



Human-Centered Design + User Empathy

Week 3: First Lecture

Real innovation comes from deeply understanding people

Product Design

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**DESIGN
EXPLORATION
RESEARCH
GROUP**

Goal

Know what human-centered design is
and how to begin doing it.

Outline

- **Business**
- **Grand Rounds**
- **Design Thinking**
- **Sketching**
- **Personas**
- **Closing**

	Su	M	T	W	Th	F	S	
Week 0								Design Philosophy & Engineering Design Essentials
Week 1								
Week 2								Complete Opportunity Development -- Initiate
Week 3			L	D	L		●	
Week 4		■	L	D	L		●	Complete Opportunity Development – User Insights
Week 5		■	L	D	L		●	
Week 6		■	L	D	L		●	Complete Concept Development
Week 7		■	L	D	L		●	
Week 8		■	L	D	L		●	
Week 9		■	L	D	L		●	Complete Sub-System Engineering
Week 10		■	L	D	L		●	
Week 11			L	D	L		●	Complete System Refinement
Week 12		■	L	D	L		●	Complete Product Pitch
Week 13		■	L					
Final Exam				●				Design Portfolio Due as Final Exam

Weekly Rhythm

Monday: Read / Reflect*

Tuesday: Class & Project

Wednesday: Designette

Thursday: Class & Project**

Friday: Project

Saturday: Submit***

...and sketch 10 min/day M-F

Decomposition

Recombination (Table)

Most Critical Module/Interface

Geometry-Material-Process Decisions

Observations (+Thoughtless Acts)

Nucor's Circle (Hedgehog Concept)

5W Problem Framing Framework

Double Diamond Process

Conversation Starters

Design Thinking Process

Stages of Development

Design Thinking

How Might We Statements

Personas

Primary Research

Secondary Research

Grand Rounds

A Case Study Discussion

Design Brief | Abbott FreeStyle Glucose Monitor

Abbott's FreeStyle Libre glucose monitor, released in 2018, was celebrated as a breakthrough in diabetes management, enabling patients to check glucose levels through a wearable sensor and mobile app. Despite technical success, reports showed that elderly and less tech-savvy users struggled with sensor placement and app navigation, leading to missed readings and dangerous insulin errors. The device met engineering requirements but created new risks through usability gaps.



Abbott FreeStyle Glucose Monitor

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How would you have avoided this problem?



Abbott FreeStyle Glucose Monitor



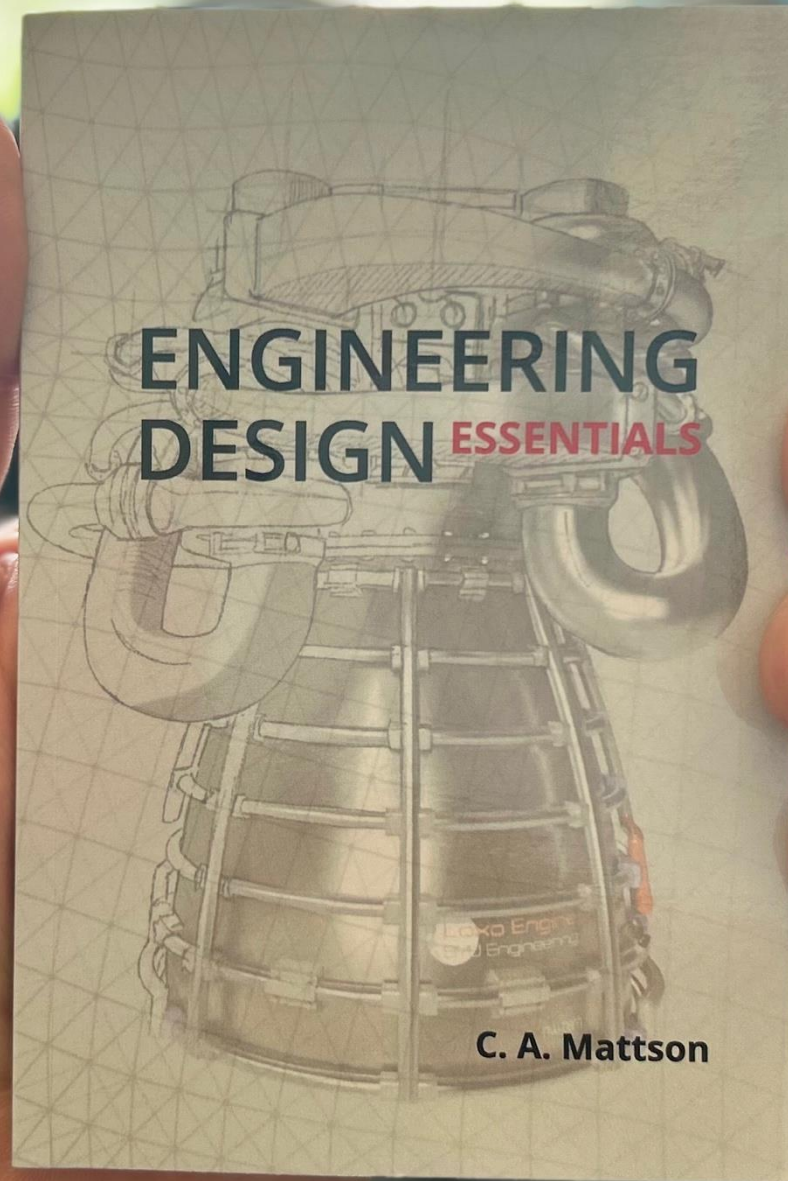
GRAND ROUNDS ACTIVITY (10 minutes)

Purpose: Solidify what specific approaches can be taken

Task:

1. Get into groups of three, consider yourself a team.
2. Choose specific (concrete) tasks/activities your team could have done to avoid this problem. Answer one of these questions fully:
 - How can engineers systematically uncover user frustrations that may not surface in lab testing?
 - Which user groups are most at risk in this case, and how might that shift your design priorities?
 - What concrete methods could you use early in development to identify and close empathy gaps before widespread release?
3. Choose activities, their sequence, and allocate time and financial resources

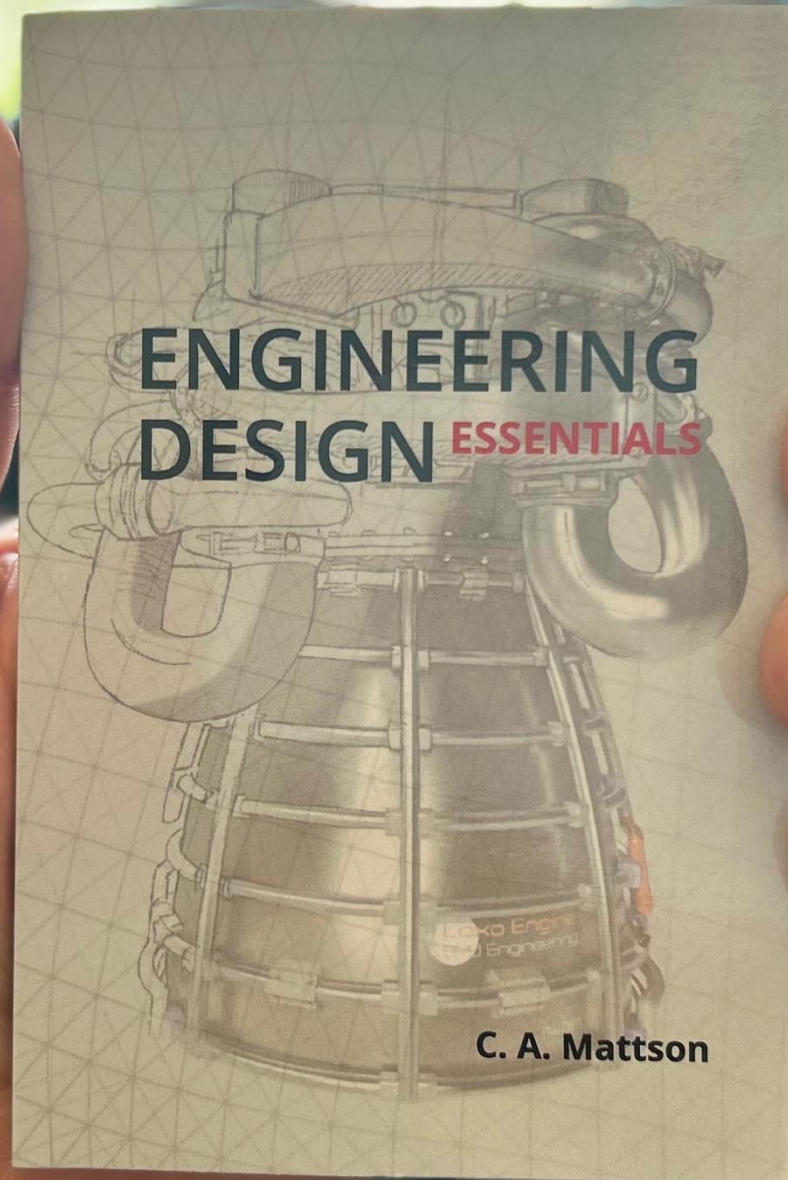
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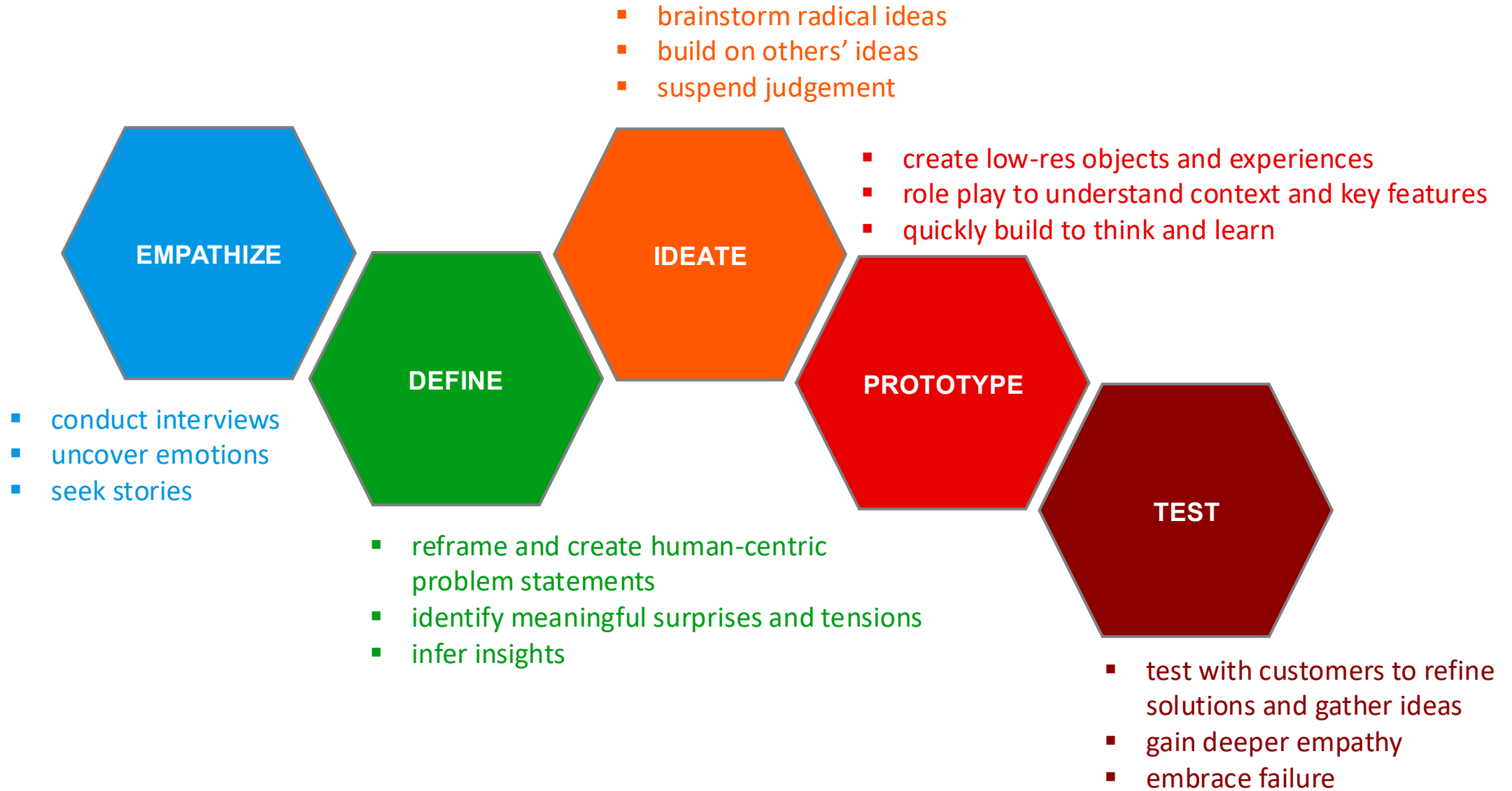


Design Thinking

Design Thinking is the discipline of finding human problems worth solving and creating viable new offerings in response to those problems – Dawan Stanford

