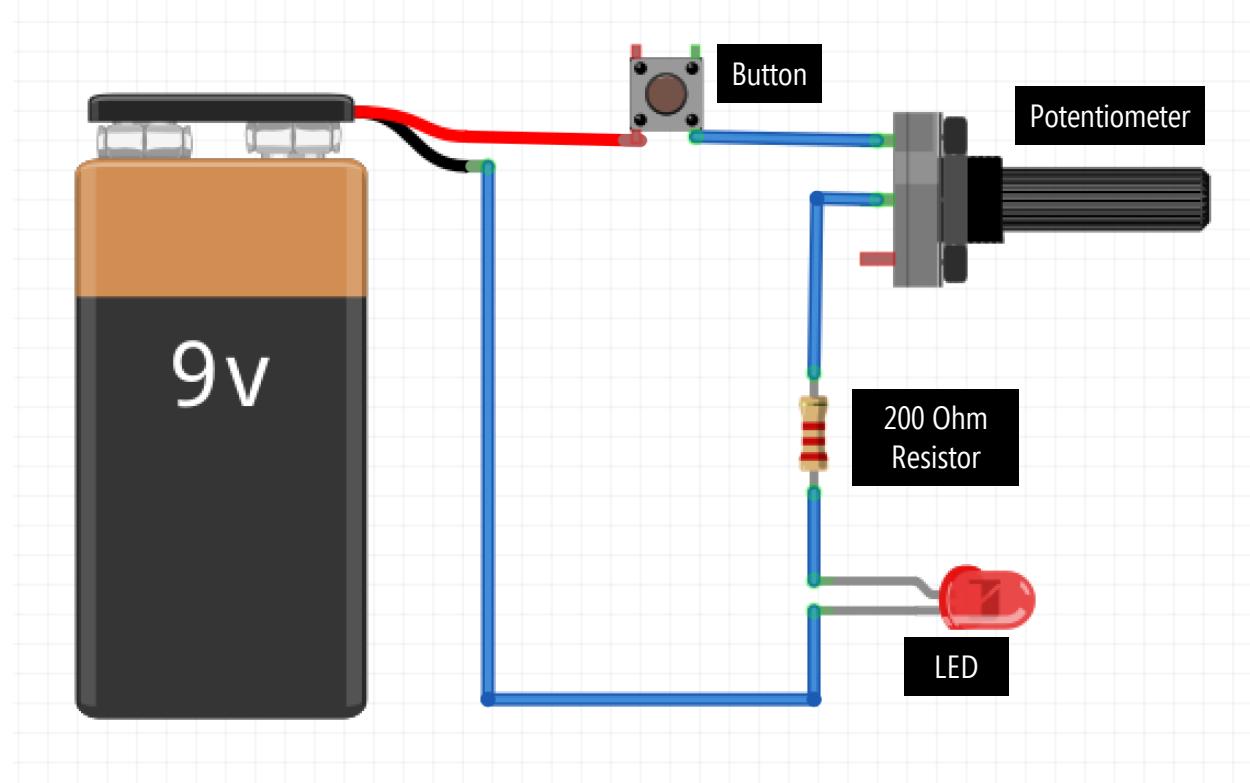
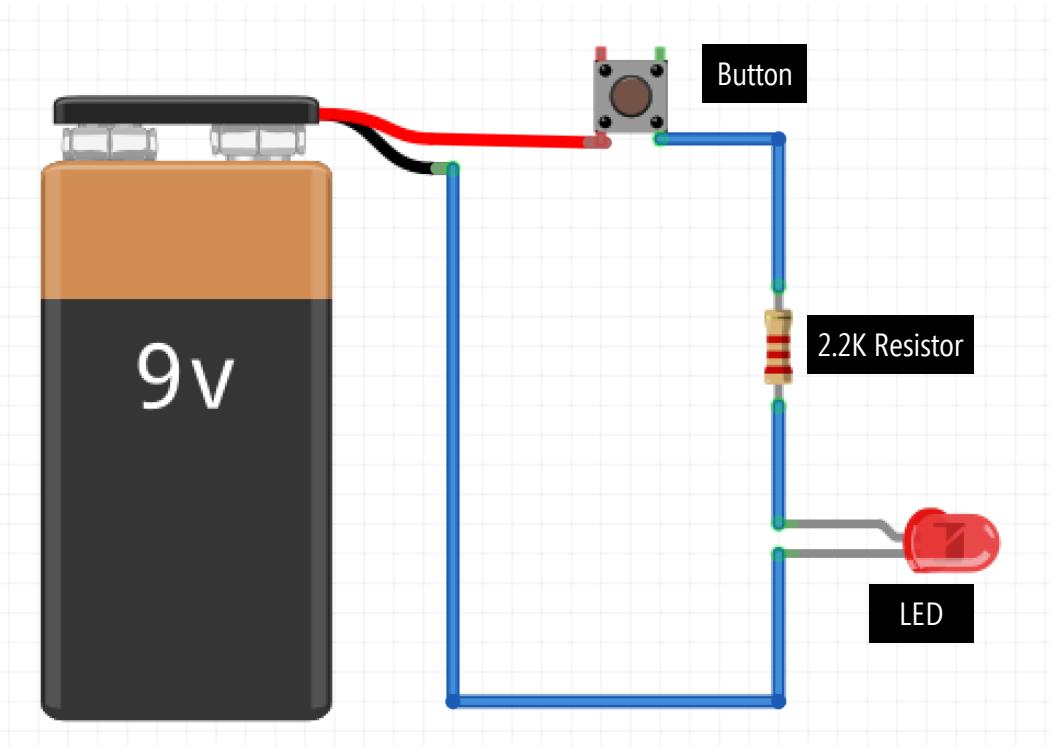
Design Challenge

FLASHLIGHT DESIGN CHALLENGE

Rapidly prototype an LED flashlight with lo-fi enclosure in 30 minutes.



FLASHLIGHT DESIGN CHALLENGE: CIRCUIT REFERENCE



REFLECTING ON DESIGN PROCESS

What **strategies** did you use to make your flashlights?

How **many different designs** did you consider

How many **did you try**?

How did you **learn**?



REFLECTING ON DESIGN PROCESS

How many teams **sketched out ideas** first before starting to build?

How many teams **tried multiple ideas** before settling on a final design?

How many teams **tried to use the weights** during the prototyping process?

How many teams **used parts in unintentional ways** (took apart clothespins)?



REFLECTING ON DESIGN PROCESS

Prototyping **function** (i.e., did the light turn on when you pressed the button?)

Prototyping **feel** (i.e., what does the device feel like in my hand?)

Prototyping **look** (i.e., what does the device look like?)



PROTOTYPING INTERACTIVE SYSTEMS

MARSHMALLOW DESIGN CHALLENGE

Teams of four, 18 minutes

Tallest freestanding structure



20 sticks of spaghetti



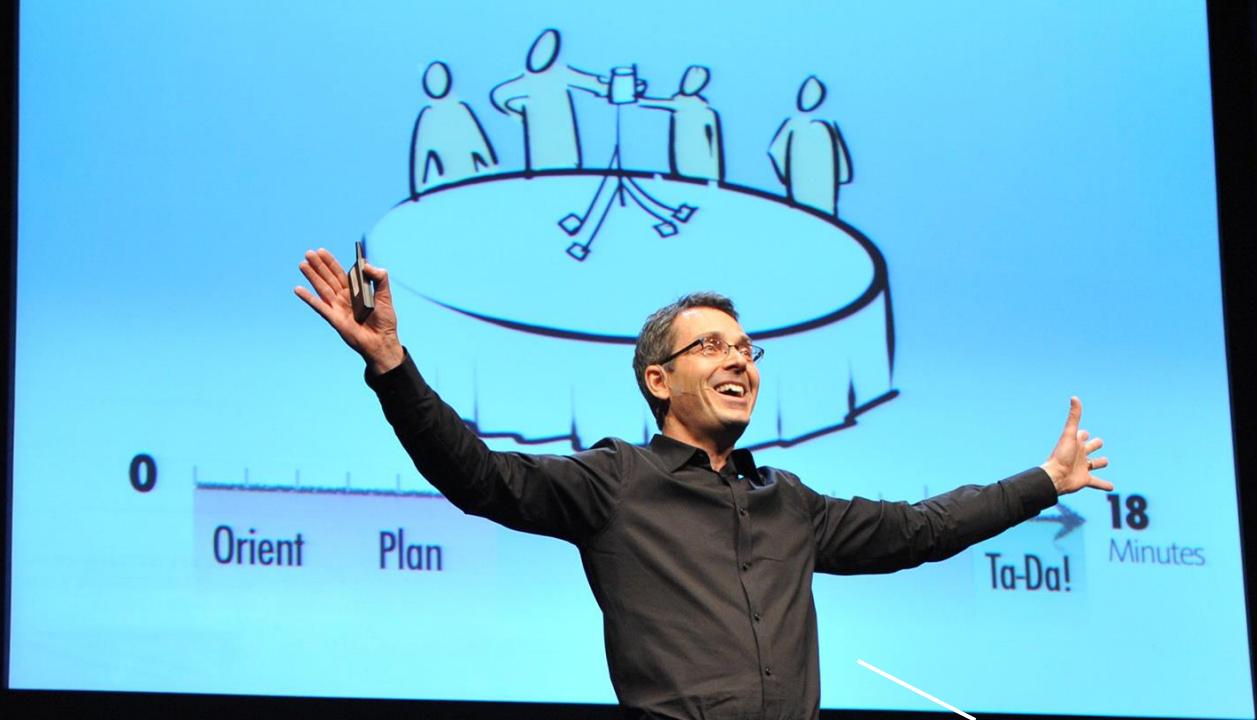
+ one yard tape



+ one yard string



+ one marshmallow



Tom Wujec
Technical Fellow at Autodesk



Start



18

Minutes



Business
Students



Kindergarten
Students

0

Orient

Plan

Build

Ta-Da!

18

Minutes

The essence of the **iterative design process**. Each version [creators] get instant feedback about what works and what doesn't

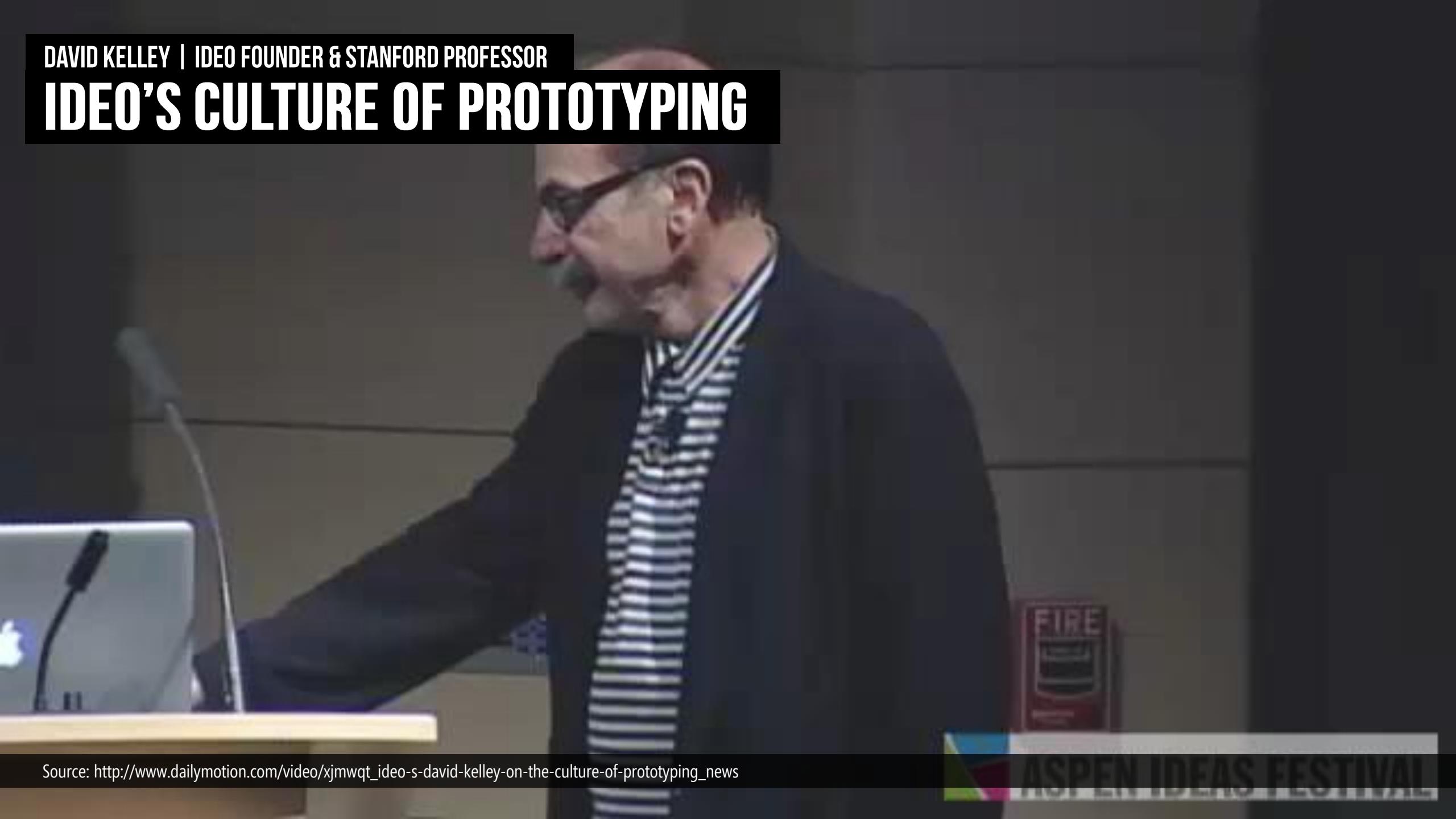
Tom Wujec
Autodesk Fellow





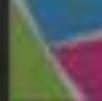
DAVID KELLEY | IDEO FOUNDER & STANFORD PROFESSOR

