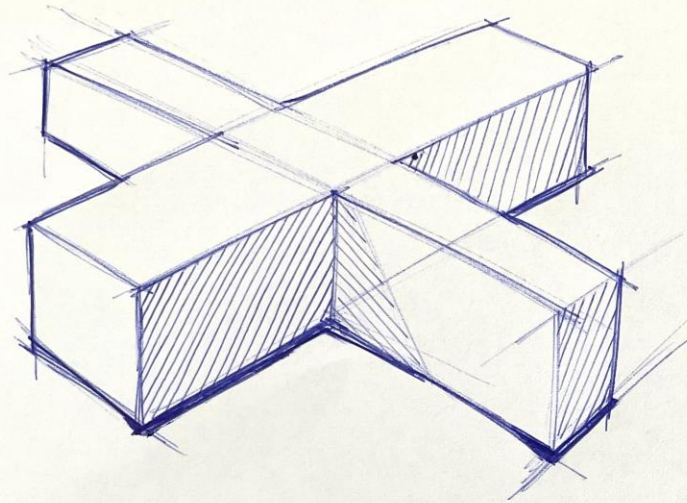


SKETCH THIS

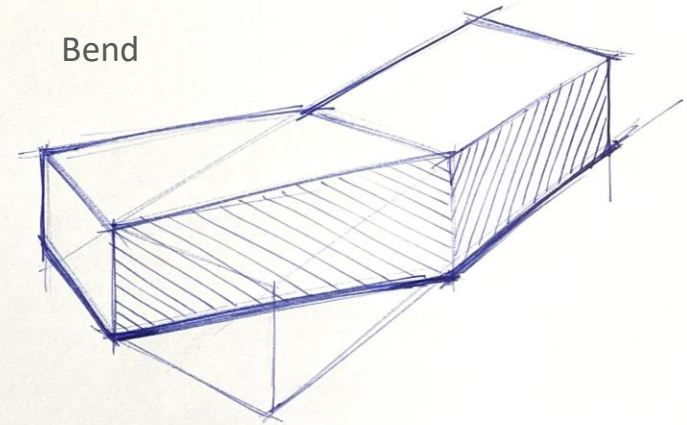
Apply the techniques you've learned in previous lectures.

How does the result compare to your Week 0 sketch?

