

# Design Thinking I

**IS4250: IT-Enabled Healthcare Solutioning**

**Week 4**

4 September 2023

# Outline

- AI + bias
- Design Thinking I
  - Understanding the problem
    - Creating a customer persona
    - Creating an empathy map
    - Interviews
    - Observations
    - Leap of Faith Assumption
- Guest lecture: Dr Alex Yip (10:40 am)

Thinking critically about  
AI and other  
technologies..

# Biases

- **Unconscious bias:**
  - Social stereotypes about certain groups of people that individuals form outside their own conscious awareness
- **Algorithmic bias<sup>1</sup>:**
  - Application of an algorithm that compounds existing inequities in socioeconomic status, race, ethnic background, religion, gender, disability, or sexual orientation and amplifies inequities in health systems
    - *“Bias can creep into the process anywhere in creating algorithms: from the very beginning with study design and data collection, data entry and cleaning, algorithm and model choice, and implementation and dissemination of the results.” – Heather Mattie*

1

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6875681/>

# Examples of unconscious bias leading to health disparities:

- White male physicians are less likely to prescribe pain medication to black patients than to white patients.
  - <https://www.youtube.com/watch?v=d2tv3Vzy0VU>
- Doctors assume their black or low-income patients are less intelligent, more likely to engage in risky behaviors, and less likely to adhere to medical advice.
- Pregnant women face discrimination from healthcare providers on the basis of their ethnicity and socioeconomic background.
- Women presenting with cardiac heart disease (CHD) symptoms are significantly less likely than men to receive diagnosis, referral and treatment, due to misdiagnosis of stress/anxiety.

# Some Sources of Biases

- **Unrepresentative data:** E.g. not enough patients from a particular background → decreased reliability for these groups
  - Missing data: often people with less access to care, lower socioeconomic statuses, or less likely to have insurance.
- From the input devices:
  - **Oximeters:** didn't work as well for darker-skinned people, people who have smaller fingers, or people who have thicker skin:  
<https://www.bbc.co.uk/news/health-58032842>
  - **Spirometers :** Black or Asians assumed to have lower lung capacity than white people.
    - “Correction” factors are applied to the interpretation of spirometer data  
→ Can affect the order in which patients are treated.

<https://www.nytimes.com/2019/01/31/opinion/ai-bias-healthcare.html>



# From oximeters to AI, where bias in medical devices may lurk

*Nicola Davis*

*Science correspondent*

**Analysis:** issues with some gadgets could contribute to poorer outcomes for women and people of colour

## Sajid Javid orders racial bias review after Covid deaths

Medical devices ‘made for white people’ may have driven higher minority fatality rates

“It is easy to look at a machine and assume that everyone’s getting the same experience. But technologies are created and developed by people, and so bias, however inadvertent, can be an issue here too.”

<https://www.theguardian.com/society/2021/nov/21/from-oximeters-to-ai-where-bias-in-medical-devices-may-lurk>

# Amplifying Biases?

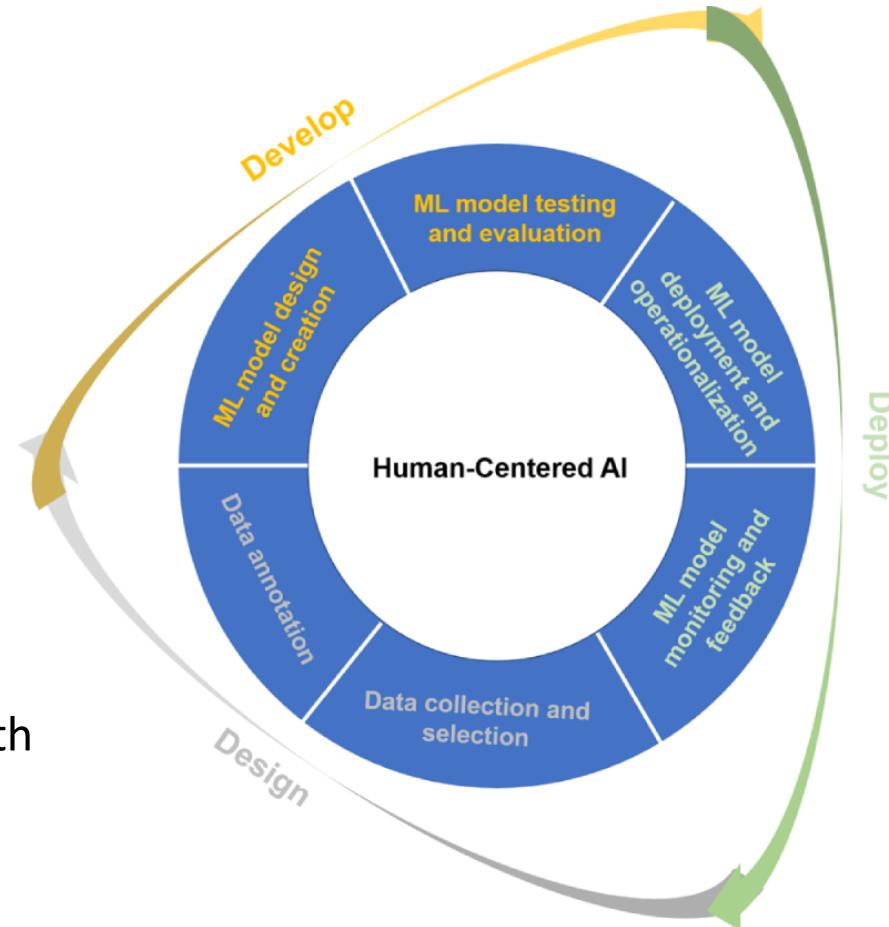
- AI can create or perpetuate biases that may worsen patient outcomes.
  - Reliance on historical data (which could have biased data generation or clinical practices)
  - Risk of incorporating, entrenching and perpetuating economic and social biases that contribute to health disparities in the first place.
- Standard AI deep learning models can predict race from medical images with high performance across multiple imaging modalities
  - Persisted over all anatomical regions and frequency spectrums of the images
  - Efforts to control this behaviour will be challenging

*“We don’t know how the machines are detecting race so we can’t develop an easy solution... Just as with human behavior, there’s not a simple solution to fixing bias in machine learning. The worst thing you can do is try to simplify a complex problem.”* - Gichoya

# Stemming Biases

## Suggestions?

- Examine the algorithms with bias in mind
- Look at how your data could lead to bias
- Continuously monitor after the algorithm is deployed
- Listen to providers and patients
  - Interdisciplinary Collaboration with Patient Advocates
  - Comparing across data types



<https://www.boozallen.com/c/insight/blog/ai-bias-in-healthcare.html>

<https://www.jmir.org/2023/1/e43251/>

# Design Thinking

# Thinking about Design

Design is the age-old human practice of manipulating and adapting our what surrounds us to better serve our needs.