IDEO'S CULTURE OF PROTOTYPING



Source: http://www.dailymotion.com/video/xjmwqt_ideo-s-david-kelley-on-the-culture-of-prototyping_news

ASPEN IDEAS FESTIVAL



ASAP IDEAS FESTIVAL

IDEO'S CULTURE OF PROTOTYPING

Bias towards **action**

Get out **into messy world**—conduct formative research

Build prototypes (fast)—even “crumby ones”

Test prototypes (watch people use them), learn, and iterate

If a picture is worth a thousand words,
a **prototype is worth ten thousand.**

IDEO Design Principle

From: Stefan Thomke, *Experimentation Matters: Unlocking the Potential of New Technologies for Innovation*, 2003





the ding the too when they put it on they reach
outther hands I try and touch the

Julia Schwarz

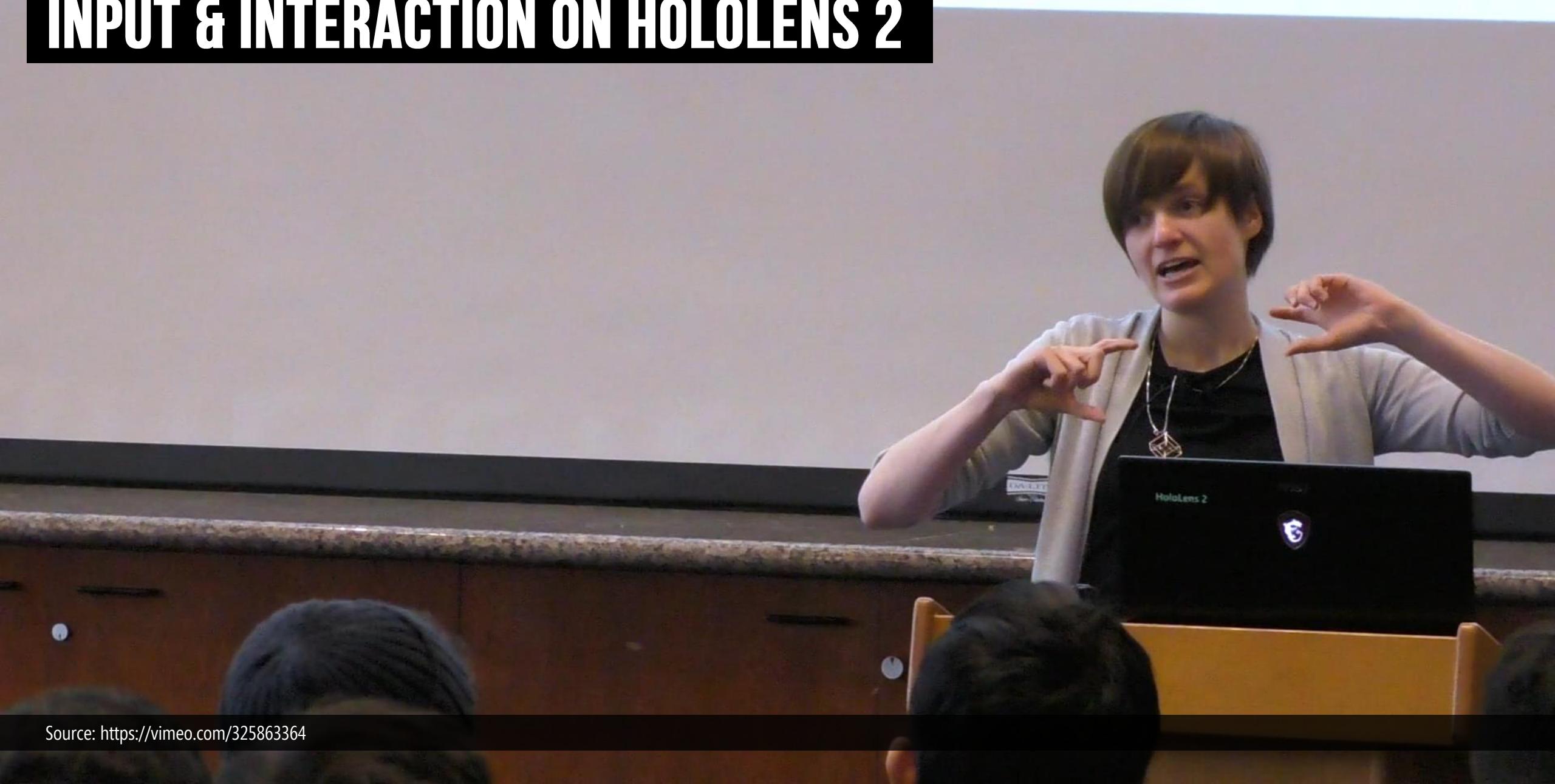
Principal Researcher at Microsoft





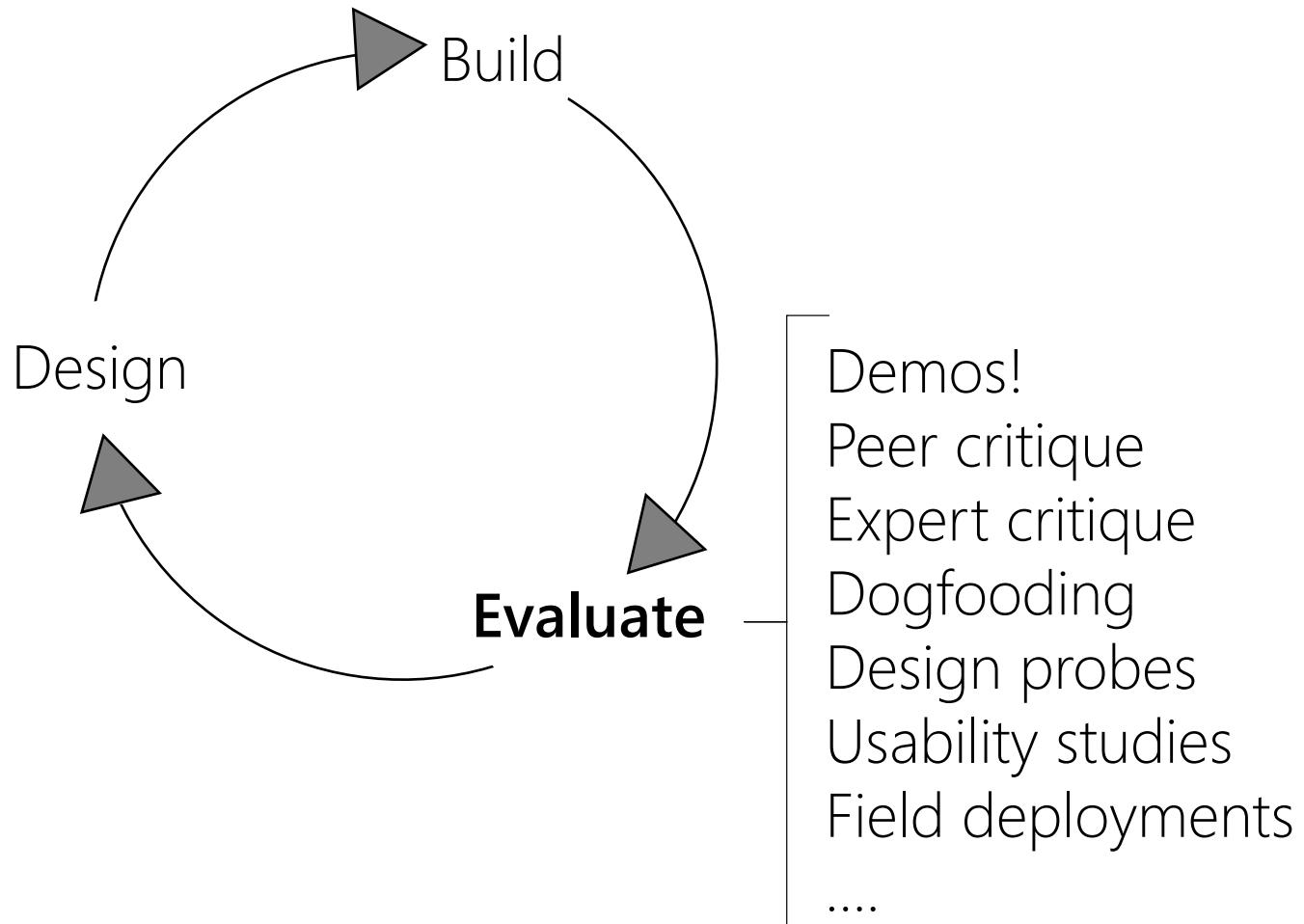
JULIA SCHWARZ | PRINCIPAL RESEARCHER AT MICROSOFT

INPUT & INTERACTION ON HOLOLENS 2





ITERATIVE DESIGN PROCESS



Autumn 2019

[Home](#)[Announcements](#)[Assignments](#)[Discussions](#)[Grades](#)[People](#)[Pages](#)[Files](#)[Syllabus](#)[Outcomes](#)[Quizzes](#)[Modules](#)[Conferences](#)[Collaborations](#)[Chat](#)[Attendance](#)[UW Libraries](#)[Add 4.0 Grade Scale](#)[Panopto Recordings](#)

CSE 599 U Au 19: Special Topics In Computer Science

[Jump to Today](#)

Course Overview

This course explores the materiality and physicality of interactive computing via rapid prototyping. In the words of MIT professor Hiroshi Ishii, we will seek to “seamlessly couple the dual worlds of bits and atoms.” This is a particularly interesting time to survey and explore this area because of three, interrelated technology trends:

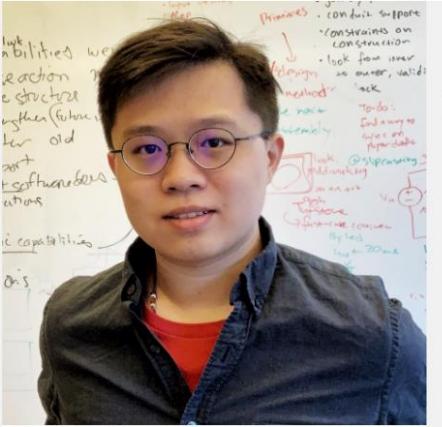
- **The emergence of the DIY/Makers movement**, which has led to widespread opportunities to interface and work with hardware that has rather low barriers of entry (e.g., the Arduino), provides new opportunities for coupling form with computation (e.g., through digital fabrication), and provides countless online materials/tutorials to help us along.
- **The pervasiveness of powerful mobile computers and IoT devices** that are constantly on and nearly constantly with

Course Status

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<	September 2019							>
25	26	27	28	29	30	31		
1	2	3	4	5	6	7		
8	9	10	11	12	13	14		
15	16	17	18	19	20	21		
22	23	24	25	26	27	28		
29	30	1	2	3	4	5		

Course assignments are not weighted.



Research Projects



Deformable Interactive Designs with 3D-Printed Springs

Liang He, Huaishu Peng, Joshua Land, Mark D. Fuge, and Jon E. Froehlich.
Adjunct Proceedings of UIST 2017 →

Liang He, Joshua Land, Huaishu Peng, Mark D. Fuge, and Jon E. Froehlich.
Symposium on Computational Fabrication (SCF) 2017 →



MakerWear: A Tangible, Modular Approach for Children to Create Interactive Wearables

Majeed Kazemitaabari, Jason McPeak, Alexander Jiao, Liang He, Thomas Outing, Jon E. Froehlich Jon E. Froehlich.
Proceedings of CHI 2017 / CHI EA 2016 →

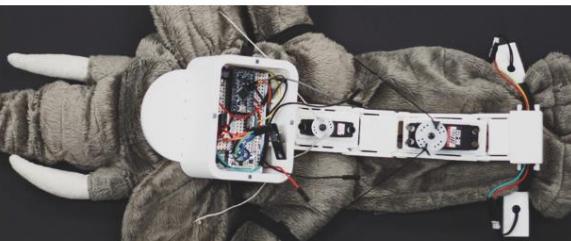
🏆 Best Late-Breaking Paper Award at CHI 2016
🏆 Best Paper Award at CHI 2017



Squeezapulse: Adding Interactive Input to Fabricated Objects Using Corrugated Tubes and Air Pulses

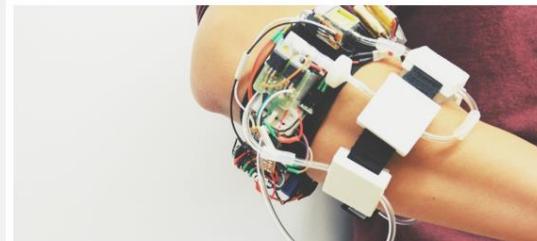
Liang He, Gieran Laput, Eric Brockmeyer, and Jon E. Froehlich.
Proceedings of TEI 2017 →

Prior Work



VRSurus: Enhancing Interactivity and Tangibility of Puppets in Virtual Reality

Ruofei Du and Liang He.
CHI EA 2016 →



PneuHaptic: delivering haptic cues with a pneumatic armband

Liang He, Cheng Xu, Ding Xu, and Ryan Brill.
Proceedings of ISWC 2015 →



CozyMaps: Real-time Collaboration on a Shared Map with Multiple Displays

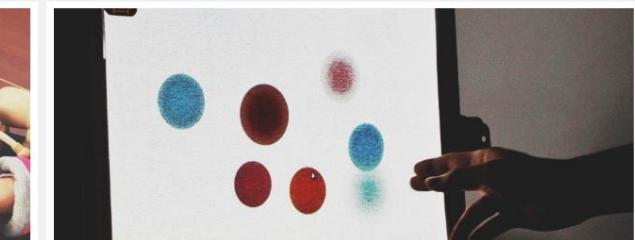
Kelvin Cheng, Liang He, Xiaojun Meng, David A. Shamma, Dung Nguyen, and Anbarasan Thangapalam.
Proceedings of MobileHCI 2015 →



Non-invasive tangible interfaces on HU

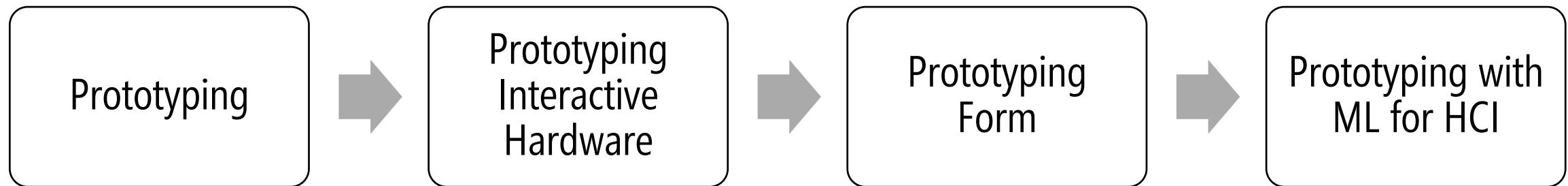


SlowSaber: a tangible light-saber-like controller without a tangible blade



Tangible objects available for tangible interaction

COURSE CURRICULUM



PEDAGOGICAL APPROACH

My teaching is rooted in **Papert's theory of constructionism**, which suggests a **strong connection between design and learning**.