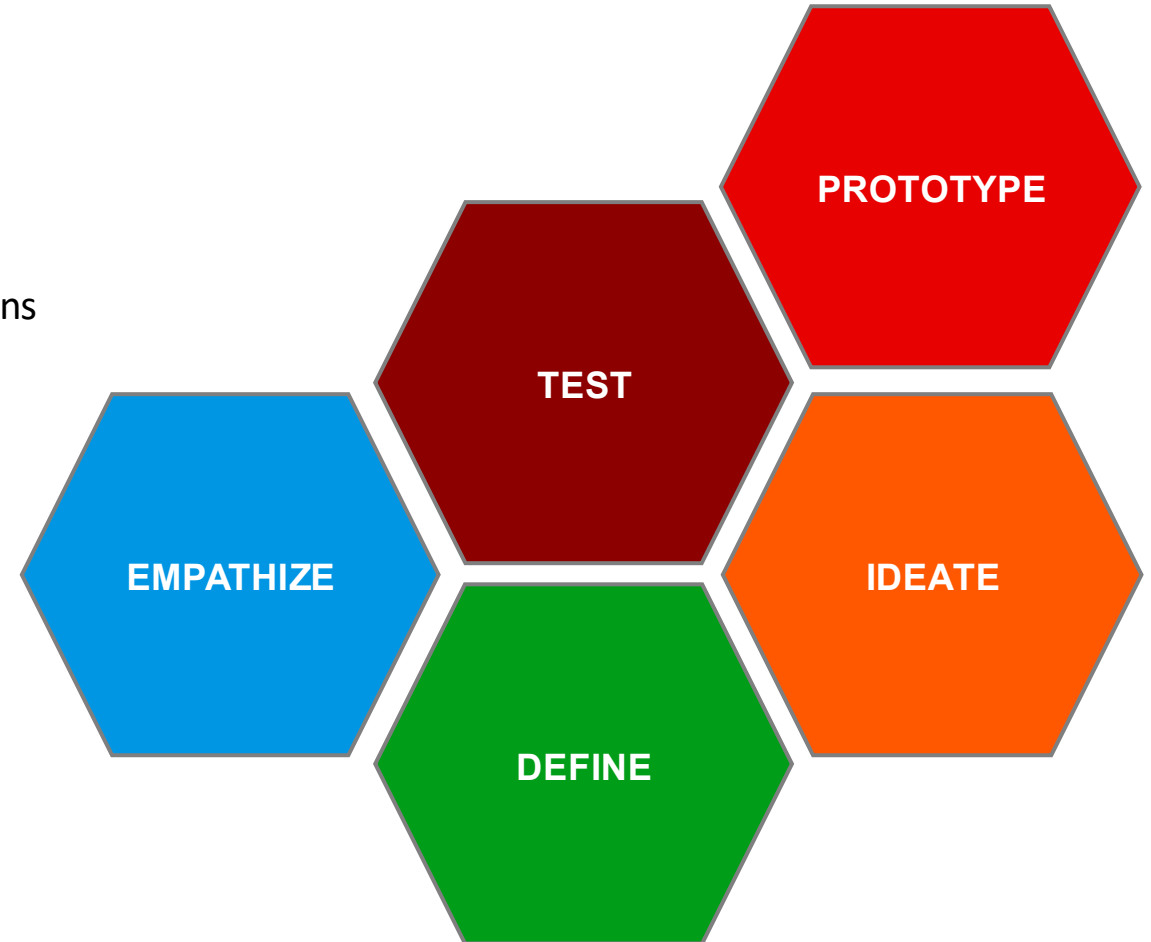
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DEFINE
IDEATE
EMPATHIZE
PROTOTYPE
TEST

- brainstorm radical ideas
- build on others' ideas
- suspend judgement
- create low-res objects and experiences
- role play to understand context and key features
- quickly build to think and learn
- conduct interviews
- uncover emotions
- seek stories
- reframe and create human-centric problem statements
- identify meaningful surprises and tensions
- infer insights
- test with customers to refine solutions and gather ideas
- gain deeper empathy
- embrace failure



DESIGN THINKING



Empathize
Understanding
people



Ideate
Generating
your ideas



Define
Figuring out
the problem

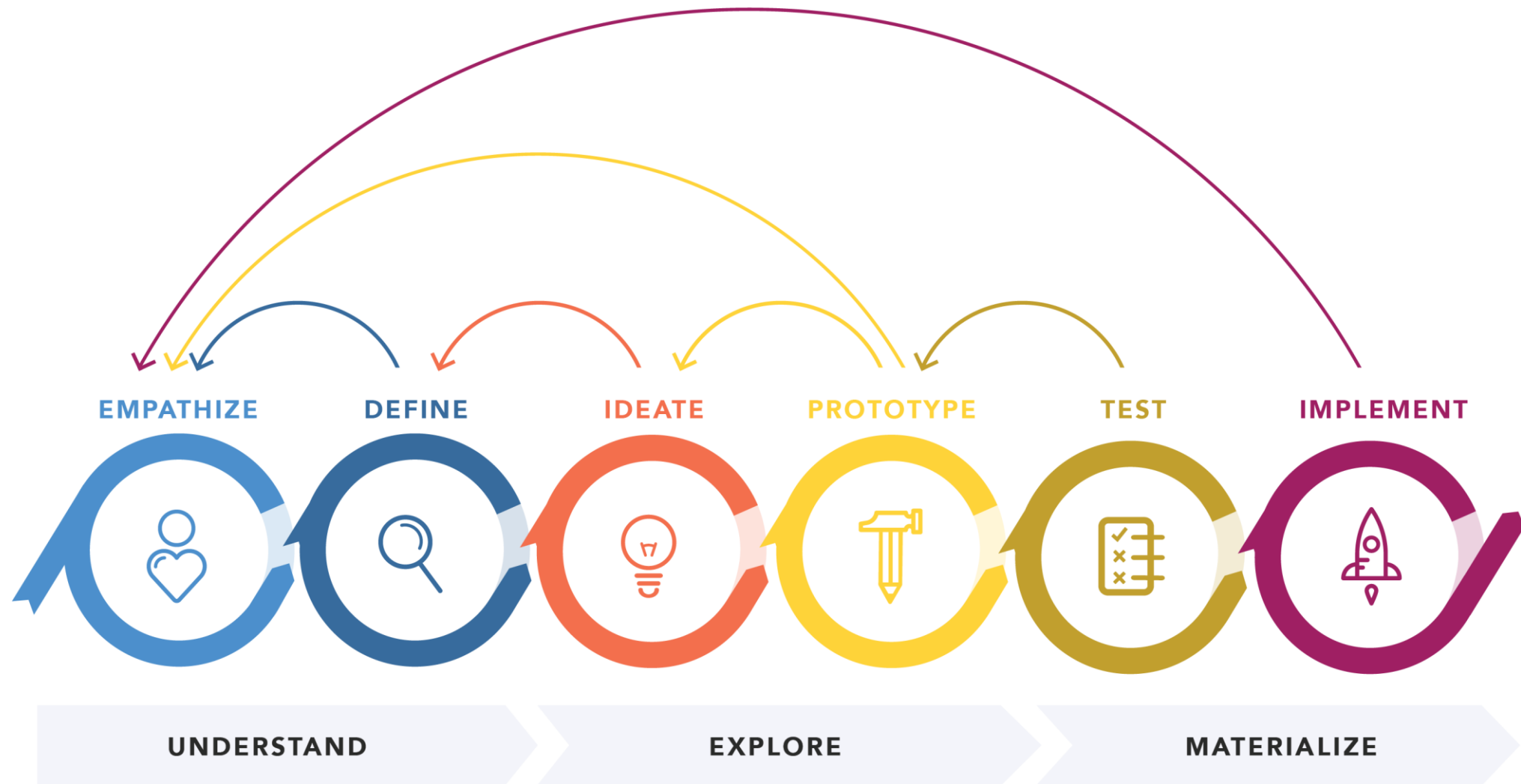


Test
Refining
the product



Prototype
Creation and
experimentation





Thought Questions (DT1)

[1A] The article distinguishes design thinking as both a process and a mindset; where in your current project would treating it primarily as a mindset (rather than a step-by-step process) meaningfully change your next action, and why?

[1B] Empathy, collaboration, and experimentation are listed as key elements; which of these is currently the bottleneck in your progress, and what specific behaviors would indicate that the bottleneck has been relieved?

[1C] The text warns against unvalidated assumptions about people's needs; identify one assumption embedded in your problem statement and outline a low-cost experiment to test it with real stakeholders this week.

[1D] Where does a purely engineering solution path suffice, and where does the article argue human insight is essential – how will you decide which path your current problem belongs on?

[1E] The article situates design thinking among other modes of thinking (engineering, scientific, creative); for your problem, where would each mode lead you astray if used alone, and how will you integrate them deliberately?

How Might We Statements

HMW for short

**How might we [do something desirable (verb)] for
[a user or stakeholder] so that [desired outcome]?**

How will you know if your HMW statement is any good?

1. Start with the problem or insights you've uncovered

Problem	Users aren't aware of the full product offerings.
HMW	How might we increase awareness of the full product offerings?

2. Avoid suggesting a solution in your HMW statement

Insight	Users are often unsure about which form to complete when they file their taxes.
HMW (poor)	How might we tell users which form to complete to file their taxes?
HMW (good)	How might we make users feel confident they are filing their taxes correctly?

3. Keep your HMWs broad

Insight	Users often spend a long time checking their submission for mistakes.
HMW (good)	How might we make it quick and easy for users to check their work for mistakes?
HMW (better)	How might we support users to efficiently draft submissions that they're happy with?

4. Focus your HMWs on the desired outcome

Problem	Users often call us because they're unsure about the application process.
HMW (poor)	How might we stop users from calling us?
HMW (good)	How might we make users feel confident they have all the information they need?

5. Phrase your HMW statements positively

Problem	Users find the return process difficult.
HMW (poor)	How might we make the return process less difficult?
HMW (good)	How might we make the return process quick and intuitive?

HMW ACTIVITY

Purpose: Practice How Might We Statements

Recognize: That we are trying to move beyond a textbook problem

Task:

1. On your own...
2. Create at three HMW statements for glucose monitor
3. Raise your hand and share with an instructor

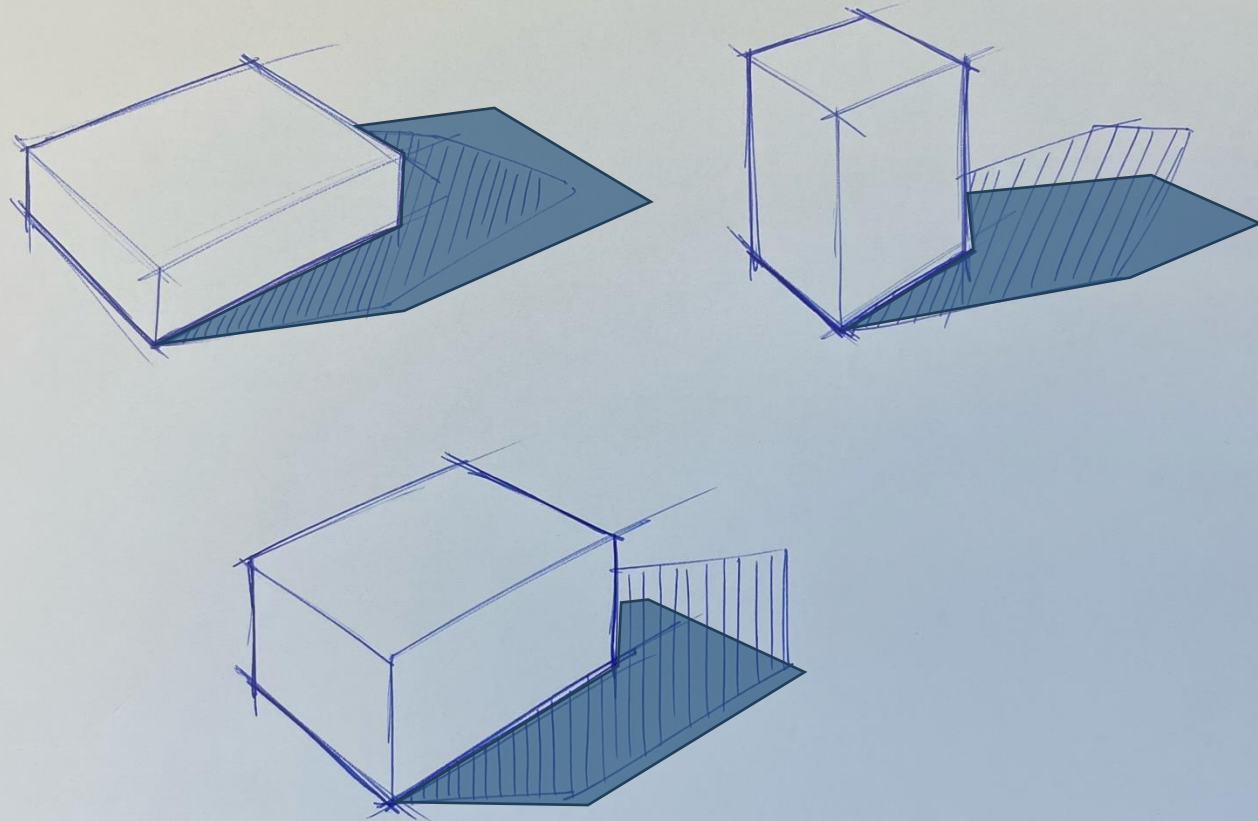
How might we [do something desirable (verb)] for [a user or stakeholder] so that [desired outcome]?