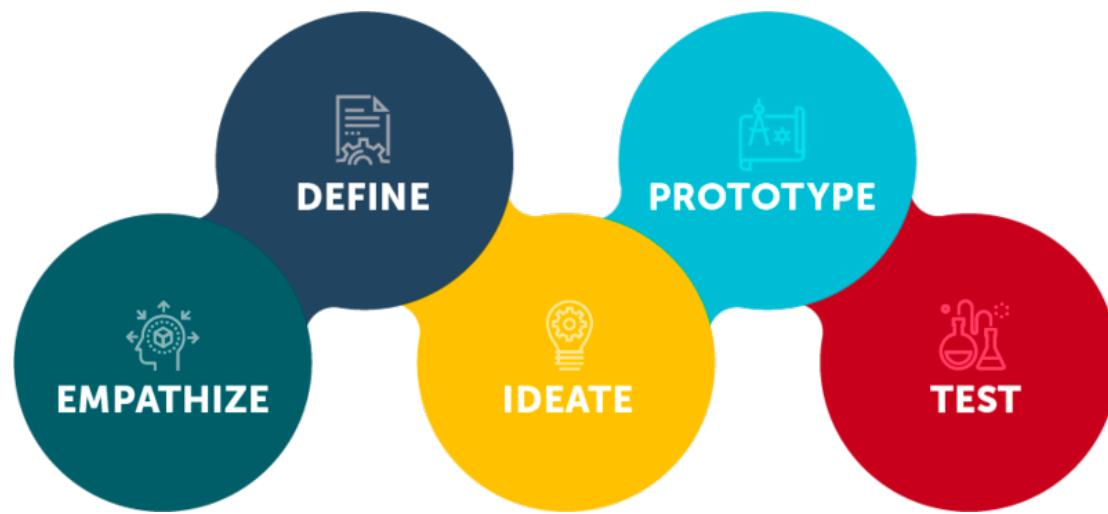
It's not just what it looks like and feels like.

Design is how it works

-Steve jobs

# What is Design Thinking?

- *Design thinking is a process for creative problem solving*
- Emphasizes the importance of *discovery* in advance of solution generation using market research methodologies that are empathic and user-driven;
- Works to *expand the boundaries* of both our problem and our solutions



# Understanding your Users

# Understanding your User

- Immersion in the user experience
  - Start with the human need
  - Who is your customer/user?
  - Avoids preexisting theories about user feedback
  - Draw inferences about needs – people sometimes have needs that are not expressed







# Getting Data

- Select the stakeholder group whose experience you want to understand more fully
- Spend some time **investigating the context** in which the stakeholder group.
  - Secondary data sources are often a good place to begin e.g. journal articles, podcasts, YouTube videos.
- Lay out your hypothetical view of what the **user's journey** looks like from beginning to end
  - Be as comprehensive as possible
- Conduct a few pilot interviews, walking systematically through the stakeholder's journey

# Sample Data Sources: PubMed

NCBI Resources ▾ How To ▾

PubMed diabetes management app | Create RSS Create alert Advanced

Article types Format: Summary ▾ Sort by: Best Match ▾ Per page: 20 ▾ Send to ▾

Clinical Trial Review Customize ...

i Your default sort order has been changed to **Best Match**. To switch back to **Most Recent**, click [here](#).

Text availability Abstract Free full text Full text

Publication dates 5 years 10 years Custom range...

Species Humans Other Animals

[Clear all](#) [Show additional filters](#)

Search results Items: 1 to 20 of 243 << First < Prev Page 1 of 13 Next > Last >>

[Tailored Communication Within Mobile Apps for Diabetes Self-Management: A Systematic Review.](#)  
Holmen H, Wahl AK, Cvancarova Småstuen M, Ribu L.  
J Med Internet Res. 2017 Jun 23;19(6):e227. doi: 10.2196/jmir.7045. Review.  
PMID: 28645890 [Free PMC Article](#) [Similar articles](#)

[A Mobile App for the Self-Management of Type 1 Diabetes Among Adolescents: A Randomized Controlled Trial.](#)  
Goyal S, Nunn CA, Rotondi M, Couperthwaite AB, Reiser S, Simone A, Katzman DK, Cafazzo JA, Palmert MR.  
JMIR Mhealth Uhealth. 2017 Jun 19;5(6):e82. doi: 10.2196/mhealth.7336.  
PMID: 28630037 [Free PMC Article](#) [Similar articles](#)

[Mobile App-Based Interventions to Support Diabetes Self-Management: A Systematic Review of Randomized Controlled Trials to Identify Functions Associated with Glycemic Efficacy.](#)  
Wu Y, Yao X, Vespaiani G, Nicolucci A, Dong Y, Kwong J, Li L, Sun X, Tian H, Li S.  
JMIR Mhealth Uhealth. 2017 Mar 14;5(3):e35. doi: 10.2196/mhealth.6522.  
PMID: 28292740 [Free PMC Article](#) [Similar articles](#)

# Tools for Understanding your Users and Their Problems

- Create a “customer persona”
- Identify the “Job to be done”
- Empathy map
- Leap of faith assumptions (next lecture)
- Hook model
  - will be covered later in the patient engagement lecture
- Interviews/ Observations

# Understanding your Users: Customer Persona

# Developing a Customer Persona

1. Find the user
2. Create the hypotheses about your users
  - e.g. similar user groups
3. Testing and confirming your hypotheses
4. Finding patterns within your group
5. Creating the persona
6. Define use cases and scenarios
7. Validation: Do you know such a person?

# Developing a Customer Persona

- Name
  - E.g. age, gender, place of residence, marital status, hobbies, education, job, etc.
- Jobs to be done
  - What task performance is supported by the product? What are the goals?
- Use cases?
  - How is the product used? Where is it used? What happens before or after? What does the purchase process look like?
- Gains:
  - To what extent do the current products make the customer happy?
- Pains:
  - What is the customer unhappy with the existing product? What are the concerns of the users (e.g. privacy, inconvenience)?

