Discover

Identify and understand opportunities and needs collaboratively through co-creation with stakeholders

MINSET

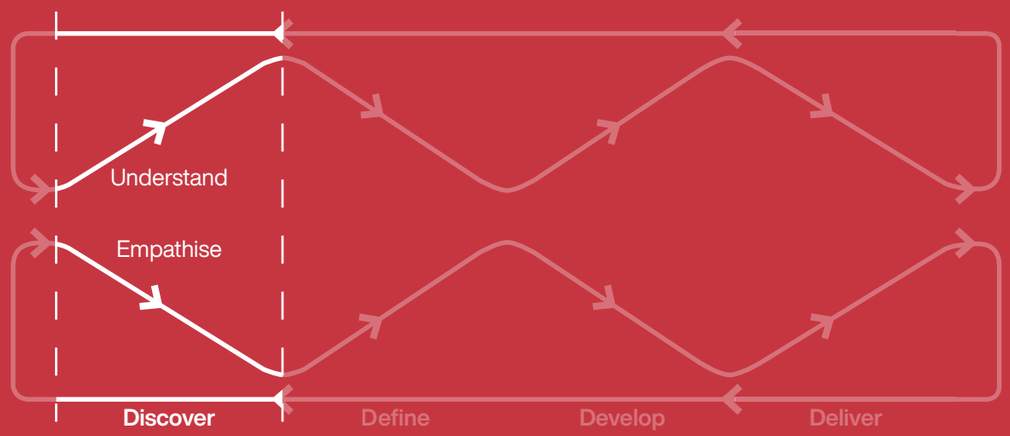
Empathy

Understand

- Who are the users and stakeholders?
- What are their needs?
- How might we delight them and their experiences?
- What are their actions, reactions and emotions?
- What is the context?
- What research and user studies are needed?

Empathise

- How do users behave?
- How do they feel?
- How do we see through their eyes?
- What extreme conditions may inform us?
- How do they interact with objects, the environment, and each other?



Method

Stakeholder Mapping

Systems Thinking | User Connection

Stakeholder Mapping is a visualisation of stakeholder analysis, used to gain an overview and prioritise stakeholders involved.

Why: Stakeholder Mapping helps designers, engineers, and professionals to understand each stakeholder deeply through asking key questions, to gain an overview of the stakeholders and to prioritise the stakeholders involved.

Materials: Sticky Notes, Stakeholder Mapping Template

Complementary methods: User Interviews, Shadowing, Personas and Scenarios

Scan or click here for a digital copy of the template

Procedure

1 **Identify**

relevant stakeholders based on the opportunity statements.

2 **Prioritise and Arrange**

stakeholders on a 2 x 2 Influence-Interest grid.

3 **Illustrate Relationships**

between stakeholders with lines or arrows and labels.

4 **Analyse**

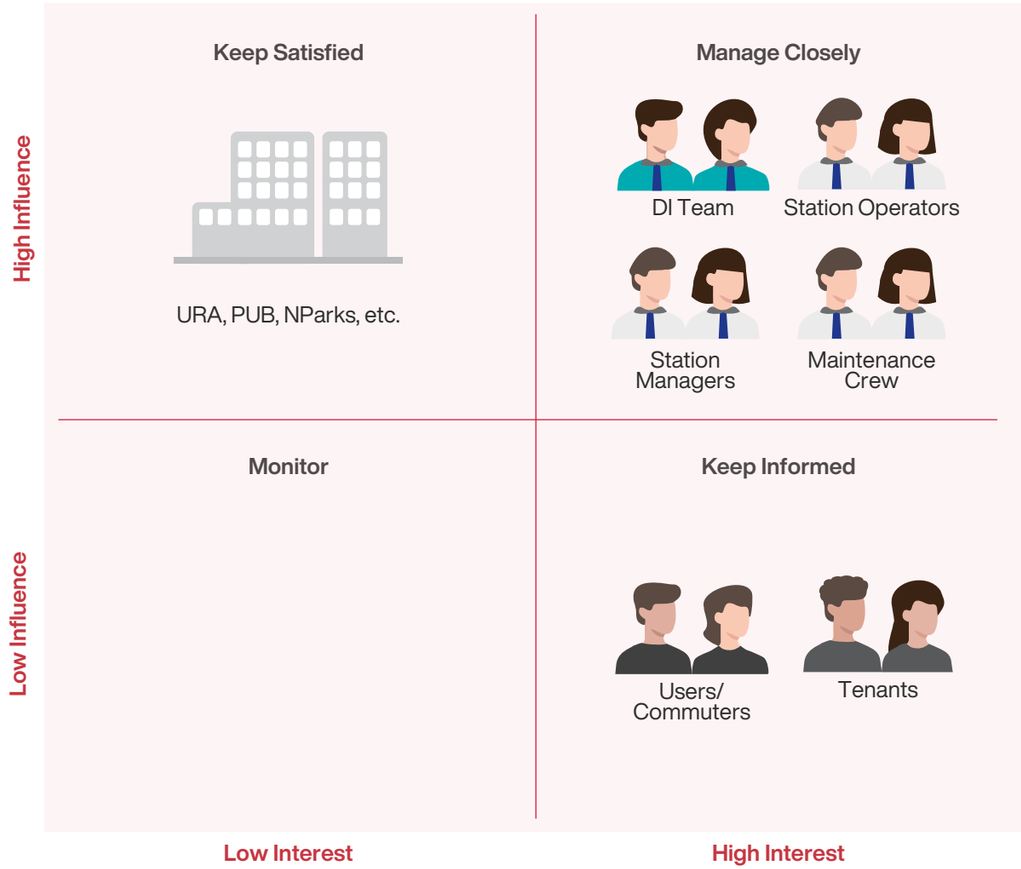
stakeholder map by taking different stakeholder perspectives. Take note of information, ideas, questions that arise.

Key Questions [2]

1. What financial or emotional interest do they have in the outcome of your work?
2. What motivates them most of all?
3. What information do they want from you, and what is the best way of communicating with them?
4. What is their current opinion of your work?
5. Who influences their opinions generally, and who influences their opinion of you?
6. If they aren't likely to be positive, what will win them around to support your project?
7. If you don't think that you'll be able to win them around, how will you manage their opposition?
8. Who else might be influenced by their opinions?

Worked Example

Based on an Operation and Maintenance problem in a train station, stakeholders are prioritised and arranged on an Influence vs. Interest grid.



Useful Tip

The stakeholder map is not a stagnant map; it can evolve and be modified according to project needs.

Method

Personas

Design Thinking | User Connection

CARD 6 Empathy

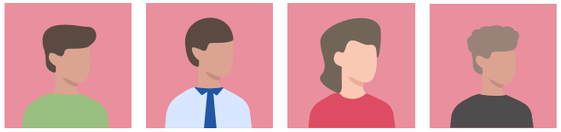
Personas are a depiction of what a typical or extreme user is like. It aggregates and maps behaviour patterns of actual users into archetypal profiles, allowing focused study based on these classifications.

Why: Creating Personas makes key characteristics of user types explicit and aids in bringing a human touch to user research.

Materials: Sticky Notes, Persona Template

Complementary methods: Stakeholder Mapping, User Interviews, Shadowing , Scenarios

Acronyms: AV - Autonomous Vehicle



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Procedure

1 Consolidate your findings

Identify which user types within your user group you want to develop into personas.

2 Find patterns

Identify themes, characteristics and differences between the user types. Clarify any initial assumptions you have, and decide on the personas to create.

3 Create and describe personas

Describe each of their demographics, needs, goals, motivations, and frustrations related to the design problem.

4 Bring personas to life

Include unique information on their lifestyles, preferences, and express them through representative portraits and quotes.

Tips

- Personas are not individuals, but the ideal representations of your target user types
- Merge personas that are conceptually similar and separate those that are meaningfully different.
- Consider both typical and extreme user types.

Useful Tip

Develop personas for both average/typical and extreme users and stakeholders. Insights from extreme users are likely to result in innovations that delight the typical users. Carry out this method with a cross-functional team, including stakeholders.

Best Practices

Validate personas with user research

Design for users and stakeholders, not just a figment of your imagination.

Work closely with users and stakeholders.

Deepen empathy with personas with embodied experience.

Engage both the positive and negatives

Engage human aspirations and passions of individuals, not just eliminate pain points.

Worked Example 1

These personas were built from methods done in the Discover phase in a 3-day design sprint. The personas would be verified and refined later on with interviews and observations at train stations.

How might we design a holistic station for the future that enables ease of maintenance and reduce operational cost to lower life cycle cost?

Auntie Soh

Female
71 years old
Married, lives alone
Multiple Downtown Line Station Cleaner

Motivations

- Seeing good cleanliness feedback
- Seeing responsible people who clean up or pick up their rubbish
- Receive appreciation for her work

Goals

- Provides for the medical bill of her husband
- Go home on time to take care of her husband
- Complete the assigned task well
- Maintain the cleanliness of the station

Frustrations

- Toilet is very dirty often
- Wet floor is very slippery and she has to move slowly from place to place
- Cannot reach the top part of the walls easily
- No place to take a break

Needs/Wants

- Take stock of status of inventory and tools
- Be able to easily remove dirt and stains from surfaces
- Able to move equipment from one place to another
- Able to keep track of consumables that are running out

Peter Lim

Male
50 years old
Married with 2 daughters
Maintenance Technician

Motivations

- Bring up his daughters in a comfortable setting
- To make Singapore's railway reliable and win the Transport Gold Award
- Make sure commuters in the morning gets a train without problems

Goals

- Provide for the university tuition fee of his daughters
- Conduct periodic checks to prevent outage of services
- Makes sure he is safely back at home everyday

Frustrations

- Colleagues for the next shift are always late, causing him to lose time for his family
- Some of the tasks are not completed by colleagues from the previous shift
- Labels on machines are too small for his eyesight
- Working in congested/ cramped area

Needs/Wants

- Want to do three 8-hours shifts over 2 days for more money
- Hopes that his task doesn't require him to squat or exerts his knee
- To find his tools quickly in the dark
- Able to be alerted of danger immediately

Worked Example 2

Autonomous vehicle (AV)

In an AV design challenge, taxi was taken as a surrogate to analyse the needs of different personas taking a transportation device.

