

# **IN4MATX 231:**

# **User Interface Design & Evaluation**

**Class 20:**  
**HCD as a research method**  
**and wrap-up**

Daniel Epstein

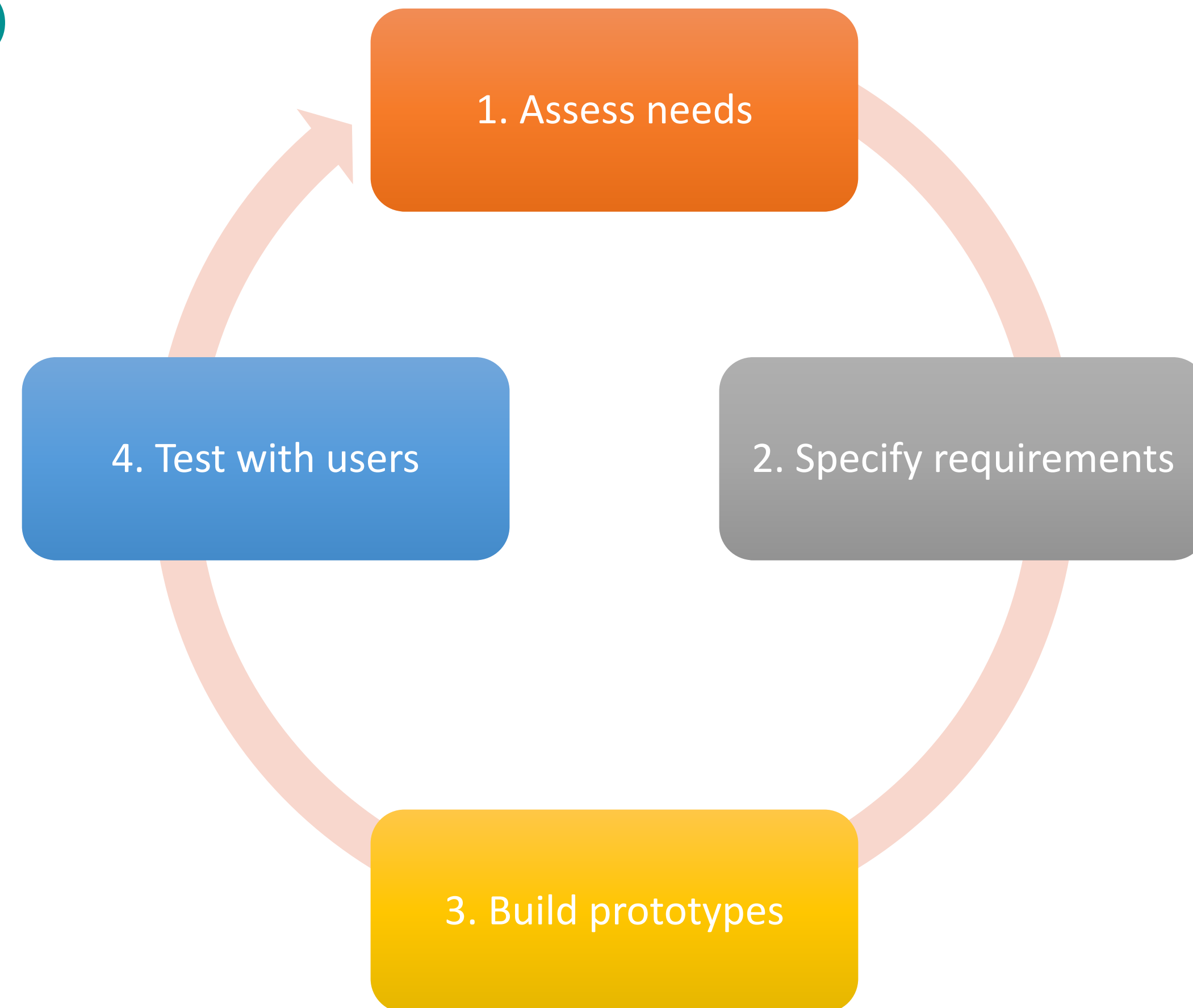
# Today's goals

By the end of today, you should be able to...

- Differentiate how Human-Centered Design is applied in research and in practice
- Discuss some best practices for applying each stage of HCD in research
- Summarize what you learned in this course