# Sample Customer Persona

ESTA RASHIDI | COURAGEOUS FIGHTER



Photo: Neil Palmer via CIAT – Flickr / License: CC BY-SA 2.0

**GENDER:** Female

**AGE:** 56

**INFLUENCED BY:**

- Clinic staff

**PERCEPTION OF HEALTH:**

- Independence
- Being able to farm

“

Taking ART is one of the most important things in my life. It keeps me going; it enables me to take care of myself. When I first started the medicine, I was very sick and weak. Since I live by myself, I could barely survive. After a few months, I started to gain weight and feel a bit better. The clinic staff supported me and coached me through this initial period.

I've had to change my medicine a few times, which is difficult because I keep having side effects, but I'll never stop taking ART. I want to do everything I can to stay healthy. Living by myself is hard, and sometimes I run out of food. Despite this, with God's grace I will keep trying and moving forward.

”

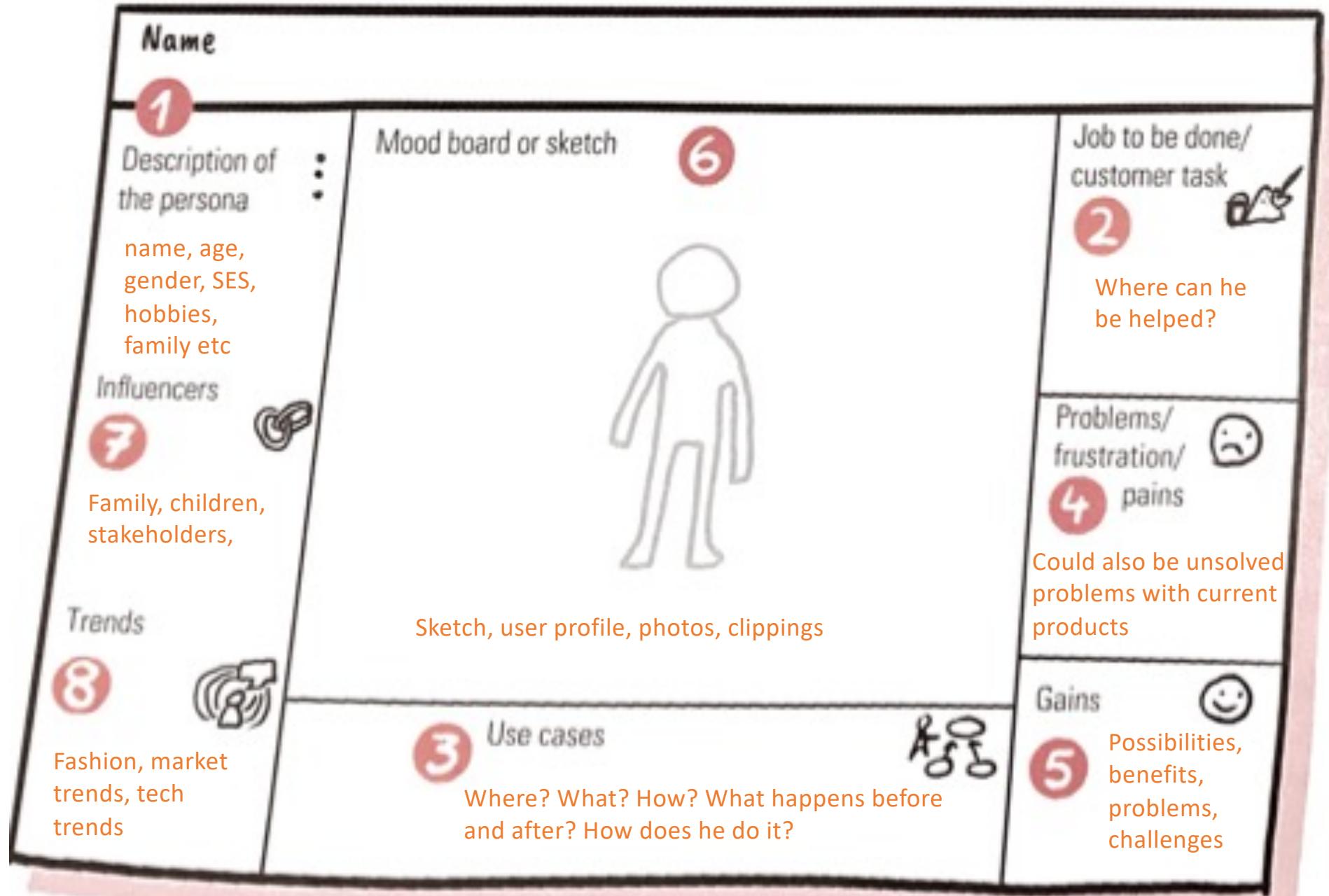
**IDEAL INTERVENTION QUALITIES:**

- Positive reinforcement for own personal motivation
- Reduces social isolation
- Encourages her to support/mentor other patients

**ADHERENCE PAIN POINTS:**

- Poverty and social adversity
- Side effects
- Regimen changes

Source: <http://mccoy.sph.berkeley.edu/patient-personas/>



Lewrick, Link and Leifer (2020)

<b>Name</b>		
<b>Description of persona</b>	<b>Mood board/sketch</b>	<b>Job to be done</b>
<b>Influencers</b>		<b>Problems/frustrations/pains</b>
<b>Trends</b>	<b>Use Cases</b>	<b>Gains</b>

# Tips

- Use real people with real names and real attributes
- Be specific (use the internet if you need)
- Draw the persona, add images
- Identify and describe the use cases in which they would use the product
  - Consider their habits
- Describe the experience and the critical elements