Seymour Papert

MIT Professor

Pioneer of AI & new learning theories

PEDAGOGICAL APPROACH

My teaching is rooted in **Papert's theory of constructionism**, which suggests a **strong connection between design and learning**.

The theory posits that '**remarkable learning**' occurs when people are **working with materials to design, create, and invent** external and **shareable artifacts**.



Seymour Papert
MIT Professor
Pioneer of AI & new learning theories

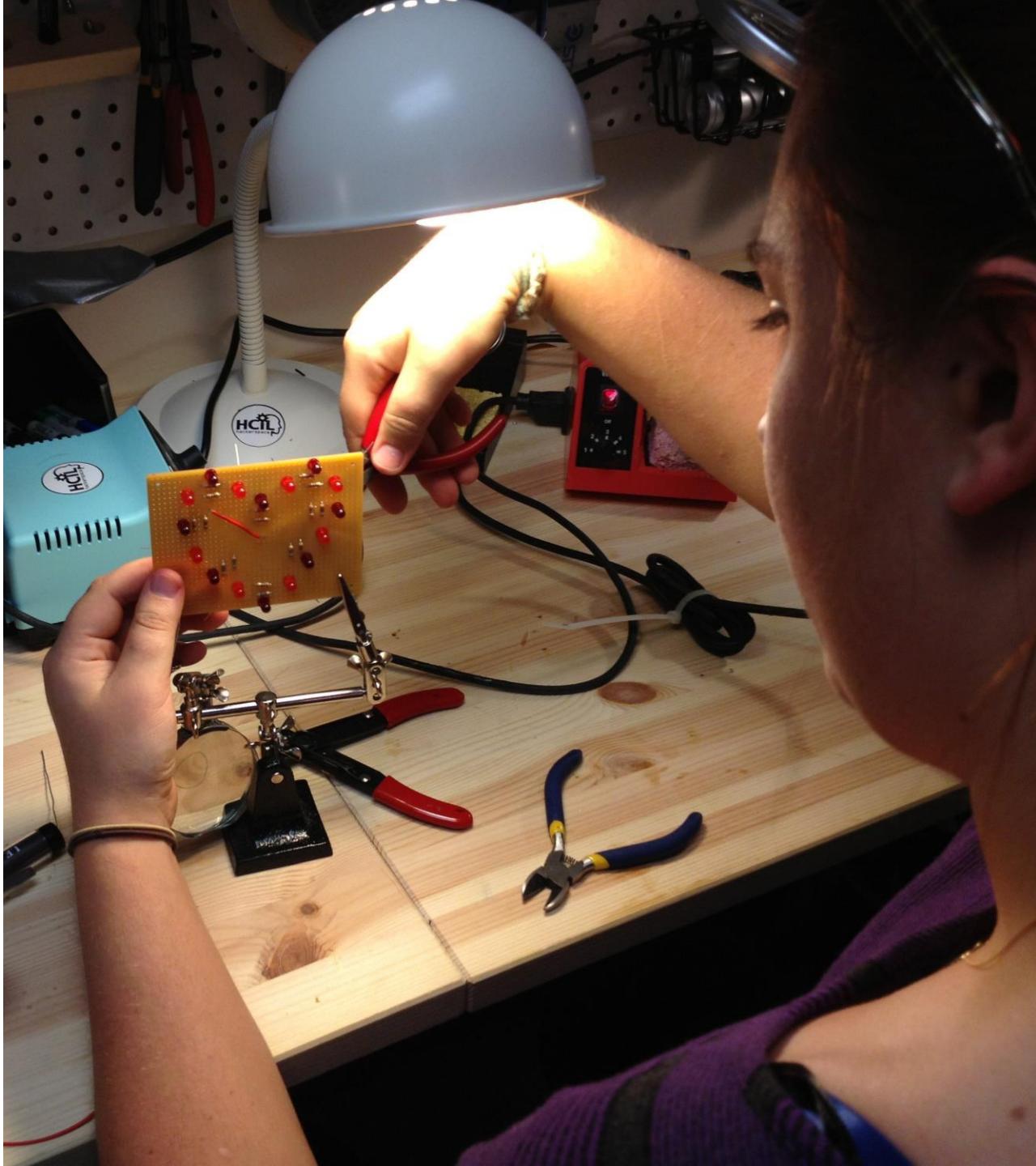
LEARNING AVENUES

Learn by doing (in-class exercises, homeworks)

Learn via critiques (share outs + critique)

Learn via lecture

Learn via self-exploration





Do not use any of the equipment in Sieg 322 until we have covered it in class or you have otherwise received my permission.

PROTOTYPING INTERACTIVE SYSTEMS
BY NEXT CLASS!

Please purchase a craft, tote, or toolbox to carry your supplies & artifacts



Sterilite 3-Layer Stack and Carry Box - Clear - 10.625 x 7.25 x 7.75 in

[Be the first to review this product](#)

\$9.99

In stock

SKU#: 00073149413864

Add to Cart

Sterilite 3-Layer Stack and Carry Box - Clear - 10.625 x 7.25 x 7.75 in is available to buy in increments of 1

Assignments

There will be **three assignments** and **one group project** (no exams). The assignments are individual while the project can be completed individually or in pairs. Assignments will include a set of required features with at least one open-ended design option (for creativity and to enable new learning opportunities). The course project will be largely up to you but must be on the theme of ‘interactive computing’ and include a physical computing + machine learning component (you will pitch ideas and receive feedback before downselecting). Deliverables include a short report, github or gitlab link, and a video demo.

- **[35 pts]:** Individual assignments covering physical computing, fabrication, and machine learning
- **[25pts]:** Course project
- **[10 pts]:** Participation based on in-class and online discussions (e.g., responding to a post), asking questions in class or on Canvas, and miscellaneous housekeeping assignments (e.g., completing MakerSpace orientation, filling out background survey). We may also have a few readings + online discussions.

ASSIGNMENT: DUE OCT 15 AT 11:30AM

A1: INTERACTIVE NIGHT LIGHT

[2 pts] **Interactive RGB circuit.** Design your light using an RGB LED. The individual color hues should be selectable via custom physical controls that you design (see next bullet). The brightness of the LED should change automatically based on ambient light (inversely proportional to light level).

[2 pts] **Lo-fi input.** Use craft materials (*e.g.*, clay, conductive paint, paper) to build a DIY input sensor

[1 pt] **Lo-fi enclosure.** Create a lo-fi form (*e.g.*, using cardboard, paper, foamcore, etc.) that fully encloses hardware. The form should be elegant and thematic.

[2 pts] **Creative feature.** Add in a creative feature of your choice--this could be a new physical control, actuation (*e.g.*, LED affixed to servo), or a way of presenting ambient information

[2 pts] **Deliverables.** Including source code, slide deck report, and short video demo. We will also have live demonstrations in class.



A1 INSPIRATIONS

TINY CLOUD



Designer: Richard Clarkson, <https://vimeo.com/111889143>



A1 INSPIRATIONS

INTERACTIVE WALL HANGING



蒲公英圖



清宮玉堂王氏作
庚午年夏月

蒲公英圖



齊東野語
庚午年夏月
畫於北京



A1 INSPIRATIONS

MECHANICAL TULIP



Designer: Jiří Praus, <https://create.arduino.cc/projecthub/jiripraus/ever-blooming-mechanical-tulip-1b0323>





PROJECT HUB

ARDUINO

ADD PROJECT

SEARCH PROJECTS

SIGN IN

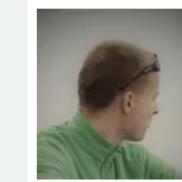


Ever Blooming Mechanical Tulip © CC BY-NC-SA

SA

Mechanical tulip sculpture that blooms with just gentle touch and can shine into any color of a rainbow.