# Applying Human-Centered Design

## Phases of HCD



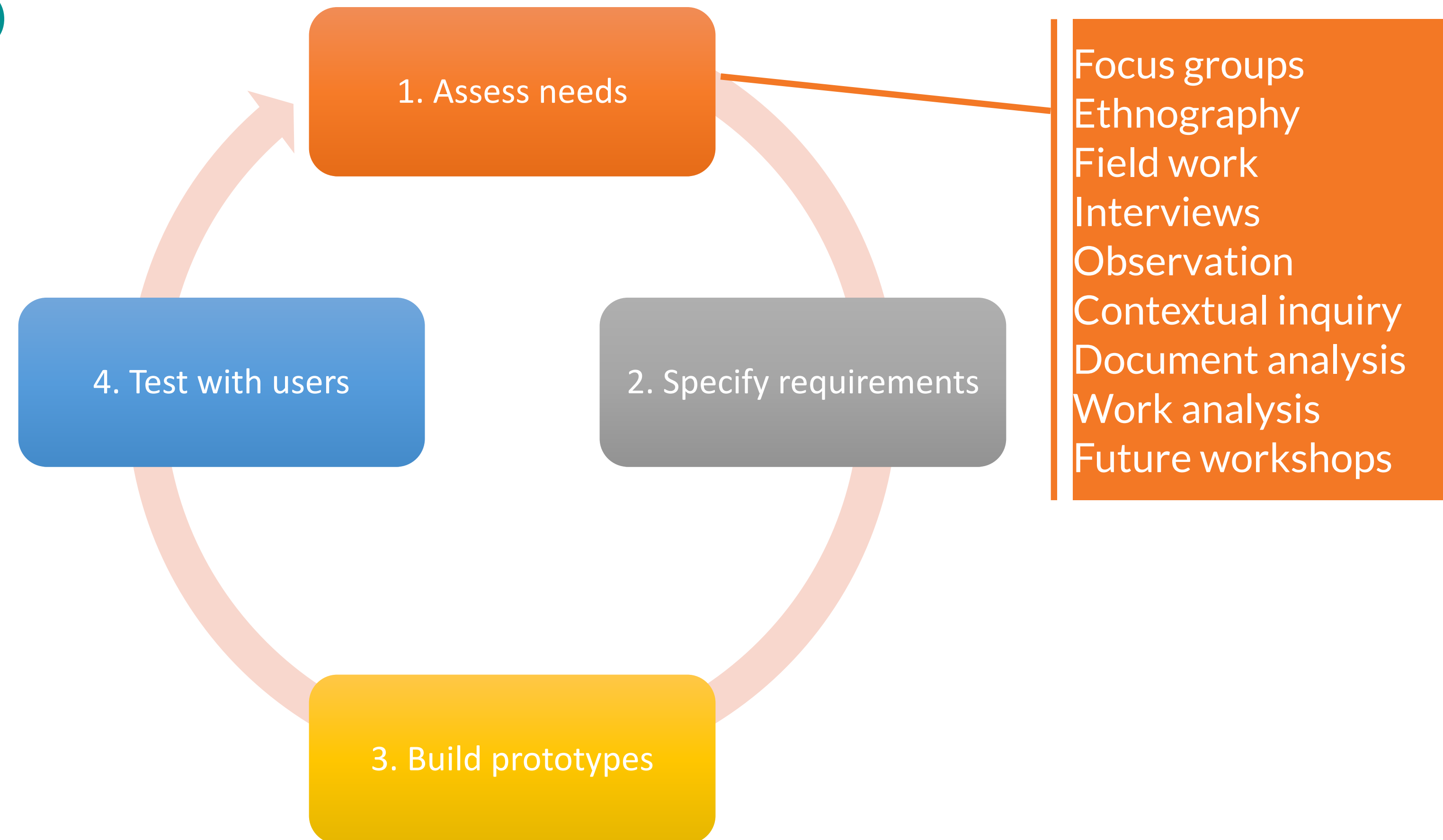
**HCI research takes parts  
from all stages of HCD**

# Applying HCD methods

- Many papers focus on a single stage of the HCD process
  - Needfinding through interviews
  - Requirements analysis through scenario development
- Others combine a few stages
  - Designing a high-fidelity prototype and evaluating it
  - Using formative surveys to inform persona development

# Applying Human-Centered Design

## Phases of HCD



# Applying HCD methods

## Assessing needs

- Often works nicely as a standalone research contribution (e.g., paper)
  - When presented with “design implications”
  - Often “triangulated” across multiple methods (surveys and interviews, forum discussions and observations)

# Applying HCD methods

## Assessing needs

- Strategy 1: information gathering
  - Interviews, surveys, etc. to understand people's practices or thoughts
- Strategy 2: co-design
  - Conduct some sort of participatory design activity to elicit needs and requirements



# Applying HCD methods

## Assessing needs

Time

7:00am

Meal Type

Breakfast

Hunger & Fullness Level (Before)

1

2

3

4

5

6

7

8

9

10

Starving

Slightly Hungry

Full

Binge Full

Food Items (Before)

Food Items (After)

Portion Size

Serving Size

1 serving

Hunger & Fullness Level (After)

1

2

3

4

5

6

7

8

9

10

Starving

Slightly Hungry

Full

Binge Full

Nutrition Facts

Calories (kcal)

1200

Carbs (g)

164

Fiber (g)

20

Fat (g)

48

Sodium (mg)

1280

Eating Strategy

Enter your eating strategy of this meal

Water Intake

4

cups of water today

Time

7:00am

Meal Type

Breakfast

Mood

Happy

Neutral

Sad

Angry

Food Items

Enter food items

Portion Size

Enter serving Size

Hunger Satisfaction Rating

1

2

3

4

5

Not Satisfied

Satisfied

Nutrition Facts

Calories (kcal)

1200

Carbs (g)

164

Fiber (g)

20

Fat (g)

48

Sodium (mg)

1280

Water Intake

4

+

cups of water today

Time

7:00am

Exercise

fitbit

Enter the type of exercise you do

Duration

1

h

20

min

Intensity

1

2

3

4

5

6

7

8

9

10

Effortless

Light

Hard

Maximum Effort

Sleep Quality

fitbit

1

2

3

4

5

6

7

8

9

10

Poor

Fair

Great

Yuhan Luo, Peiyi Liu, and Eun Kyoung Choe. 2019. Co-Designing Food Trackers with Dietitians: Identifying Design Opportunities for Food Tracker Customization. In Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems (CHI '19). ACM, New York, NY, USA, Paper 592, 13 pages. DOI: <https://doi.org/10.1145/3290605.3300822>

