Quiz!

30 minutes (1:45-2:15)

Closed note, closed book

Come up and ask if you have questions.

Design Process

CIS 7000

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Last time

Cognitive accounts can explain many challenges we face in design:

- **Design fixation:** unnecessarily focusing on a subset of the design space
- **Analogical transfer:** what do we see as related inspiration?

They can also help us be precise about how to improve design:

- **Gulfs of execution & evaluation:** what needs to be reduced?

Strategies for managing design fixation

- Demand characteristics, and strategies for managing them

Today

Quiz 1

Wicked problems

Strategies for managing wicked problems

- Participatory design
- Design patterns

Design is not a static process.

It can be studied, supported, and improved.

Wicked problems

“Math is easy.
Design is hard.”

Jeffrey Veen, former VP of Product Design at Adobe

Why is design hard?

Design: "Engineering, medicine, business, architecture, and painting are concerned not with the necessary but with the contingent – not with how things are but with **how they might be** – in short, with design" [Simon 1969]

What is it that makes design so hard to do well? Why is it hard to find preferred solutions that are actually better and creative?

Wicked problems

[Rittel and Webber 1973]

Wicked problems are problems whose requirements are contradictory or unknown: no global optimum

Conflicting perspectives & goals mean there is no "correct" solution:

- Urban planning: I can widen the sidewalks, but this will create more traffic in the streets
- Pedagogy: In CS 4120, students simultaneously want to learn more design, and more technical depth—but nobody wants more work
- Larger-scale problems too, like climate change

Design + wicked problems

[Zimmerman, Forlizzi, and Evenson 2007]

Design is challenging because it must solve wicked problems.

> Example: Wikipedia reduced the amount of spam it got, at the cost of pushing away many newcomers. It could be more welcoming to newcomers, at the cost of quality and spam.

Due to the conflicting perspectives and goals, traditional waterfall and analytical engineering methodologies will often fail.

Design + wicked problems

[Zimmerman, Forlizzi, and Evenson 2007]

Argument: **design is better tuned for solving wicked problems** than traditional waterfall and analytical engineering approaches

> "Enlightened trial and error succeeds over the planning of the lone genius." – Tom Kelley, IDEO

> If these traditional approaches ask how we combine known facts and principles to solve a problem a priori, design praxis focuses on iteration as a means of exploring and learning

> Design argues that we best learn about wicked problems through iterative feedback processes

So now what?

What do we do when we're facing a wicked problem? Just knowing that it's wicked doesn't fix it…

Step one: console yourself by telling your friends at parties that what you do is way harder than what they do, so they should think that you're cool. (This works for me 100% of the time.)

Step two: ensure that you've got the right perspectives represented either on your team or in the literature, and don't reinvent the wheel. Interventions > Solutions.

Today: design patterns

Today: participatory design

Participatory design (PD)

What power should the designer have?

In the traditional design process, designers hold positions of power and status

> They decide which stakeholders to engage with, how to prioritize each stakeholder's needs, and which design concepts to move forward with.

This power is a source of tension: synthesis is the designer's role and expertise, but it also also **cuts out stakeholders from direct or indirect control**

Participatory design

[Schuler and Namioka 1993; Mueller and Kuhn 1993]

A design process that de-centers the designer's role

Involve stakeholders in all phases of the design process:

Needfinding ←

Problem definition

Develop and focus ideas

Evaluation ←

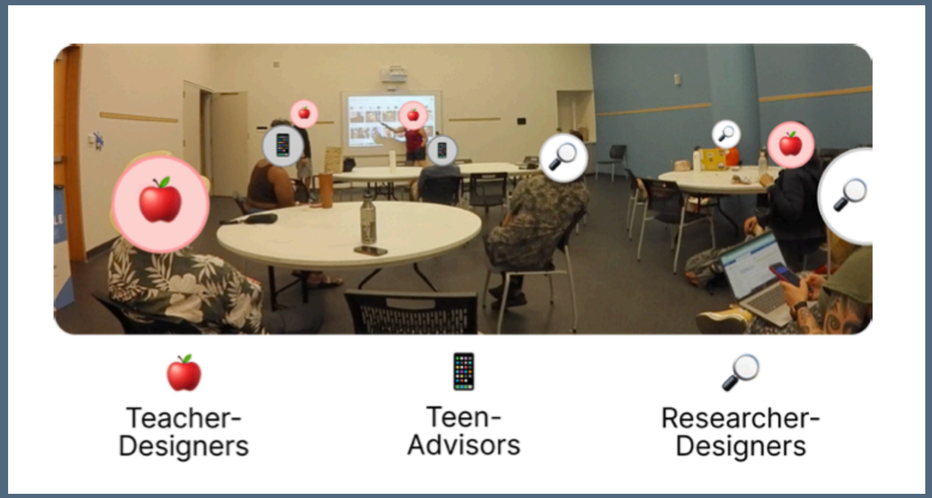
Non-participatory design processes involve stakeholders most deeply here

Examples

Collaborating with gig workers to create a platform for online collective action [Salehi et al. 2015]

Working with older adults to design health tracking applications [Davidson and Jensen 2013]

Youth as advisors designing learning activities [Noh et al 2025]