AUTHOR



Jiří Praus

3 PROJECTS 59 FOLLOWERS

FOLLOW

PUBLISHED ON

February 19, 2019

RESPECT PROJECT

WRITE A COMMENT

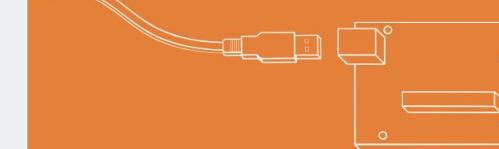
Share

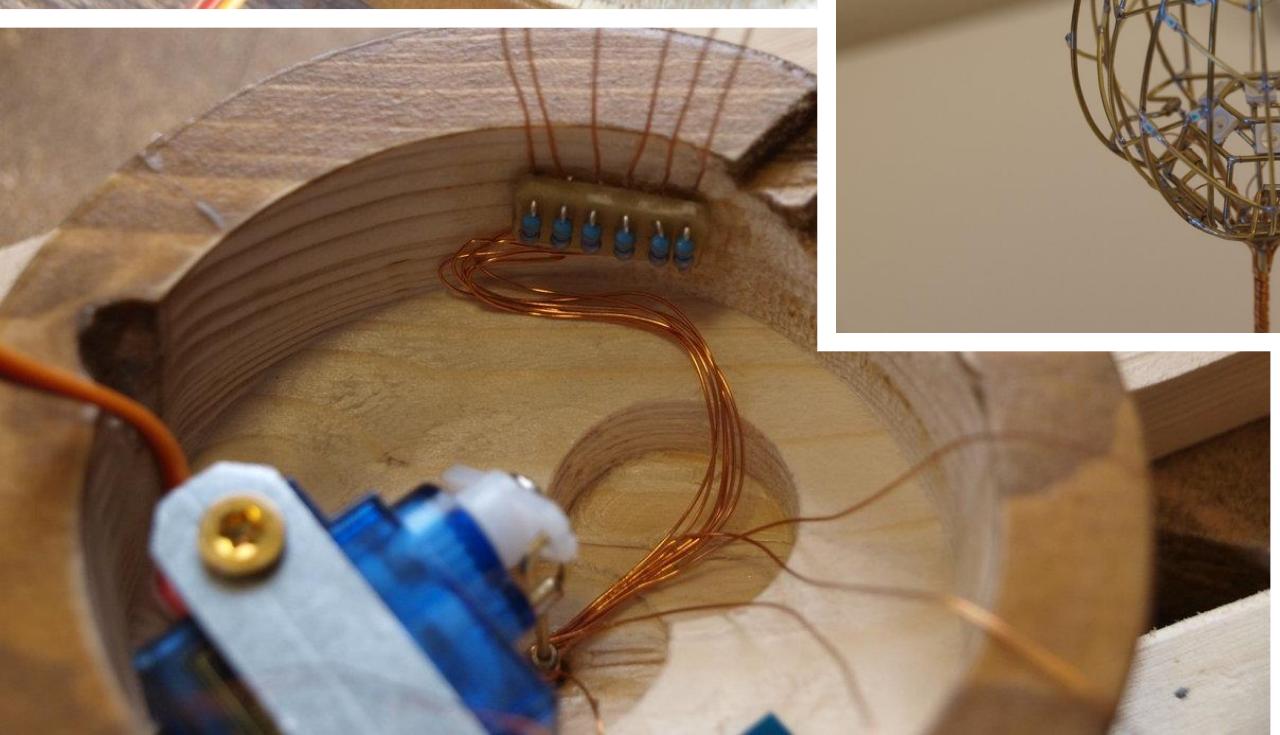
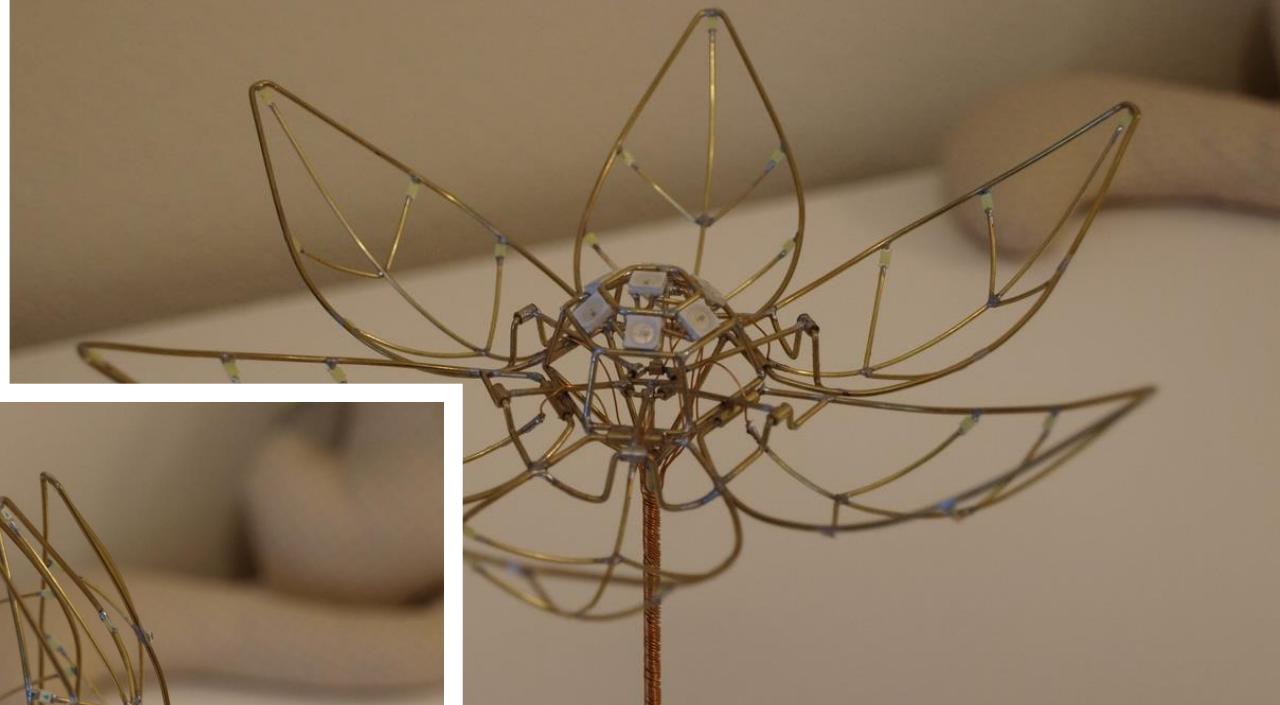
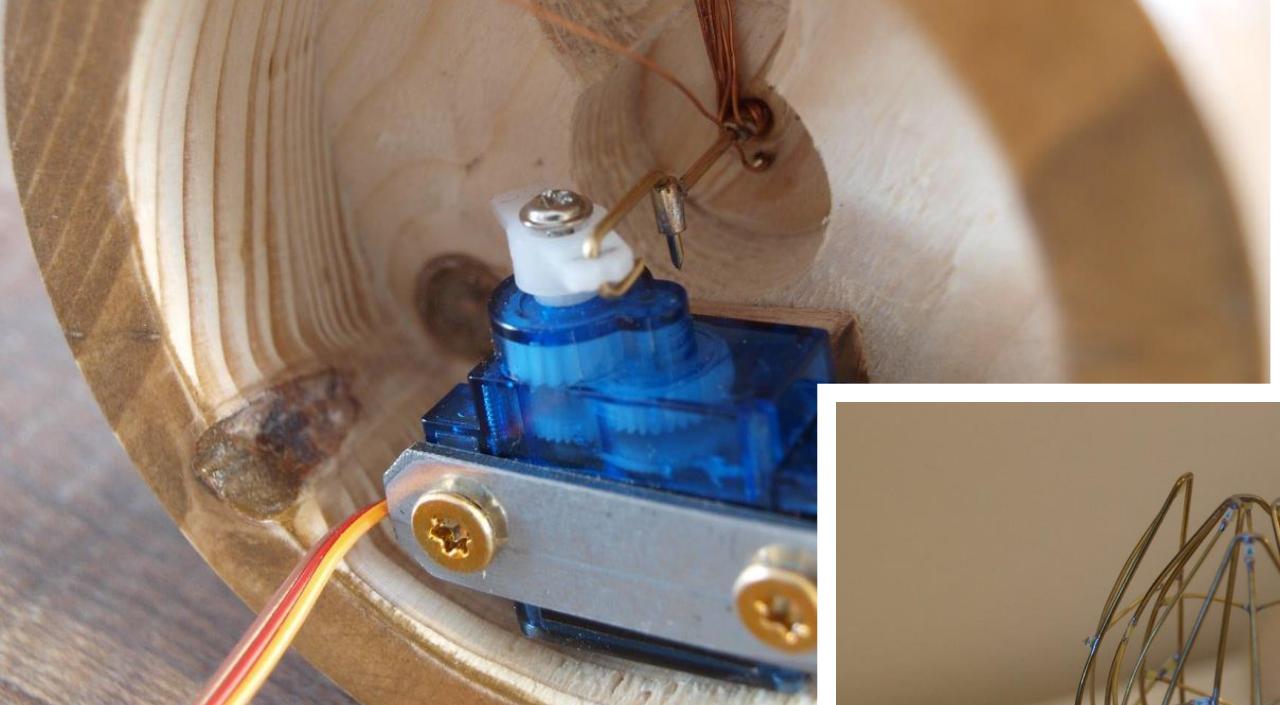
MEMBERS WHO RESPECT THIS PROJECT



and 141 others

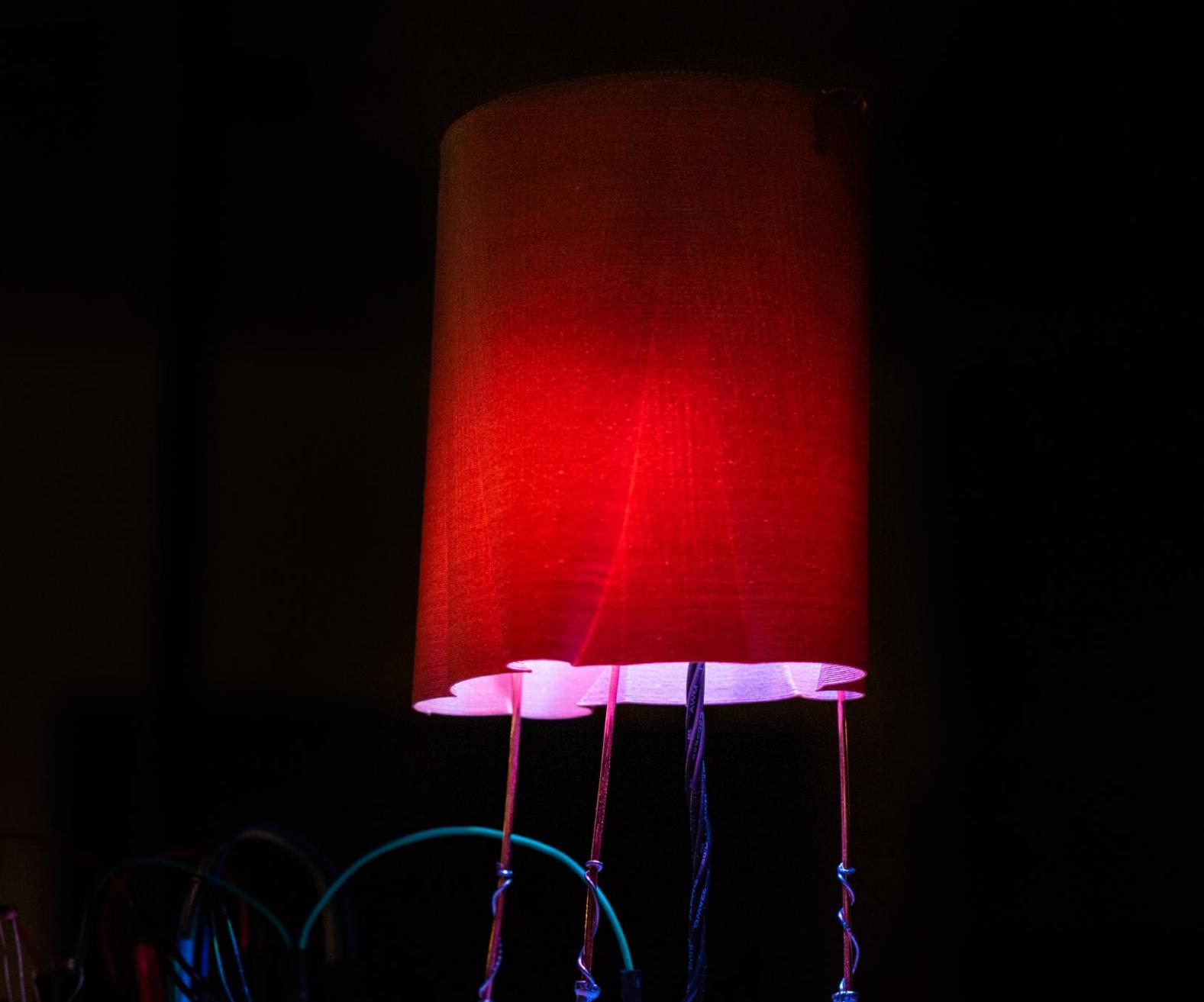
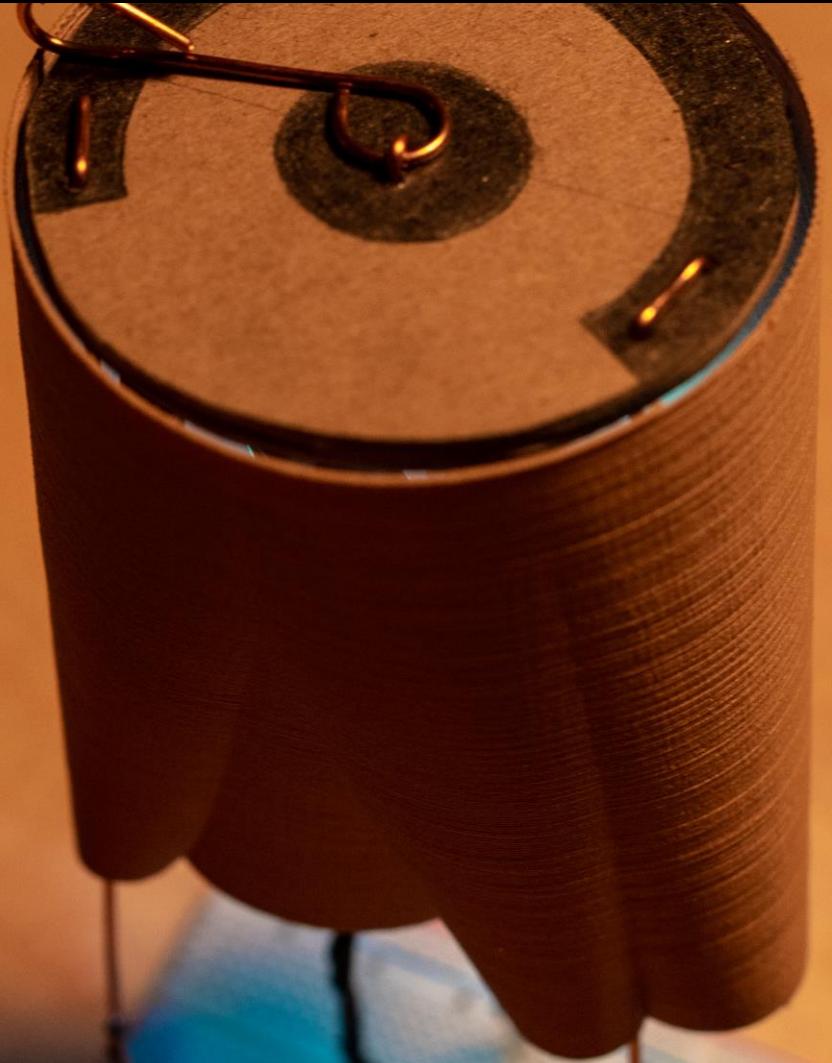
SEE SIMILAR PROJECTS
YOU MIGHT LIKE





A1 EXAMPLE

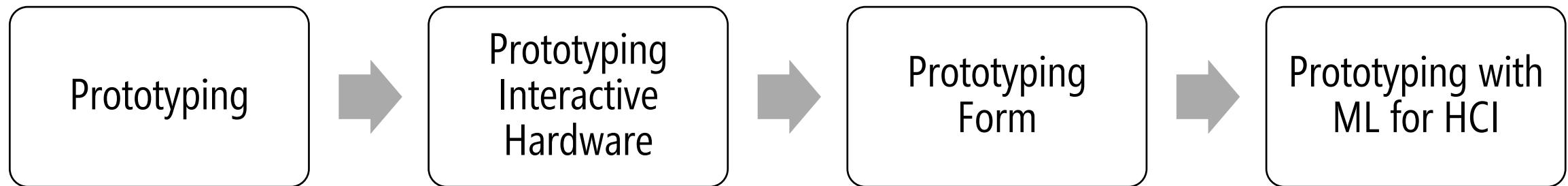
POTENTIOMETER LAMP



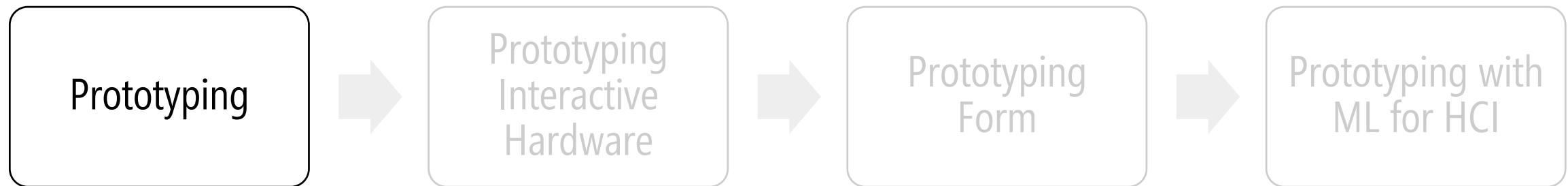
Designer: Trevor Larson, M+HCID wi2019



COURSE CURRICULUM



COURSE CURRICULUM



HOW TO PROTOTYPE

(BEST PRACTICES SUPPORTED BY RESEARCH AND INDUSTRY)

HOW TO PROTOTYPE

PROTOTYPING: BEST PRACTICES

Use prototypes to **rapidly try ideas** that **communicate and convince**

The importance of **exploring a breadth of ideas**

Focus on **rapidly building prototypes** to explore design space

Perceived fidelity of prototypes can impact **responses**

Iteration is critical

Prototype **multiple designs in parallel**

Show/test **multiple prototypes** to enable comparison

JULIA SCHWARZ | PRINCIPAL RESEARCHER AT MICROSOFT

INPUT & INTERACTION ON HOLOLENS 2





Source: IDEO, *Prototyping for Elmo's Monster Maker iPhone App*, <https://youtu.be/-SOeMA3DUEs>



BACK STORY

VIDEO PROTOTYPING ELMO'S APP



Source: http://www.slate.com/blogs/the_eye/2013/10/23/the_importance_of_prototyping_creative_confidence_by_tom_and_david_kelley.html

A single take, a quick edit, and the video clip was sent off to the Sesame Workshop team members just a few minutes before their meeting. Adam and Coe Leta's quick video was fun and endearing. It was also **much more persuasive than just talking** about their ideas would have been. They subscribe to Boyle's Law (named after one of IDEO's master prototypers, Dennis Boyle): **never go to a meeting without a prototype**. Today, if you **download Elmo's Monster Maker** from the iTunes store, you'll **see the feature they prototyped in an hour** that morning. By acting quickly, they won the team over with their creative idea.