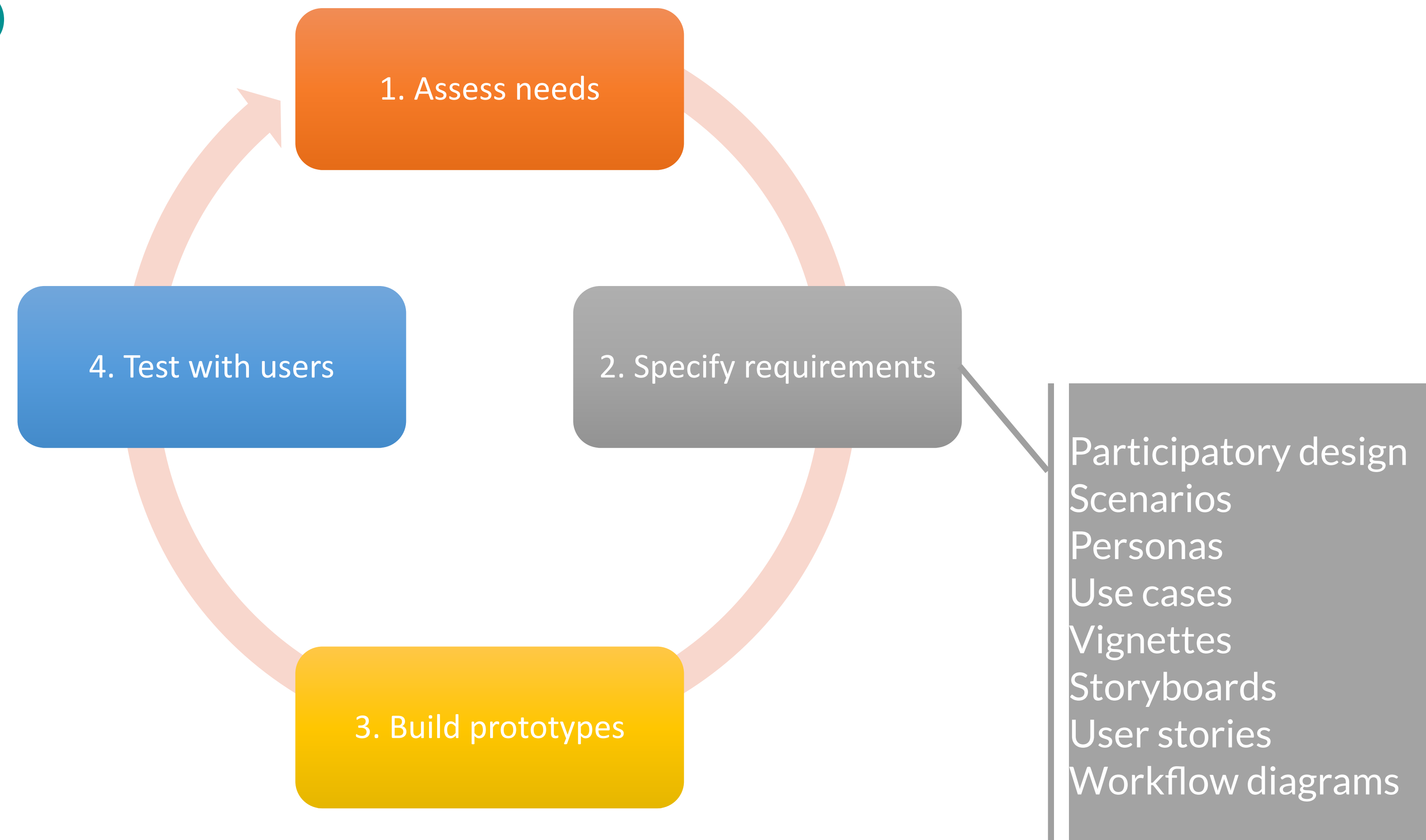
# Applying HCD methods

## Assessing needs

- Presenting as a standalone contribution requires greater depth
  - Hearing from more people
  - Hearing from people with more diverse backgrounds
  - More rigorous methods (grounded theory, inductive/deductive coding)
  - Connecting with a theoretical foundation to explain results or develop new theory (social learning theory, behavior change theory, queer theory...)

# Applying Human-Centered Design

## Phases of HCD



# Applying HCD methods

## Specify requirements

- Can be the primary contribution of a research paper, if in an area where personas/scenarios can help other researchers
- But usually still incorporated with other methods
  - Assessing needs work to determine the requirements
  - Evaluative work to determine the usefulness of the personas/scenarios



# Applying HCD methods

## Specify requirements

### Pat (Patricia) Jones



- 43 years old
- Employed as an Accountant
- Lives in Cardiff, Wales

Pat loves public transportation and knows at least three routes to get there from home. When she arrives at work, she scans all her emails first to get an overall picture before answering any of them. (This extra pass takes time but seems worth it.) Some evenings she plays computer puzzle games like Sudoku before bed.

#### Background knowledge and skills

- Pat works as an accountant in a consulting firm. She just moved to this employer 1 week ago, and their software systems are new to her. She describes herself as a "numbers person". She is not a professional programmer but she writes and edits spreadsheet formulas in her work.
- Pat has a degree in accounting, so she knows plenty of Maths and knows how to think in terms of numbers. She's never taken any computer programming or IT systems classes.
- Even though she's an accountant and deals with numbers all day at work, she likes working with numbers in her free time, too. She especially likes Sudoku and other computer games that involve puzzling.