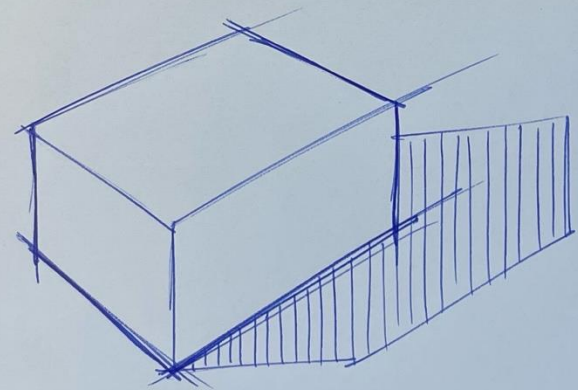
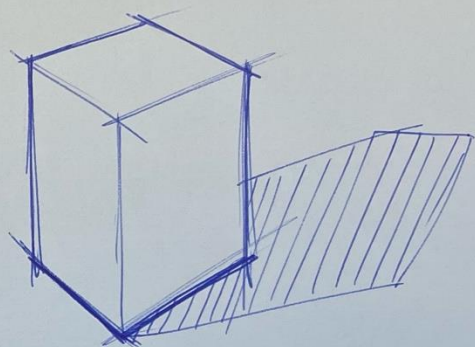
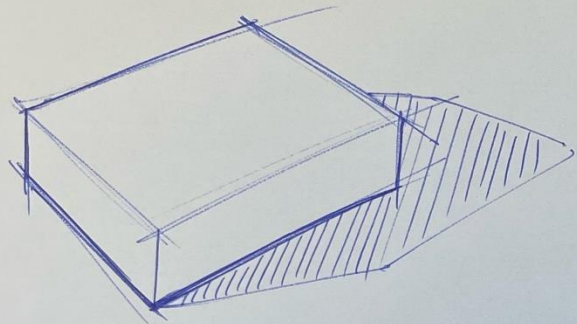
Sketching

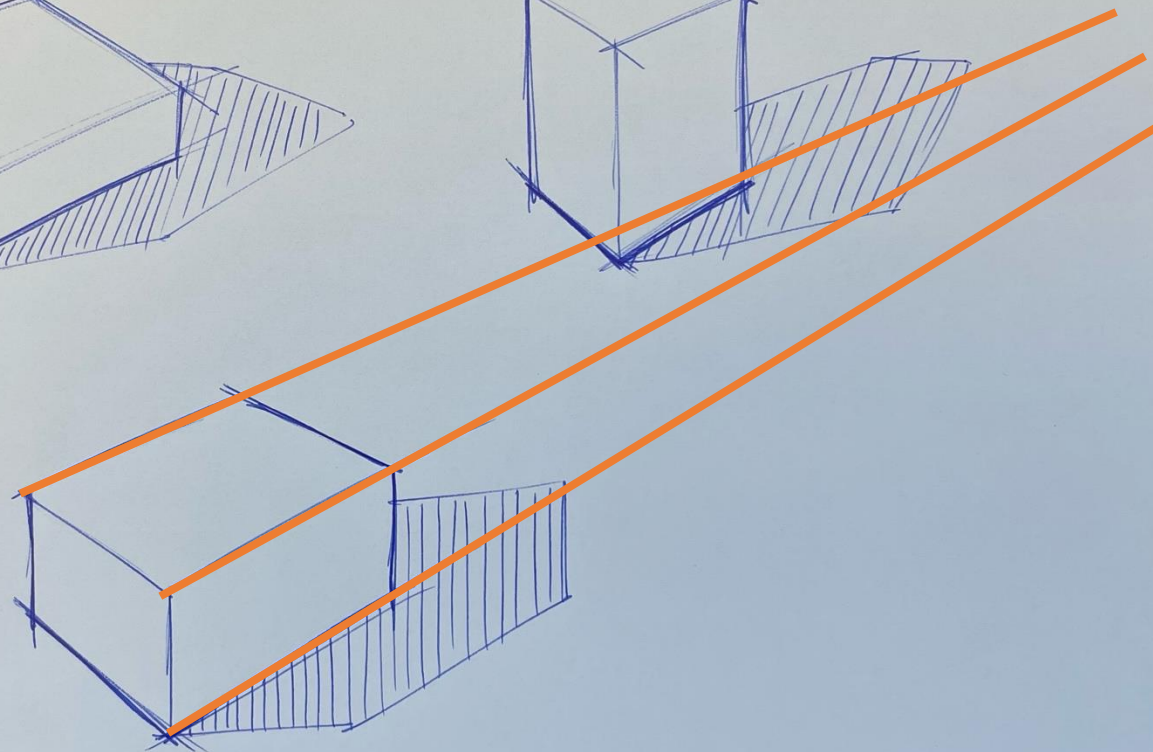
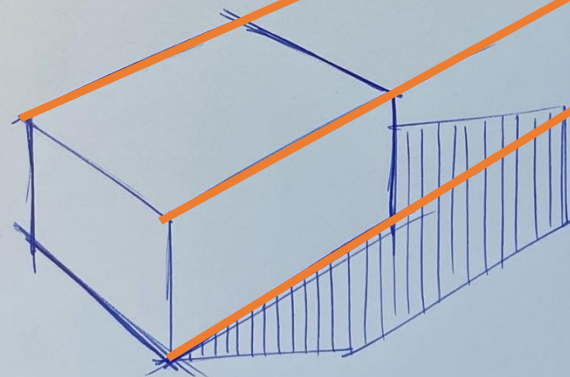
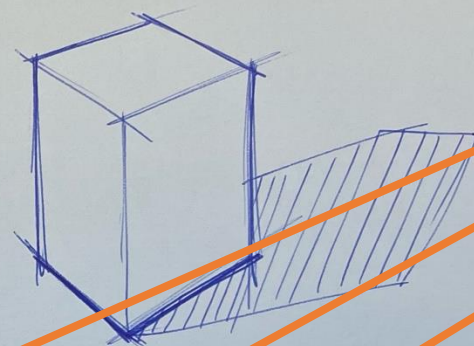
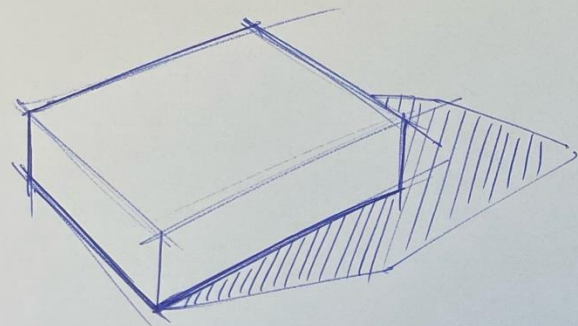
SKETCH (8 minutes)

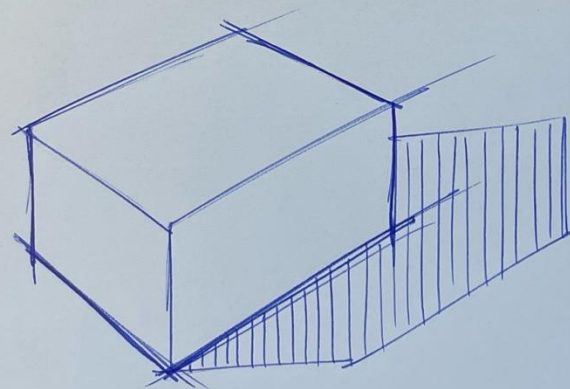
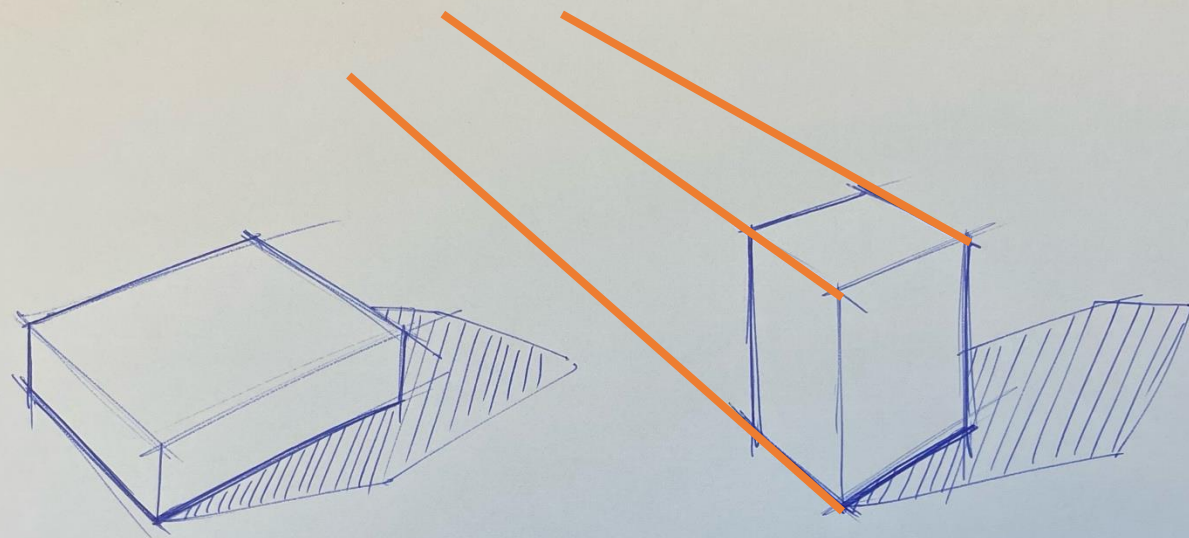
Sketch three
blocks with
shadows.

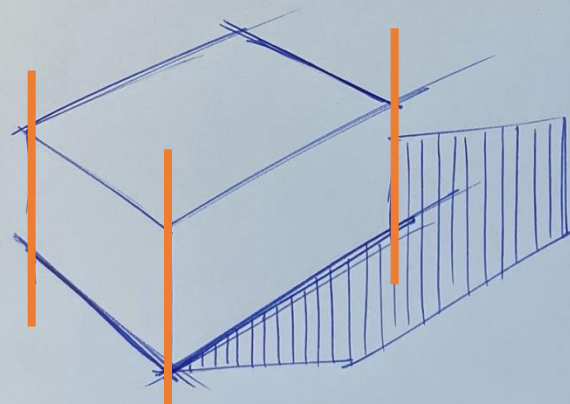
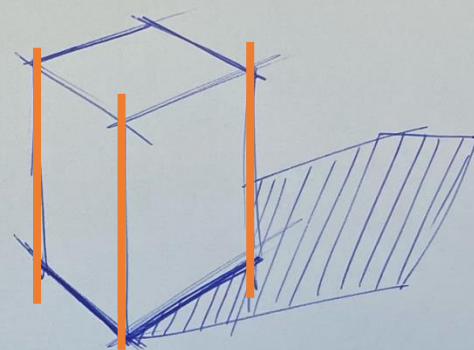
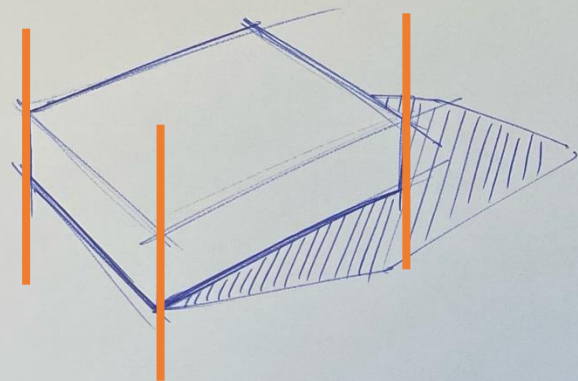
Use principles,
not copying.

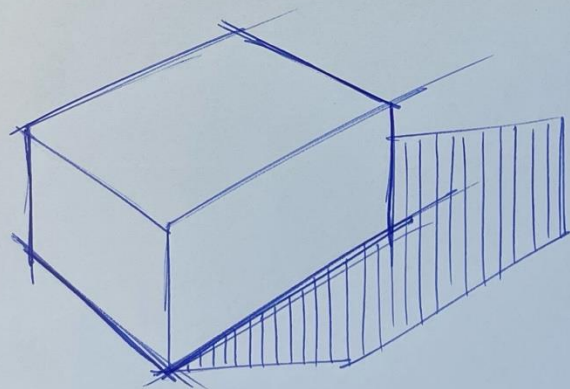
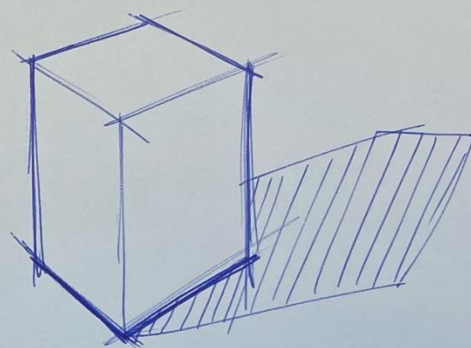
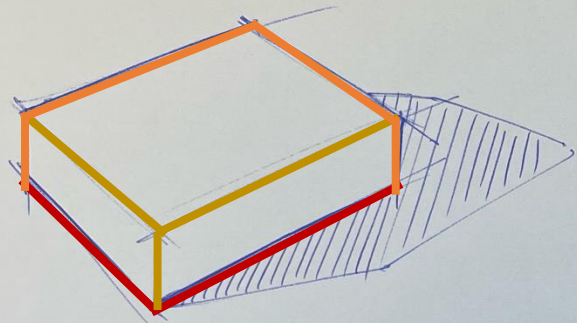


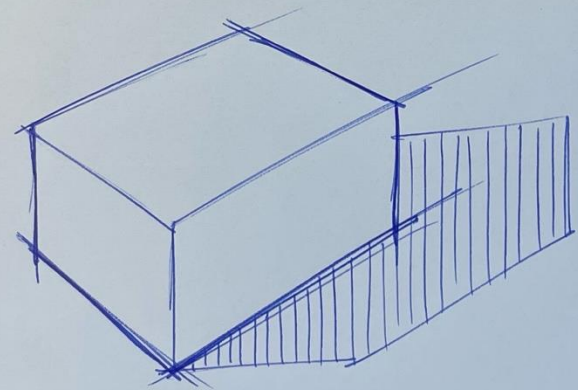
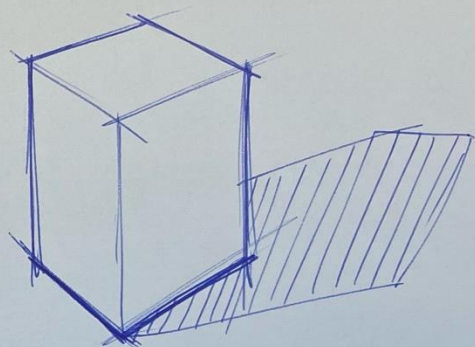
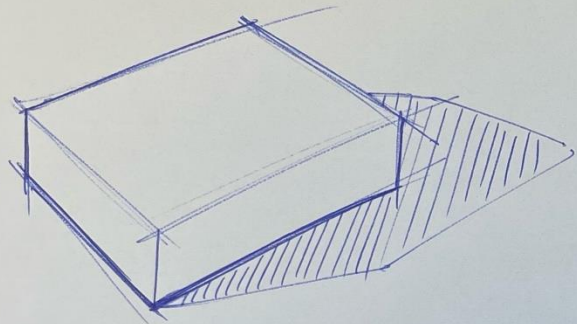