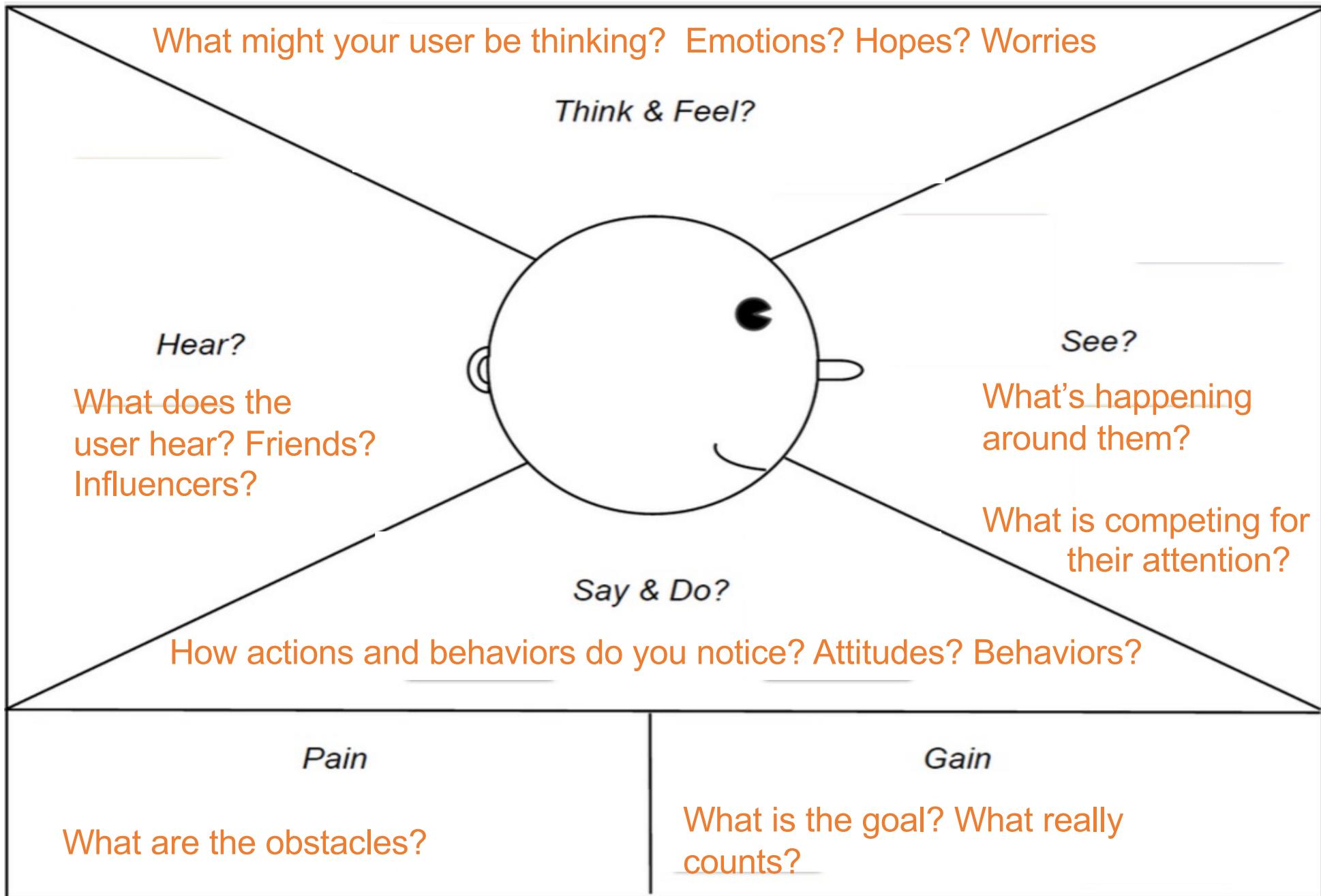
# Understanding your Users: Empathy Map

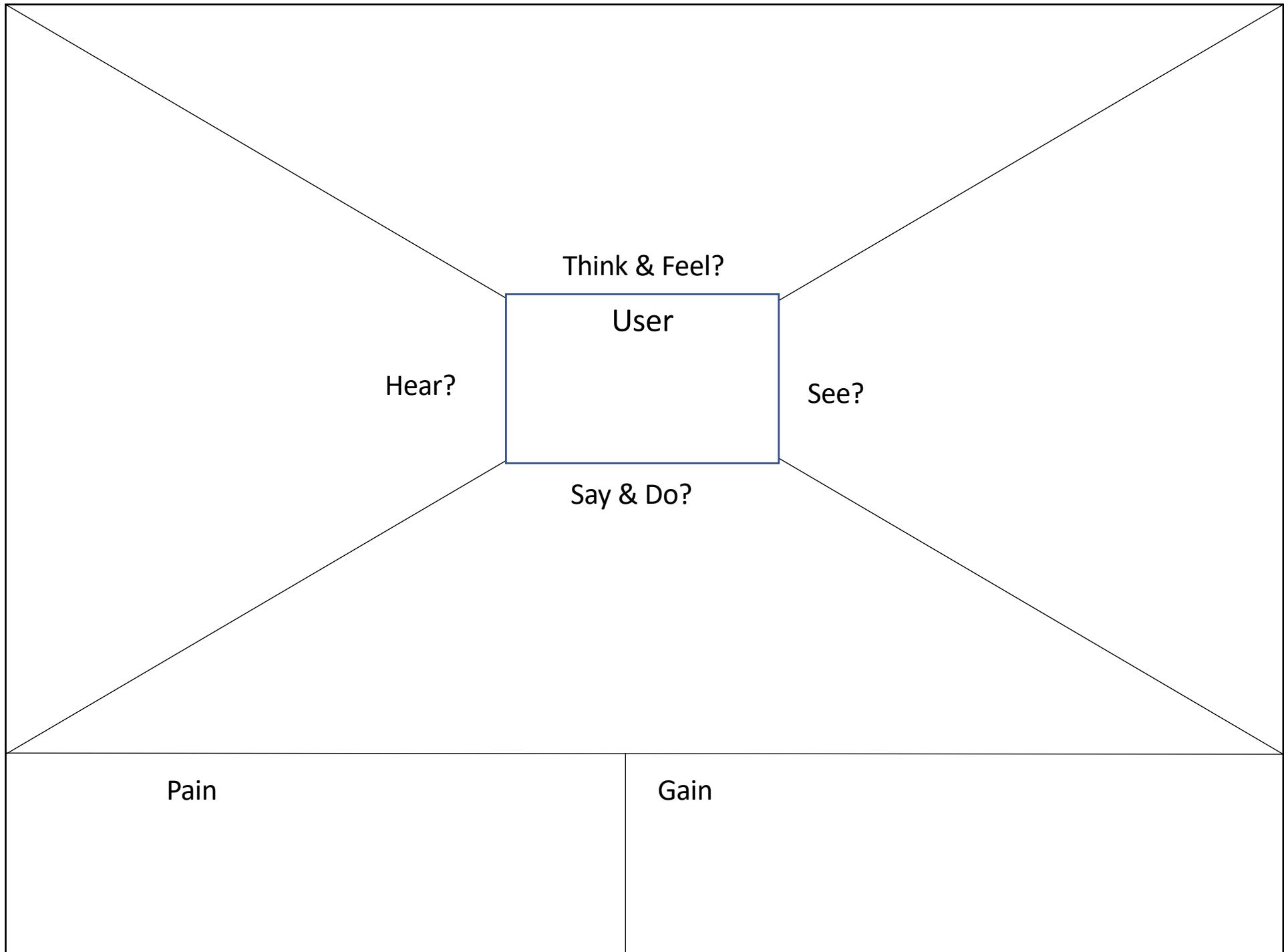
# Empathy Map

- Develop empathy through observations and interviews
  - Gain deeper understanding of the user, feel the user's emotions that drive behaviors and words
  - Summarize observations and interviews in an empathy map
- Empathy Map
  - Say and Do
  - Feel and Think
  - Hear
  - See
  - Gains and Pains
- Identify Contradictions, Insights, A-has
  - Where did this person say one thing and do another? What motivation, belief, or unarticulated need resolves contradictions? What surprises or a-has did you discover?