Typical User

John Lim

Male
28 years old
Single
Businessman

Lifestyle/Preferences/Background

- Talkative
- Driven, workaholic
- Constantly tired, deep sleeper
- Gamer but dislikes losing
- Likes music when he sleeps but dislikes wearing earpiece

Motivations

- Earn the first million by 30 years old and buy a car with cash
- Talking to clients and assisting them to meet their needs
- To upgrade himself and upskill himself constantly

Goals

- Be in the best conditions for work all the time
- Relax and enjoy every moment after getting off work
- Loves to collect mechanical watches and be fascinated by the intricacy of watches

Frustrations

- Finds sleeping on public transport uneasy because he needs to wake up at the correct stop
- Does not like his clothes crumpled after sitting in a taxi
- Always have to hug his bag when sitting down

Needs/Wants

- Prefers plenty of leg space as he is tall
- Cannot stand the extreme hear and always turn the temperature to the lowest possible
- Plays music from his speaker that is extremely high quality

Family Unit

Nurul, Hani and Farah

Female
37 years old, Hani is 4, Farah is 2
Married
Cake Shop Entrepreneur and Housewife

Lifestyle/Preferences/Background

- Live in the west but her mum lives in the east
- Doesn't employ childcare services

Motivations

- Hope to be able to be around her children in their early years
- Able to make delicious cake for her loved ones

Goals

- Own a cake shop one day
- Able to adjust her schedule flexibly
- Pass on her recipe to those who cherish them
- Develop new baking techniques

Frustrations

- Farah is very picky about milk
- Delicate orders are not handled properly by delivery personnel, resulting in a smashed cake
- Getting license to bake at home is hard

Needs/Wants

- Makes house deliveries for large orders
- Prepare and buy ingredients for baking
- Coming up with new recipes that are successful
- Handle both baking and delivery on her own

Extreme User

Mike Tang

Male
30 years old
Single
Public Speaker

Lifestyle/Preferences/Background

- Wheelchair user
- Severe peanut allergy
- Travel very frequently on public transport
- Avid tourist
- Independent and punctual
- Huge football fan
- Self-conscious

Motivations

- Wants to present a speech in front of an audience of 10000 at least once
- Able to introduce his hometown to his friends visiting Singapore
- See equality in treating of PwD with respect and respect others as well

Goals

- Confident when delivering his speech
- Be able to freely explore Singapore on his own
- Be treated with respect like other people

Frustrations

- Many places in Singapore has unclear signs for PwD pickup point and he often has to go to new places
- Unable to get into the taxi sometimes due to the unique design of car doors
- Cannot travel easily during peak hour on the bus as the bus is full

Needs/Wants

- Know where is the PWD pickup point in advanced to know how to navigate and reach the destination on time
- Practice his speech before an event
- Make sure his laptop is fully charged before his presentation

Worked Example 3

The four personas here depict different stakeholder groups within the development and operational stages of design of a web-based career resource. Personas allow us to aggregate user data from interviews and identify potential use cases.

DIGITAL DESIGN
refer to page 2

How might we design a collaborative web platform around sharing, visualising, and comparing data for the future of young professionals and potential organisations for employment?

Students/Practitioners

Brad

Male
21 years old
Single
Engineering Student

Lifestyle/Preferences/Background

- Has taken some graduate courses
- Values data and concrete information
- Does not like jumping into or doing things without a plan.

Motivation

- Strives to learn as much as he can about career options
- Has done research on some companies but wants to make sure they are a good fit for him

Goals

- Have always struggled with finding a resource where it can help me search for a program and what skills are needed.

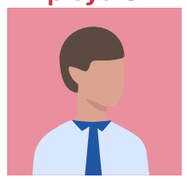
Frustrations

- Does not have a lot of extra time so researching companies for a long time only to learn that he is not a good fit can be stressful

Needs/Wants

- Finding employers' information in one place can help with being organised and help with managing job hunting
- His skills are mainly focused in one area, he wants to find a company that needs that specific skill
- Would like to casually communicate and network with employers online
- Would like employers to easily be able to discover him as well
- Would like a website that allows Brad to find what employers are looking for and recommends positions that work best for him when he input my skills.

Employers



Michael

Male
30 years old
Married
Recruiter

Lifestyle/Preferences/Background

- Has educational background in business and engineering
- Values efficiency and time-management
- Always strives to make actual connections with students before hiring them

Motivation

- Determined to find success in everyone

Goals

- Wants to help students who are struggling to find careers
- Helps people strive for success has always been something he value in my profession.
- Being able to search for students who fit his company values and needed skills becomes a beneficial relationship between the student and the organisation.

Frustrations

- He often has limited options for students to hire because he does not know how to find them

Needs/Wants

- Loves to recruit young talent
- He always senses that there is more than meets the eye for many of the students he interviews. He wishes there was a way to reveal this
- Wants to represent his organisation to build better connections in the Systems engineering field
- Wants to build relationships with various universities who have programs that match well with what sort of talent he is looking for

Universities

Sasha

Female
38 years old
Married
University Programme Director

Lifestyle/Preferences/Background

- Mentors students who need some guidance
- Has industry experience

Motivation

- Guide students to do better in their education
- Tries to be the person she wish she had as a resource back when she was a student.

Goals

- Always wants to help students maximise their potential through education and build real connections
- Hopes to learn a lot about students' interests and experiences
- To create true connections with my students and help guide them to build their education in such a way that they are perfect for the careers they are interested in – even if it means recommending another university's program.

Frustrations

- Wants to answer any question students have about industry options but cannot keep track of questions in her emails

Needs/Wants

- Wants to accurately represent her programme
- Wants to know what skills her programme focuses on so she can give that information to students and to collaborators of the university
- Needs a faster way to learn about students she can mentor more of them better and faster
- Wants a way to connect with both students and professionals in the field

Stakeholders

Albert

Male
62 years old
Married
Lead Website Designer

Lifestyle/Preferences/Background

- Keeps up with latest industry trends
- Worked as an engineering professor at several universities
- Has had a successful engineering career for 33 years
- Analyses and manages complexity and risks for every task

Motivation

- Wants to give back to the professional community
- He has always accepted opportunities to be a guest speaker at Universities to build the community
- Invested in keeping a professional society

Goals

- Believes that Systems Engineers are at the heart of creating successful new systems. They are responsible for the system concept, architecture, and design. They analyse and manage complexity and risk.
- Believes that the launch of successful systems can be traced to innovative and effective systems engineering. Having a community of systems engineer will help him and others grow in many ways.

Frustrations

- Has a hectic schedule and have no time for breaks.

Needs/Wants

- Always wants to be sure that he, and other employees and connections are professional and dependable
- Wants to help give young professionals a leg-up but wants to be sure they are ready skill-wise

Method

Scenarios

Design Thinking | Contextual Observation

CARD 7 Empathy

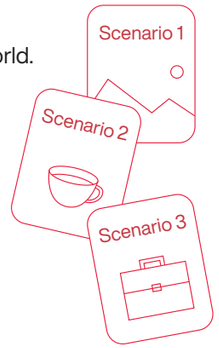
Scenarios paint the context of use of the products, services, and systems (PSS), extracting context-specific needs.

Why: Creating scenarios help us to explicitly describe our users' interactions and expectations in specific situations, bringing to light latent needs and pain points that could arise in the real world.

Materials: Sticky Notes/Cards, Wall/Board, Scenarios Template

Complementary methods: User Interviews, Stakeholder Mapping, Personas, User Journey Map

Acronyms: AV - Autonomous Vehicle
PSS - Product, Service, or System



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Procedure

1 Capture actions and interactions

of your personas through any data you have (e.g. interviews, studies). Focus on their interactions with existing products or solutions, or their reactions in a hypothetical situation.

2 Categorise scenarios

that the personas go through

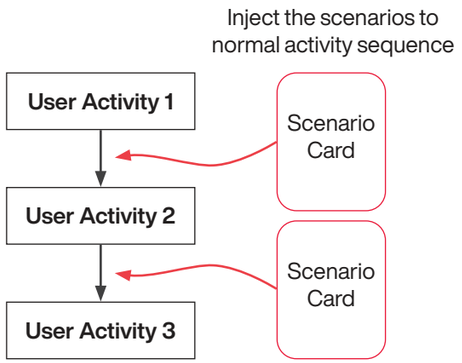
- Existing — situations which are current
- Extreme — situations where emotions are more intense (good or bad)
- Hypothetical — situations which may happen

3 Analyse your scenarios

Ask insight-driven questions like:

- Are the scenarios interconnected?
- What surface or latent needs are there?

Jot down your insights.



Model of presenting scenario cards as users engage the PSS.

Best Practices

Keep scenarios realistic

Avoid scenarios that are impossible or unrealistic.

Have diversity

Ask explicitly about a specifically negative situation, and specifically positive situation.

Categories for creating scenarios [5]

Context factors can be grouped into 3 categories:

Category	Sample Context Factors
WHO User Context	▪ Physical Abilities ▪ Skills and Education ▪ Cost Expectations
WHERE Environment Context	▪ Infrastructure (e.g. Energy & Cost) ▪ Weather and Climate ▪ Maintenance and Parts Availability
HOW/WHAT Application Context	▪ Application Task ▪ Usage Frequency ▪ Transportation Mode

Worked Example 1

Scenarios cards for prompts regarding community programmes

Who
30 y.o. Cyclist

Where
Monday afternoon, Rainy day

How/What
Cycling to Raffles Place to purchase goods

Who
60 y.o. Retiree

Where
Morning, Sunny day

How/What
Exercising and hanging out with friends

Who
8 y.o. Student

Where
Sunny day,
Outside school gate

How/What
Hanging out with friends and learning skates

Worked Example 2

Taxi Service for passengers of autonomous vehicle (AV)

Useful Tip

Craft scenarios such that each scenario generates one user need.

Typical User

John Lim

Male
28 years old
Single
Businessman

Long day at work. Extremely tired. **Just wants to sleep**.	Bad start to his morning. **Wishes he had a coffee** pick-me-up.
Extremely tired. **Doesn't wake up** when he reaches destination.	Bought coffee. Wishes his coffee would **remain hot**.
Spilled coffee in the AV.	**Forgets important document** at home. Wife is at home but she is busy and can't deliver it.
Needs to **take video call** in AV. Bumpy car ride. Video call looks very unprofessional. Lost that client.	Gets in AV, reminisces and **misses having conservation** with cab drivers.
Super hot day. Super **sweaty** when he gets into the AV.	Agitated about losing a mobile game match due to **poor connection**. Very bad mood.
His **music (that he puts on to sleep) annoys** other rideshare passengers.	Important **fragile client model** to transport. Has to hold it for the entire ride.