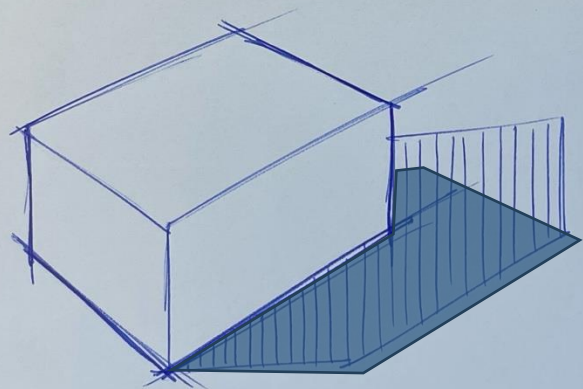
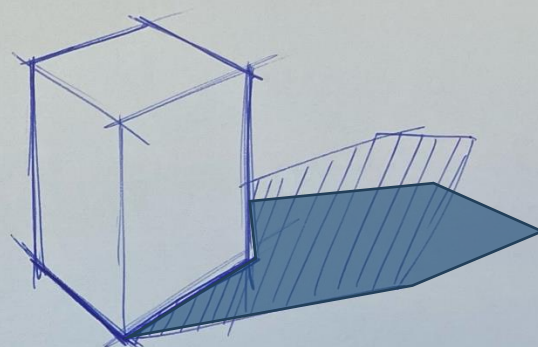
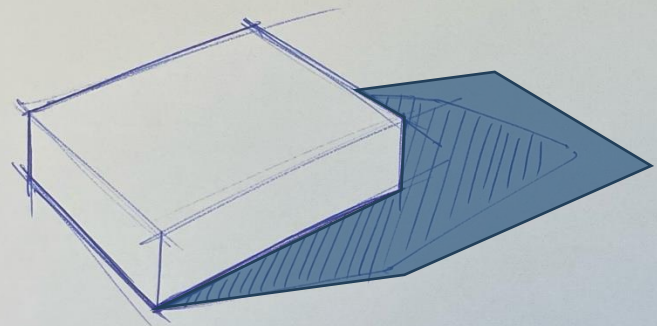


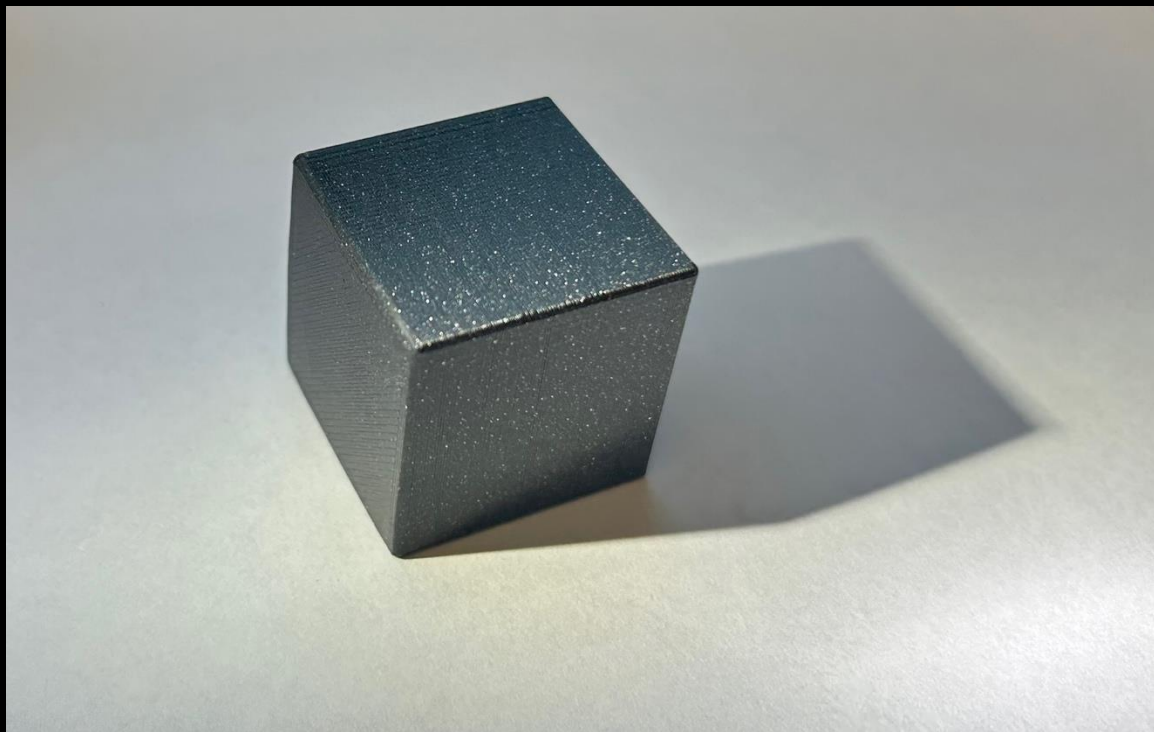
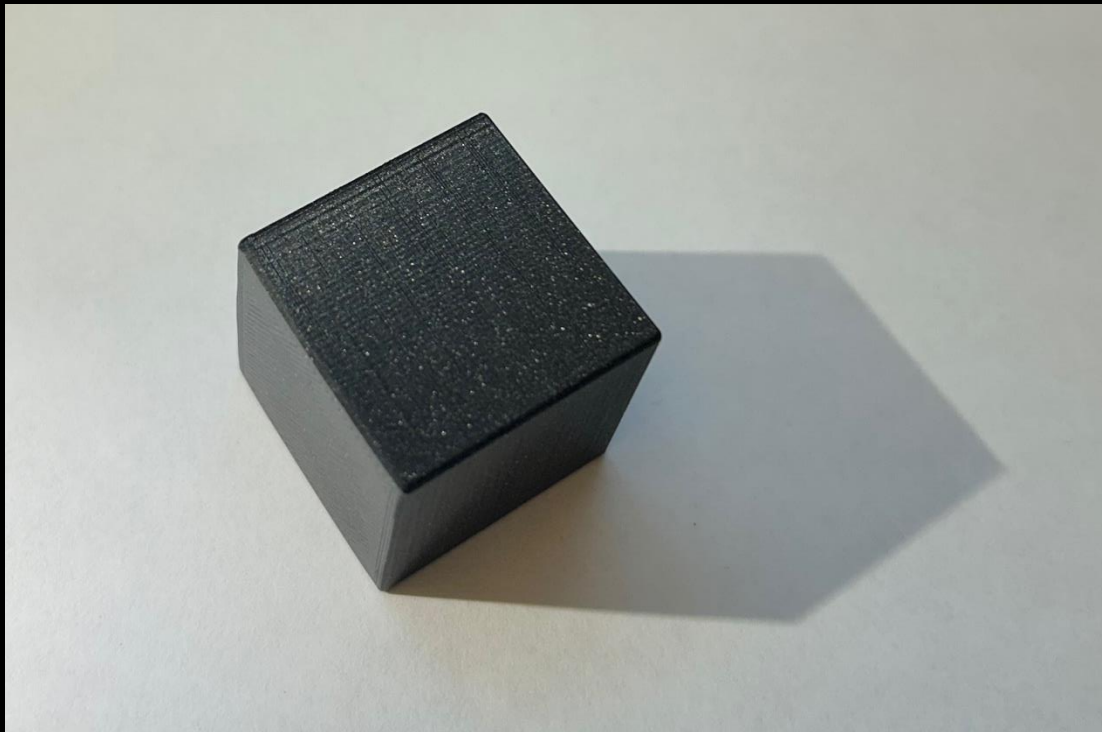


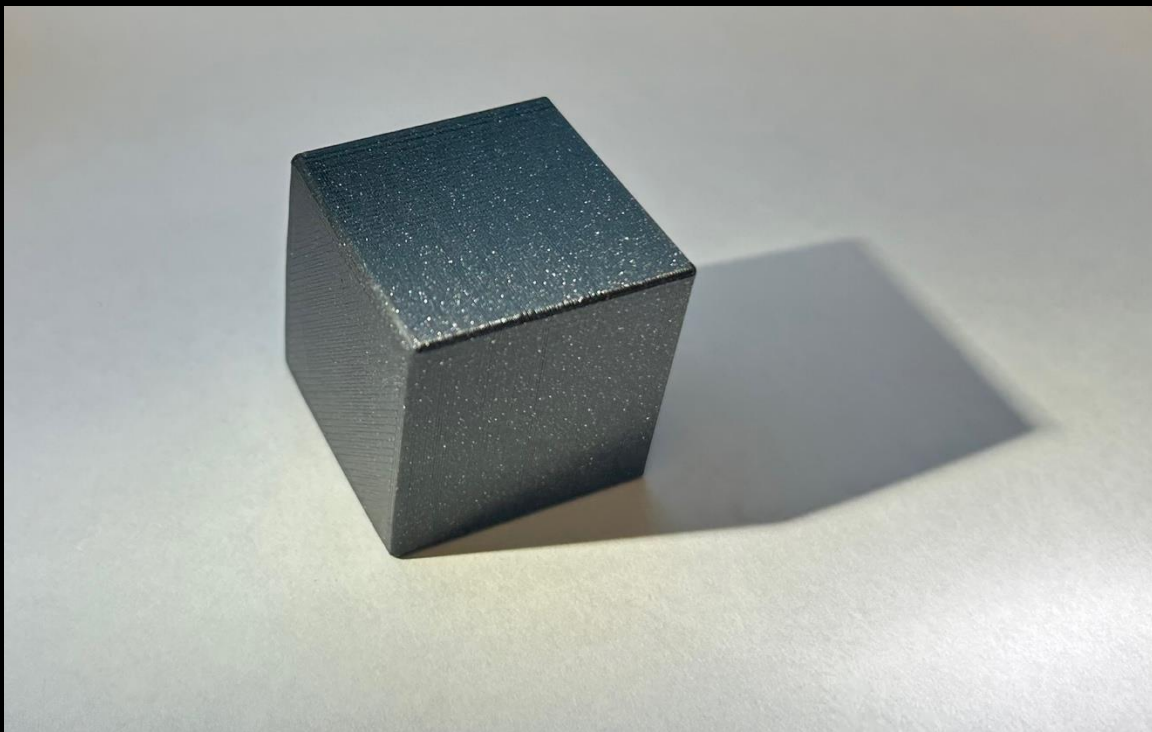
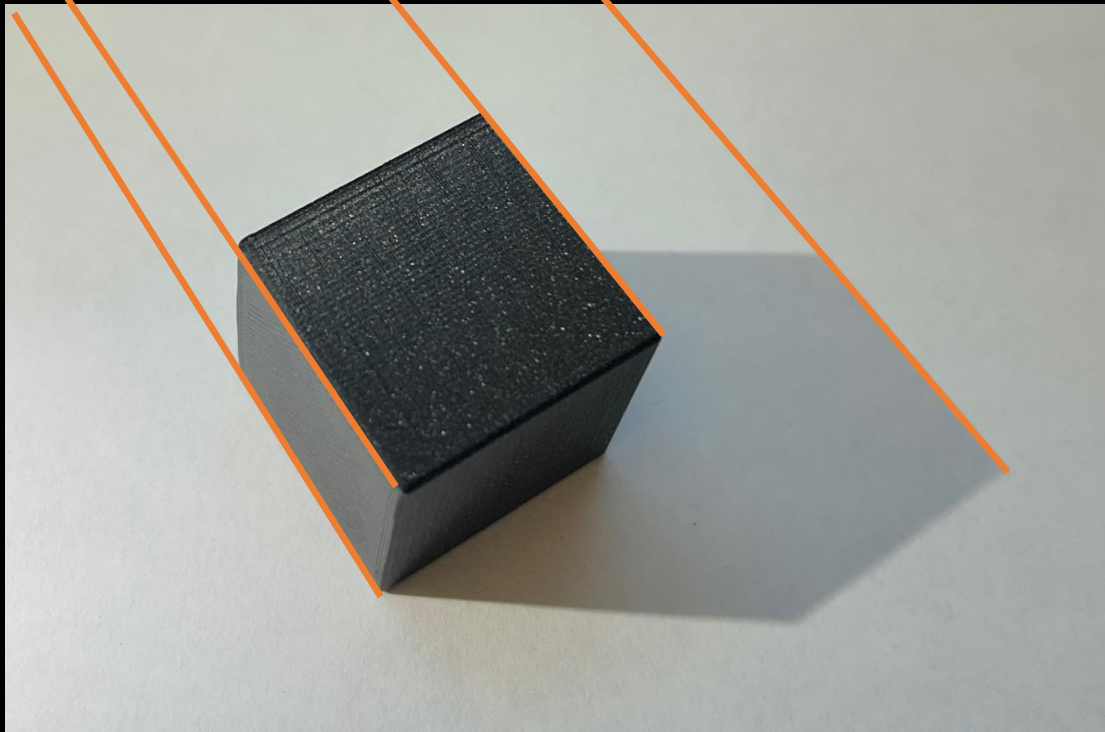