Elicitation studies

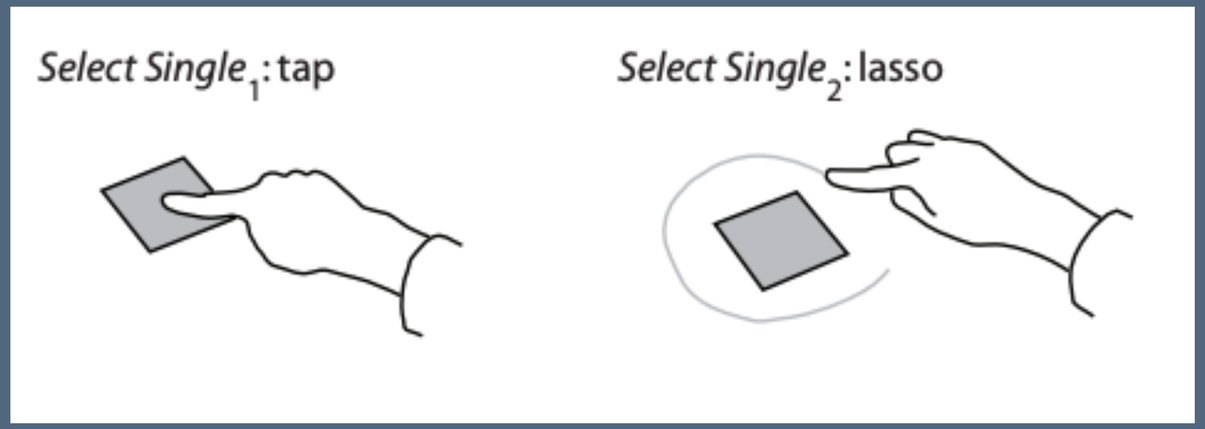
[Wobbrock and Morris 2009]

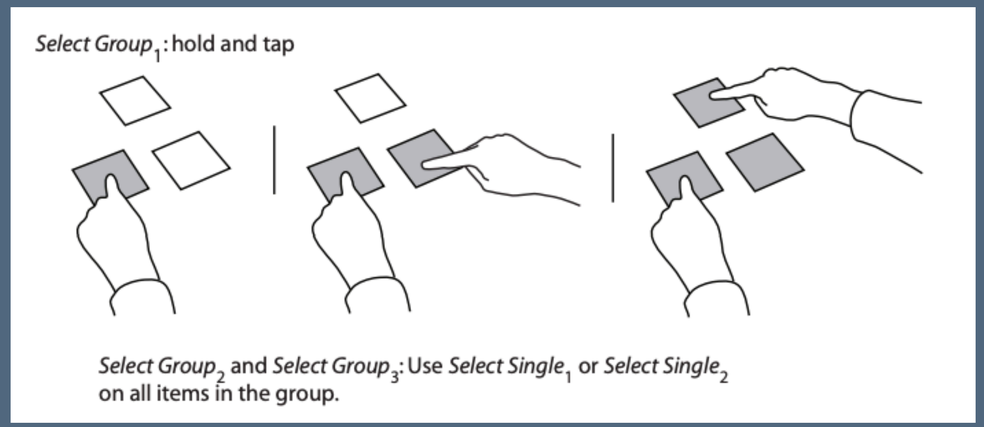
When entering a new design space (e.g., large multitouch tables, AR, mid-air interaction), **how do we know which gestures** would be the most effective for non-technical people?

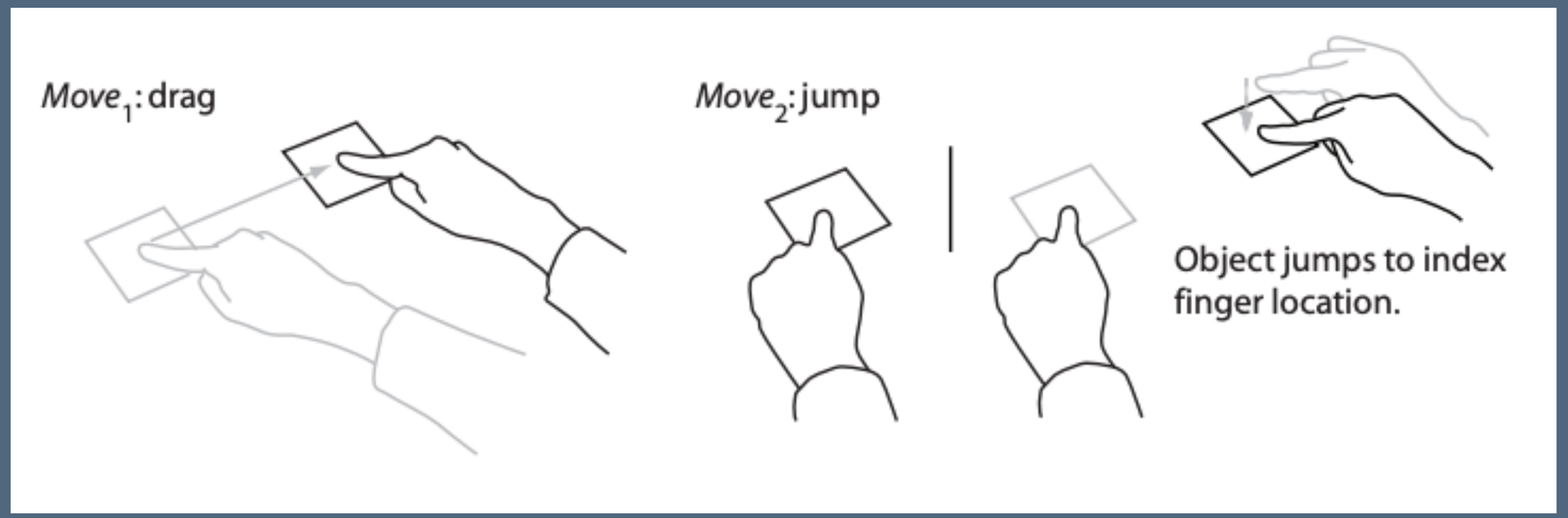
Concept: tell people the command, and **ask them to gesture in a way that they think should invoke that command**. Then, look for agreement amongst these spontaneous gestures.