Tom and David Kelley

From: *Why Designers Should Never Go to a Meeting Without a Prototype*,
Slate 2013



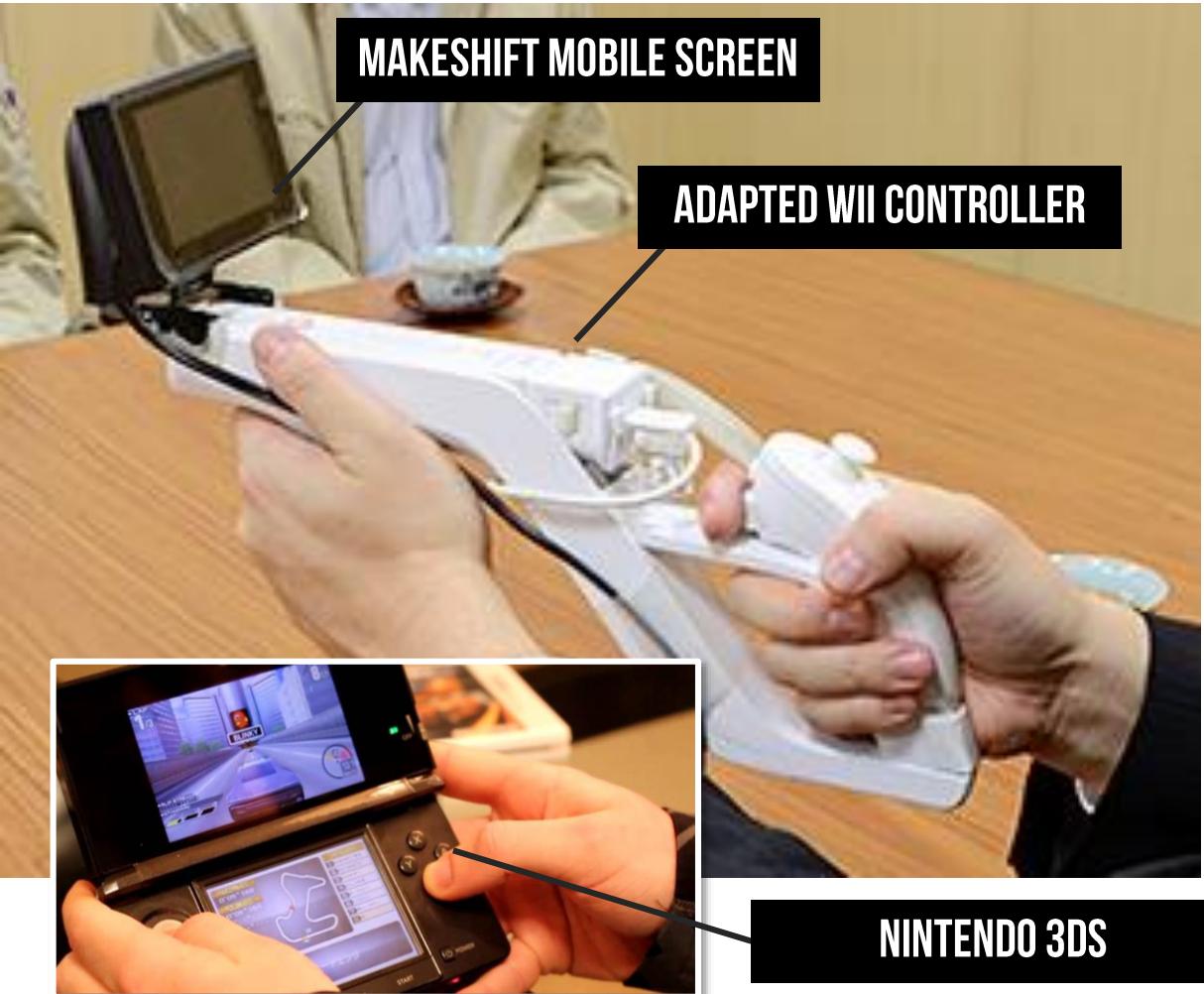
PROTOTYPING TO EXPERIENCE & COMMUNICATE

PROTOTYPING AT NINTENDO



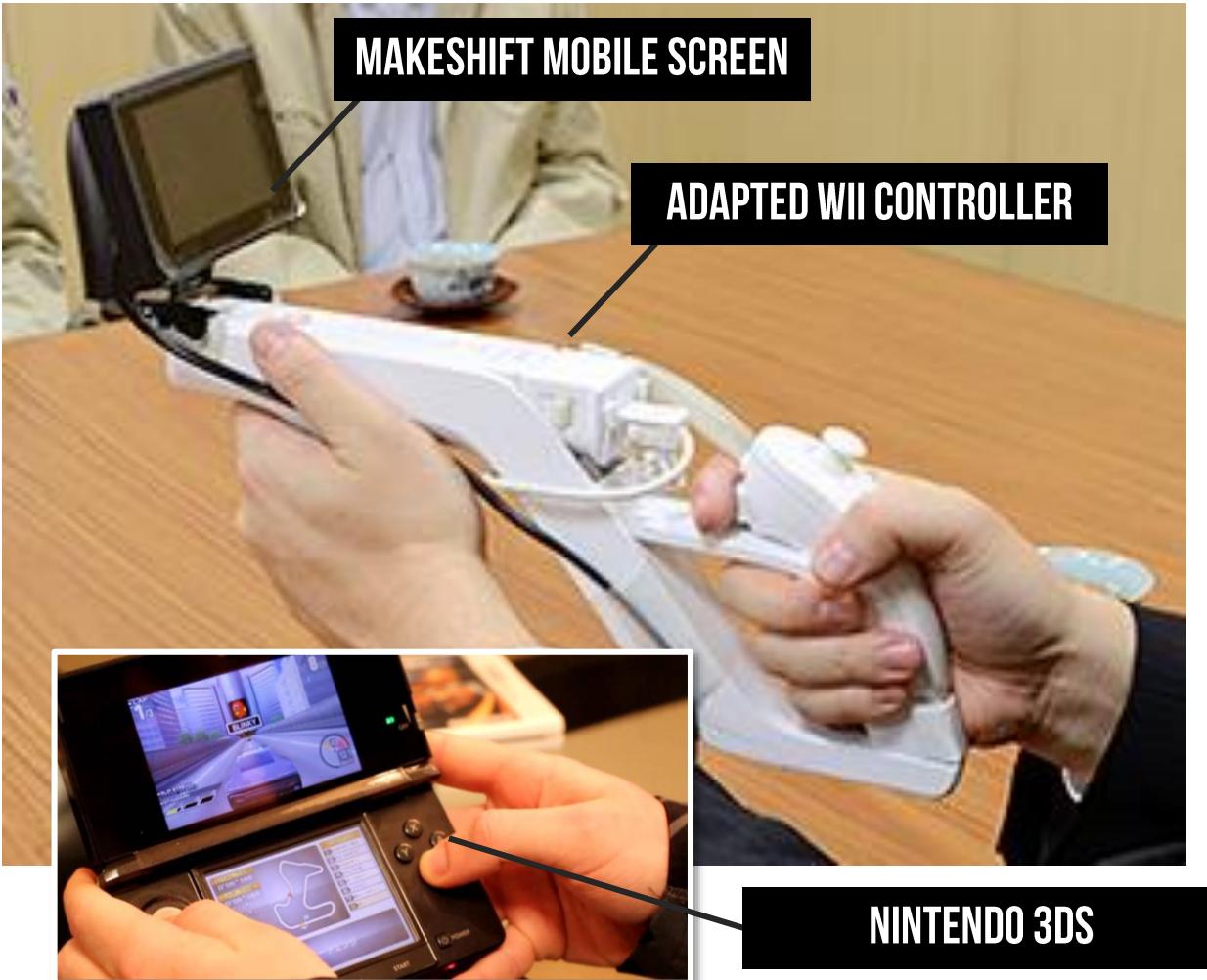
PROTOTYPING TO EXPERIENCE & COMMUNICATE

PROTOTYPING THE NINTENDO 3DS



PROTOTYPING TO EXPERIENCE & COMMUNICATE

PROTOTYPING THE NINTENDO 3DS



"We tested gameplay that involved moving the **Wii Zapper** and **having images** from the **Wii move in sync** on a **monitor in your hands**. It was fairly well received...

When **Miyamoto-san saw that experiment**, he said that he **definitely wanted to put a gyro sensor** in **Nintendo 3DS**... This happened after the people in the hardware department had already been declared that "all features are now set!"

Thanks to this **prototype**, however, we were able to **explain [our idea]** and it became **more compelling**."

- Nintendo Designer

HOW TO PROTOTYPE

PROTOTYPING: BEST PRACTICES

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HOW TO PROTOTYPE

THE IMPORTANCE OF IDEA QUANTITY/BREADTH

A ceramics teacher divided a class into two groups: those on the left side of the studio would be graded solely on the quantity of their work; those on the right solely on the quality of their work.

QUANTITY GROUP



Graded solely on the quantity of work they produced

QUALITY GROUP



Graded solely on the quality of work they produced

HOW TO PROTOTYPE

THE IMPORTANCE OF IDEA QUANTITY/BREADTH

A ceramics teacher announced that he was dividing the class into two groups: those on the left side of the studio would be graded solely on quantity of work; those on the right solely on its quality.

QUANTITY GROUP

QUALITY GROUP



Graded solely on the quantity of work they produced



Graded solely on the quality of work they produced

HOW TO PROTOTYPE

THE IMPORTANCE OF IDEA QUANTITY/BREADTH

A ceramics teacher announced that he was dividing the class into two groups: those on the left side of the studio would be graded solely on quantity of work; those on the right solely on its quality.

QUANTITY GROUP



Graded solely on the quantity of work they produced

"It seems that while the **quantity group** was busily churning out piles of work — and **learning from their mistakes** — the **quality group** had sat theorizing about perfection, and in the end **had little more to show** for their efforts than grandiose theories and a pile of dead clay."

- Bayles and Orland, 2001, p.29

HOW TO PROTOTYPE

PROTOTYPING: BEST PRACTICES

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RAPID PROTOTYPES ARE PREFERRED ESPECIALLY EARLY IN DESIGN PROCESS

Besides speeding up that process of experimentation, prototypes are easy to **throw away when they fail**. Creativity requires cycling lots of ideas. The more you invest in your prototype and the closer to “final” it is, the harder it is to let go of a concept that’s not working.

Tom and David Kelley

From: *Why Designers Should Never Go to a Meeting Without a Prototype*,
Slate 2013





Michael Bernstein @msbernst · 16 Nov 2014

@brrian timeboxing the prototype. most ideas can be boiled down to an essence that can be prototyped quickly



1

•••

[View conversation](#)

Keep in mind that **rapid** doesn't necessarily mean lo-fi.

GUILLAUME ARDAUD, APPLE DESIGNER | WWDC 2017

EXAMPLE: RAPID PROTOTYPING AT APPLE



DESIGN TASK: REDESIGN TIMER APP





HOW WOULD YOU BUILD THIS PROTOTYPE?





HOW LONG DID IT TAKE TO BUILD THIS PROTOTYPE?