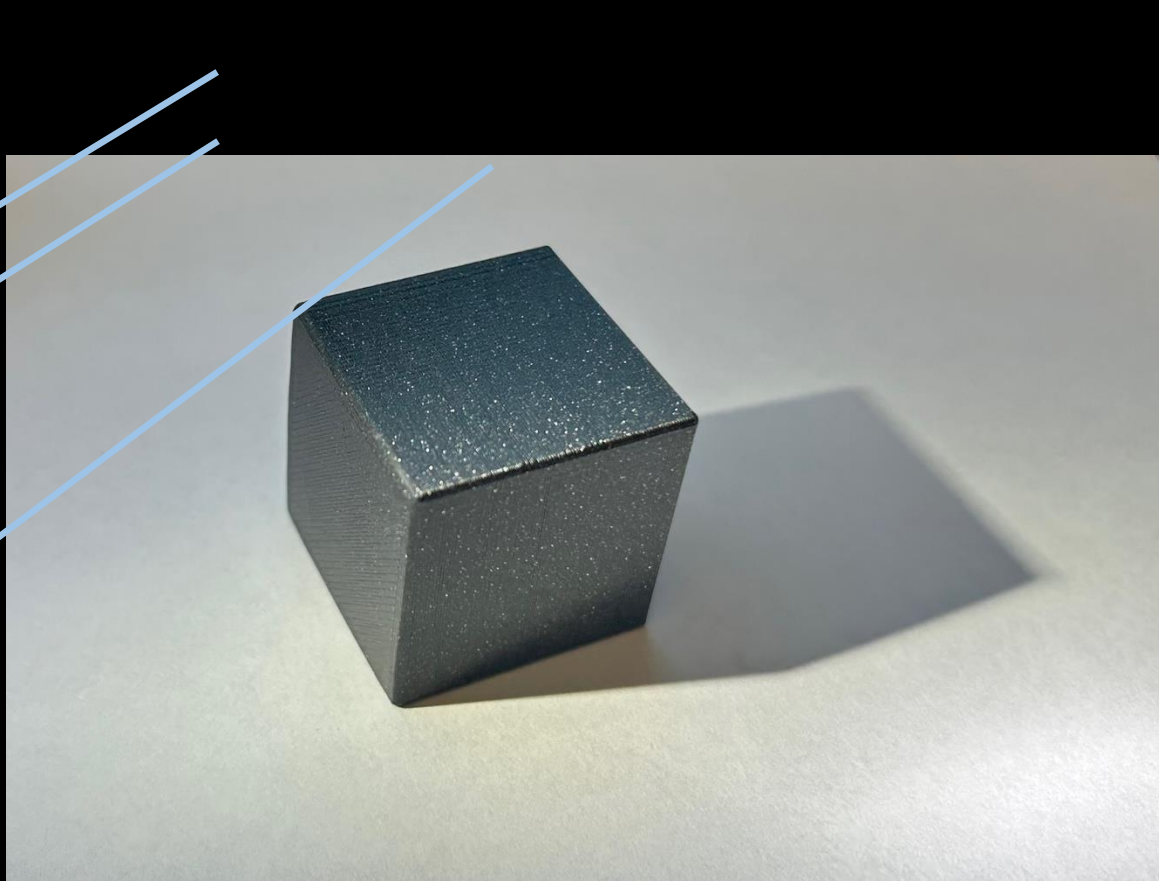
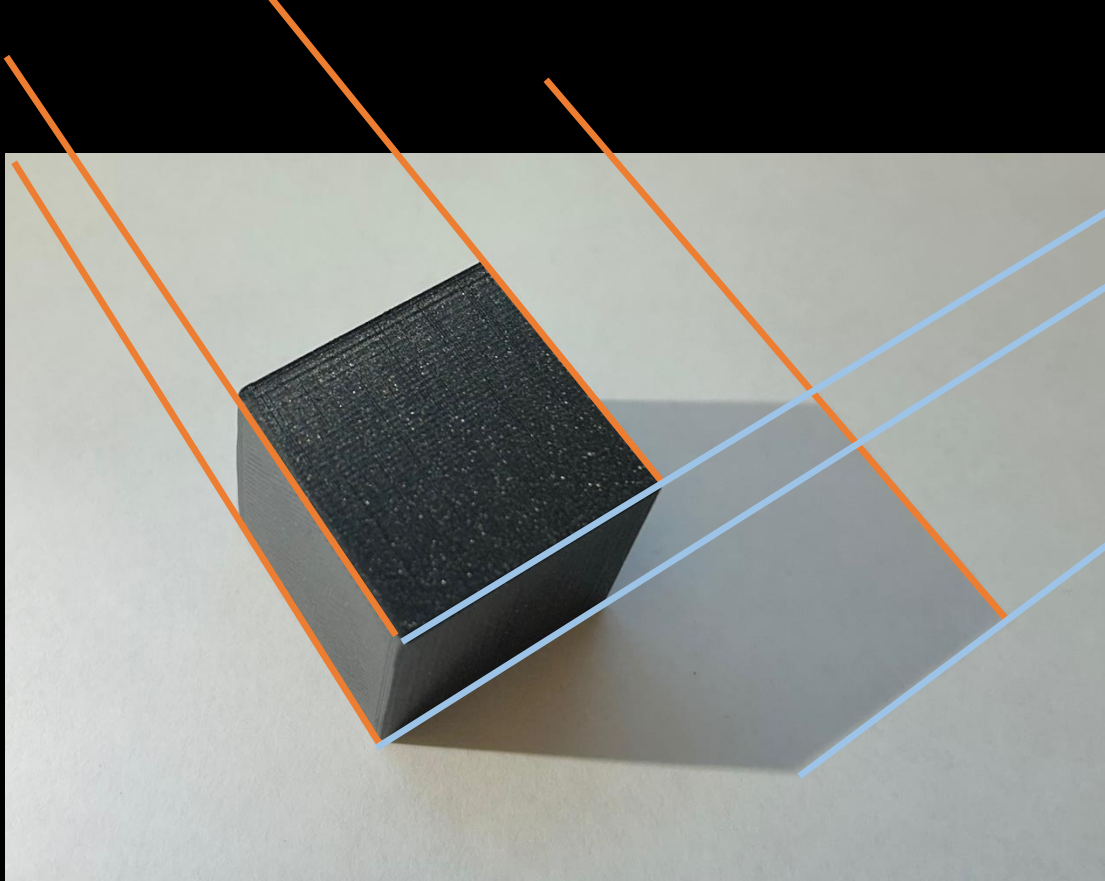


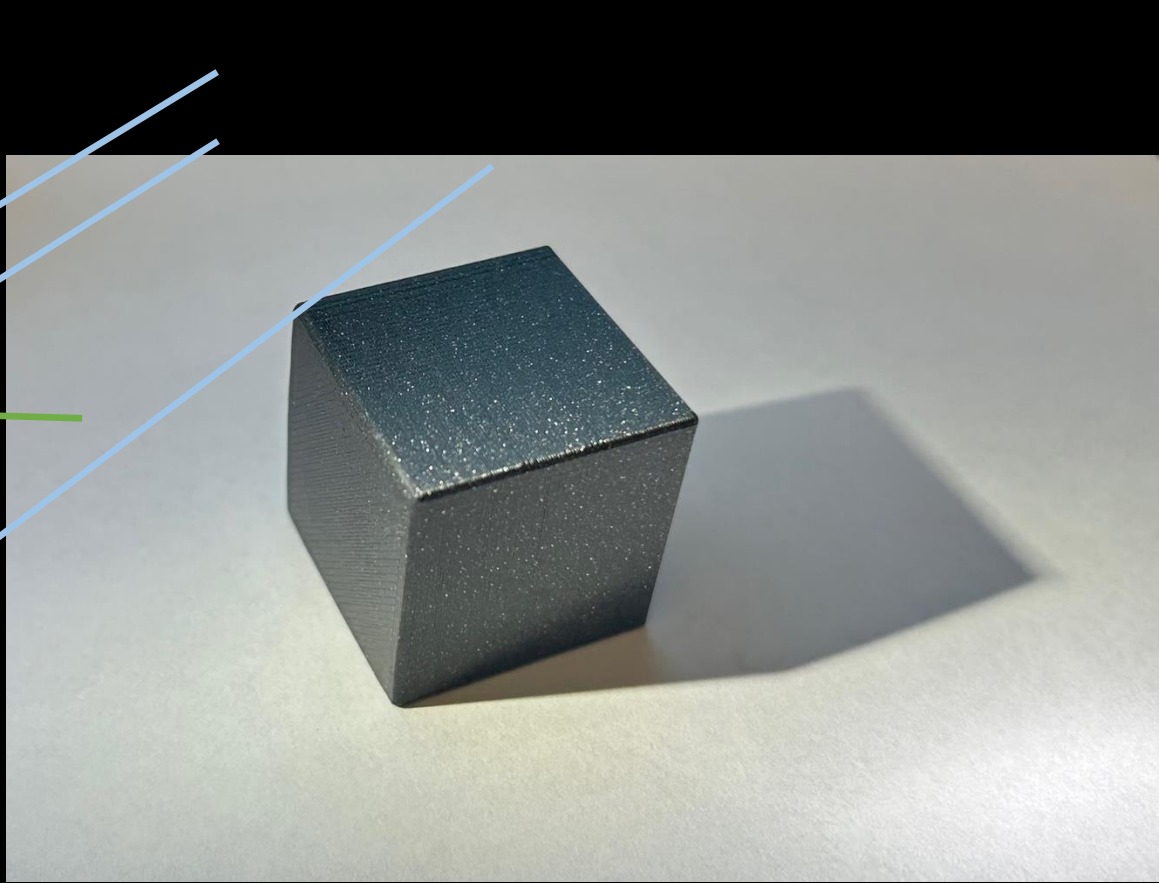
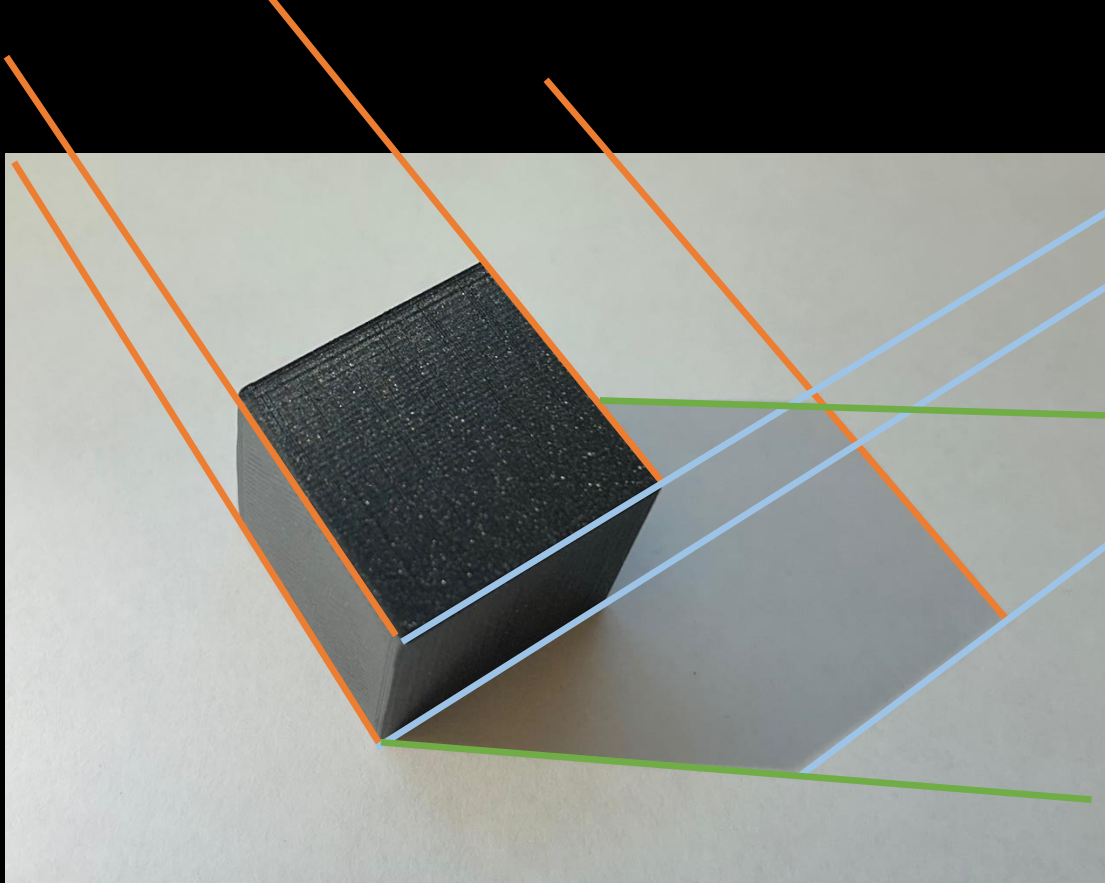


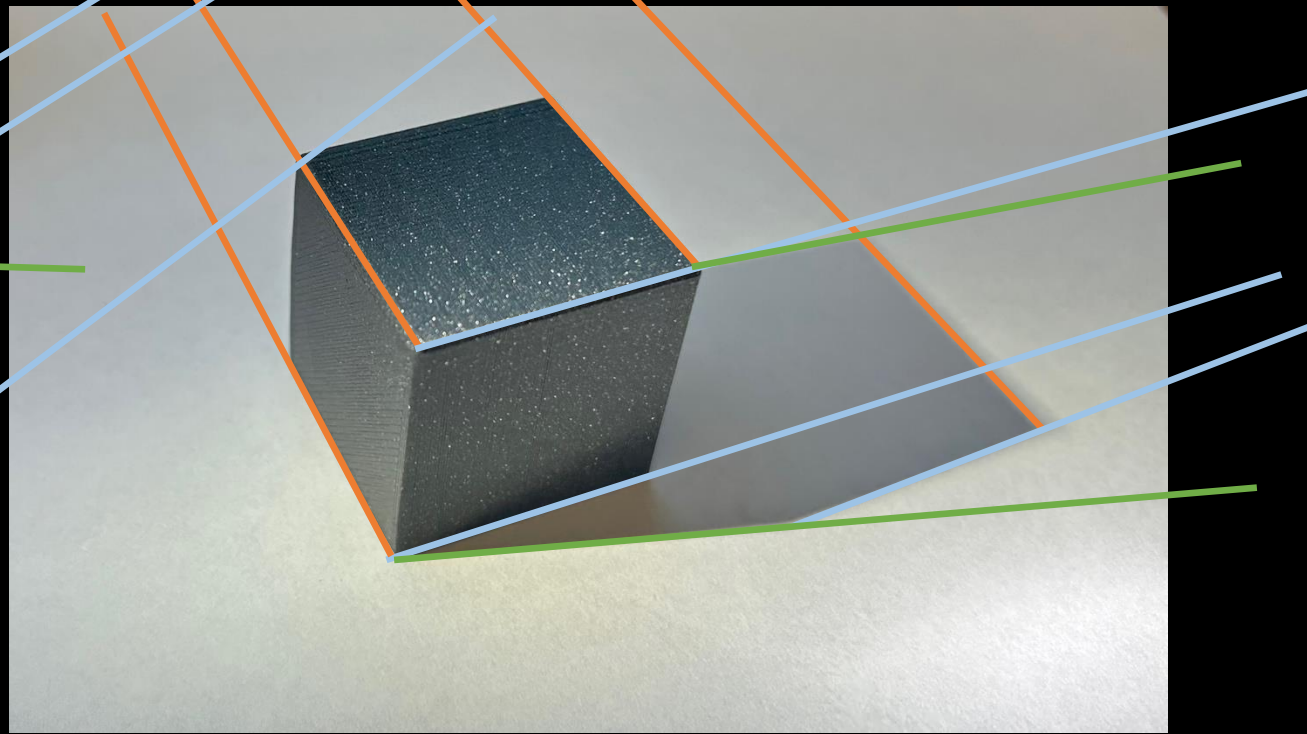
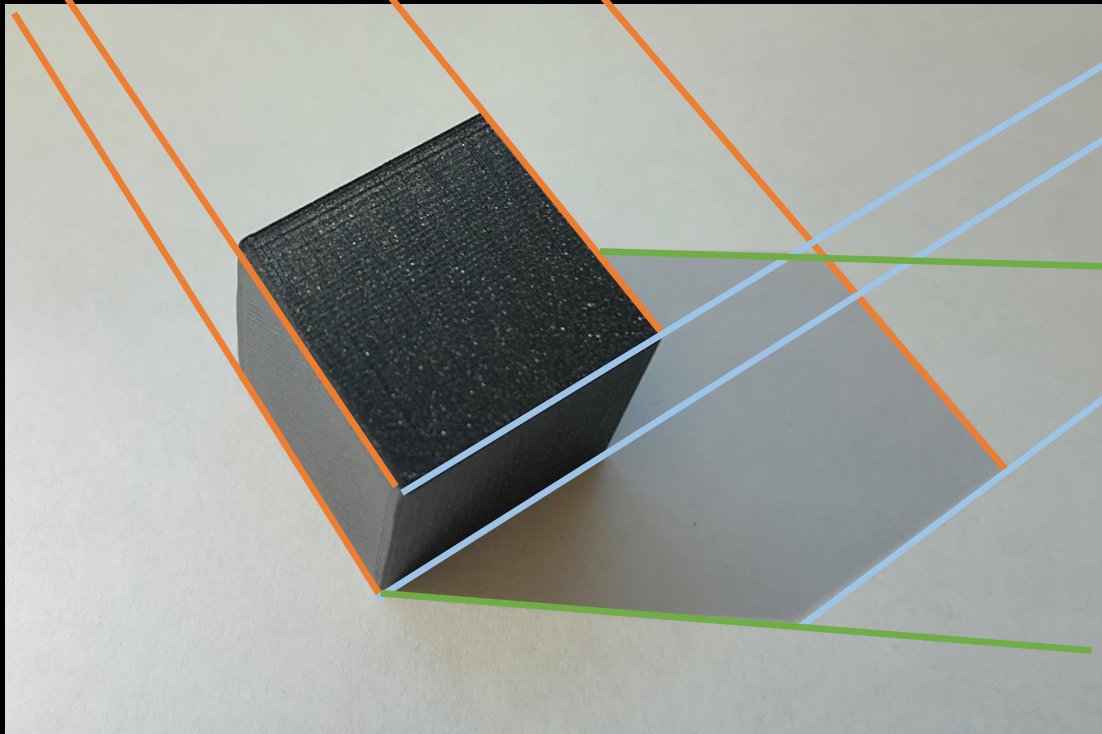