<https://www.youtube.com/watch?v=kAdbbsZoI0w>

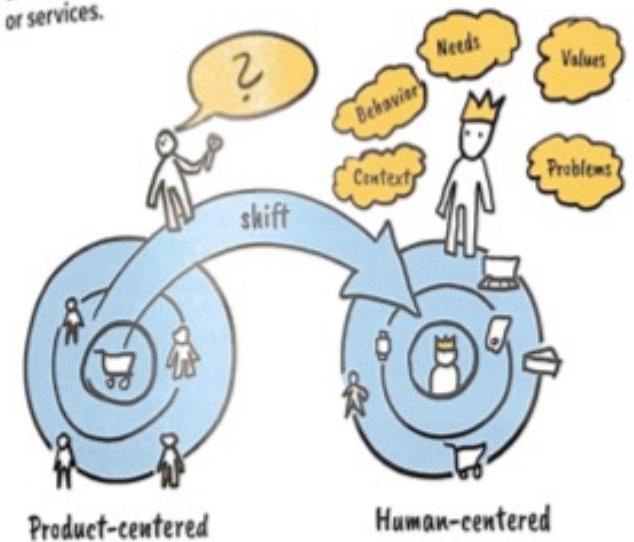
# EMPATHY MAP





# Understanding your Users: Interviews

I would like...  
to learn more about the user before thinking about new products  
or services.



# Empathy in Interviews

- Goal: understand the users' needs, emotions, motivations and ways of thinking
- Empathy is needed to gain insights that would have otherwise remained hidden (e.g. users' frustrations and deeper motives)
  - If someone is willing to tell their story – interrupt as little as possible and be careful to not influence them with your own assumptions
- Start with “warm up questions” so that they can share stories about the context of the problem
- Emphasize that the interview is not about finding a solution but understanding their problem
- Avoid questions with yes/no

# Interviews: Tips

Start with a list of questions

- Tracing behavior (i.e. chronological order):
  - How do you know that it works? How did you start doing this?
- Asking for CONCRETE examples
  - When was the last time ... How did you do this ? How did you do it before? Can you walk me through an example? What is the difference between X and Y?
- Clarification questions: Recognize contradictions between what they say versus what they do
  - What exactly did you mean by... You say that this is difficult. What exactly was difficult about it?
- Exploring exceptions
  - When didn't it work? What did you do when it didn't work?
- Imagining the future
  - How do you think you'll do it if ...
- 5 Whys / 5W+ 1H

# Interviews: Tips II

- It is ok to depart from the interview guide if questions or topics come up that are important to the interviewee
- Try to speak the language of the participant – remember, the interviewee is the expert of this own life
- Leave speculative questions to the end – i.e., what do you hope to see in ...

# Interview Guide:

## 1 Introduction:

Begin with general things. What are "broad" questions to open the conversation and break the ice?

What is your profession?

Tell me what you experienced recently.

Tell me what annoyed you recently.

## 2 Get to know the entire story:

What are the questions that help you to understand the hopes, fears and motivations of the people interviewed?

What are you saving for?

What helps you to save money?

What was the biggest challenge in this context?

What happened before/after/during?

Why?

Wait..., what exactly do you mean by that?

... (pause)

## 3 Conclusion:

Explain what happens with the answers and thank the interviewee for the discussion. Always be appreciative!

"If you had one wish to make...."

Thank you very much for the conversation

# 5W + 1 H

Template: 5W+H questions

Who	What	When	Where	Why	How
Who is involved?	What do we already know about the problem?	When did the problem start?	Where does the problem occur?	Why is the problem important?	How could this problem be an opportunity?
Who is affected by the situation?	What would we like to know?	When do people want to see results?	Where was it resolved before?	Why does it occur?	How could it be solved?
Who is the decision maker?	What are the assumptions that should be scrutinized?		Where did similar situations exist?	Why was it not yet solved?	What has already been tried to resolve the problem?

# Understanding your Users: Observations

# Observations

- Tracing the “customer’s” experience as he or she interacts with a clinician or IT system, etc
- Pay attention to the **emotional highs and lows** and the meaning that the experience holds for the customer.
- Studying customers in their own environments instead of through focus groups or surveying them.
- *Don’t ask customers for suggestions on how to improve*
- Observe and ask questions about the interactions, sequence of events and why things are done a certain way
- One key reason for the failure of new ideas is that we misjudge what customers really want



# What is the outcome of observations?

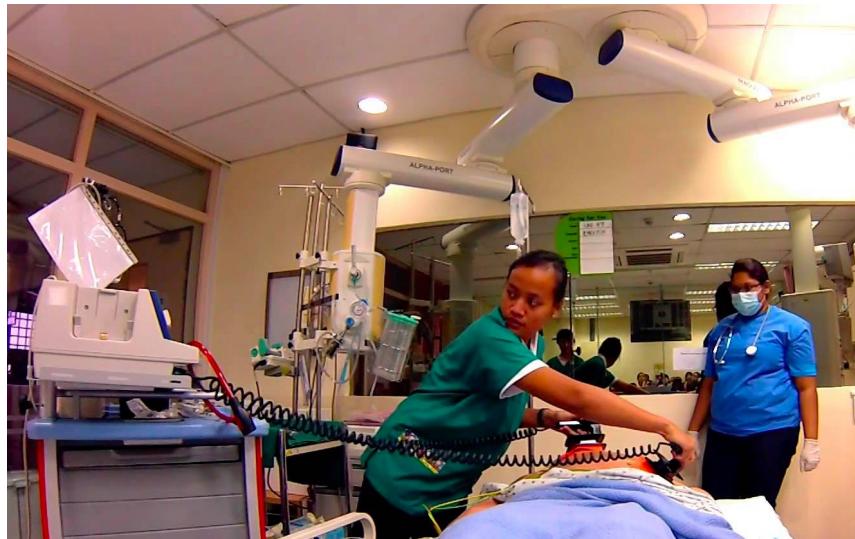
- Exploratory research tool used in the early stages of an innovation process to open up creative thinking about the unarticulated needs of customers
- **Purpose is not to produce a set of recommendations for action; rather, it is to produce a set of *hypotheses* for testing.**
  - Goal is not to produce either generalizable or statistically significant results that “prove” anything
- Remember: Set aside our own problems and wishes

# When observing:

- What's one thing you observe?  
(Don't interpret, just describe what you see.)
- Why might this be happening?  
(Add your interpretation. Think in terms of motivations and unmet needs.)
- This inspires me to think about solutions that...  
(Think in terms of new products or services that could meet the need(s) you observe.)