Family Unit

Nurul, Hani and Farah

Female
37 years old, Hani is 4, Farah is 2
Married
Cake Shop Entrepreneur and Housewife

Nurul accidentally **leaves her wallet** behind in the AV.	Nurul gets into rideshare. The **other passenger** strikes her as creepy and makes her **uncomfortable.**
Despite having a **regular schedule**, Nurul **forgets to book an AV in advance**, causing a delay in schedule	Needs to get large quantities of groceries this week. Has to make **multiple trips** to and from AV to her HDB.
Worried about other people **coming by to take her things/ AV driving off** while she does grocery shopping.	Farah cries for milk during ride and **refuses to take cold milk**.
Buys a lot of eggs. Need to **hold them** throughout the ride so they **don't break**.	Farah **requires a diaper change** halfway through the ride.
Usually husband helps to **load childseat** in AV but he is busy today.	**Milk was spilt** in the AV. Nurul wants to **notify the system** so it can be taken care of and **cleaned**.
Hani **gets bored during the long ride** to grandmother's house.	

Extreme User

Mike Tang

Male
30 years old
Single
Public Speaker

Heading for an important meeting, but laptop **battery is low**.	It's a rainy day, concerned it would be **slippery and dangerous** getting into the AV.
Had to rush out of the house. **Worried about appearance**. Trying to check his reflection.	Favourite soccer team is playing. Has to visit sister who stays at the other end of the island and is **bummed about missing the match**.
Multiple locations to visit. Because of his **special considerations**, he **would rather not switch AVs** all the time.	Heading off for an important speaking event and would like to **practice in the AV**, but ends up **distracted by noises** outside,
Would like to **check something on the internet on his phone during the ride**, but as a tourist **hasn't bought a data plan** and is unable to.	Arrives in Singapore with foreign friends **carrying lots of luggage.**
Unsure about **wheelchair access points** and waste lots of time looking for them.	Gets into rideshare. Mike wants to **watch football**, but the other passenger wants to **watch something else**.

Context Scenarios

Context Scenarios method is an extension of the Scenarios method. By considering the context of a design opportunity, we will uncover needs that are able to create contextualised design variants.

First, select a set of design parameters (or usage factors) that is related to a scenario. Putting the PSS in different contexts but in the same scenario, variants of the PSS can be discovered. These variants are needed to accommodate the context.

Context Scenario Worked Example 1

In the example given, cooking food (the chosen scenario) can be placed in different context such as backpacking, camping near car, picnic, an average home kitchen or a tiny kitchen.

Observe that the usage factor value differs due to the different needs of the context, resulting in different variant of a product that serves the same scenario, namely cooking food.

Major Context Scenarios of Cooking Products-Processes:

- Backpacking
- Camping Near Car
- Picnic
- Average Home Kitchen
- Tiny Kitchen (Dormitory)

	Backpacking Context	Heavy Domestic Use
Usage Factors	**Usage Factor Value**	**Usage Factor Value**
Storage Mode	1 = Backpack	5 = Room
Transportation	1 = By Foot	3 = Stationary
Ventilation	3 = Outdoor	2 = Some
Weather	3 = Outdoor	1 = Indoor
Energy Availability	1 = No Electricity	1 = No Electricity
Usage Frequency	1 = Infrequent	3 = Heavy
Usage Duty	1 = Light	3 = Heavy

Context Scenario Worked Example 2

A different way to use context scenarios is to pose some questions to find out more about the design context. Answering the questions that fill in the gap in knowledge of the context would achieve a higher success rate in introducing innovation.

While the need for a village cooking system in Africa is discovered, there have been failures in past attempts to improve the village cooking system.

In a paper by Barnes[4], it discusses the difficulties of transitioning from less energy efficient fuel such as biomass fuel to modern energy sources such as petroleum in developing countries.

Answering the questions that fill in the gap in knowledge of the context would achieve a higher success rate in introducing the innovation. The questions which were raised are listed below as a guide.

Historical Reasons for Failure of Improved Village Cooking Systems	
Cause of Failure of New Cooking System	**Contextual Information Required for Success**
Does not account for actual conditions of use and is therefore uneconomical and inconvenient	What are the actual conditions of use?
Does not resemble the traditional cooking system	What is the traditional cooking system?
Does not accommodate large pieces of wood	What are the available sizes and types of fuels?
Does not improve a fuel supply problem	What are the available sizes and types of fuels?
Does not improve a smoke problem due to low ventilation	What are the available locations of the ventilation?
Does not accommodate design for manufacture needs of local artisans	What are the local manufacturing practices?
Does not use locally available materials (increases cost)	What are the locally available materials?
Does not utilise mass-production of critical components	What mass-production local or import capabilities are available?

It’s not ‘us versus them’ or even ‘us on behalf of them.’ For a design thinker it has to be ‘us with them'

Tim Brown

President of IDEO

Method

User Interviews

CARD 1 Empathy

Design Thinking | Core User Engagement

User interviews are conducted to extract information from existing and/or potential users to gain a deeper understanding of their goals, motivations and pain points so that a better solution can be designed for them.

Why: User Interviews are used to extract deep qualitative insights, foresights and latent needs from users. By asking questions, designers, engineers, and professionals can uncover users' intentions, motivations and emotions[3] when they use the PSS.

Time: 1 - 2 hours (per interview or observation session)

Materials: Camera, Voice Recorder, User Interview Template, A Scribe

Complementary methods: Stakeholder Mapping, Shadowing, 5 Whys

Applicable framework: Extreme-User Experience Framework

Acronyms: CV - Curriculum Vitae
PSS - Product, Service, or System

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Procedure

1 **Conduct background research**

to identify user groups, user types, platforms to interview them (via in person or online), existing solutions available, and objective(s) of the interview.

2 **Prepare a list of questions**

that are open ended and non-leading to avoid response bias from your interviewee.

3 **Introduce yourself and the objectives**

of the interview to start things off.

4 **Go with the flow of the interview**

and be unafraid to ask questions that were originally not in the list if they seem like they will be promising leads.

5 **Observe & record the interview**

whether by audio, video (with permission), or have a teammate take notes. This will allow you to focus on the interviewee.

6 **Summarise your findings**

to clarify key points with your interviewee, and ask them if they have questions for you. The questions they ask may raise interesting points you may not have originally considered.

Best Practices[1]

Do not ask leading questions or suggest answers

Leading questions or suggesting answers might influence and bias the response of the interviewee, compromising on the accuracy of their responses.

Seek what the PSS must do, not how

Be open to explore alternative ways to how the PSS might be able to do what it should.

Go with the flow

Wherever the user/customer takes you, follow along, and ask why and how questions.

Use visual stimuli and props

Bring models of new concepts, competitors' PSS, related or analogous PSS. Ask about all of these.

Have the customer/user demonstrate

Don't just ask about the PSS; human language is only so expressive. Seeing the need in action will permit much better understanding.

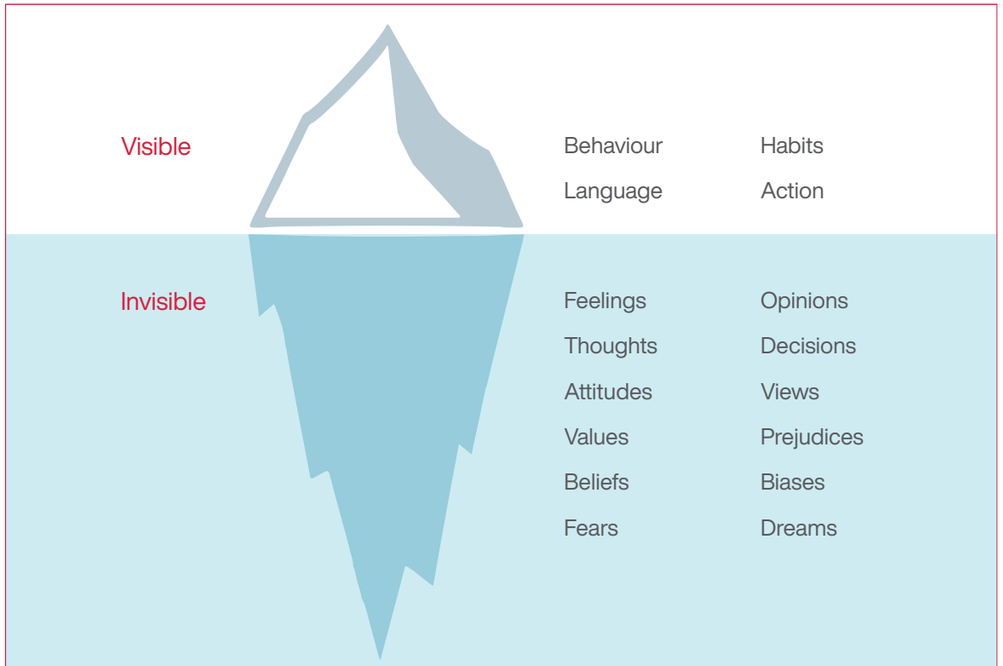
Be alert for surprises and latent needs

Pursue any surprising answers with follow-up questions until we understand the need completely. This additional level of inquiry usually uncovers the latent needs.

Watch for non-verbal information

Human language cannot communicate all sensation modes and feelings about a product. Non-verbal information includes body language, facial expressions, emotions, values and beliefs.

DI team members conducting interviews with stakeholders



Information Gathered from Interviews[4]

Interviews are like diving into the ocean to observe beyond the tip of an iceberg. While digging for more information about the users, be mindful of any need beyond the surface that is valuable for the design opportunity or problem. Seek to discover latent needs, which are not obvious and not indirectly expressed by users.

Request the users to be open to share their feelings, thoughts, attitudes, values, beliefs or even fears.

Useful Tip

Interviews are most effective when held in the environment and circumstances, or as close as possible, to where the PSS will be implemented.

To encourage more sharing in the interview, you can plan to conduct follow-up interviews and gradually build up the rapport between the interviewee and you.

Sample Questions

The sample questions below may be contextualized and rephrased in terms of the Enterprise-level or Project-level opportunity statement(s) of the team. These questions are proven through extensive research and application across domains and disciplines.

Who (Characteristics/Personas)

‘What is your occupation?’
‘Describe yourself _____ ?’
‘What tools do you use the most at work?’
‘What do you usually prefer, _____or _____, why?’
‘How familiar are you with _____ ?’