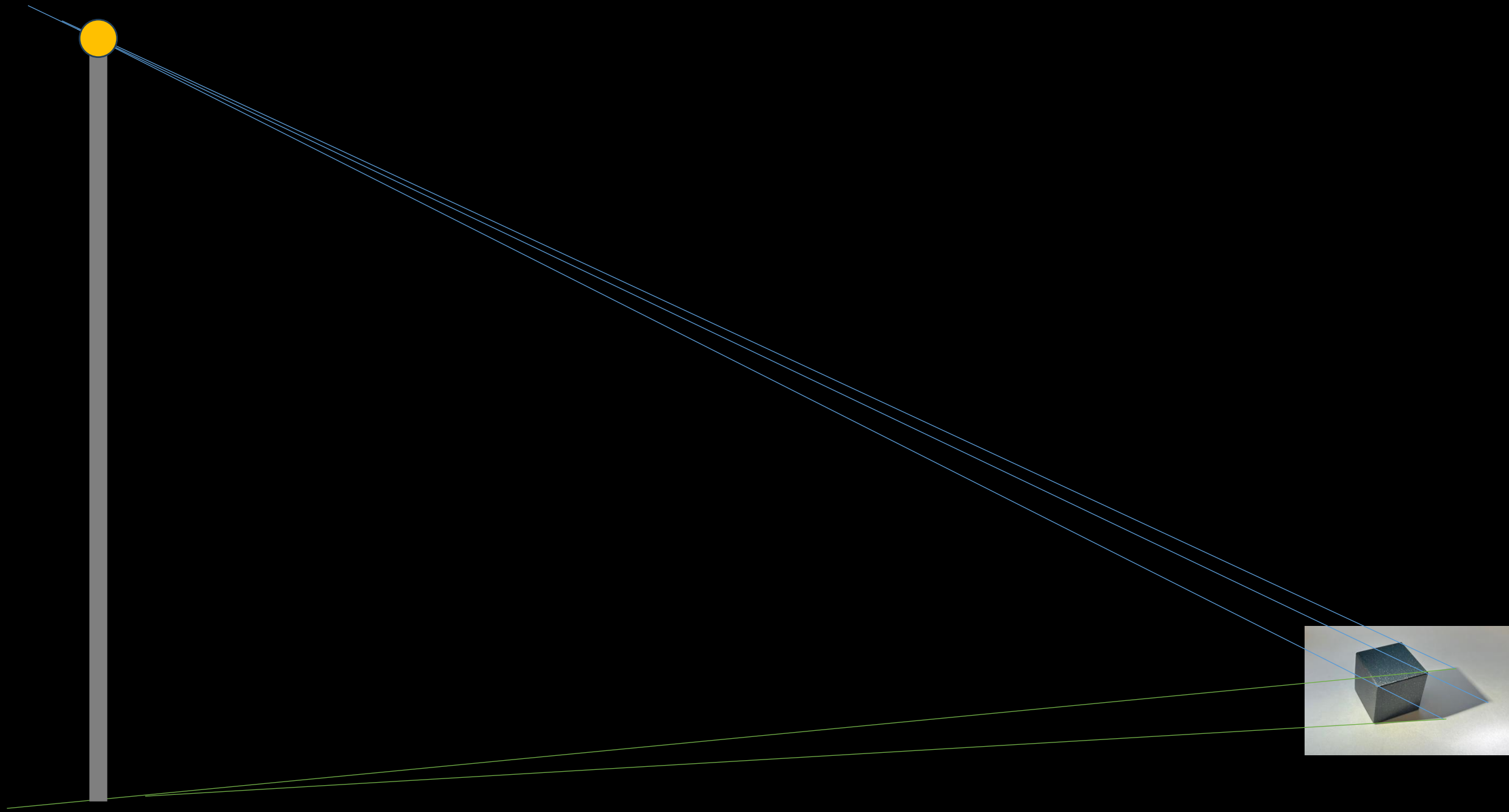


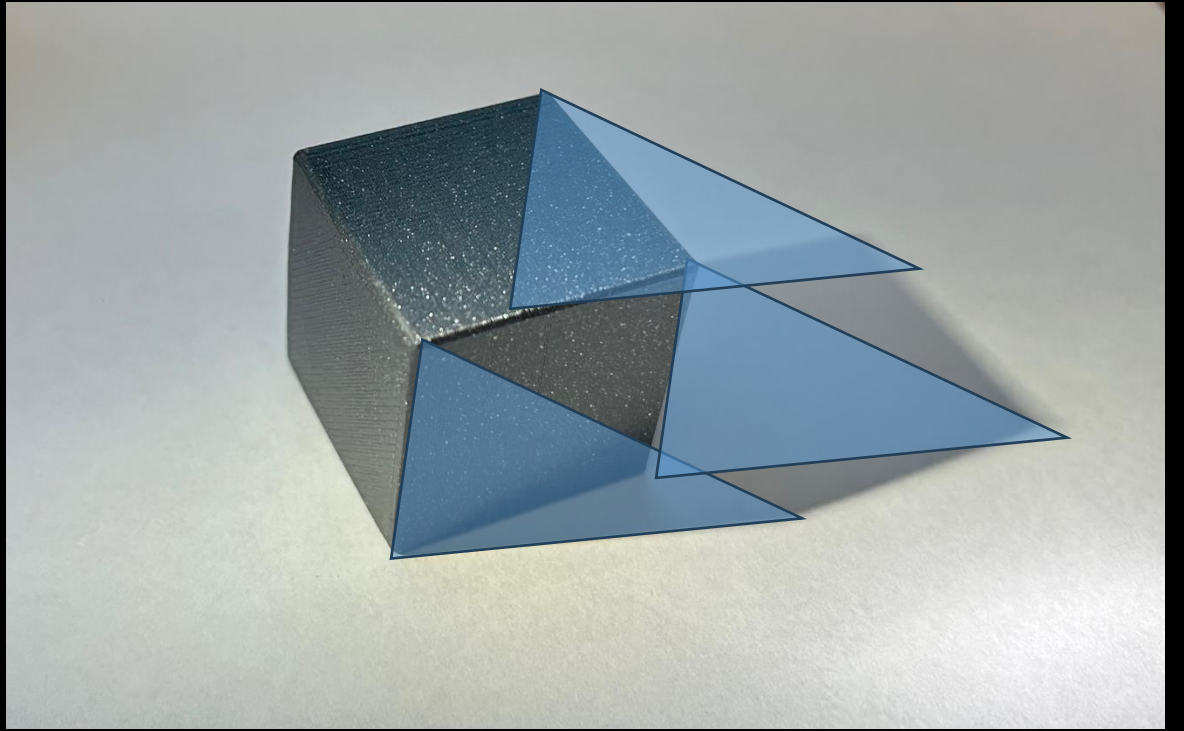
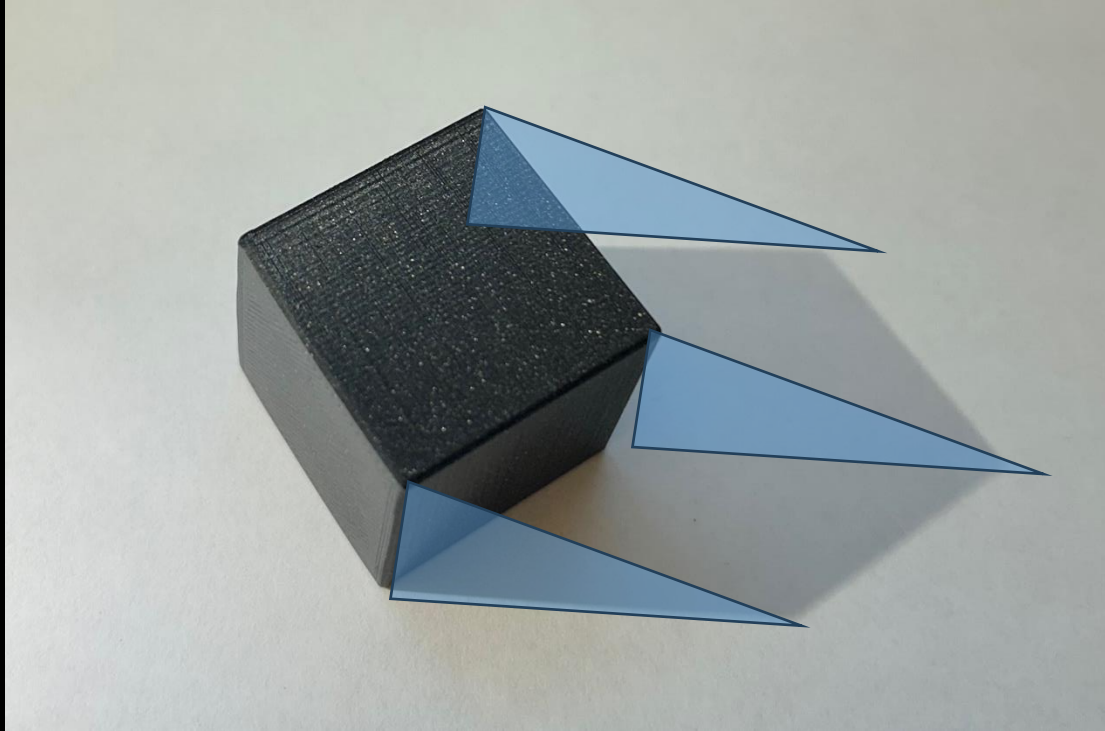


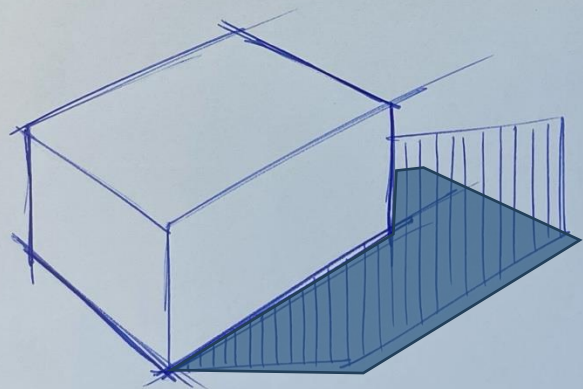
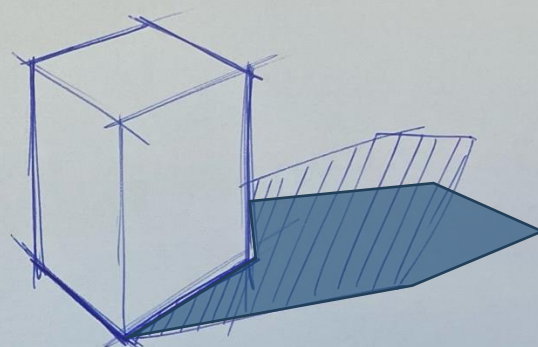
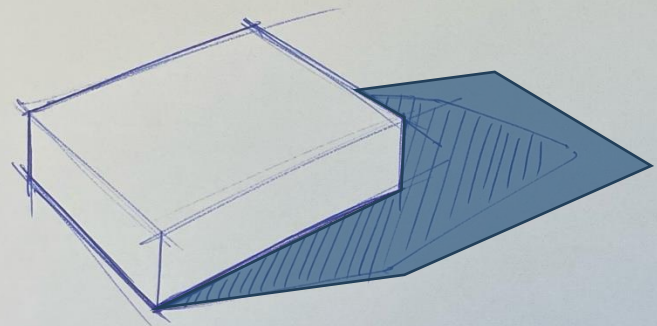