Elicitation studies

[Wobbrock and Morris 2009]







PD is not a panacea

[Harrington, Erete, and Piper 2019]

The design workshop is **not a neutral ground**

Status hierarchies cannot be erased, nor can trust be established, just by inviting people into a room

Design valorizes d.school-style creativity—**not a skill taught or necessarily comfortable** for underserved communities. *"The crayons, markers and stuff… it's like an* **elementary school** *activity."*

Design foregrounds **blue-sky utopianism** when underserved communities may simply be looking for **pragmatic solutions**

PD is not a panacea, part 2

When a design team misses the mark, an obvious critique is "**you should have included [stakeholder group X]**"

The challenge then becomes: **what's your stopping criteria** for adding stakeholder voices? Is there ever an ethical stopping point?

How do you balance between including more stakeholder groups and making sure you can still make effective decisions?

Needfinding doesn't solve this, either [Bennett and Rosner 2019]

We espouse **empathy** as a designer's solution to knowing enough about a stakeholder group to design with or for them

However, typical design strategies for empathizing can lend **false confidence** and incorrect conclusions (e.g., blindfolds)

Stuck between Scylla and Charybdis?

Scylla: Trying to build empathy on your own creates major issues — you should bring stakeholders onto your team [Bennett and Rosner 2019]

Charybdis: But bringing stakeholders onto your team creates other issues [Harrington, Erete, and Piper 2019]

Struggles in the classroom

[Roldan et al. 2020]

HCI education says "go out there and work with people!", but we often don't in practice [Hui et al. 2014]

And even when students try to engage in participatory design…

- The HCI students self-segregate and don't build relationships with other stakeholders
- Students may feel uncomfortable guiding co-design sessions: who's in charge here? Am I supposed to listen to them, or are they supposed to listen to me?
- What ought we to do?

Well, that's still a downer…

"Geez, you haven't solved the deep structural and socio-technical issues with the human-centered design process as centered in Western educational systems and capitalist industrialized societies."

Sorry. That whole "wicked problem" thing — we're all working on it.

But we can **intervene** in nearly any part of this process if we have ideas.

Design patterns

The trouble with design

Design is a praxis with many degrees of freedom, but also many ways to screw it up

Temptations to be different or creative can wind you up with terrible designs

How do we maintain breathing space for new ideas while not accidentally stepping off the ledge?

Design patterns

[Alexander 1977]

Originated in urban planning

"Each pattern describes **a problem which occurs over and over again** in our environment, and then describes the core of a solution to that problem, in such a way that **you can use this solution a million times over, without ever doing it the same way twice**."

Design patterns

[Alexander 1977]

Q4U: how does this connect to the Wicked Problems framework we just discussed?

He thinks good design emerges through life over time — wants to show how to replicate that with in-advance planning

Alexander's idea: Design as Mathematics (like a system of equations)

- To design a physical space (he's an urban planner), first list all the **needs of the community**
- Then identify how they might relate or conflict
- Finally solve (using design, materials, or construction) each interconnected piece of the puzzle (the solutions are **patterns** because they can be re-applied elsewhere)

Design patterns of a metropolis

[Alexander 1977]

"Metropolitan regions will not come to balance until each one is small and autonomous enough to be an independent sphere of culture”: patterns include…

- Subculture boundary: e.g., Chinatown is bounded by the banking area
- Identifiable neighborhood: < 500 people in local neighborhood units
- Neighborhood boundary: subcultures in neighborhoods need restricted physical access

Design patterns of a neighborhood

[Alexander 1977]