Jobs To Be Done (Social/Emotional/Functional)

‘How often do you _____?’
‘How much/often do you _____?’
‘How many time have you _____?’
‘When do you have to complete _____?’
‘Walk me through your responsibilities...’
‘When do you have to _____?’

Look for Specific Stories and Contextual Needs

‘Can you tell me about the first time you _____ ?’
‘What do you remember about _____ ?’
‘What kind of day was it?’
‘Could you tell me the story of how you _____ ?’
‘Where did that happen?’

Likes and Dislikes

‘What do you like about _____?’
‘What do you dislike about _____?’
‘What was your best experience with _____?’
‘How do you compare this and that?’
‘When was the last time you shared _____ with your friend?’

How they Feel (Pains/Gains, Emotional/Social)

‘Walk me through how you felt . . .’
‘What were you thinking at that point?’
‘Why do you say that? . . . Tell me more.’
‘Could you tell me why is that important to you?’

Worked Example

User Interviews are used to extract deep qualitative insights, foresights and latent needs from users. By asking questions, designers, engineers, and professionals can uncover users' intentions, motivations and emotions when they use a product, service, or system.

In these interviews, questions are designed to allow interviewees express their needs and aspirations by articulating how they engage with a process similar to our opportunity statement. This will inform the discovery of insights and identify opportunities for design improvement while empathising with user needs.

How might we design a collaborative web platform around sharing, visualising, and comparing data for the future of young professionals and potential organisations for employment?

Jobs To Be Done

- Have you searched for employment within your discipline? How did you do this?
- Have you searched for graduate programmes in your discipline? How did you do this?
- What does a successful job search look like for you?

Too much social upkeep is required	Likes a consolidated resource for specific field	Wants a unified location to upload resume, CV, and other resources
Likes having access to contacting companies with questions	Needs resources on how to get noticed	Read receipt for resumes
Hard to get response from employers	(Interviews) felt inadequate for the job	Likes the idea of having a display that shows job recommendations

Stories; Contextual Needs

- How would you connect to someone who specialises in the field you want to pursue?
- Can you share a story of a successful or unsuccessful connection?

Likes connecting with people their age	Likes matching skills with companies	Likes openness of information
Dislikes how much work it is to make connections and build a profile	Employment search is daunting	Dislikes how performative it is
Likes connecting with people in field easily	Advice from the actual department they are applying for	Job recruitment involves lots of back and forth emailing

Who

- What is your major?
- What year are you in?
- What is your ideal graduation date?

Likes/Dislikes

- What do you like about searching for employment?
- What do you dislike about searching for employment?
- What employment search platforms have you used, if any? What do you like or dislike about the platforms you have used?

Wants more kindness from employers	Lack of consistency between job websites	(Glassdoor) reviews are great to look at from work places (salary + job specifics)
Programs are not easy to find	More up-to-date details of programs	Hard to learn where to get information
Likes that there are learning courses	Available to work option	Networking capabilities

Feelings; Pains, Gains, Emotional, Social

- How did your search for employment make you feel? Did you have any struggles or fears?
- Do you have advice for employers or university programmes relating to the job search process?
- What kind of advice would you like to receive?

Dislikes lack of guidance or support	Likes notifications and reminders	Make strengths career test mandatory
Dislikes that programs are not specific enough on expectations	Struggled finding program that fits schedule	Better website design to get attention of user
Feels ignored	Opportunity to rebrand themselves	Likes to easily get a sense of what employment is like in various companies

Method

Survey Design

Design Engineering | Core User Engagement

Surveys are an asynchronous data collection technique that can complement other data collection methods (interviews, observation). The asynchronous mode means you don't have access to non-verbal information, but users are free to respond on their own time.

Why: Surveys are incredibly flexible with multiple types of structured and unstructured questions and visual interactions possible. In addition, a survey can allow reaching a much wider audience than interviews.

Time: 1 - 2 hours preparation, 1 - 2 weeks to collect responses, 1 - 2 hours analysis

Materials: Survey platforms (see opposite page)

Complementary methods: User Interviews, Shadowing

Acronyms: CIT - Critical and Inventive Thinking
DBL - Design-based Learning
MBL - Maker-based Learning
MOE - Ministry of Education

Procedure

1 **Determine topics**

for exploration. What are you trying to learn?

2 **Develop questions**

that are a mix of open (free response) and closed questions.

- **Open questions** are open-ended, and users can respond freely. This kind of question is best for learning about a user's experience.
- **Closed questions** force the respondent to choose from a set of options you provide. This kind of question is best for user evaluations.

3 **Select a survey platform**

that will allow you to reach your intended audience, and use that platform to customise response formatting and question flow.

4 **Pilot your survey**

by asking a small group representative of your audience to take the survey. Update questions that are confusing, vague, or too specific.

5 **Distribute your survey**

Thank participants for their time.

6 **Analyse responses**

Open questions could be analysed by looking for common themes or phrases, and closed questions could be analysed with descriptive statistics.

Best Practices & Tips

Introduce your survey

Surveys are asynchronous, so a short text introduction is your way of explaining the survey and why a participant's input is valuable.

Ask demographic questions at the end of the survey

This avoids potentially negative effects of priming or bias.

Avoid leading questions

Phrase questions to not assume people will interpret something in a given way, or respond in a given way. This minimises bias.

Always include 'none of these' or 'other' options

In a closed response survey, these options allow survey takers to accurately respond.

Ensure responses will be useful

In a Likert-style (-2...0...+2) or scale question, include no more scale points than is meaningful for you to make decisions from. In general, 5 or 7 scale points is usually sufficient.

Keep it short

An ideal length for a survey is about ten minutes, or no more than 25 questions. Depending on the audience or circumstances, your survey could be longer.

Survey Platforms

Typeform
Google Forms
Qualtrics
Survey Monkey
Microsoft Forms

Worked Example

Critical and Inventive Thinking in Singapore General Education

Research Questions

What is Critical and Inventive Thinking to school leaders, educators, students and based on the academic literature, business leaders, and government leaders worldwide?

What are the existing Singapore MOE and school programmes that address Critical and Inventive Thinking, including learning objectives, pedagogical approaches, programmes, and assessment?

How pervasive are these programmes in their implementation? How effective are these programmes? What are the systemic and resource constraints involved in these programmes?

What are MOE's future plans to address Critical and Inventive Thinking?

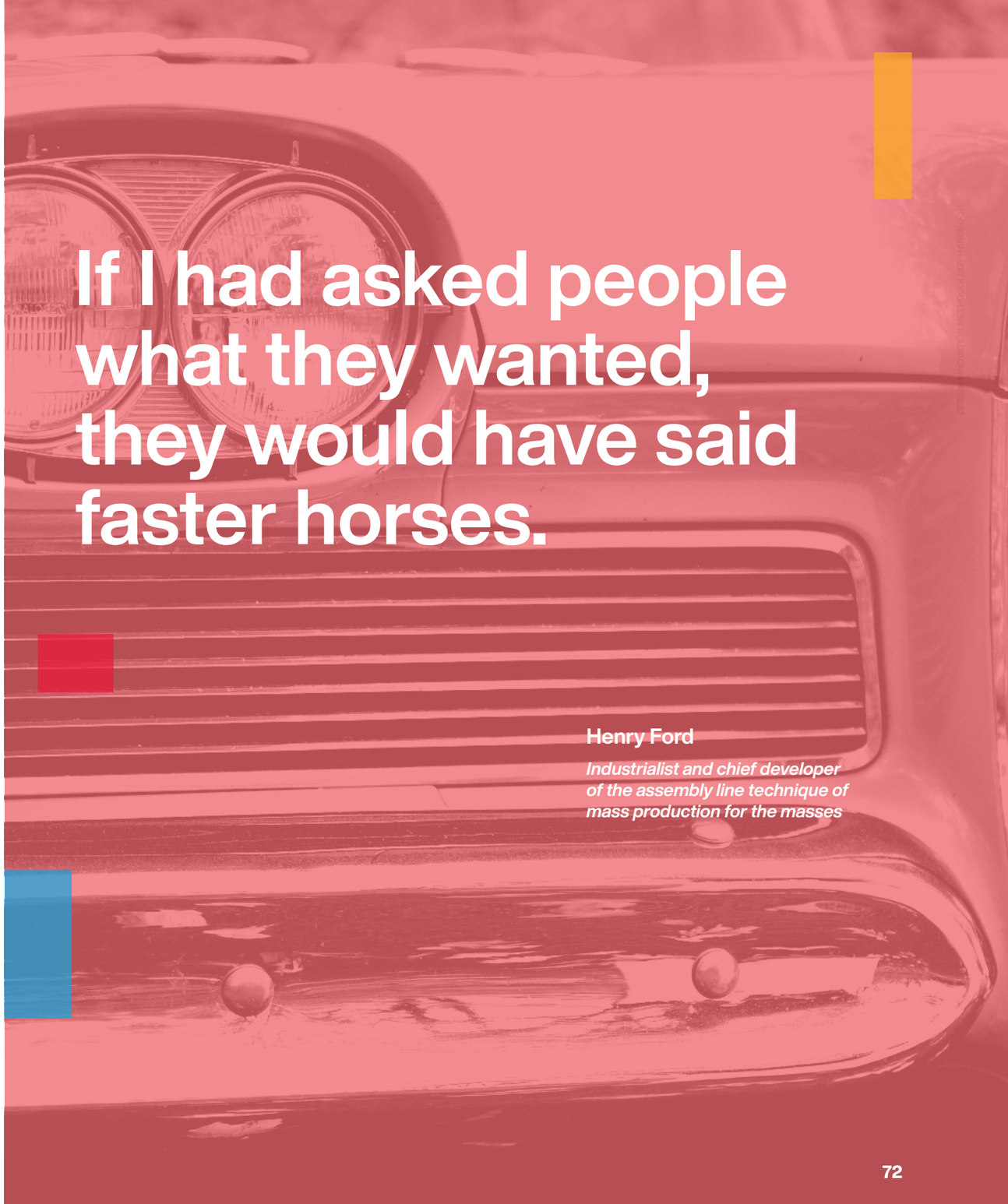
What are other countries and educational systems doing to address Critical and Inventive Thinking, including learning objectives, pedagogical approaches, programmes, and assessment?

What are the strengths, gaps, challenges and opportunities based on the afore-mentioned findings?

What are the recommendations, building on the results from Q1-Q5, for design-led creative thinking and doing (design-based learning – DBL, and maker-based learning – MBL) to value add to existing programmes?