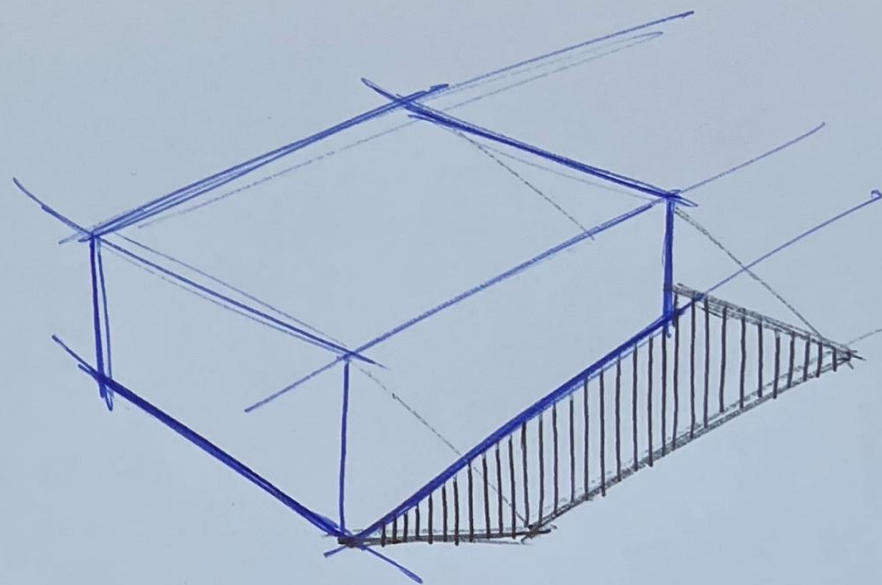
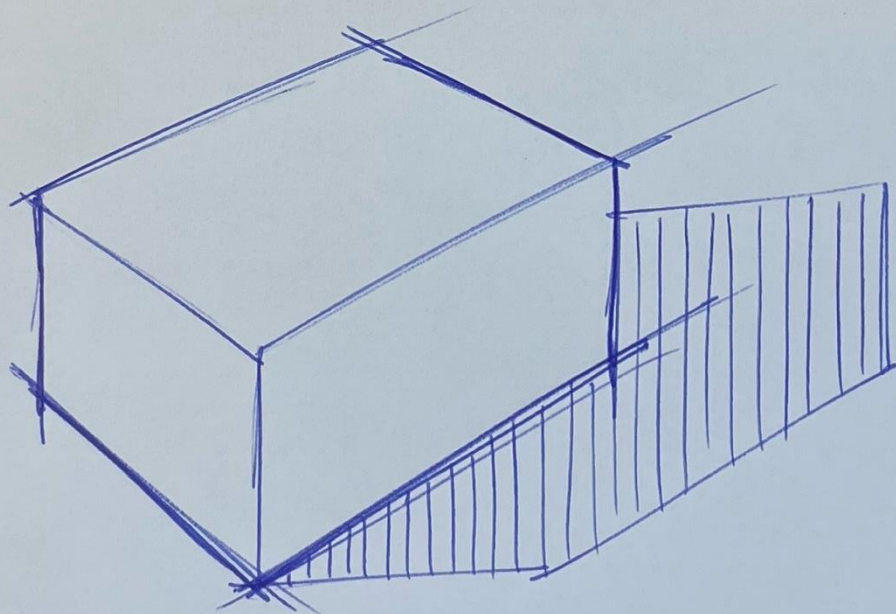
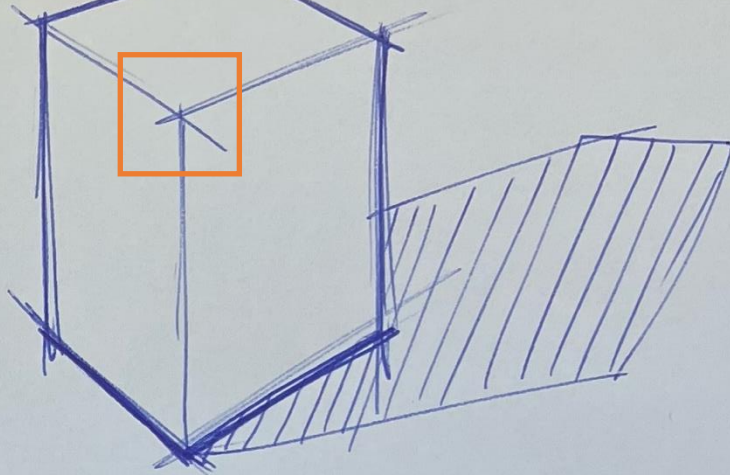
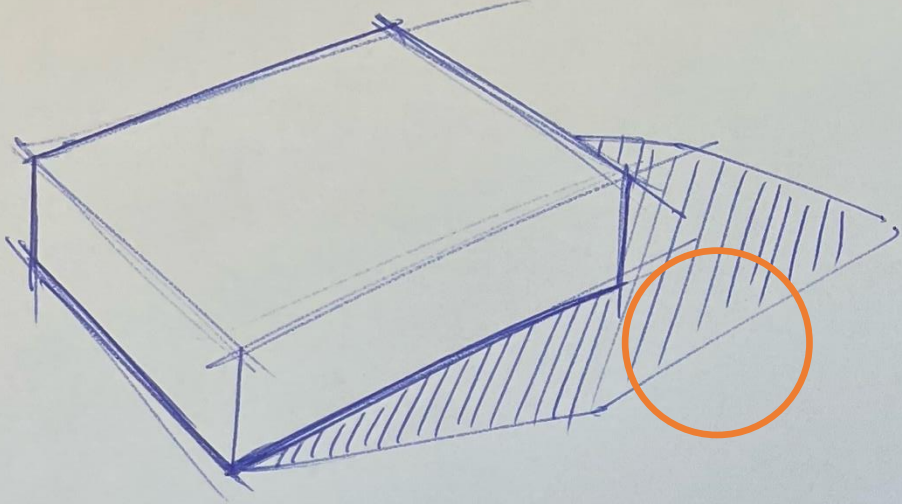








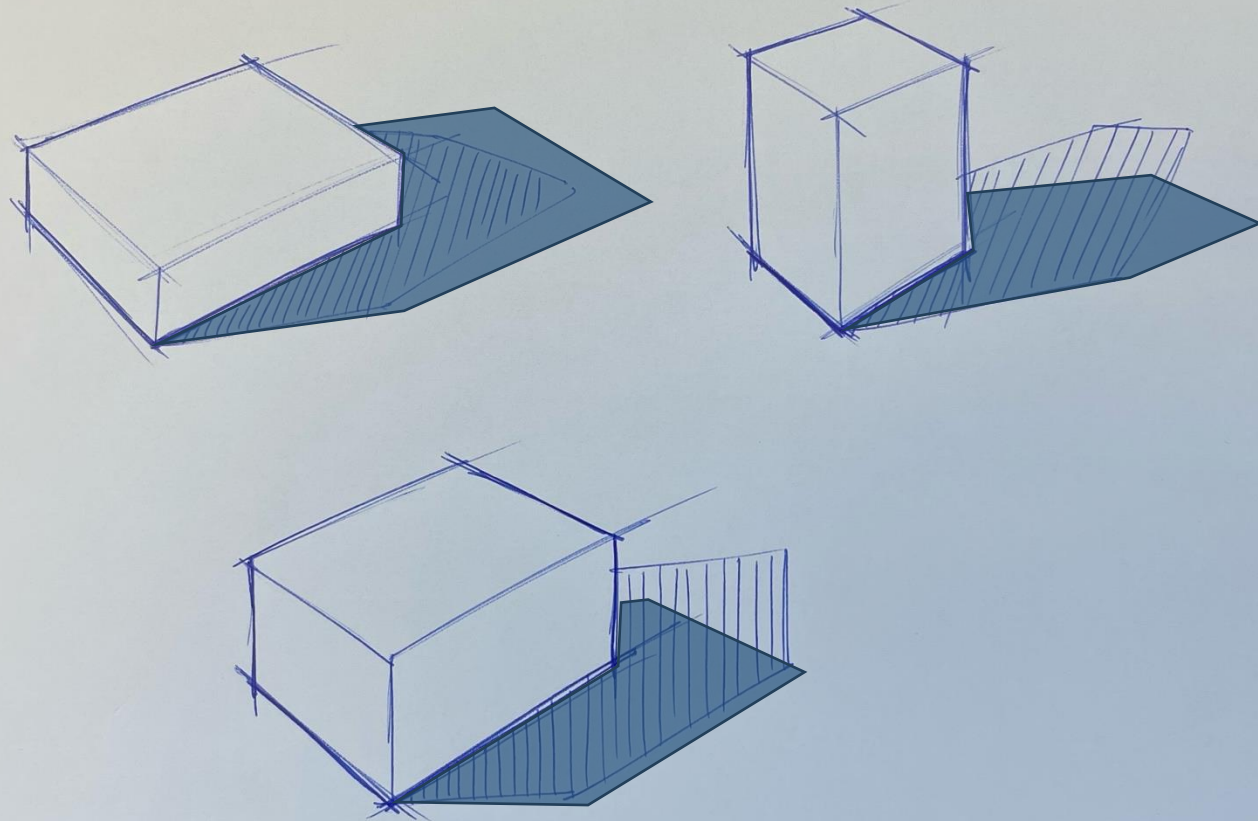




SKETCH (8 minutes)

Sketch three
blocks with
shadows.

Use principles,
not copying.



Personas

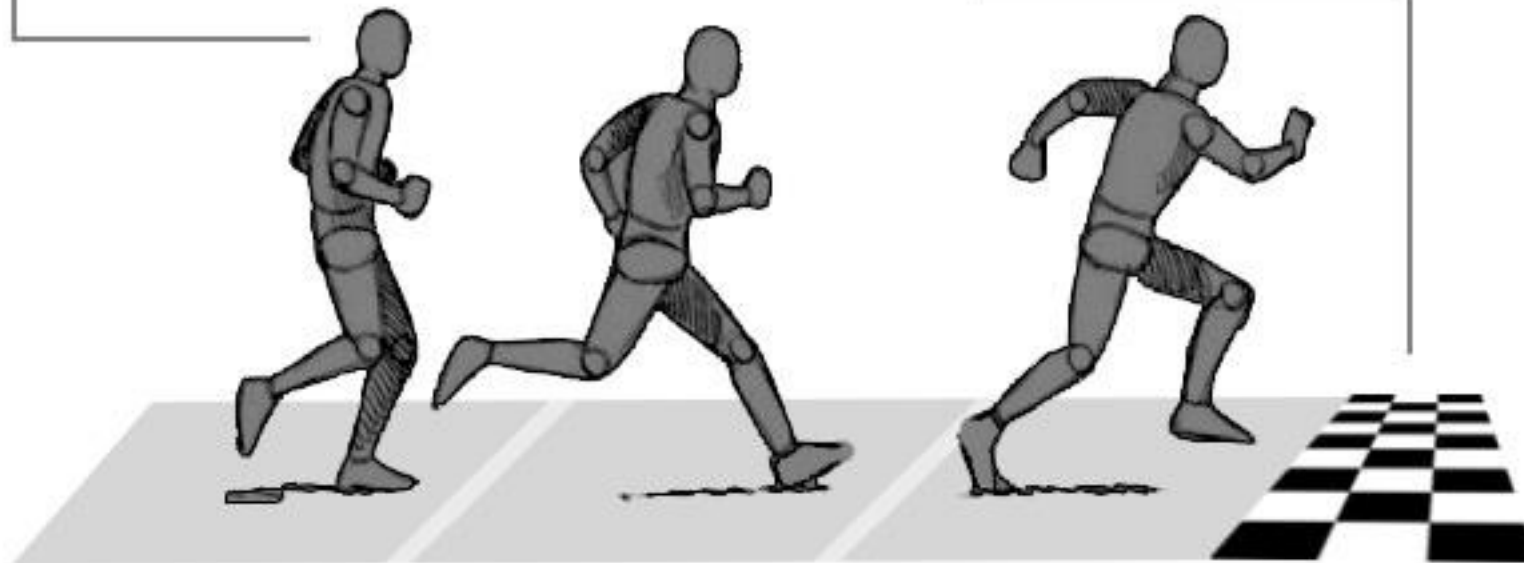
Archetypes of the people affected by our design (product)

1. Persona

Defines who the story is about. This main character has attitudes, motivations, goals, and pain points, etc.

3. Goal

Defines what the persona wants or needs to fulfill. The goal is the motivation of why the persona is taking action. When that goal is reached, the scenario ends.



2. Scenario

Defines when, where, and how the story of the persona takes place. The scenario is the narrative that describes how the persona behaves as a sequence of events.

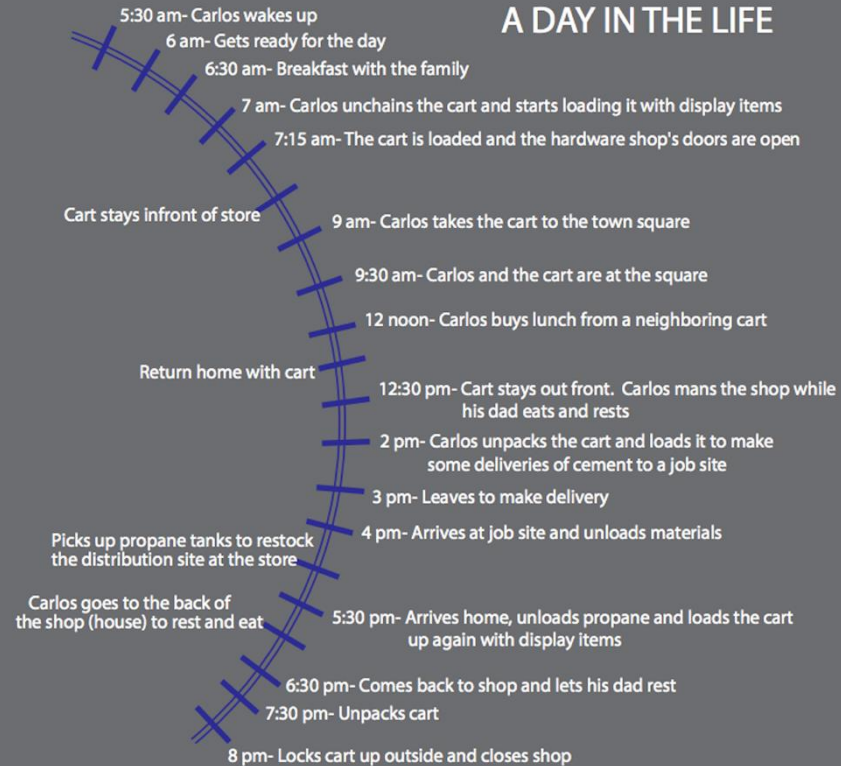


CARLOS

18 year old male // stands @ 5'5" tall // Works @ family's hardware store // Lives above the store with his mom, dad, and younger sister // Catholic // Spanish speaking // Native Peruvian (Amerindian) // Lives in the outer parts of the main city of Puno, Peru

BIO // Carlos Uceda is an 18 year old boy that works in his family's hardware store. He uses a push cart to make local deliveries - these can be further in the city or up into the lower hills - but normally Carlos isn't pushing his cart more than a few miles a day. Mostly Carlos and his cart serve as a display for some of the most popular goods the hardware store carries. The cart acts as a display as it spends time parked outside the store or in the local town square a few blocks away where Carlos sells wares remotely for his father.