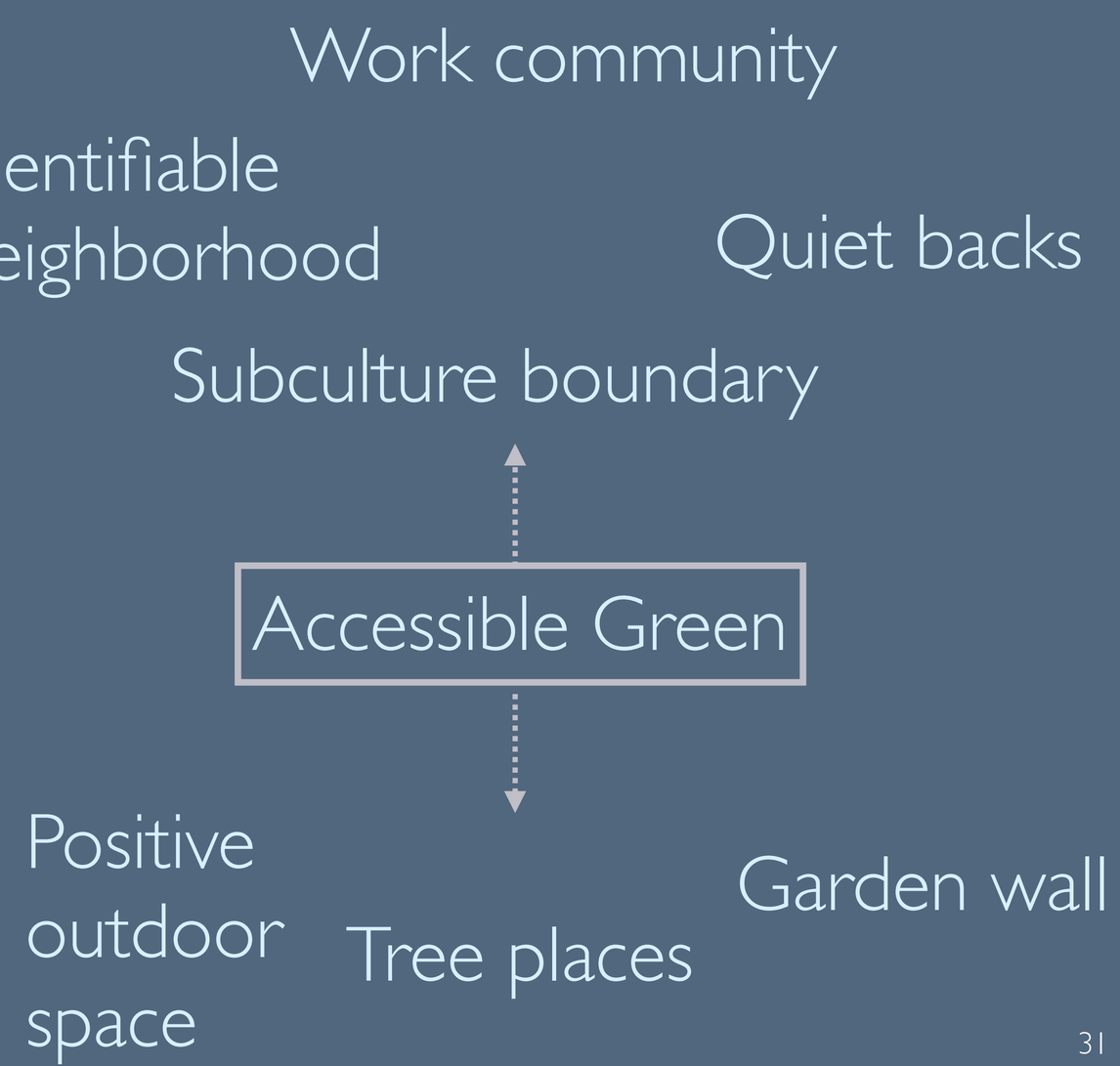
"Establish community and neighborhood policy to control the character of the local environment": patterns include…

- Four story limit: keep the majority of buildings <4 stories
- No more than 9% of land dedicated to parking
- The Street Cafe: seating into the street, encourage people to sit, watch, chat
- Ensure that the community include a balance of people at every stage of the life cycle

Design pattern of a town

[Alexander 1977]

A **pattern language** is a set of design patterns, collected together, organized, and connected to each other.