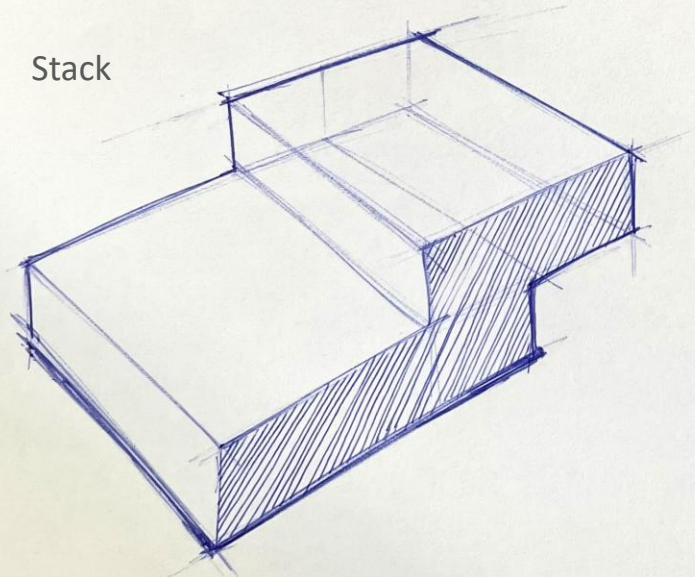
Intersect



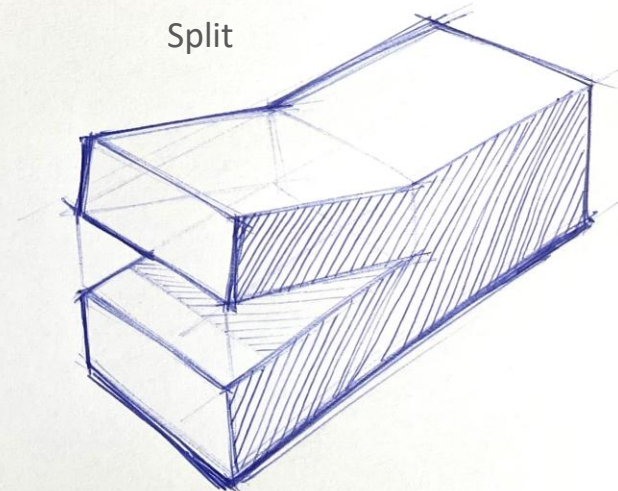
Bend



Stack



Split





The Role of the Product/Engineering Designer

Week 1: Second Lecture

Design is a responsibility, not just a technical task

Product Design

Christopher A. Mattson, PhD
BRIGHAM YOUNG UNIVERSITY



**DESIGN
EXPLORATION
RESEARCH
GROUP**

Outline

- **Business** (1 min)
- **Opening** (4 min)
- **Grand Rounds Case** (20 min)
- **Design Tools** (15 min)
- **Designette** (20 min)
- **Sketching** (10 min)
- **Closing** (5 min)

Opening

How much do you want this?

I know a lot of creative people who have become famous, who have won awards, who are successful in every field, and this is what they have in common.

They simply do the work.

Seth Godin

Best-Selling Author
Entrepreneur, Marketing



Grand Rounds

A Case Study Discussion



Gordon Knife sold by Harbor Freight

Design Brief | Harbor Freight Knife Recall

Harbor Freight Tools recalled ~1.1M Gordon Folding knives because the blade-locking mechanism could fail to engage, posing a laceration hazard.

Price: \$5

Sales: July 2008-July 2019

Failures; 7 reported, 6 laceration injuries with 4 requiring medical attention.



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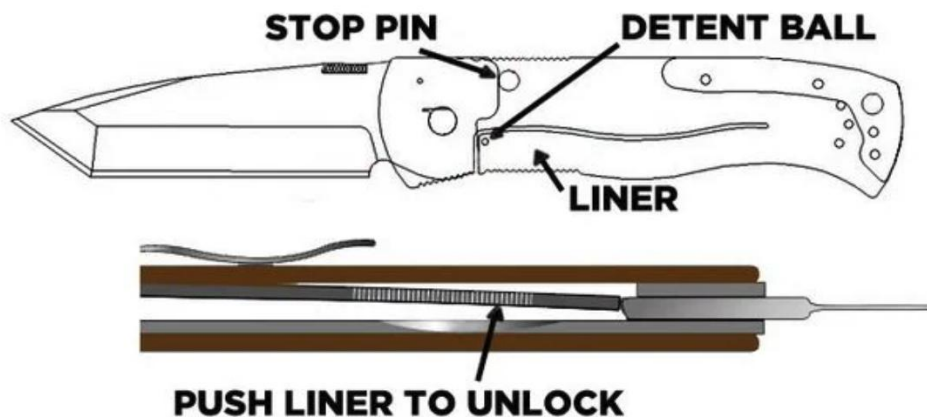
Sales: July 2008-July 2019

Failures; 7 reported, 6 laceration injuries with 4 requiring medical attention.

How do you begin decomposing this problem?

Liner Lock

Liner locks are probably the most common form of lock on modern folding knives – for ease of use, ease of assembly, and cost, it's hard to beat a liner lock. They're not the most exciting or creative lock but when executed properly they can be great. >> [Examples of liner lock knives](#)