Survey Questions for Teachers

1. How would you define Critical and Inventive Thinking (CIT) in terms of your school?
2. Does your school use Design Thinking and Maker Spaces? If so, please describe.
3. What activities have integrated CIT / Design Thinking / Maker spaces in your school? Explain.
4. For your school, how does CIT, Design Thinking and Maker Spaces integrate with and across the core subject areas? Explain.
5. Provide a brief story or vignette for your favourite CIT / Design Thinking / Maker Space - integrated activity in your school.
6. What issues or challenges (including systemic and resource constraints) exist or have existed in your school's CIT / Design Thinking / Maker Space - integrated activities?
7. What strengths exist, and what improvements and opportunities do you foresee or desire in CIT / Design Thinking / Maker Space - integrated activities in your school?
8. What might be some creative ways you envision for overcoming issues or challenges for adopting CIT / Design Thinking / Maker Space - integrated activities in your school?
9. How do you see the future of education, the classroom, and learning environment changing over the next five years or so?



Method

User Journey Map

Design Thinking | User Connection

CARD 3 Empathy

User Journey Map charts out an archetypal journey of a user's interaction with the product, service, or system (PSS), over time and across channels, fleshing out the user's emotions.

Why: User Journey Map helps teams visualise and story-tell users' journeys for deeper empathy, enabling more integrated sense-making of needs and identification of specific opportunity areas for innovation. It also creates a shared reference frame around the user experience across stakeholders.

Complementary methods: User Interviews, Activity Diagram

Acronyms: AV - Autonomous Vehicle
PSS - Product, Service, or System

Procedure

1 Choose a persona and a scenario

Clarify the persona's needs, expectations and goals within a defined scenario (refer to 'Personas' and/or 'Scenarios' cards)

2 Map the journey

Chronologically plot the relevant points of action between the user and the PSS.

3 Identify gaps and insights

Analyse the Journey Map. Identify the interactions that are pain points and note areas where the user experiences delight. Draw insights to improve on the user experience.

Framework

Apply Extreme-User Experience Framework

read more about the framework on page 39

a. Determine the physical abilities/demands needed to interact with each touchpoint

b. Use wearable situations that eliminate specific physical demands

c. Use user emotions to identify critical points for improvement.

d. Test with users and discuss experiences. Check how similar or different are they from what you anticipated.

Key Elements of a User Journey Map

- Touchpoints[3]: Instances of interaction between a user and the PSS
- Channels[3]: Mediums of interaction between a user and the PSS

Best Practices [1]

Involve different stakeholders

Co-create the journey map with different stakeholders, to align and sharpen their perspectives on the user journey.

Content first, visuals later

It can be easy to be distracted by the visual aspect of a journey map. Ensure you build a solid foundation with the content before trying to communicate the story.

Build and support it with data

Be mindful of assumptions made in developing a journey map. Strive to ground them on data.

Test and refine it with users

Show the journey map to users and get feedback from them on how representative it is in depicting their actual journey.

Worked Example

A User Journey Map is created to address the opportunity, 'How might we design and integrate an Autonomous Vehicle System for the future of Singapore?' The current travel experience of taking taxis is mapped as a proxy to the experience of taking Autonomous Vehicles.

It begins by selecting the persona and scenario involved, as seen in the topmost row. If personas are not yet created, key stakeholders can be picked.

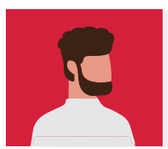
With reference to the Scenario, touchpoints and channels are then identified and listed chronologically in the next rows.

The emotional level of each touchpoint is rated, sketched and labelled with facial expressions, empathising with the Persona.

Insights and opportunities are extracted, asking, 'How can positives be amplified, and negatives turned into positives?'

How might we design and integrate an Autonomous Vehicle System for the future of Singapore?

Persona



Adam

- 32 years old
- Newly married
- Financial Advisor
- Doesn't own a car
- Has an active lifestyle with lots of appointments with clients
- Exercises regularly to keep fit
- Loves dogs
- Wishes traveling can be more fun

Scenario

Travel Experience Taking Taxis

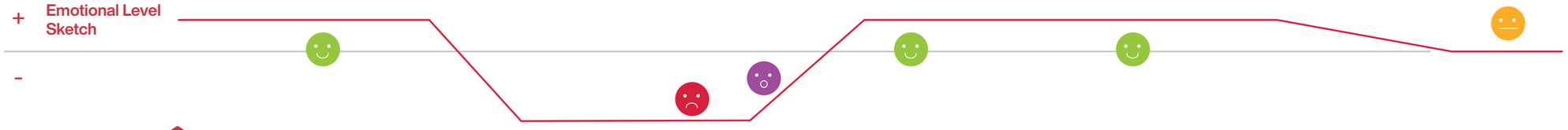
- Travels by taxi to meet a client on a regular workday in Singapore
- Carries a briefcase with a laptop and work documents
- Needs to reach destination promptly

Touchpoints

Arranges/ Confirms meeting with client	Book Taxi	Travel to Pick-up Point	Waits at Pick-up Point / Looks out for Correct Vehicle	Vehicles Arrives, Boards Vehicle	Rides in Vehicle, Waits to Arrive at Destination	Alights Vehicle	Gives Rating for Ride	Walks to Destination

Channels

Emotional Level Sketch



Insights and Opportunities

How to book vehicle without looking at the screen?	Option to book vehicle with dog inside	Minimise taxi waiting time	Display "Welcome (user name)" for easier recognition	Customisable Rides	Ensure nothing left behind
	Option to book vehicle with exercise equipment inside		Vehicle to identify user	Make vehicle interior more conducive for exercise and rest	Give directions to walk
			Option for easy boarding if user has a lot of items	Give recommendation on places to meet client	

Extreme-User Experience Framework
refer to the previous page

Method

Contextual Needs Analysis

Design Thinking | Immersive User Experience

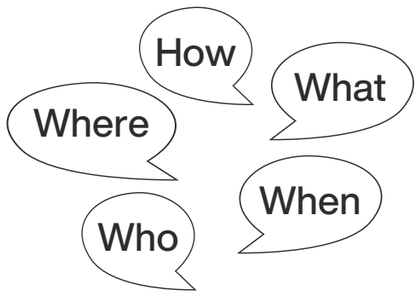
Discover the context surrounding products, services, or systems (PSS) to understand and account for context in the design process.

Why: User satisfaction with a PSS critically depends on the context it is used in. By considering the context, the function is integrated and harmonised with its surrounding.

Note: To be present in the context of the PSS.

Complementary methods: User Interviews, Site Analysis

Acronym: PSS - Product, Service, or System



Context setting questions

Procedure

1 **Ideate interview questions**

What do we need to know about? Where? How? and Who?

2 **Context questions template**

Add, delete and modify questions as needed.

3 **Interview users**

While using product, service or system in a realistic context.

4 **Form a user needs list**

Translate voice of user - combine and prioritize needs.

5 **Form scenarios In context**

by combining contextual answers to each question.

Framework

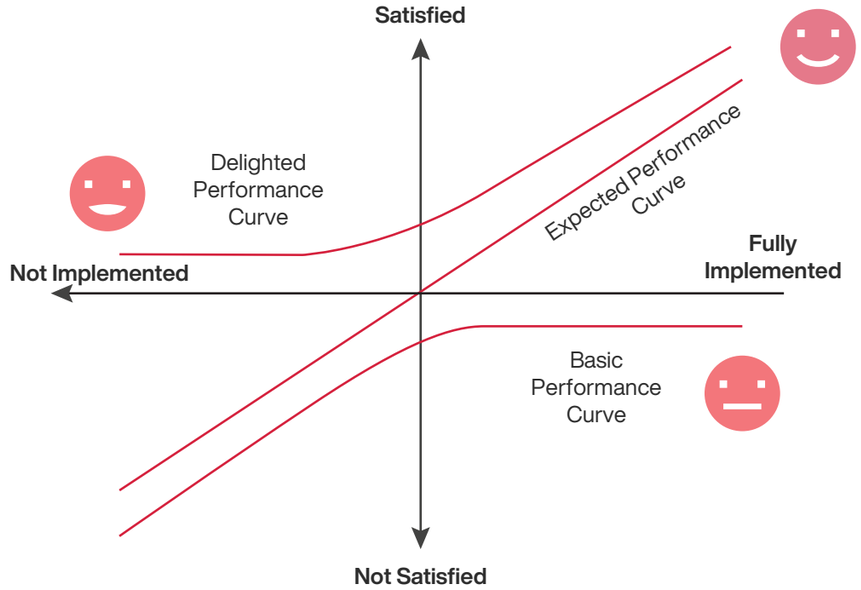
Apply Extreme-User Experience Framework (Optional)

read more about the framework on page 39

User with [Extreme-User demand] [interacting with product, service or system] [environmental/spatial extremes]

Measure context against: Kano Model

Users will always have certain expectations of products, services and systems based on what they are used to. That can be viewed as the Expected Performance Curve. Should our new products positively exceed expectations, we can delight consumers. Conversely, should our products fail to deliver on what consumers have come to expect as the 'norm', they will be upset even if our design is super polished and fully implemented.



5 categories of customer preferences

1. Must-be	Expected and taken for granted
2. One-dimensional	Satisfaction if fulfilled, vice versa
3. Attractive	Satisfaction if achieved, does not cause dissatisfaction if unfilfilled
4. Indifferent	Neither good nor bad
5. Reverse	High degree of achievement resulting in dissatisfaction

After defining the context(s) of use, measure the user satisfaction of a product, service or system (PSS) against a Kano Model.

Method

Empathic Lead Users

Design Thinking | Immersive User Experience

CARD 12 Empathy

Empathic Lead User enables a Lead User* experience by simulating extreme conditions in using the products, services, or systems (PSS).

*Lead users are users whose present strong needs will become general in a marketplace months or years in the future.[5]

Why: It encourages new perspectives on user interactions with the PSS, and identifies needs that are latent among a wider population of users.

Materials: Empathic Lead User Template, Lead Users, Extreme-User Experience Framework

Complementary methods: Stakeholder Mapping, Personas, Scenarios, Affinity Analysis

Acronyms: DI - Design Innovation
MRT - Mass Rapid Transit
PSS - Product, Service, or System

Framework

This method follows Extreme-User Experience Framework
read more about the framework on page 39

Procedure

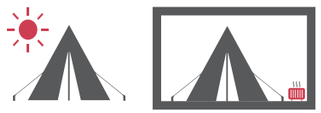
1 Develop list of extreme usage conditions

that are likely to occur and deviate from typical experiences. Consider the physical, sensory and cognitive demands that might occur during the use of the PSS.