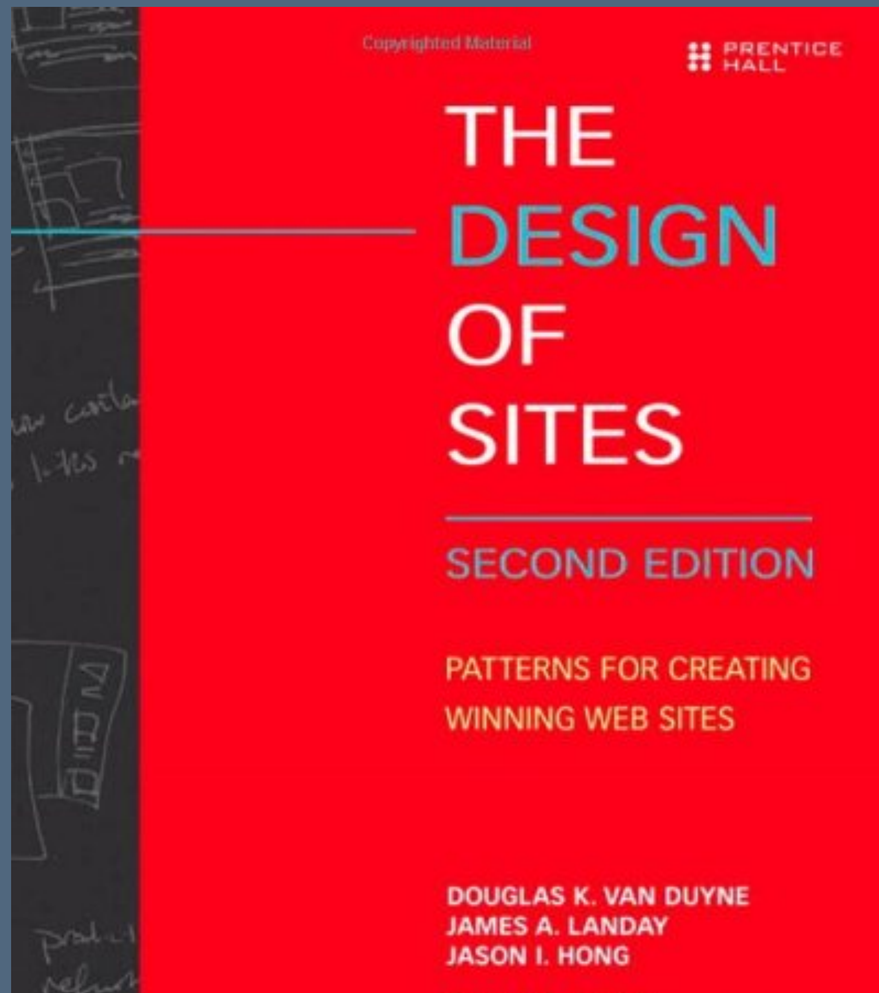
Interaction design patterns

[van Duyne, Landay, and Hong 2006]

Web design, much like urban planning, can be characterized by design patterns

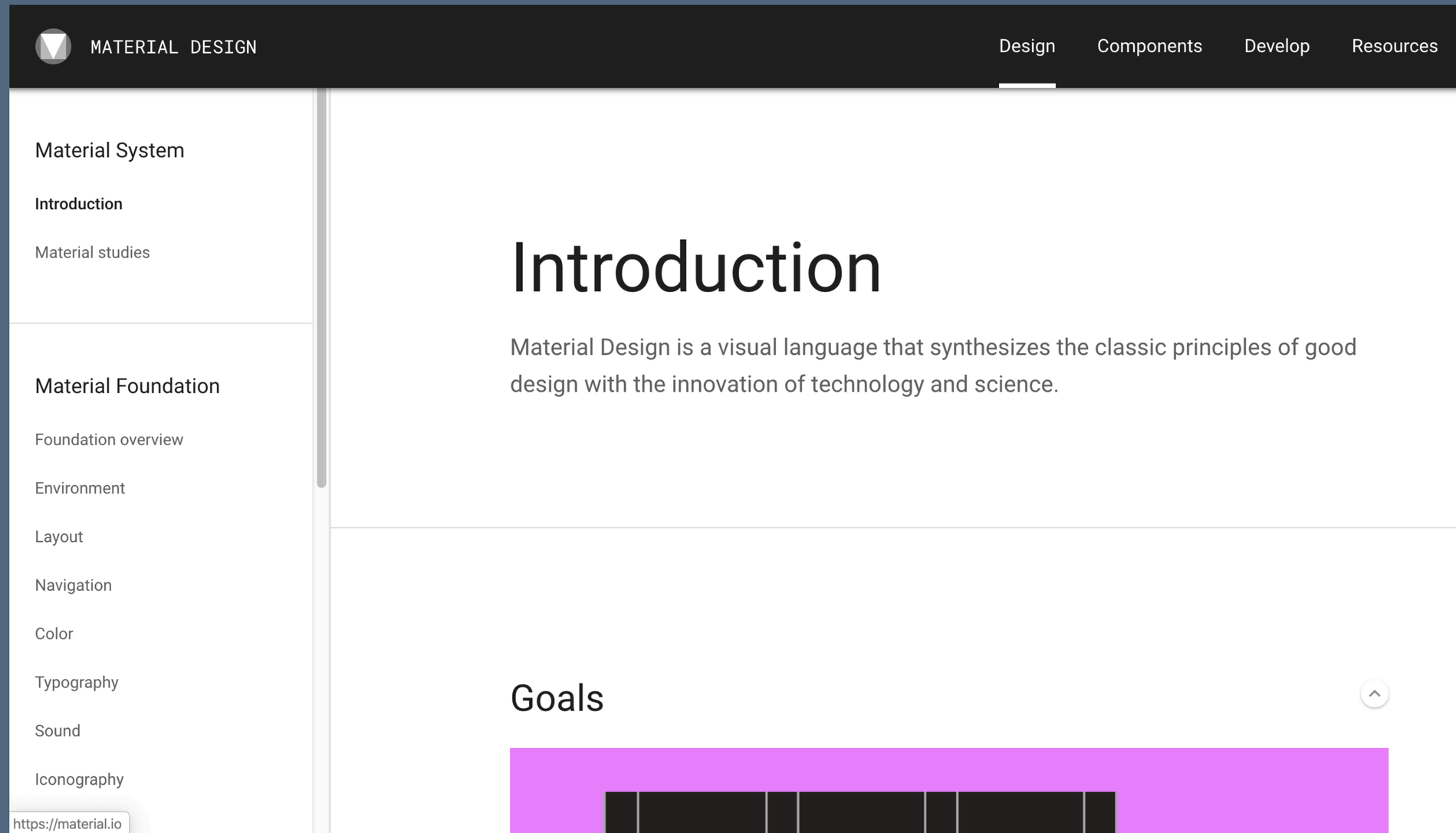
Examples...