#### Motivations and Strategies

- **Motivations:** Pat is proficient with the technologies she uses. She learns new technologies when she needs to, but she doesn't spend her free time exploring technology or exploring obscure functionality of programs and devices that she uses. She tends to use methods she is already familiar and comfortable with to achieve her goals.
- **Information Processing Style:** Pat leans towards a *comprehensive information processing style* when she needs to gather information to problem-solve. That is, before following any option that seems promising, she first gathers information comprehensively to try to form a complete understanding of the problem before trying to solve it. Thus, her style is "burst-y"; first she reads a lot, then she acts on it in a batch of activity.

#### Attitude to Technology



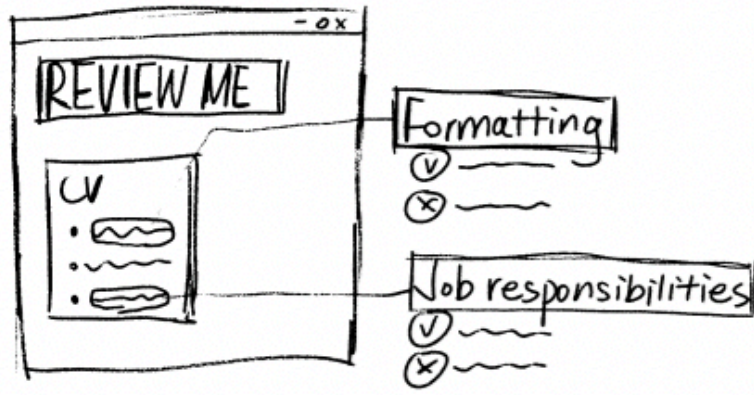

- Pat is generally comfortable using familiar technology, but she does not get a big kick out of obtaining the latest gadgets or learning how to use them. She prefers to stay with the technologies for which she has already mastered the peculiarities.
- **Computer Self-Efficacy:** Pat has medium computer self-efficacy, meaning that she has some self-confidence in performing computing tasks other than the ones she is familiar with. This has a variety of impacts on how she uses software. For example, she will keep on trying to figure out how to achieve what she has set out to do for quite awhile; she doesn't give up right away when computers or technology present a challenge to her.
  - **Attitude toward Risk:** Even so, Pat is risk averse when she uses computers to perform tasks. When confronted with new software features, Pat worries that she will spend time on them and not get any benefits from doing so. She prefers to perform tasks "the safe" (ie, familiar) way if possible, even if less familiar features might promise a more direct solution.
  - **Willingness to Explore and Tinker:** When Pat sees a need to learn new technology, she does so by trying out new features or commands to see what they do and to understand how the software works. When she does this, she does so purposefully; that is, she reflects on each bit of feedback she gets along the way to understand how the feature might benefit her. Eventually, if she doesn't think it will get her closer to what she wants to achieve, she will revert back to ways that she already knows will work.

Margaret Burnett, Simone Stumpf, Jamie Macbeth, Stephann Makri, Laura Beckwith, Irwin Kwan, Anicia Peters, William Jernigan, GenderMag: A Method for Evaluating Software's Gender Inclusiveness, *Interacting with Computers*, Volume 28, Issue 6, 19 November 2016, Pages 760–787, <https://doi.org/10.1093/iwc/iwv046>