Source: IDEOU (2023)

# Sample: Portable AED Redesign



<https://www.ideo.com/work/health-and-wellness>

Chang (2020)

# Understanding the Context

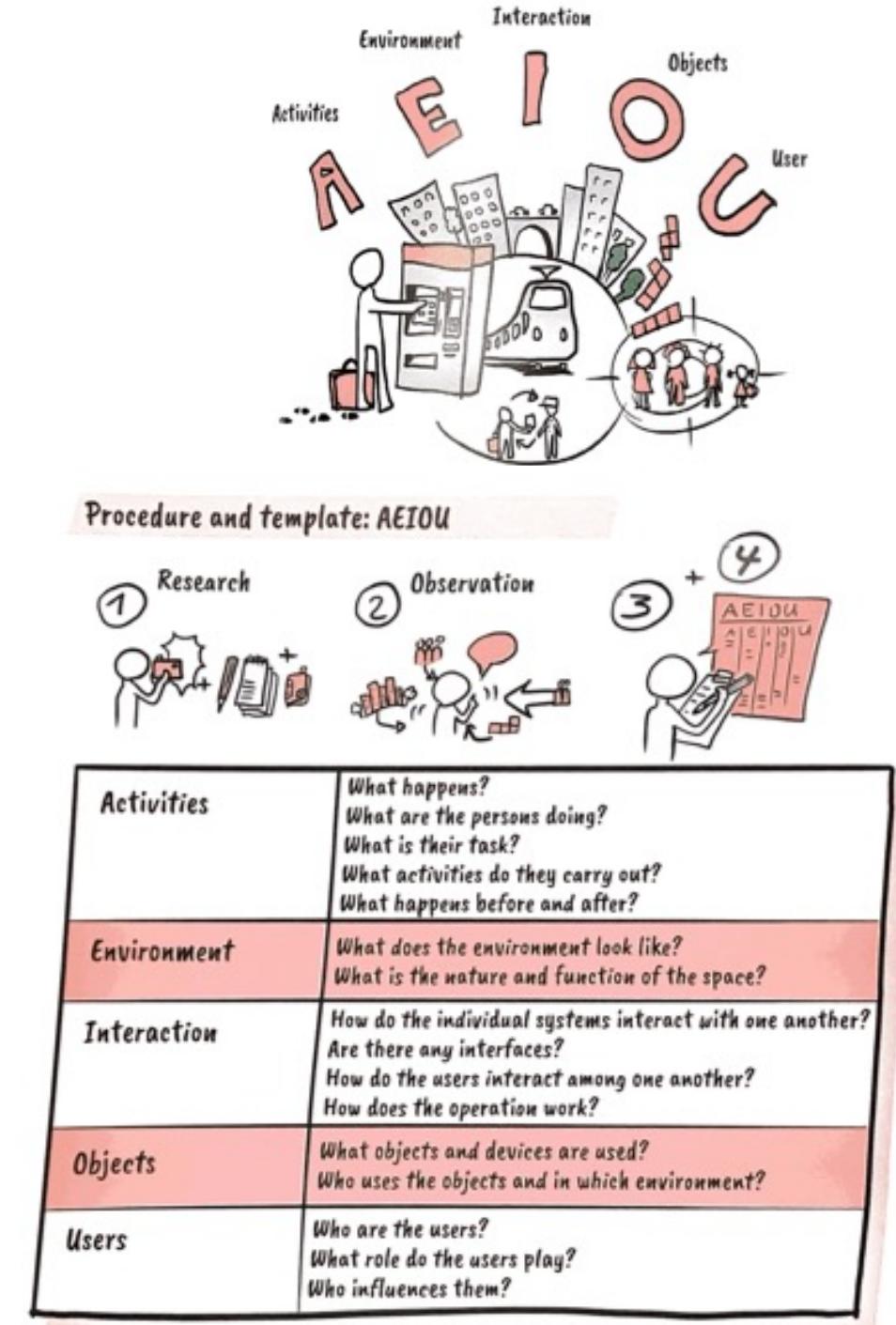
Medtronic N'Vision programmer



Chang (2020)

# AEIOU

- What do you observe?
- Start with where the user is in the context of your problem
- Work with the AEIOU template
  - Record your impressions in the form of notes, photos, interviews, videos and observations
- Cluster the themes in the findings with summary blocks



Lewrick, Link and Leifer (2018)