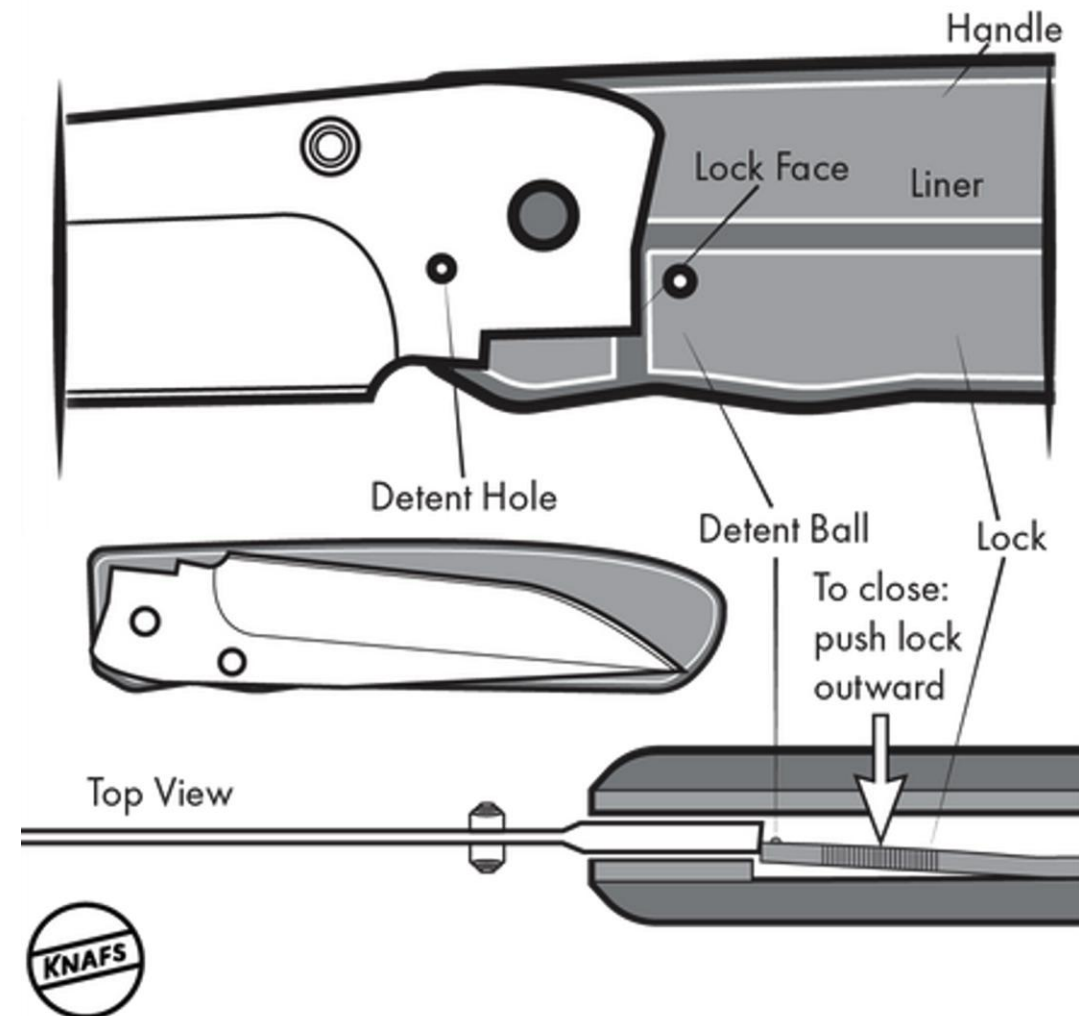
The basic design uses one of the blade's liners, cut out and bent to create a spring effect, to engage the back of the blade tang when the blade is opened. While liner locks have been around for a long time, the modern implementation of the liner lock is credited to custom knifemaker **Michael Walker**, who made two important upgrades: using a **stop pin** anchored to the scales to precisely align the blade when open, and adding a **detent ball** on the liner lock to hold the blade closed, providing a snappy opening action – as well as added safety to keep the blade from accidentally opening.

LINER LOCKS

Pros: Simple to use, inexpensive to make, familiar to almost anyone that's ever used a folding knife, allows for a fast opening action thanks to the ball detent.

Cons: The user's fingers are in the path of the blade when closing, not normally suited for heavy-duty use due to the thin nature of the liner itself.