- Distinctive HTML titles
- Quick-flow checkout
- Floating windows
- News mosaics



Interaction design patterns

Web design also features pattern languages: very similar to a “design system” except design systems are focused lower level



Web design patterns

[Kumar et al., CHI '13]

Crawl the web and index large-scale design elements

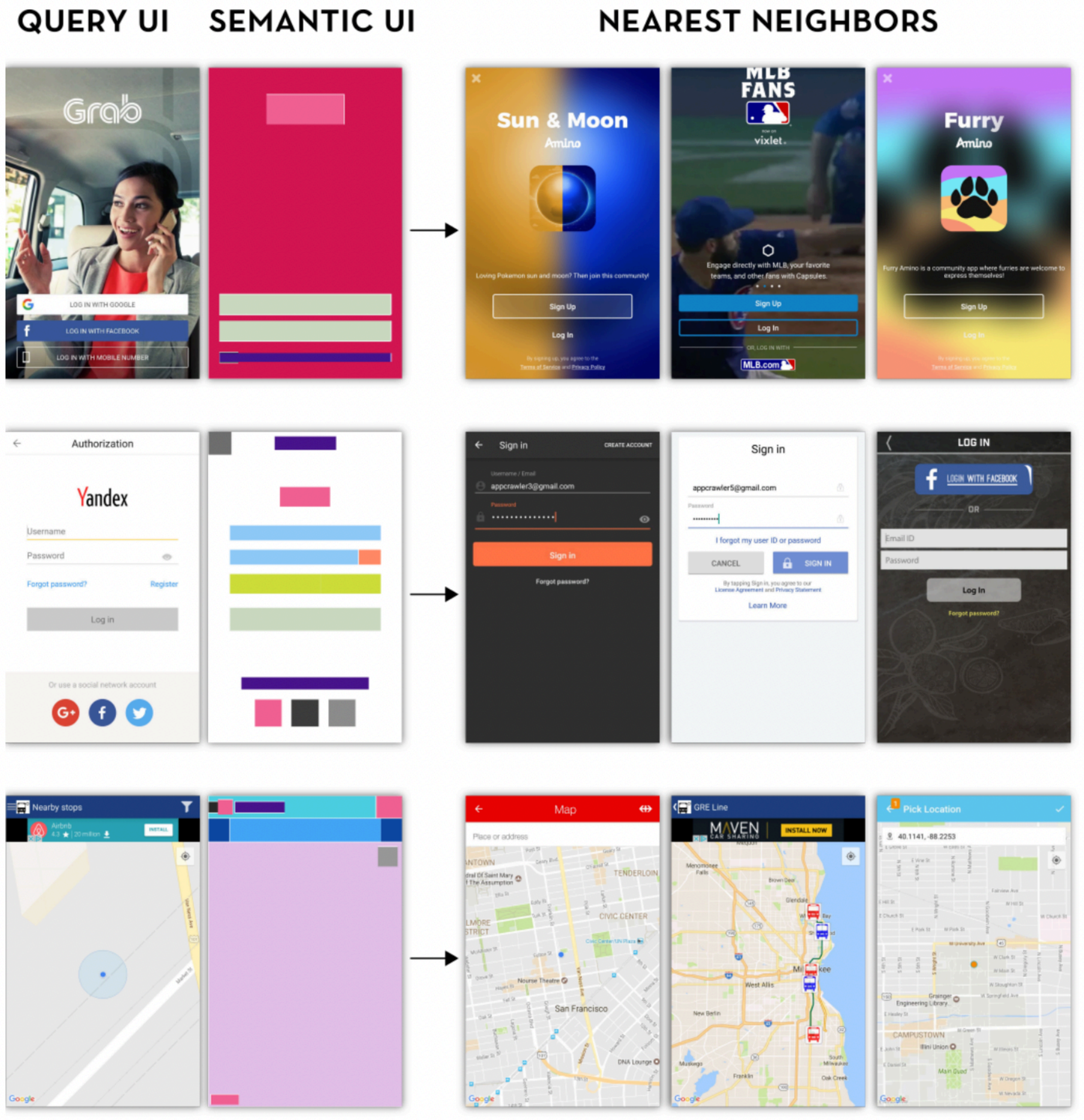
What happens to web design if we start data mining design patterns rather than user interaction data?