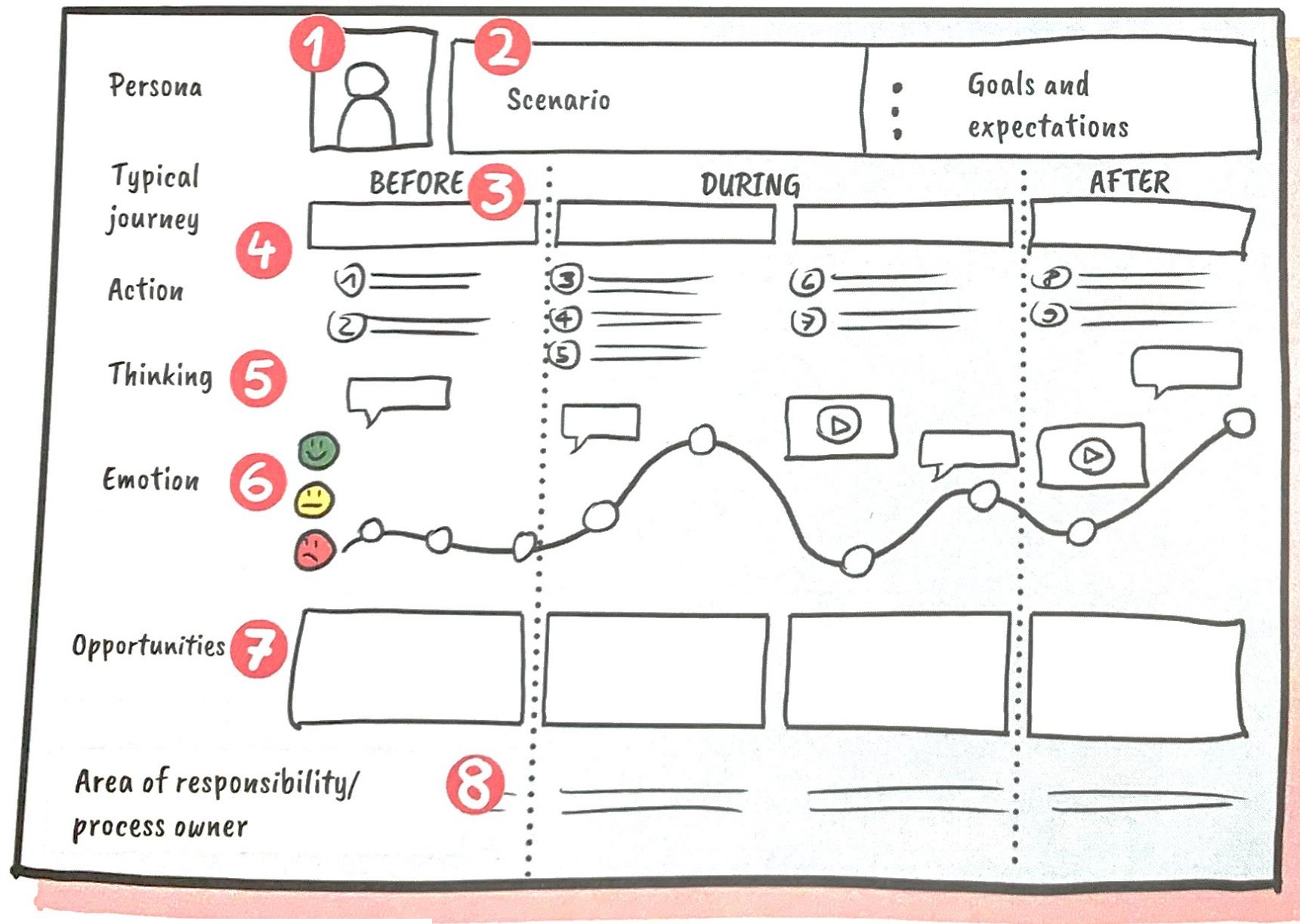
# One Product of Observations: Customer Journey Map

Outcome:

- Identify “moments of misery” that affect the users’ experiences
- Achieve solid understanding of all user touch points
- Design a new and improved experience
- Allows us to build empathy



## Procedure and template: Customer journey map



# Ask 5 whys

- Start with: “why does the user currently do this?”
- Goal:
  - To discover the true cause of the problem
  - To develop a sustainable solution
  - To dig deeper and get to know more than just the symptoms that are obvious
- Equally important is “why not?”



1

Detailed description of the problem.

1. Why is it a problem (problem description)?

2. Why?

3. Why?

4. Why?

5. Why?

2

Consequence

What is the problem?

What are its symptoms?

Direct impact

Why does the problem occur?

What technology is used?

Cause – effect

What could be another cause of the problem?

Organizational hurdles

How could the problem be avoided?

Systematic hurdles

The systematic approach

might prevent the occurrence?

# Framing Problems As Questions

- “How Might We” statements can be optimistic invitations to explore more (IDEO).
- “How” is solutions-oriented, the “might” encourages optimism, and the “we” is collaborative.

## Examples:

- How might we help people stick to their personal goals?
- How might we make the weekly work meeting something everyone looks forward to?
- How might we deepen local connections while keeping socially distant?

# Understanding your Users: Leap of Faith Assumption

# Leap Of Faith Assumption

- Don't make decisions, create hypotheses and tests them
- The designers' role is NOT to provide answers, but ask questions
  - if "this", then we should get 10% improvement in waiting times

**The most important behavior that must be true for your idea to have its intended performance outcome (e.g. behavior change).**

**You assume it to be true but have not yet “proven” this assumption**

# Assumptions

- Questions to ask:
  - What does the user want to achieve by applying our idea?
  - What motivates the user to use our idea?
  - What prevents the users from using our idea?
- Examples
  - Couch potatoes want to exercise to prevent chronic diseases [need]
  - Senior citizens don't have access to facilities to exercise on a regular basis [trigger]
  - Senior citizens want to feel healthy so that they can watch their grand children grow up [need]
  - Senior citizens don't feel comfortable when they exercise at a gym with young people [emotional blocker]

# Leap of Faith Assumptions

One way to think about your problems, leap of faith assumptions and possible solutions:

The problem you observe and are trying to target



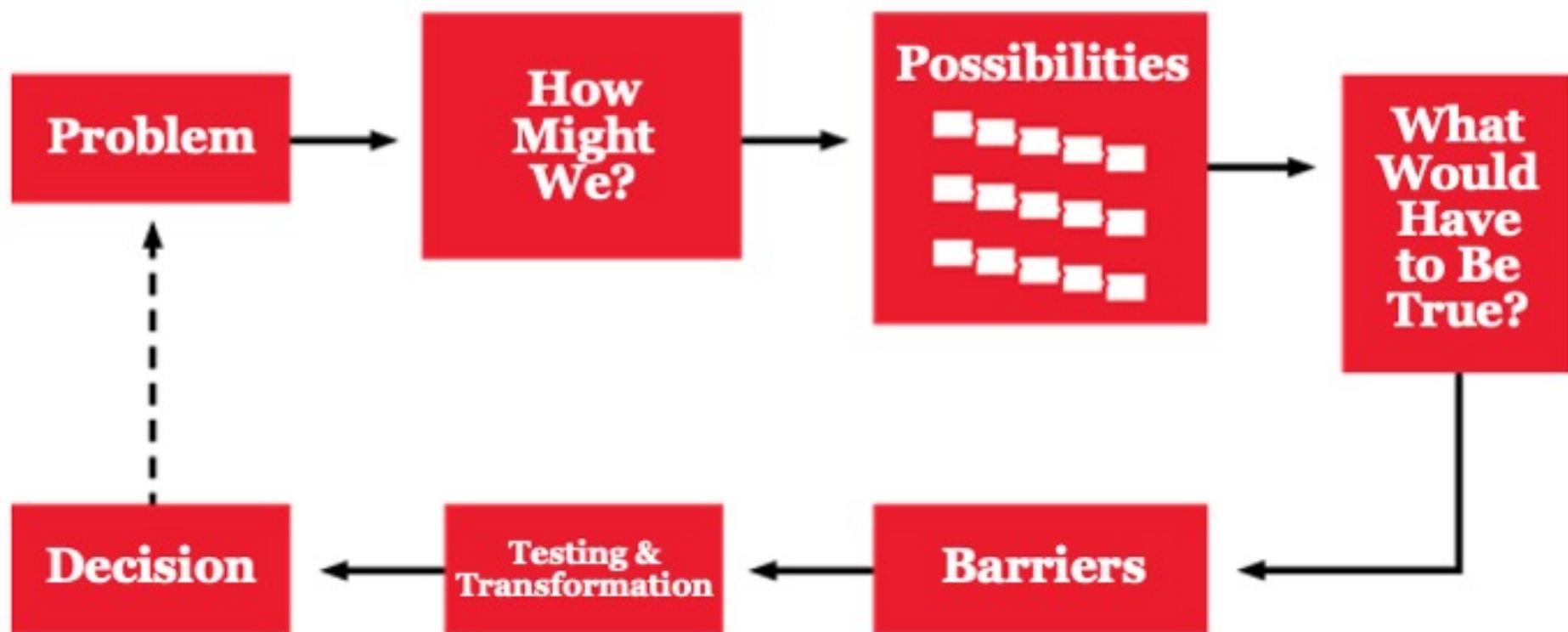
LOF assumptions target the mechanisms that shape this process  
- Proposed solutions aim to target this mechanisms to create behavior change