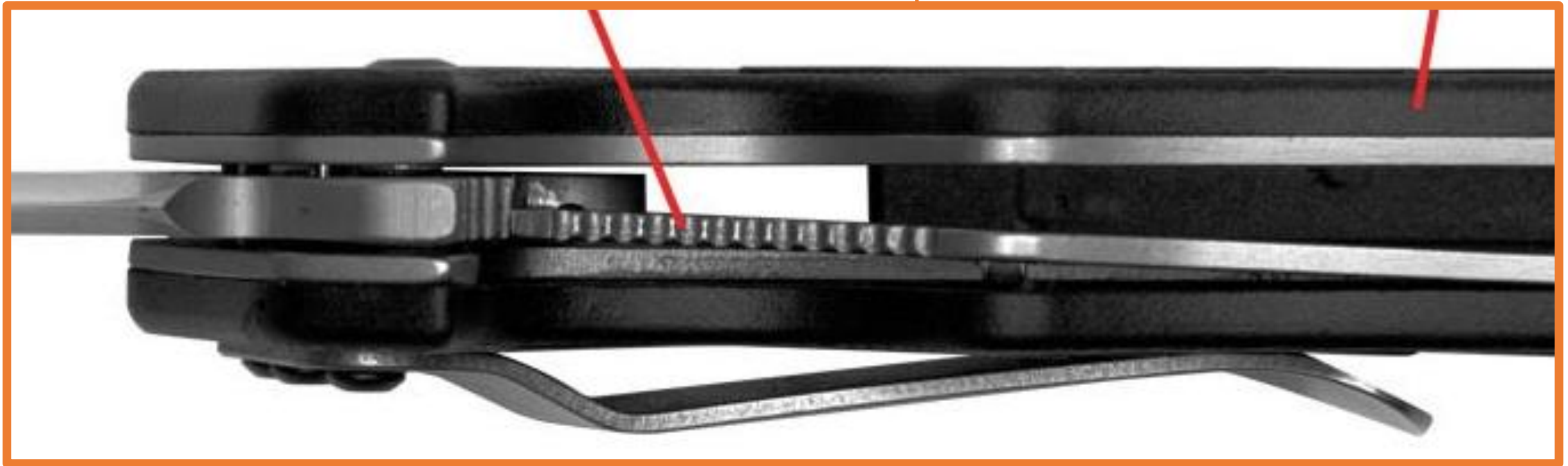
Insider Tip: Look for where the liner engages relative to the tang of the blade – enthusiasts refer to this as "early" or "late." An early engagement (closer to the locking liner side) is much safer than "late" engagement (towards the non-locking liner) as force on the blade will naturally move the lock away from the locking side. If the liner engages very late it can slide off of the tang and the blade can close on your hand. Also check for side to side blade play when locked open and if possible (i.e. if the knife has an adjustable pivot) tune any play out – it's a balancing act with liner locks to get the pivot action just right. There are less worries about lint buildup than with backlocks.