App design patterns

[Liu et al. 2018]

Collect a large dataset of Android app interaction traces

Query with a design, and find how others have developed similar designs

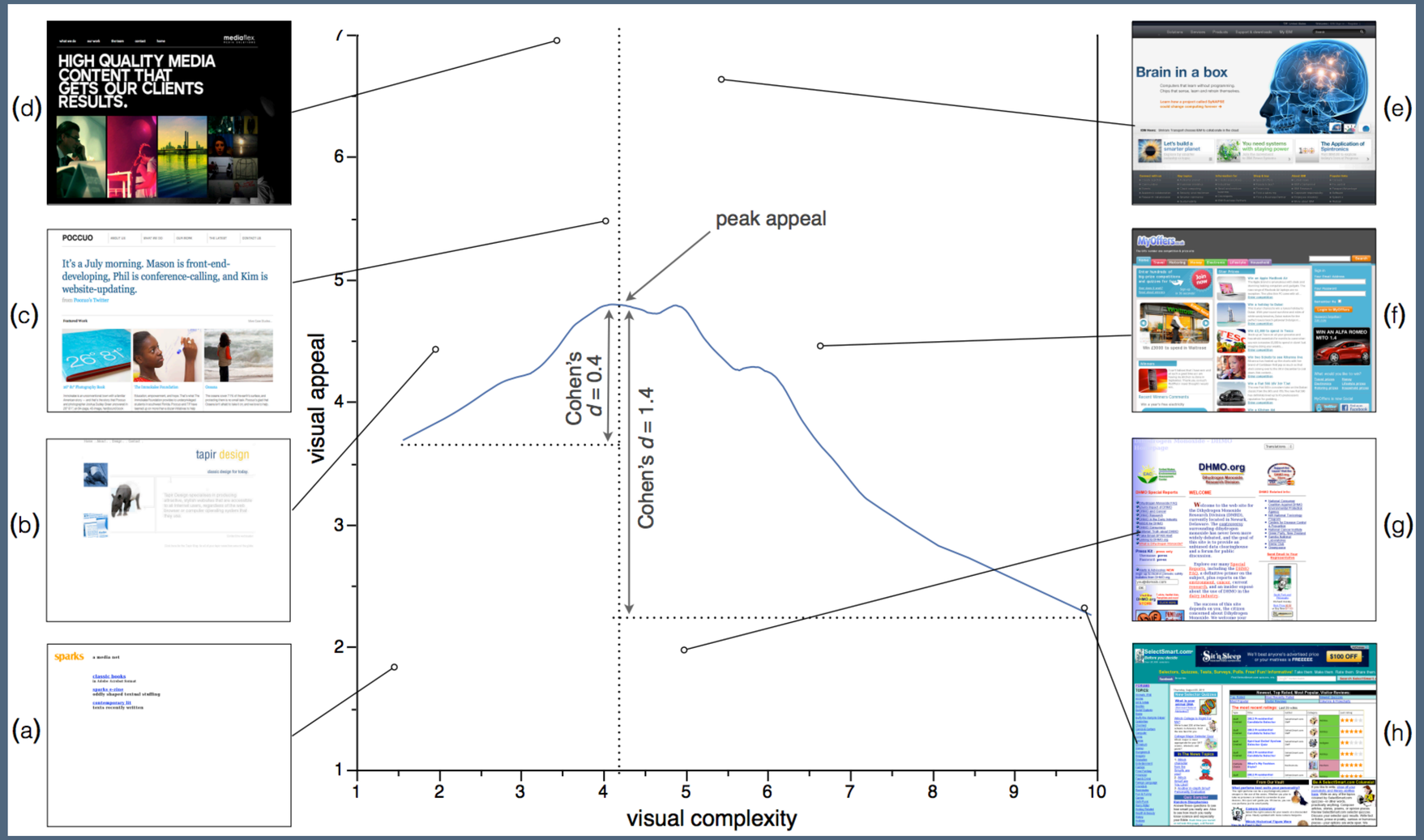


Quantifying Visual Preferences

[Reinecke and Gajos 2014]

Online quiz about which web sites you like

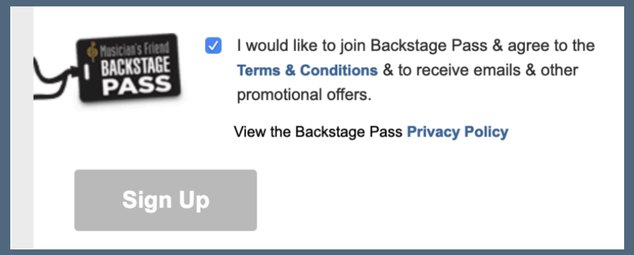
Analyzed sites to identify levels of, e.g., visual complexity that are preferred in different cultures



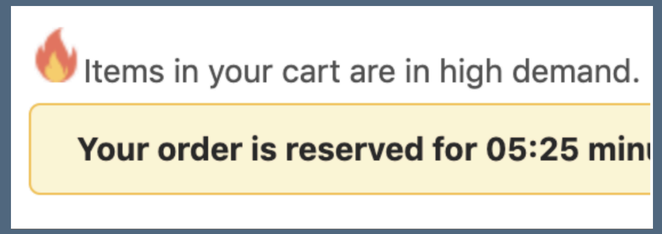
Dark design patterns

[Mathur et al. 2019]