2 Simulate extreme conditions

in a controlled and/or creative environment.

For example:



Setting up a camping tent in a dark room to simulate the perspective of users with visual impairments.

3 Collect simulation data

Get users to think aloud as they use the PSS. Observe interactions and record insights.

4 Identify latent needs

based on data collected and follow-up interviews.

Useful Tip

Use the Extreme-User Experience Framework to guide your Empathic Lead User method.

Best Practice

Use Situational Extreme-User Experiences

Situational Extreme-User Experience refers to getting knowledge or skill from doing, seeing, or feelings things inspired from instances that highlight the similarity in needs experienced by the extreme and general population users.

For example, someone listening to music on a noise cancelling earphone experiences a situational extreme that overlaps with the experience of someone with hearing impairment (direct extreme).

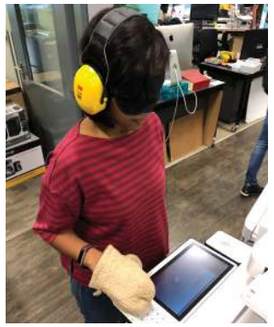
Be willing

to experience the life of the Extreme-User instead of talking about their experience. Extreme-User conditions may need to be repeated many times in different scenarios to understand the Extreme-User well.

Emulation and Simulation Tools

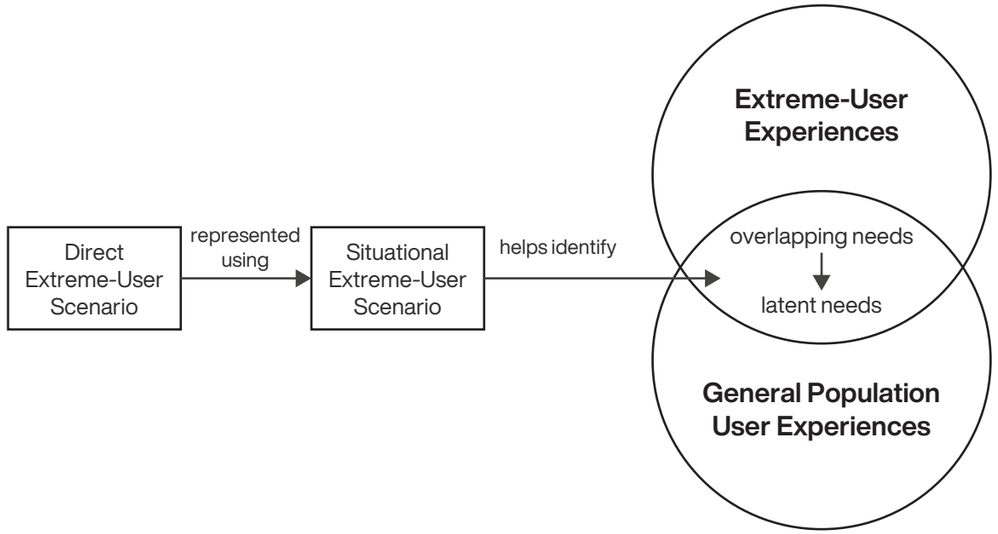
Use the corresponding simulation tools to eliminate the parameters. People can get creative with these tools!

Identified Physical Demand	Simulation Tool
Vision	Eye mask, blindfold or dark glasses
Both hand usuage	Hand band
Dexterity	Low dexterity glove or mitts
Listen	Noise canceller, ear plugs or background noise
Standing on feet	Your chair
Limited strength	Strap-on weights or joint wraps



An eye mask, ear muff and oven glove were used to simulate visual impairment, hearing impairment and slowness in dexterity respectively.

Role Of Situational And Direct Extreme-User Scenarios



Useful Tip

While these simulations are never a replacement for actual users, they play an efficient role in challenging designer perceptions and expectations.

Worked Example

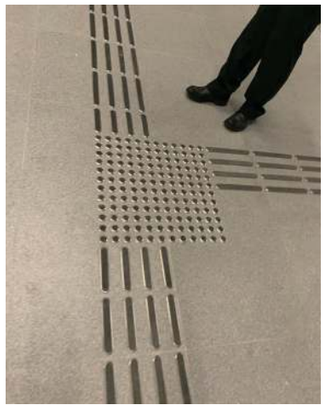
DI team members paired up and took turns to attempt to navigate the station, putting on different aids to enhance their sensitivities to the needs of extreme users of MRT station such as the visually and audibly impaired.

How might we enable the public and visually impaired to navigate a station more confidently?

A

Extreme usage condition

Visual impairment:
Using tactile flooring for navigation



B

Performing simulations

DI team member takes on the role of a user, putting on blindfolds to simulate visual impairment, while a designer guides him and observes the way navigation is done.

C

Identify latent needs

The DI team identifies the following latent needs:

- Wider corridor leading to the lift (congested flow around lift was felt acutely by the blindfolded DI team member).
- Easily noticeable alert to train passenger load information. (Would enhance the experience of users who would prefer to avoid crowded train journeys)

Method

Video Ethnography

CARD 4 Empathy

Design Thinking | User Observation

Video Ethnography is a visual data recording tool that focuses on precise recording and review of documented footage from user observations.

Why: Video Ethnography supports user studies and user needs method by providing user information that are graphical and dynamic.

Materials: Phone, Video Camera, Computer

Complementary Methods: Shadowing, Site Analysis

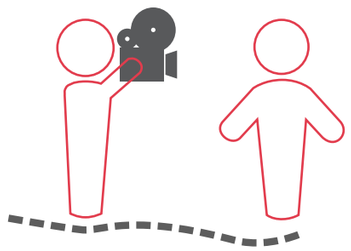
Procedure

1 **Select an activity or journey**

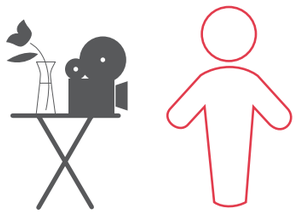
that the user carry out related to the design/problem opportunity.

2 **Capture the user's behaviour through their journey**

by following the users as he/she walks through the experience.



by setting up a camera on-scene to document repeated activities.



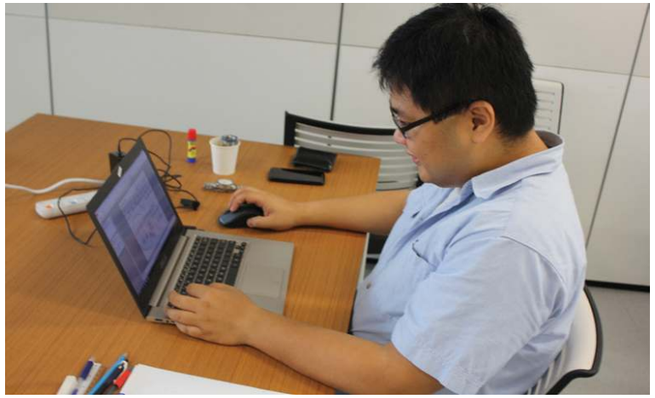
3 **Record and transcribe**

the patterns in user behaviour and interaction.

4 **Analyse and extract**

any insights regarding user needs that are uncovered during the study.

Expected Footages



User using a product, observing usage patterns and expressions.

Users navigating a space, observe line-of-sight, wayfinding cues.

Useful Tip

As the observer or videographer, try to set up the recording devices or position without disturbing the user during the observation. Write down questions (if any) and ask after the session.

Have more than one observers to captures different camera angles, such as the first person view of the users or from a third person view. You may find pieces of information that is valuable or unusual.

Method

Site Analysis

CARD 5 Empathy

Design Thinking | Contextual Observation

Site Analysis explores the relationship between the selected space and the surrounding environment or infrastructure. Documentation assists analysis on site.

Why[2]: Site Analysis enables designers, engineers, and professionals to deeply understand the spatial context of use of the Products, Services and Complex Systems (PSS), uncovering latent needs and insights.

Materials: Accessibility to Site

Complementary methods: Benchmarking

Acronyms: PSS - Product, Service, or System
SI - Soil Investigation

Procedure

1 Select

The site and specific process or features of the site to analyse.

2 Reviewing existing data of the site

to understand the site's physical, mental, and social landscape (e.g. floorplans, functional zones, security etc.).

3 Develop a Template

and collect data on identified factors (e.g. stakeholder, activity, zones, etc.)

Stakeholder	Activity	Location

Fill up data collection template as you walk through the site

4 Select and construct model

that best communicates the results of the site analysis.

Relevant models

Architectural model

IDEF0

System Model

Floor Plan

Heat Map

Possible analysis data to collect[2]

- Location and neighbourhood context
- Legal information
- Natural physical features
- Man-made features
- Traffic or human circulation patterns
- Utilities
- Sensory
- Social and cultural information

Outcomes

- Internal structure
- User flows
- System structures
- System flow and checkpoints

Useful Tip

Take photos and videos to describe the observations and make use of objects to denote the scale in the photos or sketches.

Worked Example

The example shows two different methods used in site analysis. The method chosen depends on the context and the information requested. Thus, the selection of the methods should be systematic.2 The list of data required, their priority and length of investigation should be drawn up before embarking on the site analysis.

Site analysis can be done using tools such as drones or static cameras for canopy view of site. Videos and images can be transmitted real-time to assess site conditions. Recordings can be also used for calculation and data visualisation (e.g. traffic and pedestrian flow along certain roads).

Soil investigation (SI) is done to obtain the geotechnical properties for design and because of the heterogenous nature of soil, every site is treated uniquely. Information obtained from SI will be used throughout the various phases of the project and not only in the design phase.

Method

Semantic Inquiry

CARD 9 Empathy

Design Engineering | Core User Engagement

Semantic inquiry lists out a set of questions that requires responses on a rating scale, capturing the desired 'feel' of the product, service, or system.

Why: The method is geared towards discovering the desired emotion, experience, appearance, feel, layout, and usefulness of a design.

Materials: Semantic Inquiry Template, Online survey platforms

Complementary method: Affinity Analysis

Acronym: PM - Prime Minister

Scan or click here for a digital copy of the template

1 2 3 4 5

Procedure

1 Generate descriptive words

related to the desired product, service, or system.