LINER LOCK

HANDLE
SCALE

LINER



MCM

Most Critical Module



MCI

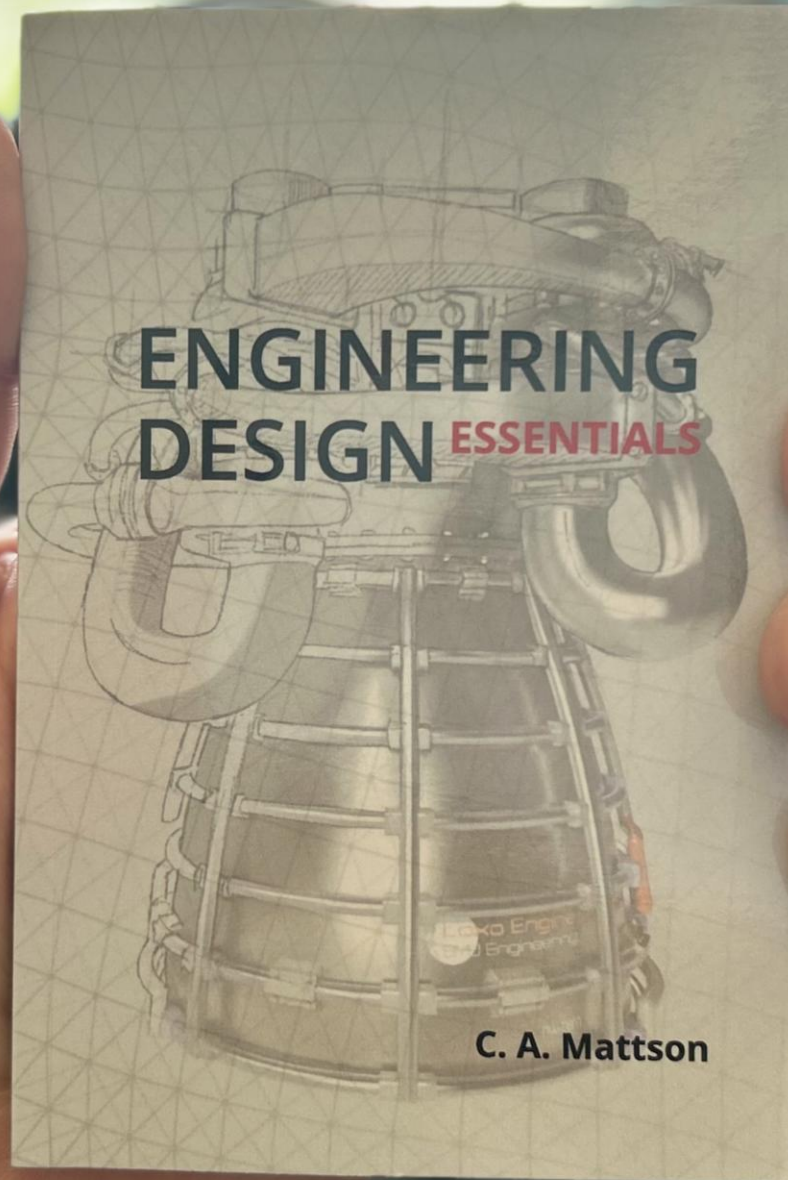
Most Critical Interface

What is the most critical module(s)?
What is the most critical interface(s)?

Create an engineering sketch (2D) of the problem.



● Go to Page 48 (48-51)



Discussion

1. What specific responsibilities fall on the design engineer once a product has failed in the field?
2. How might a stronger sense of responsibility earlier in the process have prevented this failure?
3. What steps would you take now to ensure both immediate safety and long-term trust in your role as a designer?



Gordon Knife sold by Harbor Freight

Design Brief | Harbor Freight Knife Recall

Harbor Freight Tools recalled ~1.1M Gordon Folding knives because the blade-locking mechanism could fail to engage, posing a laceration hazard.

Price: \$5

Sales: July 2008-July 2019

Failures; 7 reported, 6 laceration injuries with 4 requiring medical attention.

Remedy:

“Consumers should immediately stop using the recalled knives and return them to a Harbor Freight Tools store for a full refund in the form of a \$5 store gift card plus sales tax.”

How to be an effective designer

Noise / Uncertainty / Patterns / Insights

Clarity / Focus



Research & Synthesis

Concept / Prototype

Design

Observations

Innovation Begins with Eye – David Kelley, IDEO



observe

infer

validate





THOUGHTLESS ACTS

TEABAG SUPPORT



WAYS THAT WE
ADAPT TO THE
WORLD WITHOUT
THINKING





NOTICE
DO NOT REMOVE
BICYCLES FROM
THIS RACK
454-6376

Table R.4: Personal Project Schedule and Time Allocation

Weeks	Stage and Focus	Expected Time
Weeks 1–2	Opportunity Development: Initiate Focus: Topic selection, framing, and planning. Milestone: By the end of this stage, the student has identified a meaningful opportunity, developed a defensible problem frame, and articulated preliminary requirements to investigate and refine through user research.	5.5 hours
Weeks 3–4	Opportunity Development: User Insights Focus: User research, needfinding, and insights. Milestone: The student demonstrates a well-evidenced understanding of stakeholder needs and has translated insights into actionable design requirements and clear evaluation criteria.	7.0 hours
Weeks 5–6	Concept Development Focus: Idea generation, selection, and early testing. Milestone: By the end of this stage, the student has selected a single, well-justified concept that meets requirements and shows sufficient promise to merit continued development.	7.0 hours
Weeks 7–9	Subsystem Engineering Focus: Prototyping, iteration, and feedback. Milestone: The overall system and its parts are sufficiently defined – in geometry, materials, and interactions – that the student is ready to build and test a near-final working prototype.	12.0 hours
Weeks 10–11	System Refinement Focus: Refined prototyping and storytelling. Milestone: The student has identified and resolved weaknesses exposed during system testing, resulting in a more desirable and coherent solution.	7.5 hours
Week 12	Product Pitch Focus: Final preparation, critique, and presentation. Milestone: The student presents a technically grounded, thoughtfully refined design and communicates how the product meets needs and evolved across development stages.	3.0 hours
Total		42.0 hours