# Applying HCD methods

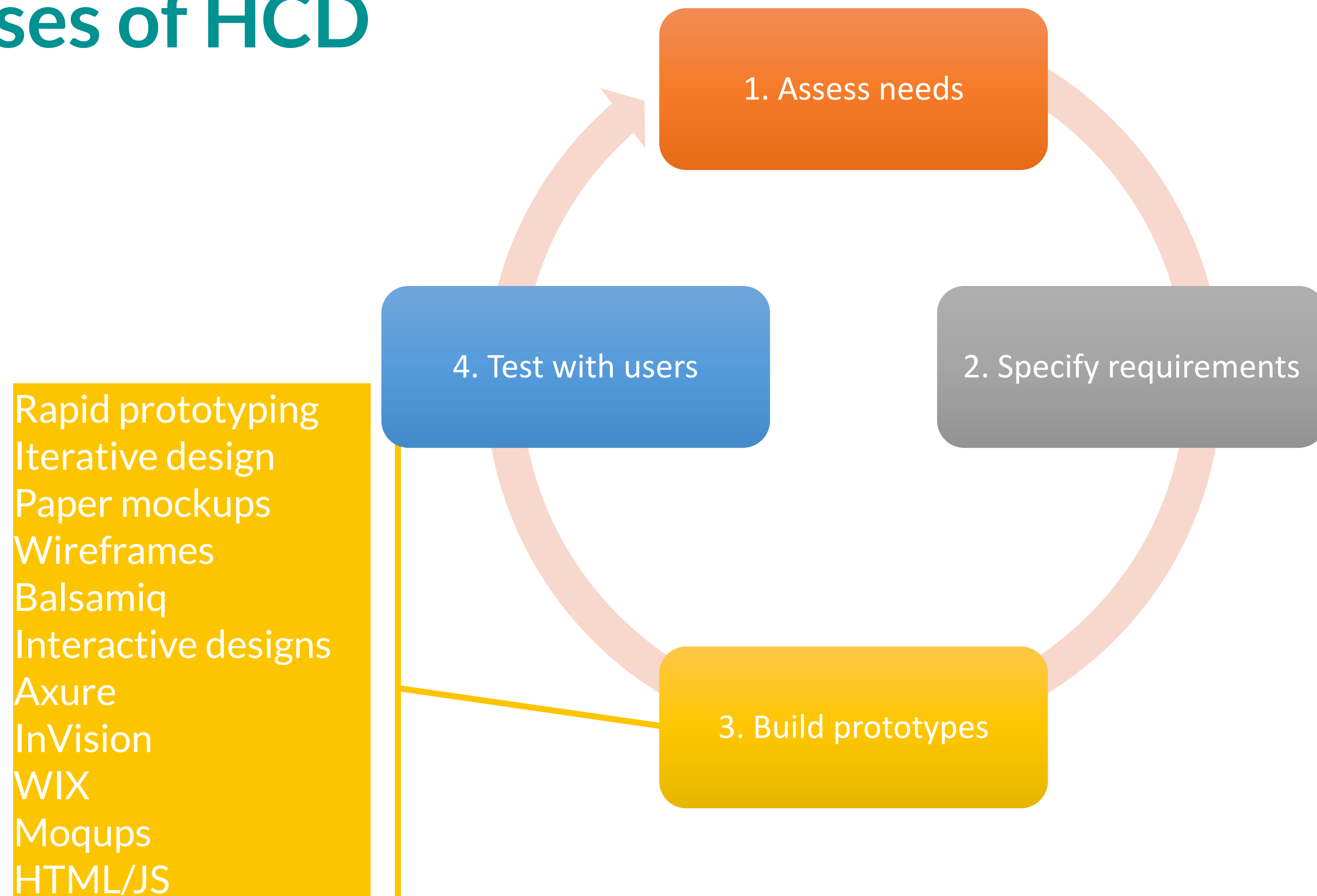
## Specify requirements

	
Joe is creating his CV and is unsure what he should include.	Joe's friend tells him about <i>Review-Me</i> ; a tool that provides feedback on resumes.
	
Joe submits a rough draft of his CV, and receives specific details about how to rephrase his job responsibilities and improve the formatting of his CV.	After making the changes, Joe has a CV that better highlights his job responsibilities and is easier to read.

Tawanna R. Dillahunt, Jason Lam, Alex Lu, and Earnest Wheeler. 2018. Designing Future Employment Applications for Underserved Job Seekers: A Speed Dating Study. In Proceedings of the 2018 Designing Interactive Systems Conference (DIS '18). ACM, New York, NY, USA, 33-44. DOI: <https://doi.org/10.1145/3196709.3196770>

# Applying Human-Centered Design

## Phases of HCD



# Applying HCD methods

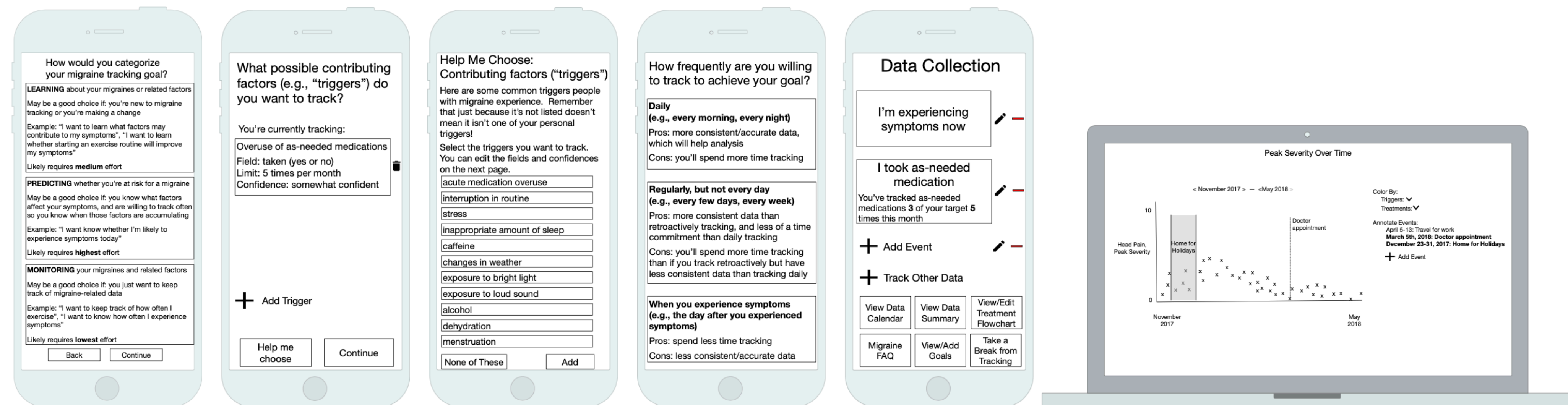
## Build prototypes

- Many papers present novel low- or high-fidelity prototypes alongside participant feedback
- The design typically embodies some novel idea or approach
- The feedback usually points to design implications or feedback given that idea