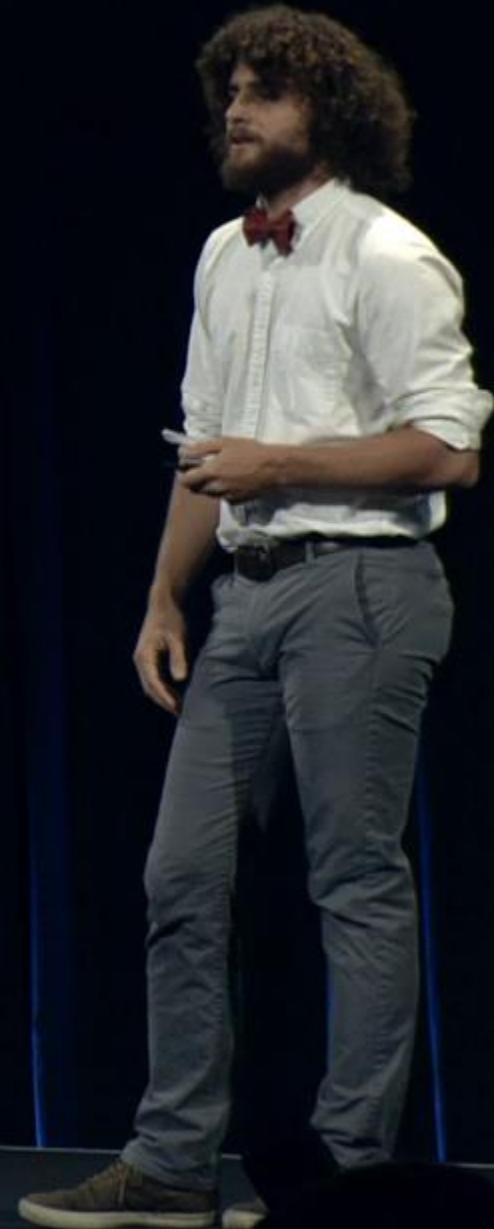
HOW LONG DID IT TAKE TO BUILD THIS PROTOTYPE?

60 SECS | BUILT USING KEYNOTE





MAKING THINGS FAST ENABLES EXPLORING MANY IDEAS



HOW TO PROTOTYPE

PROTOTYPING: BEST PRACTICES

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HOW TO PROTOTYPE

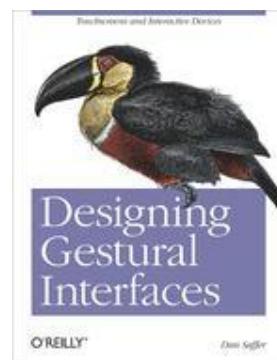
PERCEIVED FIDELITY OF PROTOTYPES CAN INFLUENCE REACTIONS

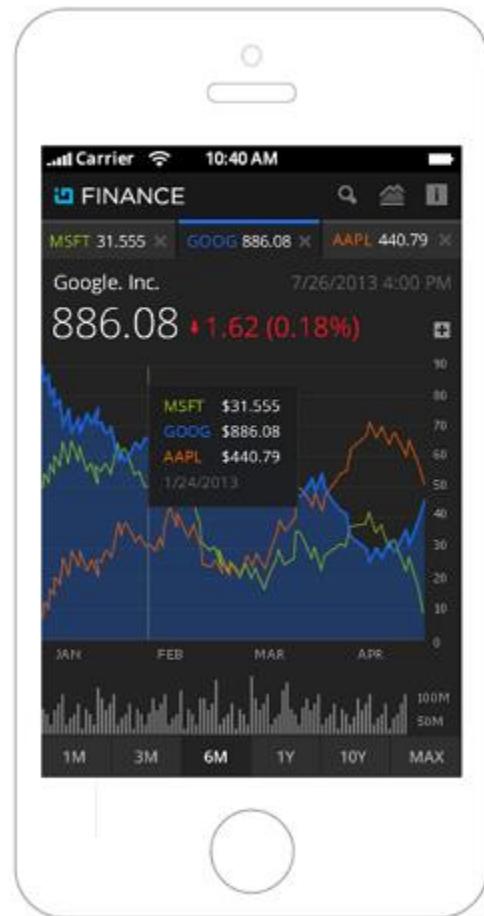
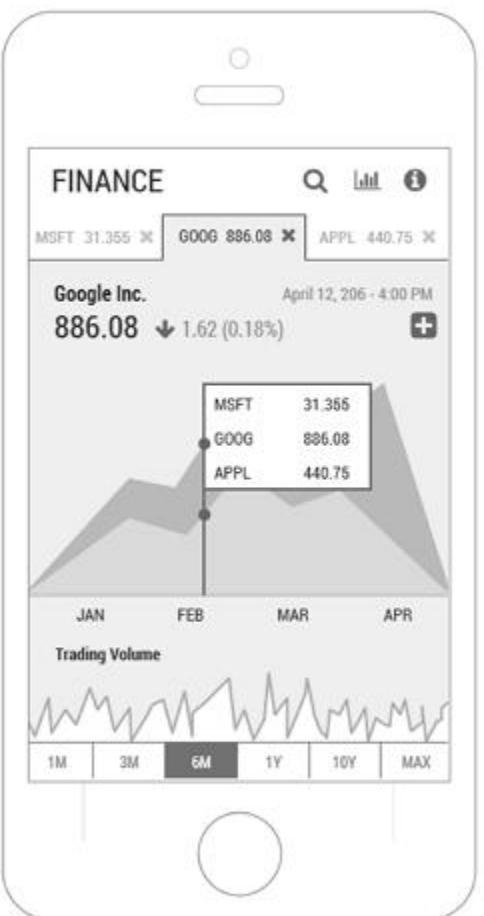
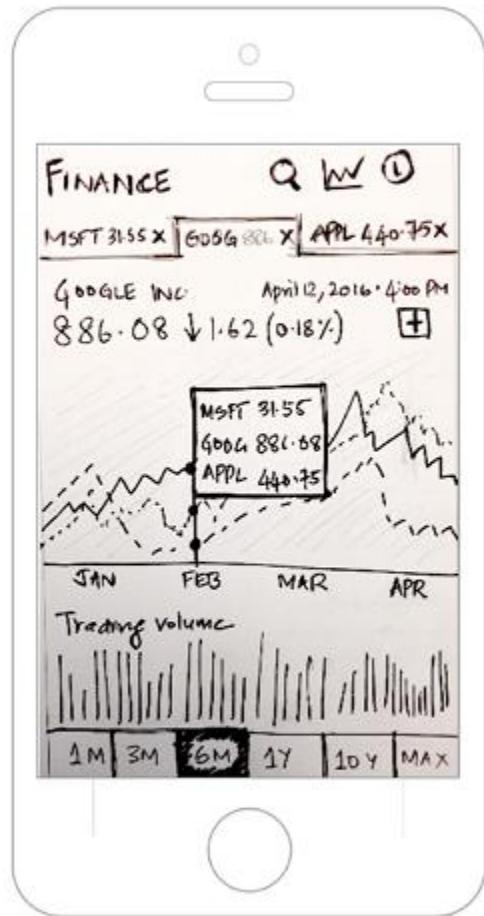


The **more refined the prototype** is, the **more refined the response** to it will likely be.

Dan Saffer

Chapter 6: Prototyping Interactive Gestures
Designing Gestural Interaction, 2008



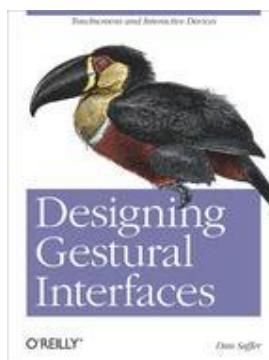


PERCEIVED FIDELITY OF PROTOTYPES CAN INFLUENCE REACTIONS

Oddly, **refined feedback can be a bad thing**. A high-fidelity, working prototype could engender lots of comments about the colors used or typefaces involved, not about the concept, features, gestures, and system flow, which may be what you really care about (and should care about in the early stages of prototyping).

Dan Saffer

Chapter 6: Prototyping Interactive Gestures
Designing Gestural Interaction, 2008



HOW TO PROTOTYPE

PROTOTYPING: BEST PRACTICES

Use prototypes to **rapidly try ideas** that **communicate and convince**

The importance of **exploring a breadth of ideas**

Focus on **rapidly building prototypes** to explore design space

Perceived fidelity of prototypes can impact **responses**

Iteration is critical

Prototype **multiple designs in parallel**

Show/test **multiple prototypes** to enable comparison

DESIGN ITERATION EXPERIMENT: EGG DROP STUDY

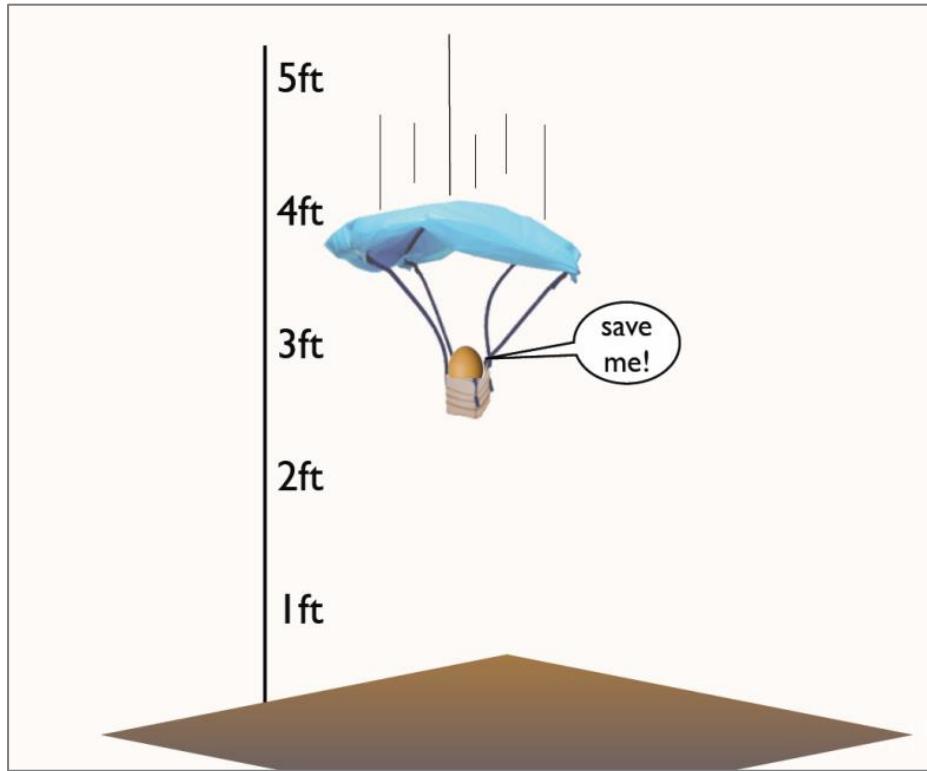


Design task selection



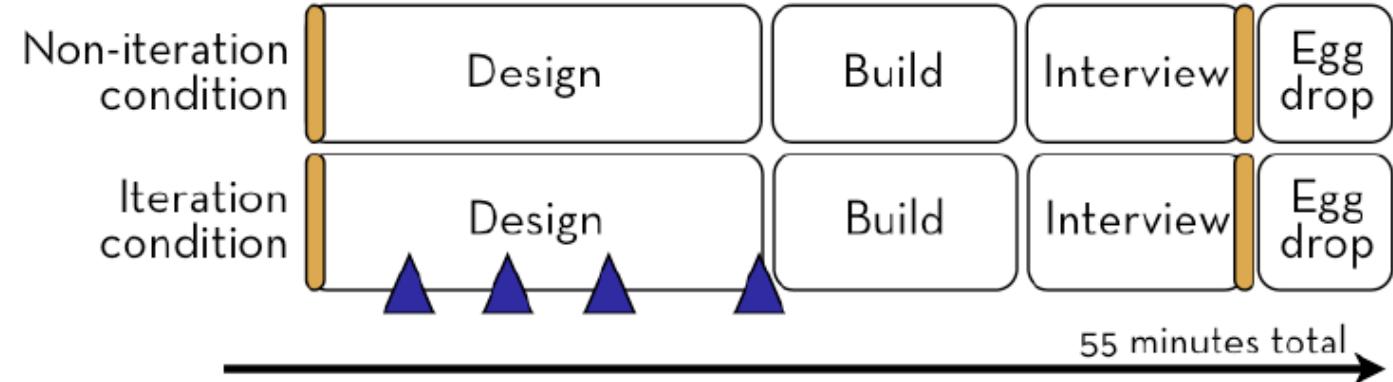
IMPORTANCE OF ITERATION

DESIGN ITERATION EXPERIMENT: EGG DROP STUDY



STUDY TASK

Design a robust egg drop vessel that maximizes the height of the drop without breaking the egg.

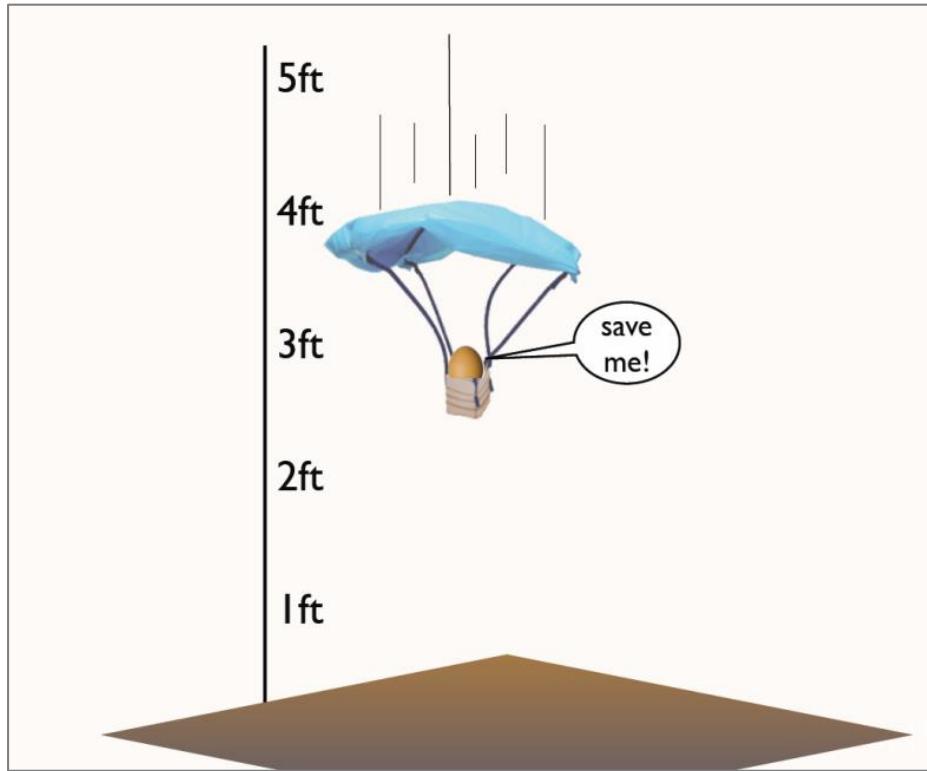


EXPERIMENTAL DESIGN

Study had two groups (between subjects design): one group given a full carton of eggs and encouraged to conduct test drops (iteration group). The other group was given only one egg, which was used the final egg drop.