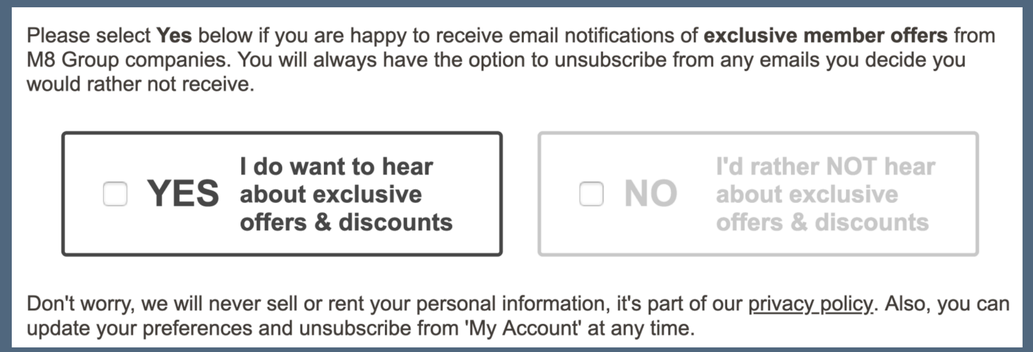
Not all design patterns are good: **dark patterns** are strategies that designs use to coerce, steer, or deceive you into making a decision that its creators want



Forced enrollment



Pressure tactics (applied to every item in the store)



Graying out the option to decline

Summary

The design process is a set of structured activities meant to address problems in how we generate and develop ideas

These activities are well attuned to solving **wicked problems**, which feature contradictory or conflicting goals

Participatory design is a movement to decenter the designer's power in these activities. It offers many opportunities, but also many challenges.

Design patterns help us avoid reinventing the wheel.

We can intervene on these activities to address shortcomings in how we practice design: e.g., **parallel prototyping** and **comparing multiple designs** (to reduce **design fixation** and **demand characteristics**)

References

Alexander, Christopher. A pattern language: towns, buildings, construction. Oxford university press, 1977.

Bayles, David, and Ted Orland. Art & fear: Observations on the perils (and rewards) of artmaking. Image Continuum Press, 2001

Bennett, Cynthia L., and Daniela K. Rosner. "The Promise of Empathy: Design, Disability, and Knowing the" Other"." Proceedings of the 2019 CHI conference on human factors in computing systems. 2019.

Davidson, Jennifer L., and Carlos Jensen. "What health topics older adults want to track: a participatory design study." Proceedings of the 15th International ACM SIGACCESS Conference on Computers and Accessibility. 2013.

Deng, Wesley Hanwen, et al. "Beyond General Purpose Machine Translation: The Need for Context-specific Empirical Research to Design for Appropriate User Trust." arXiv preprint arXiv:2205.06920 (2022).

Dow, Steven P., et al. "Parallel prototyping leads to better design results, more divergence, and increased self-efficacy." ACM Transactions on Computer-Human Interaction (TOCHI) 17.4 (2010): 1-24.

Hui, Julie S., Elizabeth M. Gerber, and Steven P. Dow. "Crowd-based design activities: helping students connect with users online." Proceedings of the 2014 conference on Designing Interactive Systems. 2014.

Kumar, Ranjitha, et al. "Webzeitgeist: design mining the web." Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. 2013

References

Liu, Thomas F., et al. "Learning design semantics for mobile apps." Proceedings of the 31st Annual ACM Symposium on User Interface Software and Technology. 2018.

Muller, Michael J., and Sarah Kuhn. "Participatory design." Communications of the ACM 36.6 (1993): 24-28.

Noh, Daniel J., et al. "Youth as Advisors in Participatory Design: Situating Teens' Expertise in Everyday Algorithm Auditing with Teachers and Researchers." Proceedings of the 24th Interaction Design and Children. 2025. 415-428.

Reinecke, Katharina, and Krzysztof Z. Gajos. "Quantifying visual preferences around the world." Proceedings of the SIGCHI conference on human factors in computing systems. 2014.

Rittel, Horst WJ, and Melvin M. Webber. "Dilemmas in a general theory of planning." Policy sciences 4.2 (1973): 155-169.

Roldan, Wendy, et al. "Opportunities and challenges in involving users in project-based HCI education." Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems. 2020.

Salehi, Niloufar, et al. "We are dynamo: Overcoming stalling and friction in collective action for crowd workers." Proceedings of the 33rd annual ACM conference on human factors in computing systems. 2015.

Schuler, Douglas, and Aki Namioka, eds. Participatory design: Principles and practices. CRC Press, 1993.

Simon, Herbert A. The Sciences of the Artificial. MIT press, 1969.

References

Tohidi, Maryam, et al. "Getting the right design and the design right." Proceedings of the SIGCHI conference on Human Factors in computing systems. 2006.

Van Duyne, Douglas K., James A. Landay, and Jason I. Hong. The design of sites: Patterns for creating winning web sites. Prentice Hall Professional, 2007.

Wobbrock, Jacob O., Meredith Ringel Morris, and Andrew D. Wilson. "User-defined gestures for surface computing." Proceedings of the SIGCHI conference on human factors in computing systems. 2009.

Zimmerman, John, Jodi Forlizzi, and Shelley Evenson. "Research through design as a method for interaction design research in HCI." Proceedings of the SIGCHI conference on Human factors in computing systems. 2007.