Feminine
Fast Sleek
Delicate
Elegant Light
Specific

2 Form pairs of adjectives

that are opposites and rate them on a scale of 1 to 5

Opposite extremes		
Feminine	○ ○ ○ ○ ○	Masculine
Dark	○ ○ ○ ○ ○	Light
Formal	○ ○ ○ ○ ○	Informal
Modern	○ ○ ○ ○ ○	Classic
Reserved	○ ○ ○ ○ ○	Expressive

3 Gather images

that capture these qualities.

4 User feedback

let users rank their impressions of the desired product, service, or system in terms of the descriptive words.

Useful Tip

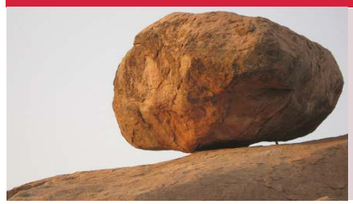
The Thesaurus or WordVis (http://wordvis.com/) can help you to generate the descriptive words.

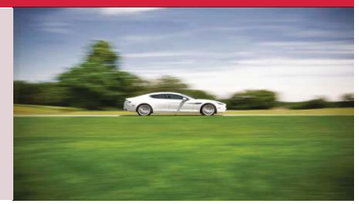
Worked Example 1

Ideation

Select the point between the two images that you feel best fits the target product/system in terms of mood/vibe.

Static ○ ○ ○ ○ ○ Dynamic





Calm ○ ○ ○ ○ ○ Exciting

Survey questions using Semantic Inquiry

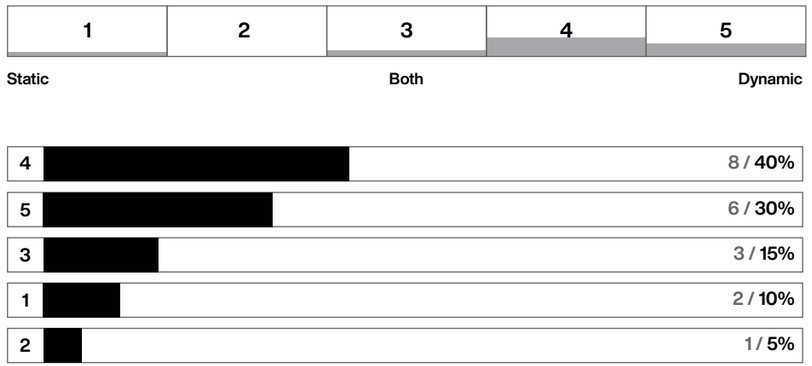


Image exploring user feedback results

Worked Example 2

Of Founders' memorial phase II

In his parliamentary statement on 13 April 2015, PM announced that he had asked Mr Lee Tzu Yang to chair a committee to gather views from the public and conceptualize a Founders' Memorial to educate future generations on the values and principles of the founding generation of leaders, and to take the project further if the idea finds resonance among Singaporeans.

More than 13, 000 visitors contributed their views on the possible design features and visitor experiences through Semantic Inquiry:

On a scale of 1 to 5, should the memorial:	1	2	3	4	5	Total
Be a Gallery (5), Park (1) or both?	27%	19%	39%	8%	7%	100%
Be Forward-Looking (5), Historical (1) or both?	16%	18%	47%	11%	9%	100%
Be Recreational (5), Commemorative (1) or both?	12%	20%	44%	14%	10%	100%
Cater for Large-Scale Programmes & Events (5), Individual & Reflective Spaces (1) or both?	13%	18%	38%	16%	15%	100%
Have Outdoor (5), Indoor spaces (1) or both?	11%	15%	50%	15%	9%	100%
Have Personal (5), Formal (1) or both?	10%	13%	41%	23%	13%	100%

The results showed that Singaporeans expressed support that the memorial should meet the following requirements in the chosen design:

1. Not only honour the past, but inspire the future
2. Be in a park setting, amidst greenery
3. Be located near water, reflecting Singapore's story
4. Be sited in an open space, with possibilities for future growth
5. Be accessible for all Singaporeans to visit with family and friends
6. Stand the test of time and be relevant for current and fture generations
7. Incorporate an indoor gallery for education and programmes to be conducted

Worked Example 3

Of Founders' memorial phase III

Attendees received a form like the one shown at every design booth

If attendees felt the design met a requirement, they had to shade that circle completely

Founders' Memorial Public Engagement | May 25 - 26

To respond, shade the box or circle completely with a dark pen

Design Booth

☐ A ☐ B ☐ C ☐ D ☐ E

Age

☐ 18 and below
☐ 19 - 35
☐ 36 - 59
☐ 60 and above

Ethnicity

☐ Chinese ☐ Malay ☐ Indian ☐ Other

Is not only able to honour the past, but also inspire the future

◯

Makes good use of the park setting, amidst greenery

◯

Makes good use of the site built near water, reflecting the Singapore story

◯

Makes good use of the site's open space, offering possibilities for future growth

◯

Would be accessible for all Singaporeans to visit with family and friends

◯

Would be able to stand the test of time and be relevant for current and future generations

◯

Has the capability to incorporate an indoor gallery for education, and the flexibility to run different programmes

◯

You never really understand a person until you consider things from [their] point of view - until you climb into [their] skin and walk around in it

Atticus Finch

Author of To Kill a Mockingbird

Method

Shadowing

Design Thinking | User Observation

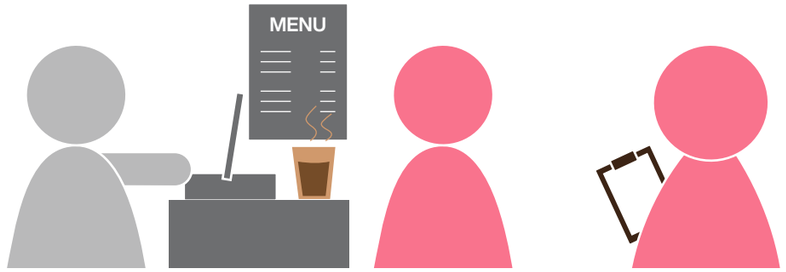
CARD 10 Empathy

Shadowing is a qualitative research technique where researchers act as observers of participants' natural behaviour with minimal interruption.

Why: Shadowing technique enables researchers to get as close to a first-hand or first-person perspective as possible to what users experience by direct observation. It also allows researchers to spot any discrepencies from the expected behaviour.

Materials: Camera

Complementary methods: Site Analysis, Multi-sensory Analysis



Procedure

1 **Brief the participants**

complete your preparation by building trust with the participants, encouraging them to think aloud, demonstrating if necessary.

2 **Preserve the natural state of the venue**

and allow for natural movement of participants at all times.

3 **Shadow your participants**

Take notes of observations or questions to clarify later.

4 **Seek clarifications**

After shadowing, hold a reflective exercise to clarify your observations and questions with participants. Dig deeper into the rationale behind their actions.

Template Structure

Where Location: **When** Date: Time: **Who** Name: Age: Gender: **Why** **Key Findings**	**Likes**	**Dislikes**	**Habits**
	Activities	**Objects**	**Space**

Worked Example

Shadowing a wheelchair user riding a taxi

Where Location: Taxi Stand **When** Date: 19-01-09 Time: 10 AM **Who** Name: Mike Tan Age: 40 Gender: Male **Why** Mike is an extreme user with disability **Key Findings** For wheelchair bound users, entering/exiting a vehicle unaided is demoralising and almost impossible	**Likes** Speaking to the taxi drivers and hearing about the stories of their lives.	**Dislikes** Visibly uncomfortable with having to bother drivers to help him get in and out of vehicle. He feels like he is inconveniencing them.	**Habits** Double and triple checks his belongings before exiting the vehicle.
	Activities Asks the taxi driver for recommendations of eating places along the route they are driving.	**Objects** Small sling bag he carries in the font for easier access.	**Space** The gap from the curb to the seat of the vehicle makes it hard for Mike to transfer himself without help.

Method

Multi-sensory Analysis

CARD 11 Empathy

Design Thinking | Contextual Observation

Multi-sensory analysis engages a user's sensory experience to understand the user's human experience, memories and emotional attachment to a product, service and system (PSS).

Why: Being rich in our sensory information gathering would be useful to discover latent needs, especially when designing for users who have one of their senses impaired.

Complementary methods: Site Analysis, Shadowing

Acronym: PSS - Product, Service, or System

Procedure

1 Record

user perception (qualitative) of various senses towards a PSS in a set time period.

2 Describe

Perception of various senses towards a PSS, through first hand experience. Best performed on site. Supported by Videography or Photography.

Key Components To Capture

Emotional
Reaction, both positive and negative

Visual
What visual stimulus, note colour and light

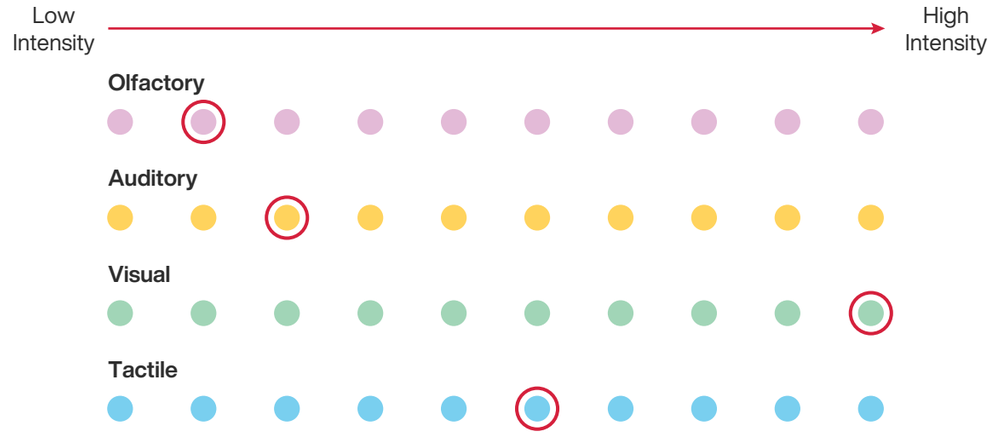
Auditory
What sounds indicate when heard

Olfactory
What smells users react to and why

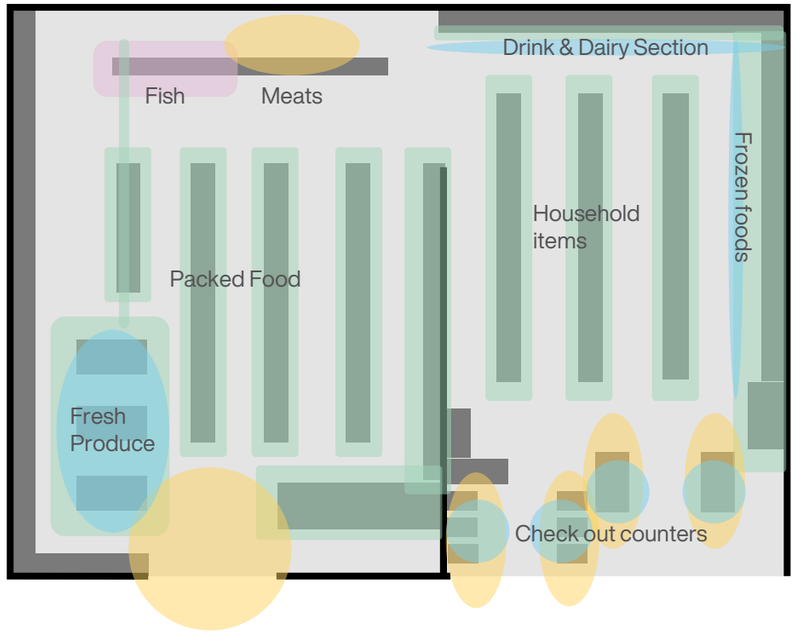
Tactile
What is felt by hand or skin

Worked Example

Multi-sensory Analysis of a Supermarket



Template structure of capturing key components in context.