IMPORTANCE OF ITERATION

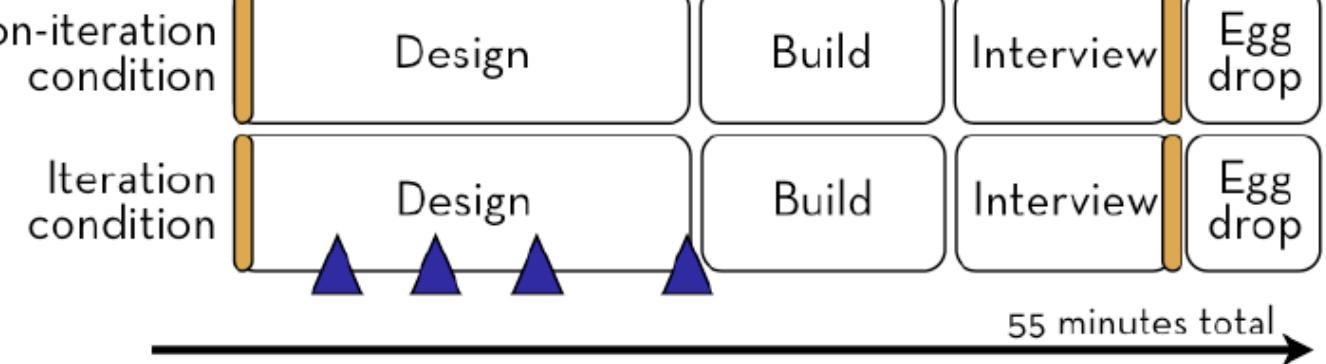
DESIGN ITERATION EXPERIMENT: EGG DROP STUDY



STUDY TASK

Design a robust egg drop vessel that maximizes the height of the drop without breaking the egg.

WHICH GROUP DID BETTER?



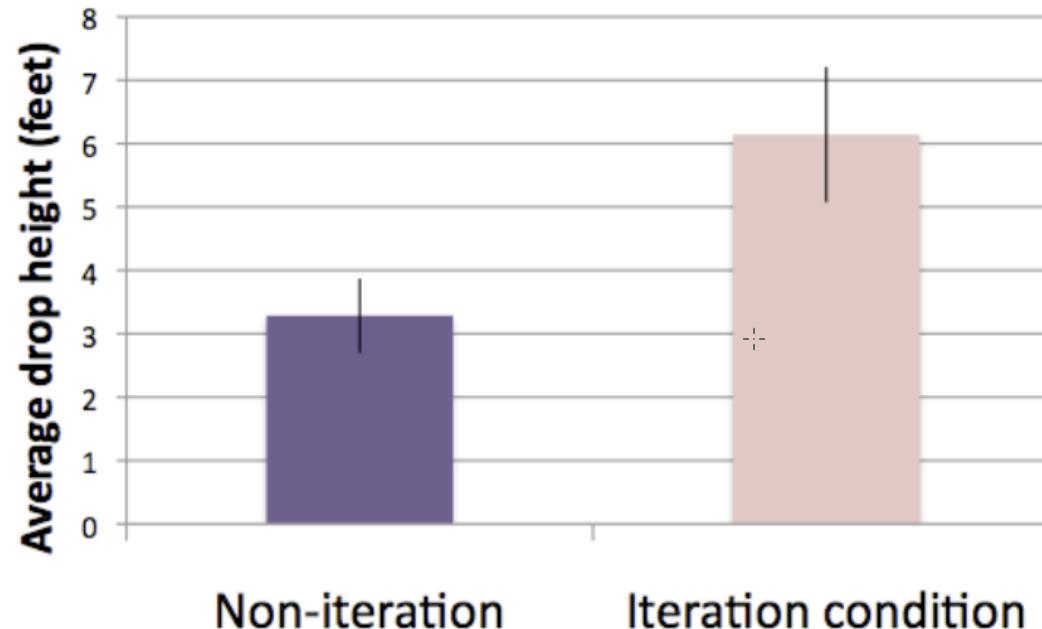
EXPERIMENTAL DESIGN

Study had two groups (between subjects design): one group given a full carton of eggs and encouraged to conduct test drops (iteration group). The other group was given only one egg, which was used the final egg drop.

IMPORTANCE OF ITERATION

RESULT SUMMARY

Iteration group outperformed non-iteration group & gained more confidence while designing.



PRIMARY RESULT

Participants in the iteration condition significantly outperformed the non-iteration condition in the egg drop design task.

This study also nicely highlights **design fixation** and
getting stuck in local maxima.

Participants learn through experimentation



LARRY TESLER, APPLE 1980-1997

DESIGN ITERATION EXAMPLE: PROTOTYPING APPLE LISA USER INTERFACE





Bill Atkinson

Apple Computer
20525 Mariani Avenue
Cupertino, Calif. 95014
USA
(415) 408-1010



Make

Learn

Show



HOW TO PROTOTYPE

PROTOTYPING: BEST PRACTICES

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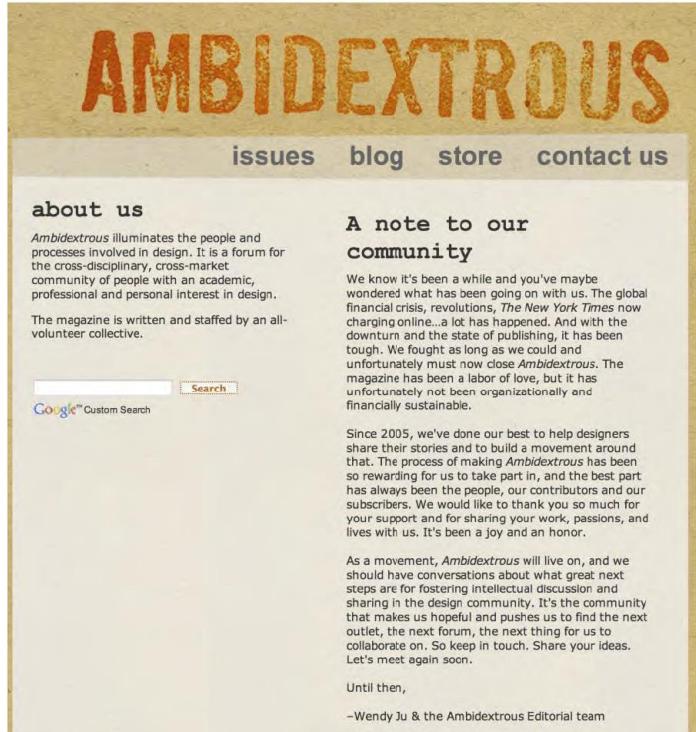
Iteration is critical

Prototype **multiple designs in parallel**

Show/test **multiple prototypes** to enable comparison

HOW TO PROTOTYPE

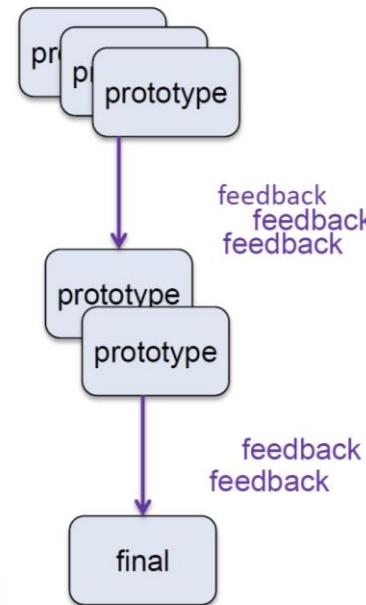
IMPORTANCE OF CREATING MULTIPLE PROTOTYPES IN PARALLEL



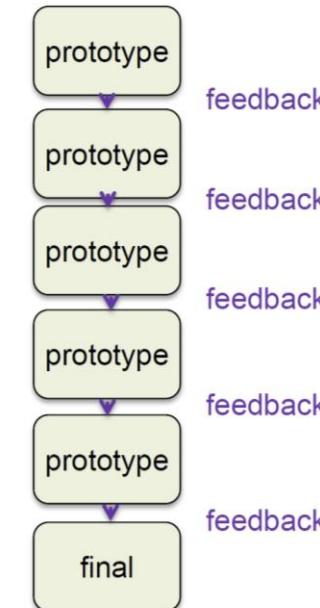
STUDY TASK

Create a web banner ad for Ambidextrous magazine

PARALLEL GROUP

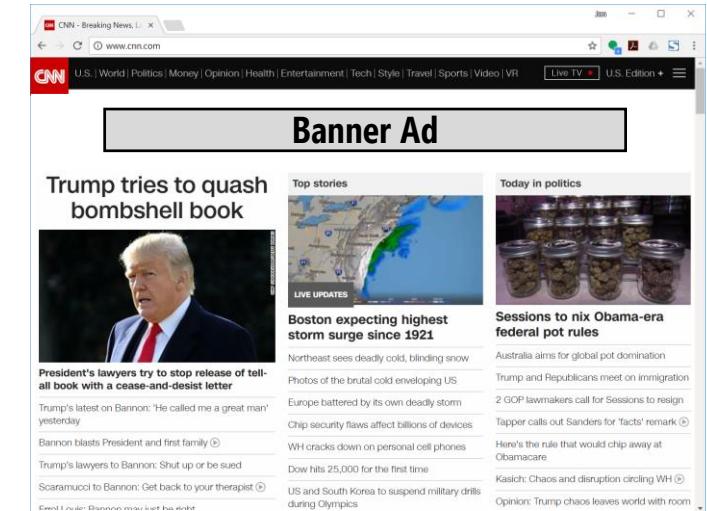


SERIAL GROUP



STUDY DESIGN

Two study groups (again, between subjects). One group was the parallel prototyping group that was told to prototype multiple designs in parallel. The other, the serial group, was told to produce one design and iterate.

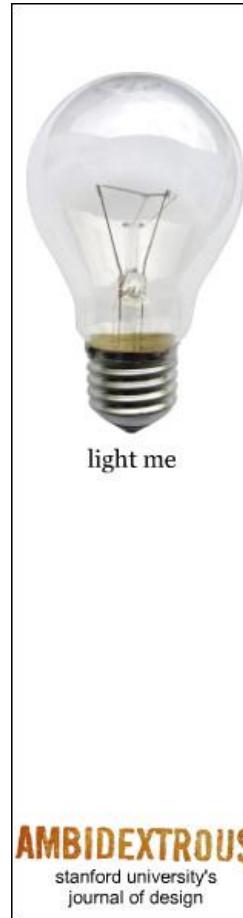
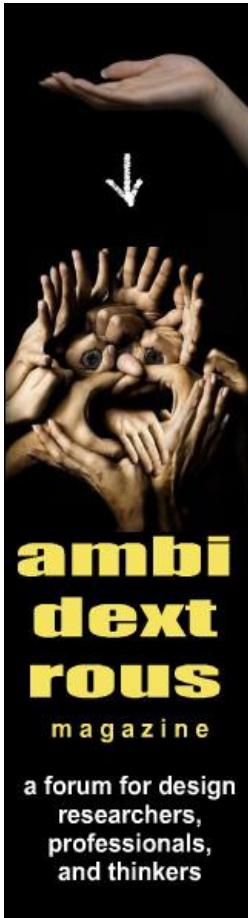


MEASURES

They deployed the ads and actually measured click-through rates. Also received novice and expert critiques

HOW TO PROTOTYPE

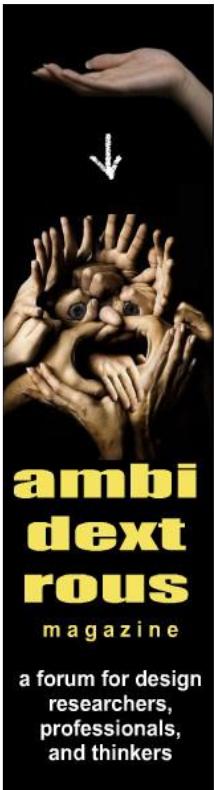
SOME EXAMPLE FINAL ADS: WHICH IS YOUR FAVORITE?



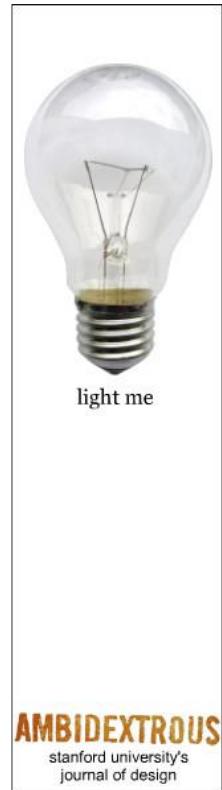
HOW TO PROTOTYPE

SOME EXAMPLE FINAL ADS: WHICH IS YOUR FAVORITE?