LOFs for the problem and solution:

**What  
is  
true?**

**What  
would  
have to  
be  
true?**

# LOF: What would have to be true for something to be a success?



Copyright © Roger L. Martin 2020

Source: <https://roger-78069.medium.com/strategy-integrative-thinking-96ac0769709b>

# LOF

**Note: You don't need data YET. Just logic!**

- Multiple LOFs may apply
  - Solutions may also target multiple LOFs
- To understand the needs of our customers
  - [User] needs to [need] because [surprising insight]
  - [Who] wants [what] for [need] because [motivation] ...
  - E.g. a patient is willing to wear a Fitbit to get access to health data because he....
  - Involves recognition of patterns in the needs of users
  - VSM covered in early classes may be helpful

# Exercise:

Prepare a 2.5 to 3 minute presentation

- Describe your customer (45 seconds)
- Describe your problem (45 seconds): highlight **key moment** in user experience you are targeting
- Describe the leap of faith assumption you are making (1 minute)
- Classmates will provide feedback online during your presentation
- It is ok to have only 1 person present

**BE CREATIVE, HAVE FUN, GET ANSWERS!**

# Learning Outcomes

- Understand the importance and application of empathy maps and customer personas
- Review your experience with other users iteratively and never stop being curious about their real needs!

# Next Class

- **Design Thinking II**
  - Presenting your Leap of faith assumptions
  - Job to be done
  - Ideation
  - Prototyping/ experimentation
- Deliverables:
  - Leap of faith assumption presentations (next Monday in class!)
  - Initial proposal due 12/9/23 8:59 pm
  - SaveMom case due 17/9/23 8:59pm



Dr Alexander Yip is the Clinical Director, Health Innovation & Technology at Alexandra Hospital, which looks at how innovation and technology help transform care delivery in the hospital and community. He also serves as a Deputy CMIO of Alexandra Hospital and Deputy Director for the Centre of Innovation in Healthcare, in the NUHS

## Alexander Yip · 1st

Clinical Director, Healthcare Redesign at Alexandra Hospital, Singapore

### Experience



#### Alexandra Hospital, Singapore

3 yrs 6 mos

- **Clinical Director, Healthcare Redesign**

Full-time  
May 2022 - Present · 9 mos

- **Head of Division, Gastroenterology & Hepatology**

Full-time  
Apr 2022 - Present · 10 mos

- **Consultant**

Full-time  
Aug 2019 - Present · 3 yrs 6 mos  
Singapore

[Show all 5 experiences →](#)

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#### Deputy Director

Centre for Innovation in Healthcare -CIH  
Dec 2019 - Present · 3 yrs 2 mos  
Singapore



#### National University Hospital

6 yrs 2 mos

- **Senior Resident, Division of Gastroenterology & Hepatology**

Full-time  
Jul 2016 - Aug 2019 · 3 yrs 2 mos  
Singapore

- **Internal Medicine Resident**

Jul 2013 - Jul 2016 · 3 yrs 1 mo



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#### Clinical Research Manager

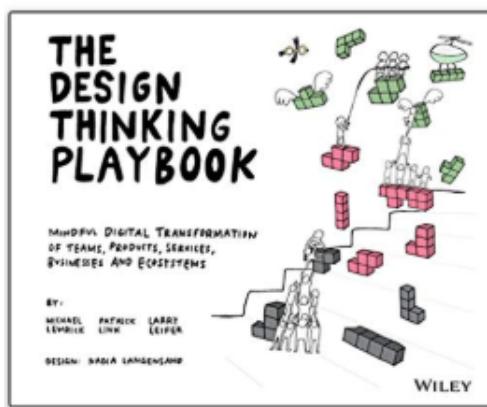
Children's Hospital Boston  
Mar 2007 - Mar 2008 · 1 yr 1 mo  
Greater Boston Area

Optimal Weight for Life (OWL) Program at Children's Hospital Boston



+  
Centres for  
Health System  
Innovation

# Additional Resources



**The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems** Paperback –

22 May 2018

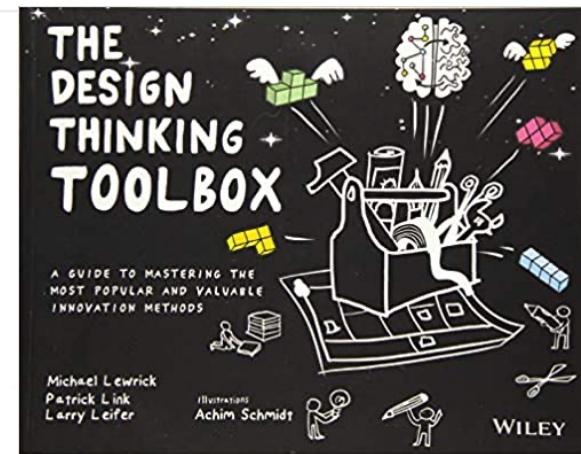
by Michael Lewrick (Author), Patrick Link (Author), Larry Leifer (Author)

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Paperback

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**Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation**

Unabridged

by Tim Brown (Author), Tim Roberts (Narrator)

★★★★★ 14 ratings

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