# Applying HCD methods

## Build prototypes

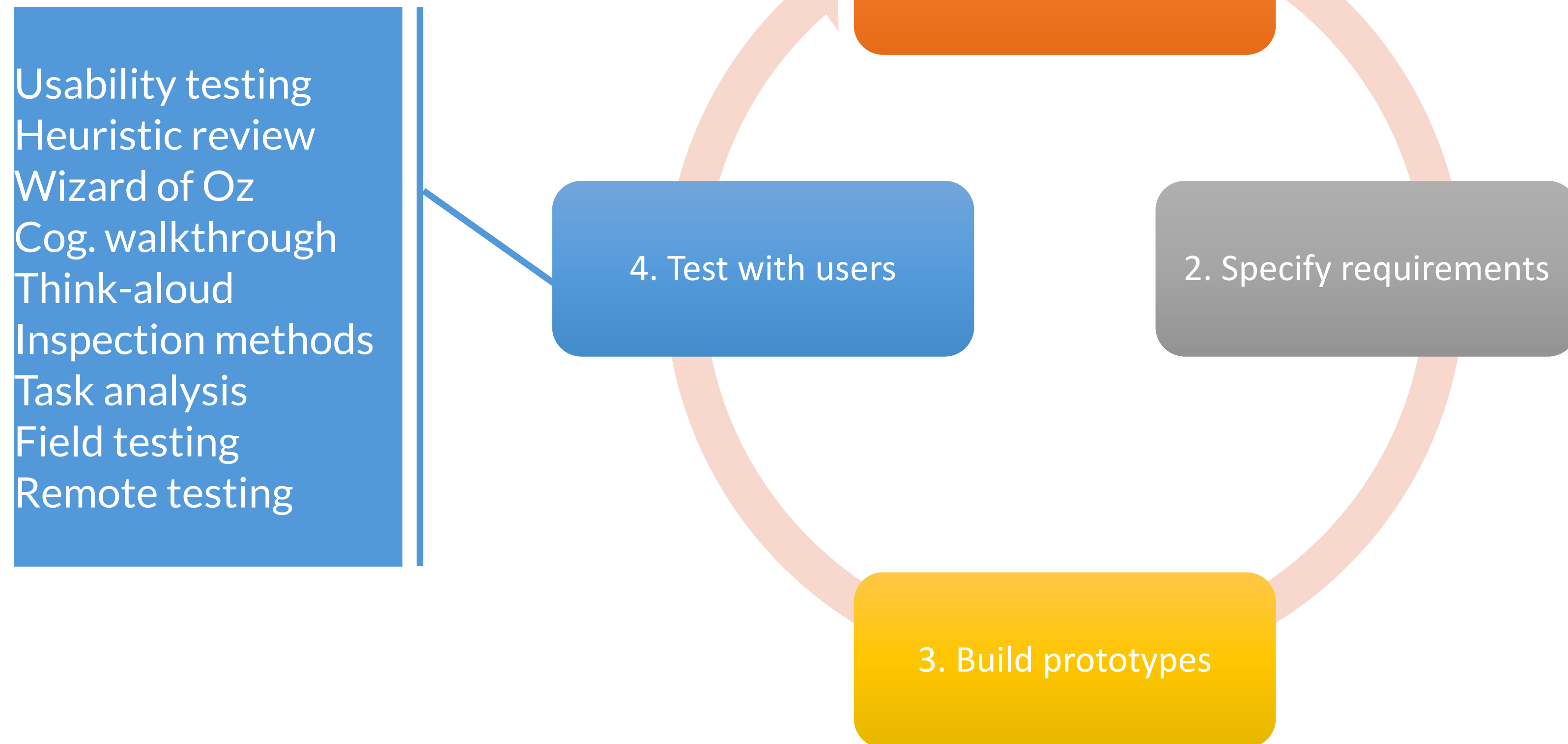


**Fig. 1. Our paper prototype walks people through selecting a goal, configuring tracking towards that goal, and collecting and interpreting data for that goal. The full prototype can be found in the supplementary materials.**

Jessica Schroeder, Ravi Karkar, Natalia Murinova, James Fogarty, Sean A. Munson. 2020. Examining Opportunities for Goal-Directed Self-Tracking to Support Chronic Condition Management. In Proceedings of ACM Journal on Interactive Mobile Wearable Ubiquitous Technology (IMWUT), 3, 4. ACM, <https://doi.org/10.1145/3369809>

# Applying Human-Centered Design

## Phases of HCD



# Applying HCD methods

## Test with users

- Some studies evaluate a novel design through a field deployment or a lab study, like the readings
- But testing is often done throughout/alongside the other phases

# Testing with users



- For the research papers you read:
  - How did they assess needs?
  - How did they specify requirements?
  - What prototype did they build?
  - How did they test with users?

# Testing with users



- For the research papers you read:
  - Lightweight formative interviews (or deep ethnographic involvement)
  - Motivating scenarios or simple personas
  - Design rationale or explicit design guidelines
  - Qualitative outcomes (versus experimental ones)
  - Multiple phases of iteration
  - Recommendations for future designs and systems