PARALLEL PROTOTYPING CONDITION



CLICK-THROUGH RATE: 1ST
EXPERT RATING: 6TH



CLICK-THROUGH RATE: 9TH
EXPERT RATING: 1ST

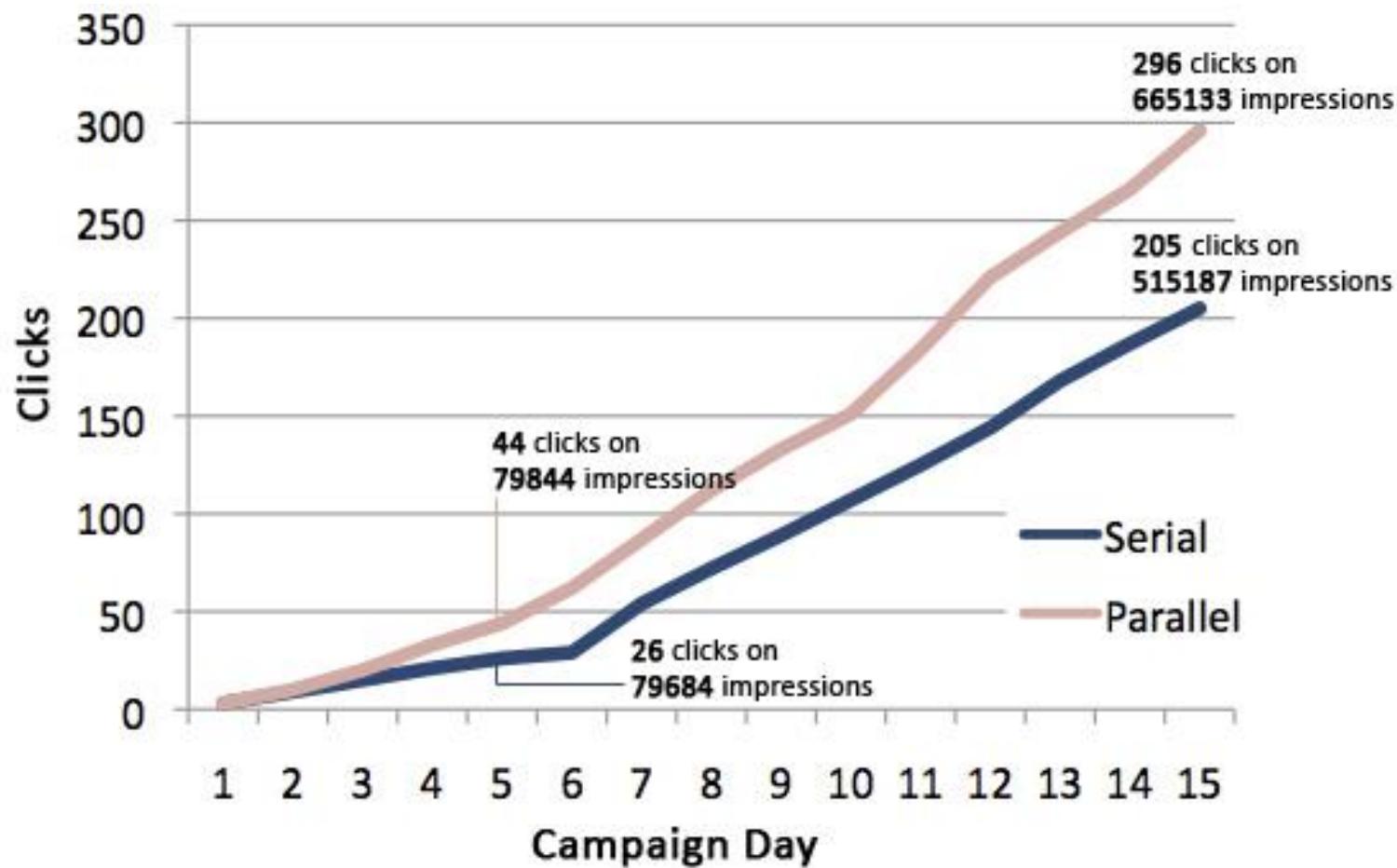
SERIAL PROTOTYPING CONDITION



CLICK-THROUGH RATE: 4TH
EXPERT RATING: 32ND

OVERALL RESULTS: CLICK-THROUGH RESULTS

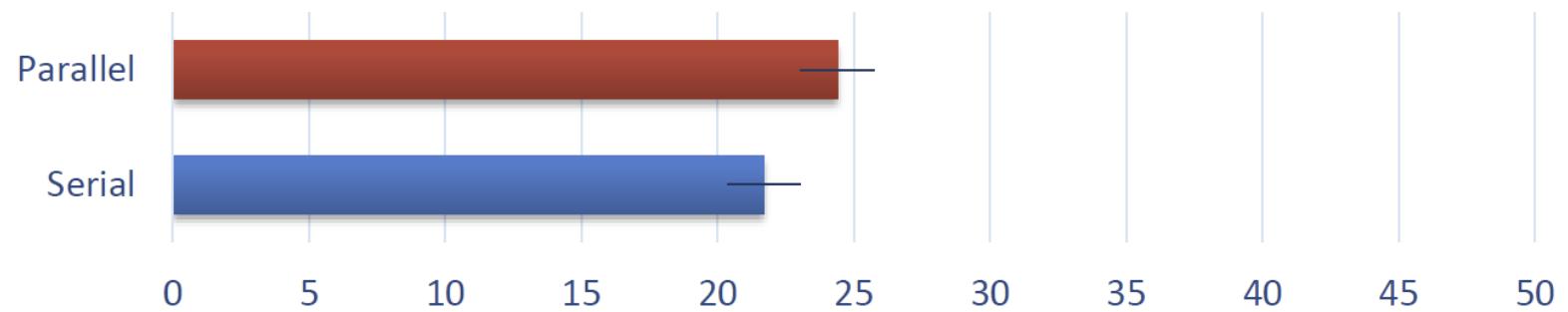
Parallel ads received more clicks—and more clicks per impression—than serial ads during 15-day campaign.



OVERALL RESULTS: SUBJECTIVE RATINGS

EXPERT QUALITY RATING

Scale of 0-50; 50 is best



Experts rated ads produced in parallel group as significantly better than ads in serial group. Importantly, the experts did not know how the ads were produced.

HOW TO PROTOTYPE

PROTOTYPING: BEST PRACTICES

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HOW TO PROTOTYPE

IMPORTANCE OF TESTING MULTIPLE PROTOTYPES TOGETHER

IMPORTANCE OF TESTING MULTIPLE PROTOTYPES TOGETHER



We have found **subjects reluctant to be critical of designs** when they are asked to assign a rating to the design. In our usability tests, we see the same phenomenon **even when we encourage subjects to be critical**.

Wiklund, Thurrot, & Dumas
Human Factors Society 1992

IMPORTANCE OF TESTING MULTIPLE PROTOTYPES TOGETHER



We have found **subjects reluctant to be critical of designs** when they are asked to assign a rating to the design. In our usability tests, we see the same phenomenon **even when we encourage subjects to be critical**. We speculate that the test subjects feel that giving a low rating to a product gives the impression that they are "negative" people, that the ratings **reflect negatively on their ability** to use computer-based technology... or that they **don't want to hurt the feelings of the person conducting the test**.

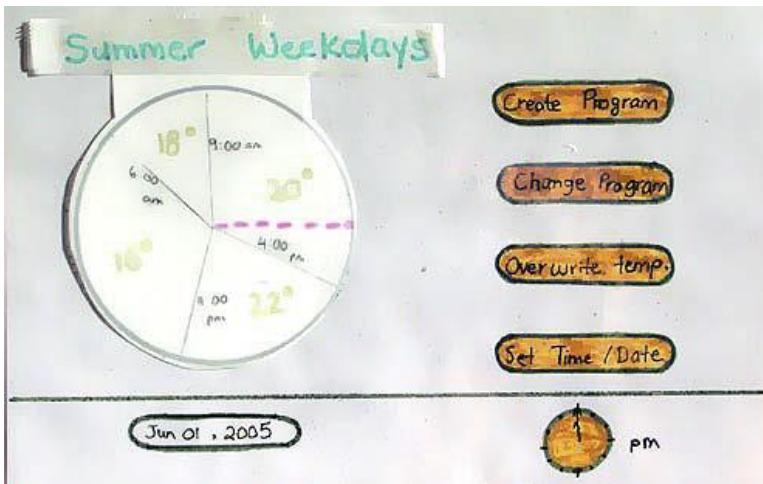
Wiklund, Thurrot, & Dumas
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HOW TO PROTOTYPE

TESTING MULTIPLE PROTOTYPES TOGETHER: AN EXPERIMENT

Developed three lo-fi prototypes. All designed by same team. Tried to ensure that all three designs were consistent in terms of fidelity, functionality, and quality

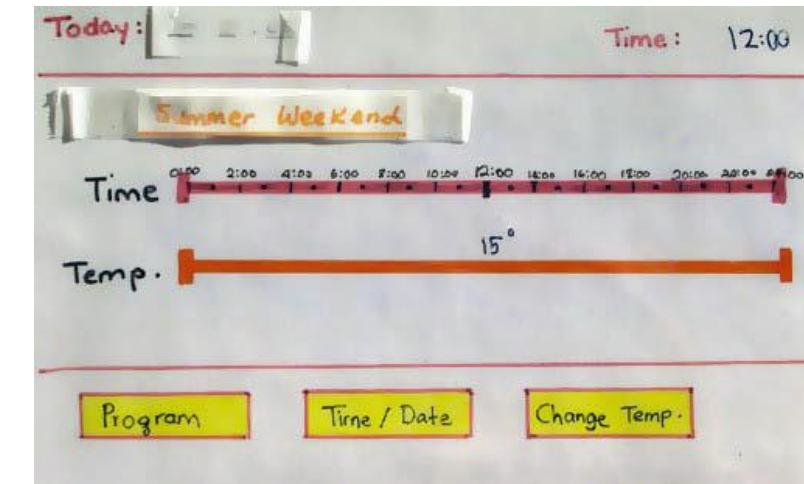
CIRCULAR PAPER PROTOTYPE



TABULAR PAPER PROTOTYPE

A tabular paper prototype for a programming interface. It includes a "Program" section with a dropdown menu set to "Summer on Vacation". Below are four sections: "Morning", "Day", "Evening", and "Night", each with "From" and "To" time pickers and a "temperature" slider. At the bottom are "Date", "Time", and "Temperature" fields, along with a date picker and a time picker.

LINEAR PAPER PROTOTYPE



STUDY DESIGN

48 participants. Two groups (between subjects design). One group only used one prototype. Other group used all three.

STUDY TASKS

Participants performed four tasks, including setting the time/date, setting the temperature, & programming thermostat.

STUDY DATA

Observational notes, video recordings, questionnaires, post-study interviews

HOW TO PROTOTYPE

TESTING MULTIPLE PROTOTYPES TOGETHER: AN EXPERIMENT

CHI 2006 Proceedings • Usability Methods

April 22-27, 2006 • Montréal, Québec, Canada

Getting the Right Design and the Design Right: Testing Many Is Better Than One

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ABSTRACT

We present a study comparing usability testing of a single interface versus three functionally equivalent but stylistically distinct designs. We found that when presented with a single design, users give significantly higher ratings and were more reluctant to criticize than when presented with the same design in a group of three. Our results imply that by presenting users with alternative design solutions, subjective ratings are less prone to inflation and give rise to more and stronger criticisms when appropriate. Contrary to our expectations, our results also suggest that usability testing by itself, even when multiple designs are presented, is not an effective vehicle for soliciting constructive suggestions about how to improve the design from end users. It is a means to identify problems, not provide solutions.

Author Keywords
Design, Prototyping, Usability Testing, Evaluation, Methods, User Centered Design, Participatory Design.

ACM Classification Keywords
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION
The use of low-fidelity and paper prototypes is now well established in the design of commercial user interfaces [11, 12, 14]. This is largely due to their relatively low cost, coupled with the results of a number of researchers [2, 13, 15, 16] who have found that the usability data that they got from low and high fidelity prototypes were comparable. Hence, this type of instrument can provide a means to gain early insights into a design before the size of the investment prevents changes being made.

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CHI 2006, April 22-27, 2006, Montréal, Québec, Canada.

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Much of the often cited literature [11, 14] emphasizes the use of paper prototypes in usability testing [8]. The primary benefit in this case is to provide an inexpensive way to refine a design earlier in the process than would otherwise be possible. In this, they serve as an aid in *getting the design right*.

Another aspect of the relatively low cost of paper prototypes is their potential to enable the early exploration of more design alternatives than would otherwise be affordable (in time and money). Taking these two things together, an underlying question in our research is, "Can exposing users to multiple design alternatives also help us in *getting the right design*?" Besides helping us improve the usability of any particular design, can they also help us explore alternative designs?

Much of the often-cited literature on paper prototyping [11, 13, 14] focuses almost exclusively on the former. However, there is some literature on "parallel design" where different teams independently work on the same problem [7, 8, 9, 10], but this only touches on what we are interested in with the latter. Our experience in the traditional design arts, such as industrial design, graphic design and architecture, is that the simultaneous investigation of multiple alternatives by the same designer or team and the exploration of alternative designs pervades all stages of the process. The following quote from the VP of design for a major corporation captures this:

*...a designer that pitched only one idea would probably be fired. I'd say 5 is an entry point for an early formal review (distilled from 100's). Oh, and if you are pushing one particular design you will be found out, and also fired. By my standard it is about open mindedness, humility, discovery, and learning. If you aren't authentically dedicated to that approach you are just doing it wrong!*¹

In this study, we investigate the impact of simultaneously evaluating three designs compared to just one during early usability testing.

Participants exposed to multiple prototypes (i.e., alternative designs) were more critical compared to participants exposed to only a single design.

No differences were found in providing design suggestions.

¹ Alistair Hamilton, VP Design, Symbol Corp. Personal Communication.