Multi-sensory map of a supermarket

Method

Participatory Radar Map

Design Thinking | Core User Engagement

This map guides stakeholders in listing and prioritising their considerations, framed by select topics.

Why: Participatory Radar Map uncover what stakeholders are thinking. It challenges your assumptions and yields results that inform the design.

Time: 15 - 20 minutes

Materials: Participatory Radar Map Template, Sticky Notes

Complementary methods: Affinity Analysis, Hierarchy of Purpose, User Interviews

Scan or click here for a digital copy of the template

Procedure

1 **Identify**
within the Opportunity Statement for consideration

2 **Create**
a template of the radar map.

3 **Identify subcategories**
of the topic and label as the segments in the maps

4 **Invite**
a group of stakeholders to be participants or work on it individually.

5 **Apply**
Have each person individually reflect on the question and sections of the radar using Sticky Notes, and then plot those items according to personal significance

6 **Seek**
any insights and ask to understand their rationales for the plot.

Best Practices

Listen closely
when the stakeholders are sharing their thoughts, you might find valuable information that challenges your views.

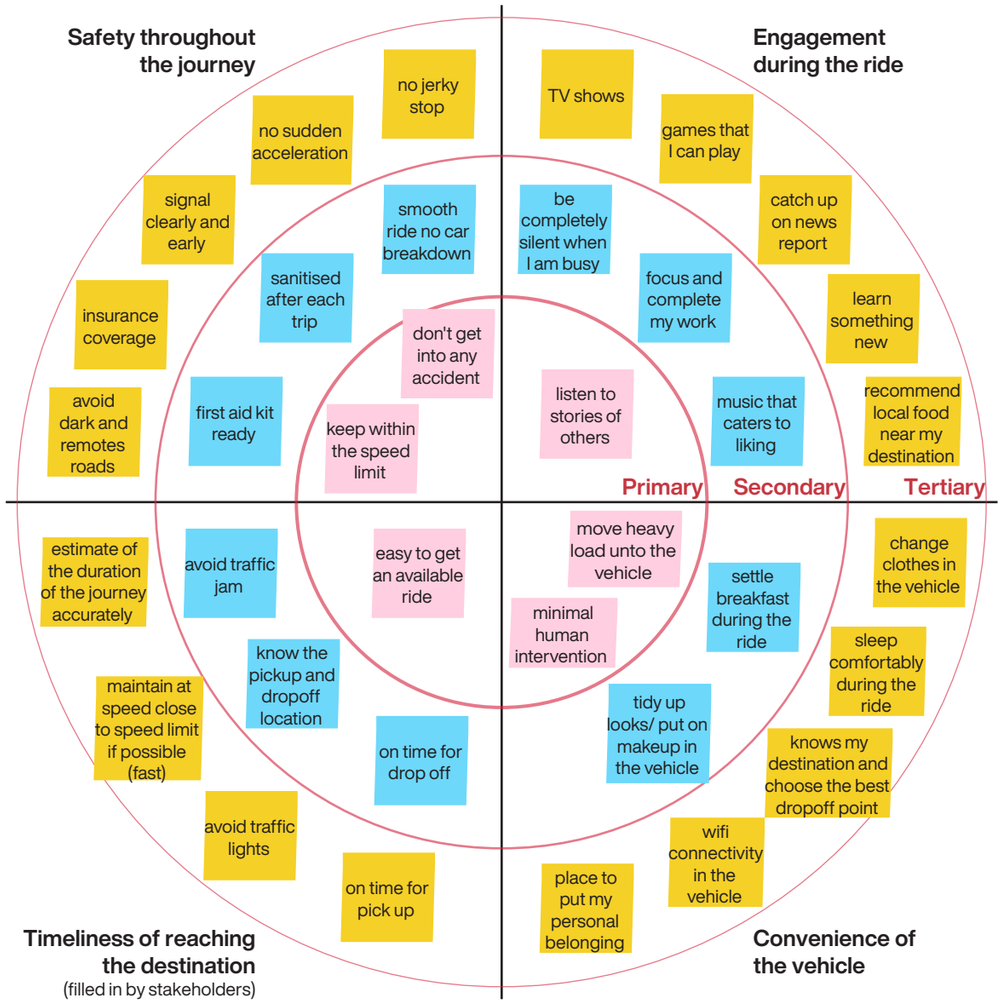
Leave some blanks
Leave 1-2 segments blank for the stakeholders to fill in themselves.

Divide a radar
into as many sections as you need. Most radars range between 2-8 sections.

Limit the number of items
that can fit into each section, (i.e., 1-2 for primary per section, 3-4 for secondary, and 4-6 for tertiary)

Worked Example

How might we design an autonomous vehicle for the future of Singapore?



Method

Cognitive Walkthrough

Design Thinking | Immersive User

A cognitive walkthrough provides usability evaluations of a product, service, or system (PSS) from the perspective of a user. Cognitive walkthroughs originated in cognitive science and human factors practice and are often used in user experience and user interface (UX/UI) design.

Why: When the tester vocalizes their decision making and reactions to the design, they help clarify where the design confuses or delights.

Time: 1 hour

Materials: Prototypes of various forms, such as wire frames, storyboards, role playing, mock ups, desktop walk through, etc.

Complementary methods: Wireframing, Physical Model, Wizard-of-Oz, Mockups (Paper Prototypes), Scaled Model, Isolated Subsystem Model, Immersive VR/AR, Additive Manufacturing (AM) Principle Design, Desktop Walkthrough

Acronyms: PSS - Product, Service, or System
UX - User Experience
UI - User Interface

Procedure

1. **Identify**
   the type of experience you want to learn more from your users about.
2. **Choose**
   your testers. You may learn something different from stakeholders, users, and experts.
3. **Prepare**
   an experience or a prototype that testers can interact with.
4. **List**
   tasks you will use to guide the tester through the experience. Often tasks are centered around specific interactions with the PSS.
5. **Probe**
   the tester as they engage in tasks, encouraging them to vocalize their thinking process as they learn how to interact with the PSS.
6. **Practice**
   with team members, both asking the tester probing questions, and taking notes of responses.
7. **Evaluate (Optional)**
   after the walkthrough, ask the tester to evaluate the experience on a standardized usability or other scale.
8. **Analyze**
   responses from multiple testers to identify PSS updates, modifications, improvements, advancements, spirals, and additional user needs surfaced by the walkthrough.

Best Practices

Actively listen

It is the tester's thinking process that is most important. Avoid leading questions to get the most genuine responses.

Engage

people with diverse experiences as testers. Broad perspectives of usability will best inform your decisions.

Centre

tasks around assumptions you want to test.

Adapt

to suit what information is most valuable. Tasks can be the primary or secondary structure for the walkthrough:

1. A primary task list guides each tester through the experience in the same way, which can be useful if you want to get feedback on a specific interaction flow
2. You may prefer to let the tester explore the experience to learn what grabs their attention, and use the task list to ensure you have covered all areas you are interested in.

Worked Example

App that helps students search for internships or jobs

Here are the objectives for the Cognitive Walkthrough session:

1. Identifying pain and gain points in the process of using the application
2. Discover usability issues in the current flow of application
3. Understand how users interact with the features

As the gestures for a phone application and laptop are different, be sure to explain this to the testers.

The testers will interact with the app prototype using a laptop. A set of tasks are prepared for the Cognitive Walkthrough. Tasks are single goals, accompanied by a few questions. Once they have completed a task, pause and ask them the questions.

Here are some guiding questions:

Task 1 - Apply internship or job

1. Is there any other info you would like to see on the job information page?
2. What are your thoughts about the recommended options?
3. How do you feel about the summary page of options?
4. What features would you like to add to this process?
5. What emotions do you feel or are invoked throughout the app interaction?

Method

Regulatory Context

Design Thinking | Contextual Observation

Legal and ethical parameters for opportunity spaces.

Why: No design is independent of its context. Legal and ethical considerations are generally intended to ensure user safety, minimize risks, and ultimately affect whether a PSS can enter a certain market.

Time: 1 week

Materials: Regulatory Context Template, Sticky Notes

Complementary methods: Risk Management Process and all methods under core and advanced prototyping methods

Acronym: PSS - Product, Service, or System

Scan or click here for a digital copy of the template

Procedure

1 Determine

what possible regulations or policies apply to your opportunity space. These might include ethical codes of conduct, local legislation, medical approval processes, or intellectual property concerns.

2 Gather information

from regulatory bodies and talk with experts to be sure you have the most up to date guidance.

3 Frame (Optional)

the state of the art in your opportunity area based on intellectual property filings (patents, copyright statements, and/or trademarks).

4 Plan

to collect and submit supporting data and evidence as needed to show your design concept meets relevant regulations.

5 Submit

a study plan or data collection plan to appropriate organisations, as needed to show your design concept meets relevant regulations.

Best Practices & Tips

Localise

Regulations differ by location throughout the world, and differ by industry.

Plan ahead

use regulations to inform prototyping and testing plans.

Risk awareness

Be cognizant of potential risks and benefits that may directly or indirectly affect users of your PSS. Can you minimize risks?

Look online

Many patent directories are online. (https://ipportal.wipo.int/, https://www.uspto.gov/patents/search)