A DAY IN THE LIFE



the catholic church where Carlos worships



storefront area where Carlos and his family live and work



markets where Carlos might take his cart and sell his family's goods



rough streets in the hilled parts of Puno



area of the city where Carlos uses his cart



a simple and favorite meal of Carlos and his family



Primary Research

Secondary Research

Time to get really good at both.



■ Primary Persona

Name: Patrick (26 years old)

Education: Graduated 2 years ago in finance

Work: Works for tech company in CA, makes \$105k annually

Personal: Lives in an apartment with his golden doodle. Recreational photographer and drone-flyer. On weekends he loves hanging out with friends, going to the beach or mountains, and taking pictures of his dog.



■ Secondary Persona

Name: Richard (32 years old)

Education: Graduated 8 years ago in marketing

Work: Works as a real estate agent in CO, makes \$84k annually

Personal: Lives in suburban area, married 5 years and has 1 child. Uses his drone regularly at work and charges co-workers a small fee to take work-related photos. Enjoys spending time with family, visiting local parks, and mountain biking.



Peter

Works as product manager for a mid-sized company.

Is 35 years old, holds a marketing degree.

Has got experience working as a product owner on software products with agile teams.

Has had some Scrum training.

Has managed mature products successfully. Now faces the challenge of creating a brand-new product.

Wants to leverage his agile knowledge but needs advice on creating innovative product using agile techniques.



"I want to spend less time ordering a healthy takeaway and more time enjoying my meal."

Lucas Mellor

AGE	31
OCCUPATION	Content Manager
STATUS	Single
LOCATION	London, UK
TIER	Early Adopters
ARCHETYPE	The Creator

Practical

Adaptable

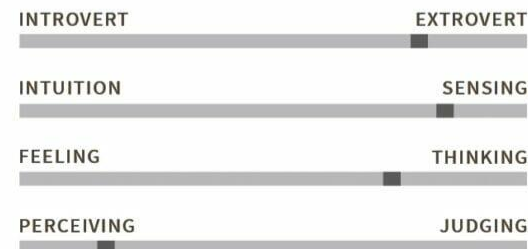
Spontaneous

Active

MOTIVATIONS



PERSONALITY



BEHAVIOUR & HABITS

- Lucas usually had meals out before the lockdown, as he wasn't very keen on cooking. He relied on ready meals and takeaways.
- He is technology savvy and has ordered all his meals exclusively online in the comfort of his home.
- During the lockdown, he began taking part in online HIIT exercise sessions and started to implement changes to enjoy a healthier lifestyle.
- Lucas works from home during the lockdown and finds it hard to balance work and his newfound healthy lifestyle.
- While purchasing meals online, he always looks to select the healthiest options.
- He orders a takeaway about 3 to 4 times a week.

GOALS & NEEDS

- To enjoy a healthy diet and lifestyle during the lockdown.
- To have all the information, he needs to select a healthy takeaway meal.
- To select takeaways based on his dietary needs.
- To have the convenience of takeaways swiftly delivered.

FRUSTRATIONS

- Wasting time Googling menu items because of a lack of images or descriptions.
- Can't find a category for healthy meals on the cuisine section.
- Don't know the contents of the meals ordered for takeaway.
- Restaurants offering pre-order delivery only aren't marked as such on the homepage.
- Restaurant menus are confusing, I'm not sure if it's the contents page or menu items?

Archetype | Stereotype

Archetype | Stereotype

- Evidence based patterns observed in real people
- Emerges from Data
- Represents meaningful behavior

Abstractions based on Evidence

Archetype

- Evidence based patterns observed in real people
- Emerges from Data
- Represents meaningful behavior

Abstractions based on Evidence

Stereotype

- Over Simplified (often negative)
- Superficial without Evidence
- Reduces Complexities
- Can reinforce harmful biases

Shortcuts based on assumptions



Drew

Influencer

ABOUT

 Age 25-34

 \$50K-75K

 High Tech Proficiency

EVENT ATTENDANCE ATTRIBUTES

Frequent event go-ers (monthly), tend to be very early planners, and more likely to travel regionally or nationally for an event, tend to go to trending events only.

EVENT INFLUENCERS



MOTIVATIONS

Motivated to find new things to do and share them with network, having influence, being the first to know about something and getting tickets right away.

CORE NEEDS

Finding events on social media and being able to easily share them. Being able to see trending events that will up their klout. Also getting notificatinos of on-sale so they can be the first to get tickets.

PAIN POINTS

Finding the time to attend events and staying on budget.

39%

Total Universe GTV

12

Events per month

*GTV Calculated based on # of Users x Frequency of Events.
Based on a study conducted with 115 participants.

PERSONA ACTIVITY

Purpose: Discuss how to plan for creating a persona

Task:

1. Discuss how you would go about creating personas for Abbott



Emma Larsen

28

Elementary School Teacher

Type 1 Diabetes

Demographics & Background

Diagnosed with type 1 diabetes at age 12; uses basal-bolus insulin or sometimes an insulin pump. Tech-comfortable, uses smartphone apps to log food, insulin, and glucose ([2] Graham et al., 2017).

Goals & Motivations

Wants to reduce finger-sticks and avoid nighttime hypoglycemia — anxiety about nocturnal lows is one of the most common reasons for CGM adoption in type 1 users ([3] Karakuş et al., 2021). She also values proactive glucose trending to maintain HbA1c near target (<7.0-7.5%) ([1] Barthold et al., 2024).

Pain Points & Frustrations

Significant anxiety about hypoglycemia, especially overnight; CGM use has been shown to reduce fear of nocturnal lows ([3] Karakuş et al., 2021). Finger-sticks often reveal highs too late, leading to fatigue or disruption ([2] Graham et al., 2017).

Behaviors & Context

Multiple checks per day (meals, bedtime, when feeling off). Adjusts insulin around workouts (jogging, yoga). Uses apps to track meals and glucose trends ([2] Graham et al., 2017).

Opportunities / Design Implications

Comfortable sensor, long wear, minimal calibration. Real-time alerts for highs and lows ([2] Graham et al., 2017). Clear overnight trend graphs are particularly valuable for preventing sleep-related events ([3] Karakuş et al., 2021).



Michael Chen

56

Sales Manager

Type 2 Diabetes

Demographics & Background

Diagnosed with type 2 diabetes ~8 years ago. Started with lifestyle changes; now on oral medication, occasional insulin. Has comorbid hypertension and mild neuropathy, consistent with population-level findings for middle-aged T2D cohorts ([1] Barthold et al., 2024).

Goals & Motivations

Wants to avoid complications such as kidney damage and neuropathy, both highlighted in longitudinal T2D studies ([2] Kerr et al., 2023). His primary motivation is reducing burden of monitoring & maintaining stable energy levels day-to-day.

Pain Points & Frustrations

Irregular meals and travel schedules make consistent monitoring difficult; these are documented barriers to self-management in T2D patients ([4] Frank et al., 2024). Cost is a key issue: studies show out-of-pocket expenses increase significantly after age 65 with Medicare, influencing adherence ([1] Barthold et al., 2024, [3] Karakuş et al., 2021).

Behaviors & Context

Checks glucose only several times per week, more often during travel or when symptomatic ([2] Kerr et al., 2023). Uses a smartphone but rarely adopts health apps ([3] Karakuş et al., 2021).

Opportunities / Design Implications

For him, low-cost sensors and clear insurance reimbursement pathways are essential ([4] Frank et al., 2024). Reports that data can be shared with clinicians occasionally are more useful than day-to-day data overload ([2] Kerr et al., 2023).

References for Diabetic Personas

- [1] Barthold, D., et al. (2024). *Patient Out-of-Pocket Costs for Type 2 Diabetes Medications When People Enroll in Medicare*. JAMA Network Open.
- [2] Graham, C., et al. (2017). *Continuous Glucose Monitoring and Global Reimbursement*. Diabetes Technology & Therapeutics, 19(S3), S-6–S-10.
- [3] Karakuş, K. E., et al. (2021). *Benefits and Drawbacks of Continuous Glucose Monitoring: Patient Perspectives in Socioeconomically Diverse Populations*. Journal of Patient Experience.
- [4] Frank, J., et al. (2024). *A Microsimulation Model and Cost-Effectiveness Analysis of CGM Reimbursement by Medicaid*. Journal of Managed Care & Specialty Pharmacy.
- [5] Kerr, D., Duncan, I., et al. (2023). *Cost Analysis of Self-Monitoring Blood Glucose in Nonintensively Managed Type 2 Diabetes*. American Journal of Managed Care, 29(12), 670-675.

11.45 Personas and Locales

Understand and teach others about who your product serves

Personas are archetypes of the people – often end users – who will be affected by the product you're developing. They're thoughtfully developed by the product development team to better understand who the product serves, and to teach other decision makers about those people. Effective use of personas helps the team abandon the idea that their product will serve 100% of the population, helps them focus on who the product does serve, and when used during the decision-making process, helps teams create products that are truly loved by the market.

How to create a persona

1. Establish the objective of your product development effort (see Project Objective Statement). This is an important first step because personas need to be developed for your specific project and its objectives.
2. Considering the project objective, decide which general part of the population is served by your product (e.g., people with difficulty sleeping).
3. Discover as much as you can about the general part of the population your product serves. While doing this, begin noticing and further researching the characteristics that are pertinent to your product. Various sources are available such as online databases, social media analytics, web analytics, and more.
4. Look for trends in the data that allow you to start dividing your part of the population into primary and secondary users and other pertinent stakeholders.
5. Develop 3 to 5 *believable* personas:
 - Give each persona a name
 - Choose a photograph to represent the persona
 - State the role of the persona (e.g., primary user, maintenance worker)
 - Develop a description of the persona including their desires, needs, expectations, motivations
6. Evaluate the persona and revise as needed.

How to use personas to advance the design

Develop and use believable personas early in the product development process to help team members be human-centered during the development. Post the persona description on the wall of the team space. Refer to it often. Use a persona during a team meeting and see how it changes the discussion from that of *product* to that of *who the product serves*. This can be particularly useful when team decision-making digresses to a struggle between what one team member wants versus another. Personas help teams shift back to what the end user would want.

Persona pitfalls to avoid

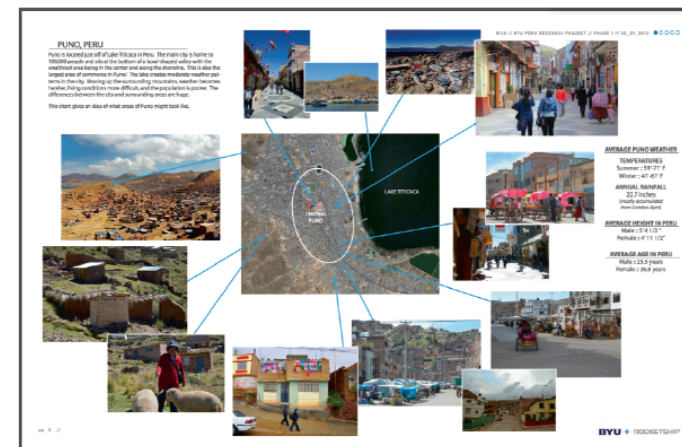
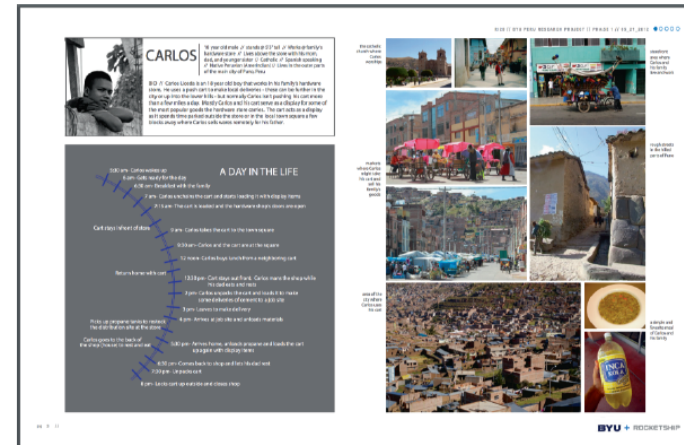
To be useful, personas need to be accurately developed. They cannot be based on team member opinions about who the end user *might* be or based on unvalidated assumptions. Personas need to be believable before they can become something the team rallies around.

Further Reading

van Boeijen A, Dalhuizen J, Zijlstra J, van der Schoor R (2014) Delft Design Guide BIS Publishers. pp. 94-95.

Hanington B, Martin B. (2012) Universal methods of design: 100 ways to research complex problems, develop innovative ideas, and design effective solutions. Rockport Publishers. pp. 132-133.

Persona representing a shopkeeper in Puno, Peru.



Locales

When the location where the product will be used is crucial to the product design, a locale can be developed. The locale is a description similar to a persona, but it focuses on a real or representative location. It has the same product development objectives as a persona, but with a focus on location and context for product use. The use and pitfalls of locales are the same as personas.

See also

Development Reference: Project Objective Statement (11.49), Storyboards (11.64).

Locale describing Puno, Peru.

“If you are open and stay tuned
to what’s happening, the
answers will be revealed.”

Rick Rubin

What to do now

- Use the Study Guide
- Work on the Project Watch Your Time
 - Complete the Designette