# Putting it all together

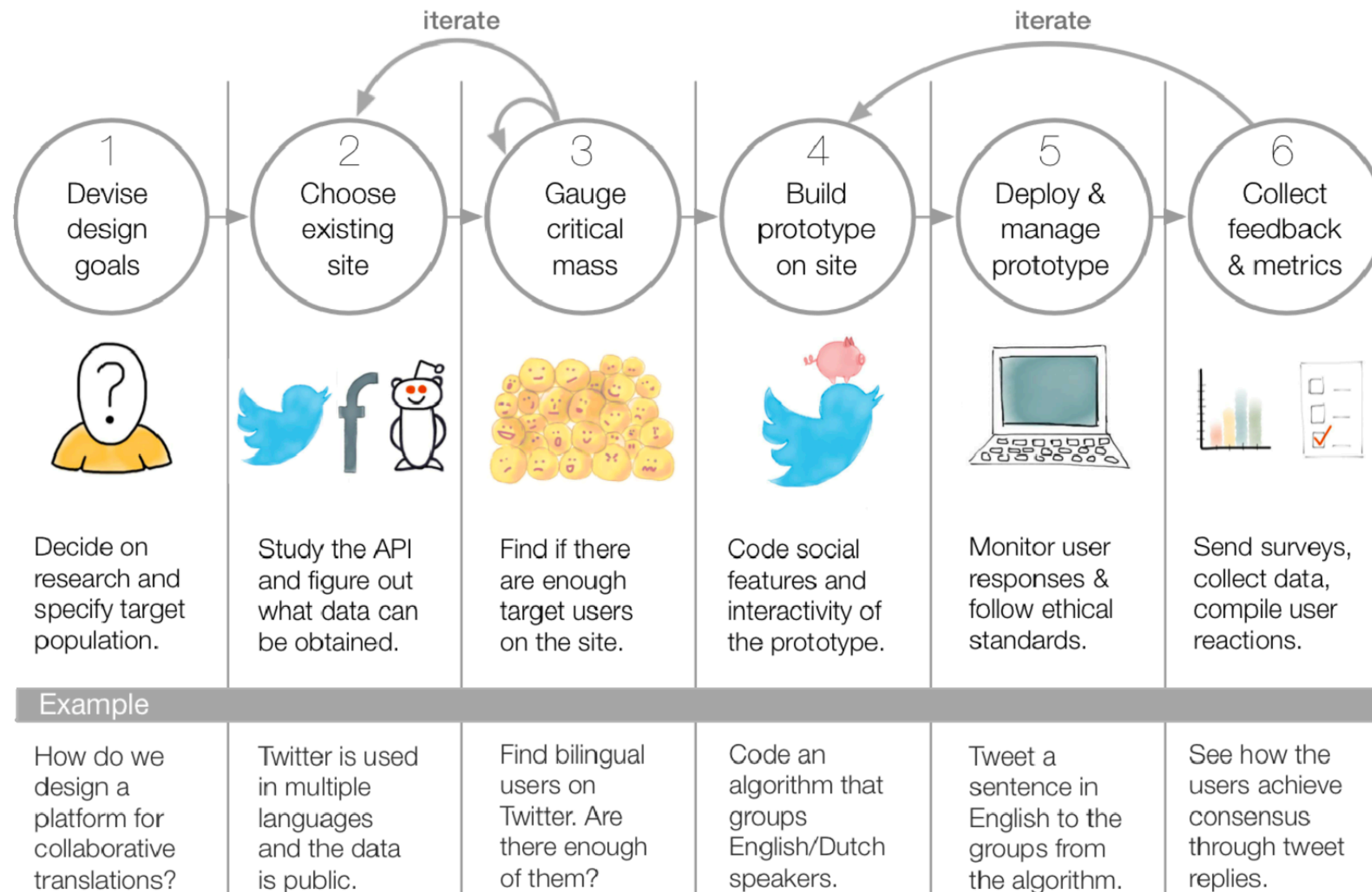
- Some papers go through all phases of the HCD process
- A “holistic” research contribution is often trickier to make
  - Time burdens lead to sacrificing depth at each phase
  - Space burdens lead to unclear requirements or design novelty
  - Easy for reviewers to tear apart methods and results based on the above
- In my opinion, a holistic contribution makes more sense for radical redesigns than iterative improvement of preexisting ideas

# Putting it all together

- For a novel system, is there a “known” problem you can motivate from?
  - Maybe another paper outlines needs or requirements
- Do your prototype need to be developed or at high fidelity to answer your research questions?
  - “Is this design a good idea” or “which design idea is best” may be answerable through low-fidelity mockups
- Can your build out a single feature in your prototype?
- Can you build on existing technical solutions?



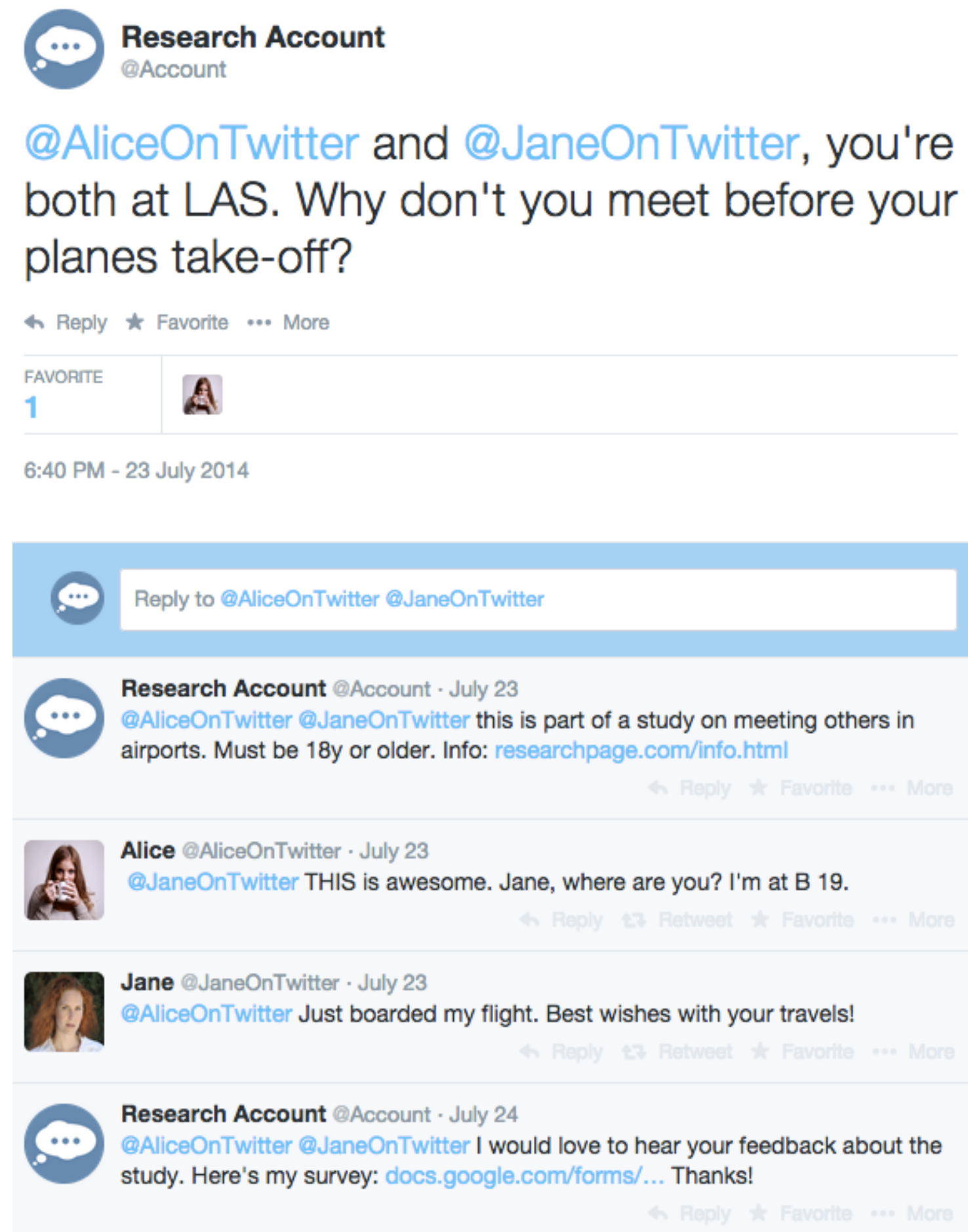
# Putting it all together



Catherine Grevet and Eric Gilbert. 2015. Piggyback Prototyping: Using Existing, Large-Scale Social Computing Systems to Prototype New Ones. In Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems (CHI '15). ACM, New York, NY, USA, 4047-4056. DOI: <https://doi.org/10.1145/2702123.2702395>



# Putting it all together



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**I've been impressed with your progress  
this quarter!**

# Your progress

- Needfinding methods
  - Contextual inquiry
  - Surveys
  - Interviews
  - Focus groups
  - Diary studies
  - Many more...

# Your progress

- Requirements elicitation
  - Task analysis
  - Personas
  - Scenarios
  - Participatory design

# Your progress

- Prototype development
  - Sketching
  - Storyboarding
  - Video prototyping
  - Paper prototyping
  - High-fidelity prototyping
  - Development tools

# Your progress

- Test with users
  - Usability evaluation
  - Cognitive walkthrough
  - Heuristic evaluation
  - Field studies

# Your progress

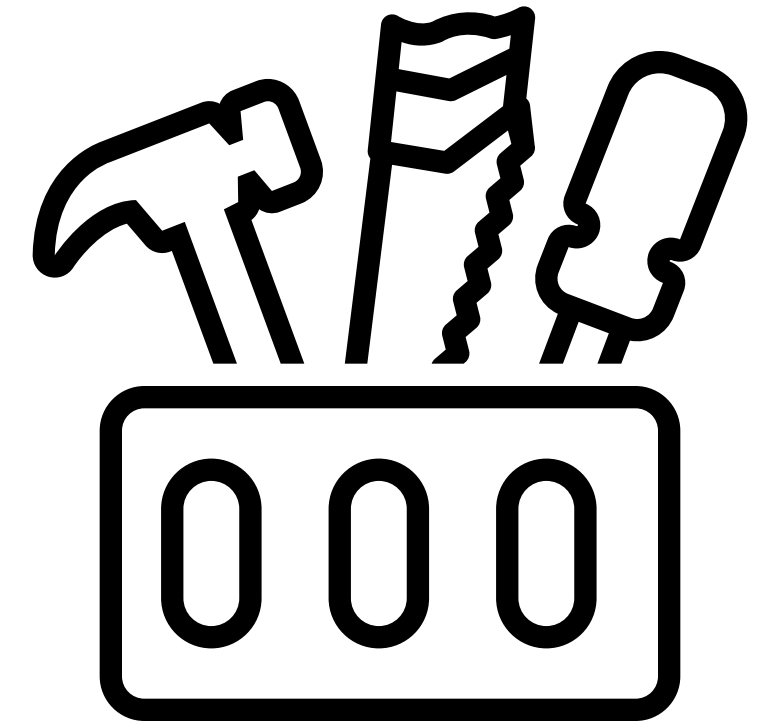
- Generalizable principles
  - Interface design patterns
  - Human performance
  - Accessibility
  - Applications to mental health
  - HCD in research

**Human-centered design is a set of tools**



# Human-centered design tools

- You have many methods available in each stage
- There is rarely a “right” method or an “ideal” method
- As a designer, your job is largely to make informed decisions based on your context or task
  - And translate the insights you gain into a design



**It's been an honor to work  
with you this quarter.**

**I look forward to seeing  
what you design next!**

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- Discuss some best practices for applying each stage of HCD in research
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