Nucor's Circles

Hedgehog Concept

11.38 Nucor's Circles

Find market opportunities that match your skills and passions

Nucor's Circles can be used to systematically identify high-potential opportunities to pursue. Opportunities that lie at the intersection of (i) things we are passionate about, (ii) things we can be the best at, and (iii) things the market wants to have great potential.

How to do it

1. Choose one of the three sets: (i) things we are passionate about, (ii) things we can be the best at, and (iii) things the market wants. Make a somewhat large list of items for that set. For example, assume we choose the set *things we are passionate about*. The large list we create might include:

- High tech products
- Camping
- Phenomenal product design
- Helping people in need
- Materials
- Creating things in my shop
- Reading

2. Now choose another of the three sets and make a list while considering the already completed list. For example, make a list of *things we can be the best at* while considering *things we are passionate about*.

- Phenomenal product design
- Helping people in need
- Materials
- Hard work and dedication

3. Make a list for the remaining set. For this example, *things the market wants*. Do this in the context of the other lists.

- Helping people in need
- High tech products

4. Identify the items (if there are any) that exist in all three circles. These represent the opportunities of greatest potential.

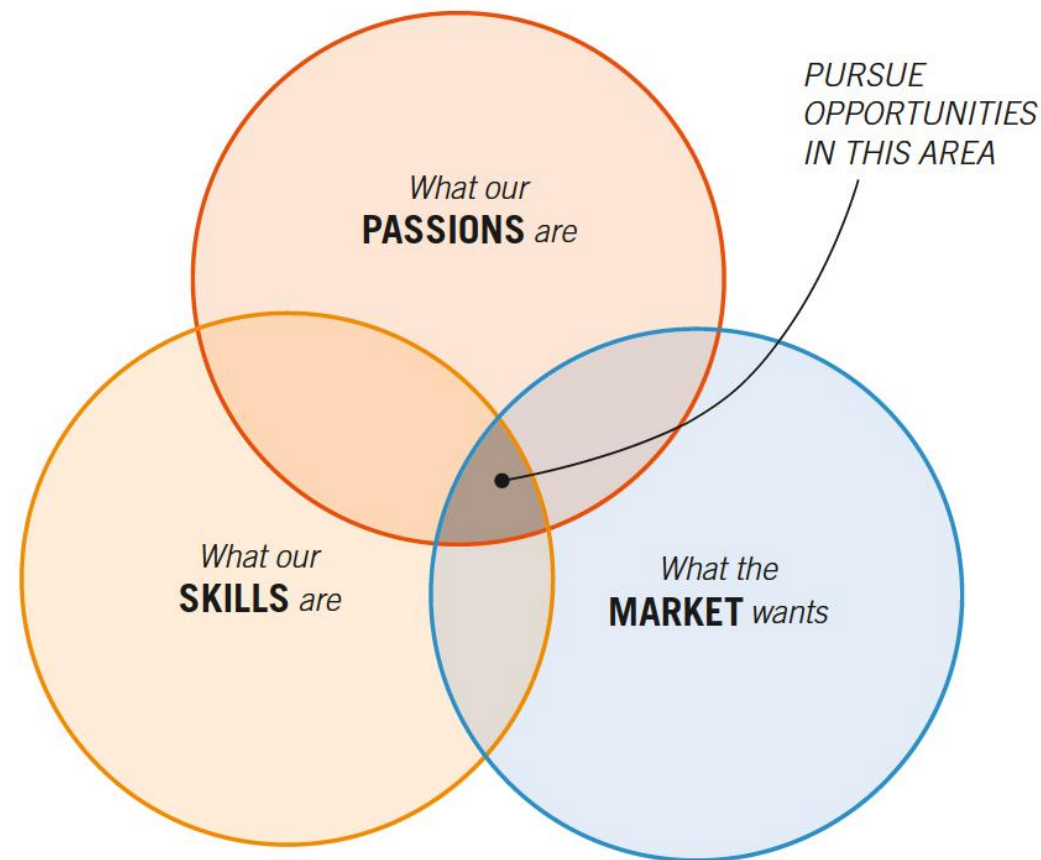
Why it's named after nucor

Nucor Steel is considered to be one of the great Fortune 500 companies in an impressive study carried out by economist Jim Collins. Nucor significantly outperformed its competition in the stock market over a sustained period of time. When attempting to discover what distinguished Nucor from its competitors, Collins discovered that Nucor made all of its decisions in accordance with the overlapped section of three circles: passion, expertise, and economic denominators.

For Nucor the circles looked like: "Passion for eliminating class distinctions and creating an egalitarian meritocracy that aligns management, labor, and financial interests. Economic Denominator of profit per ton of finished steel. And could become the best in the world at harnessing culture and technology to produce low-cost steel."

Further Reading

Collins JC (2001) Good to great. Random House, New York.



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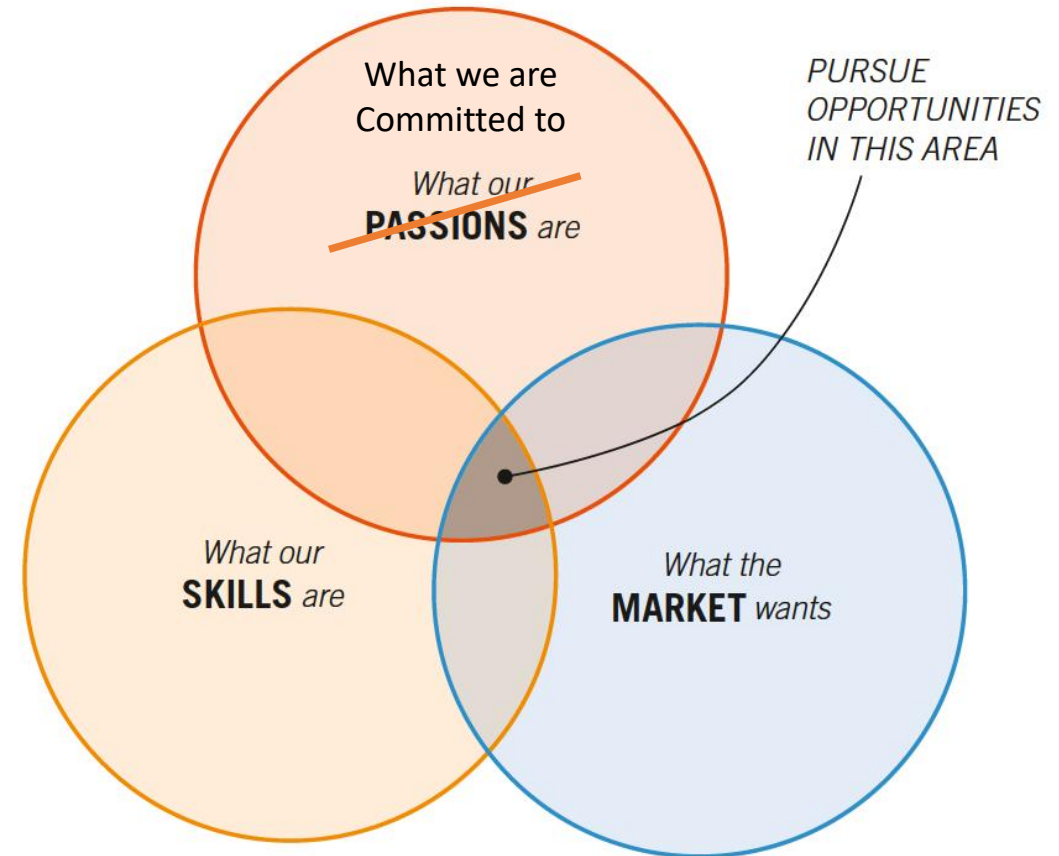
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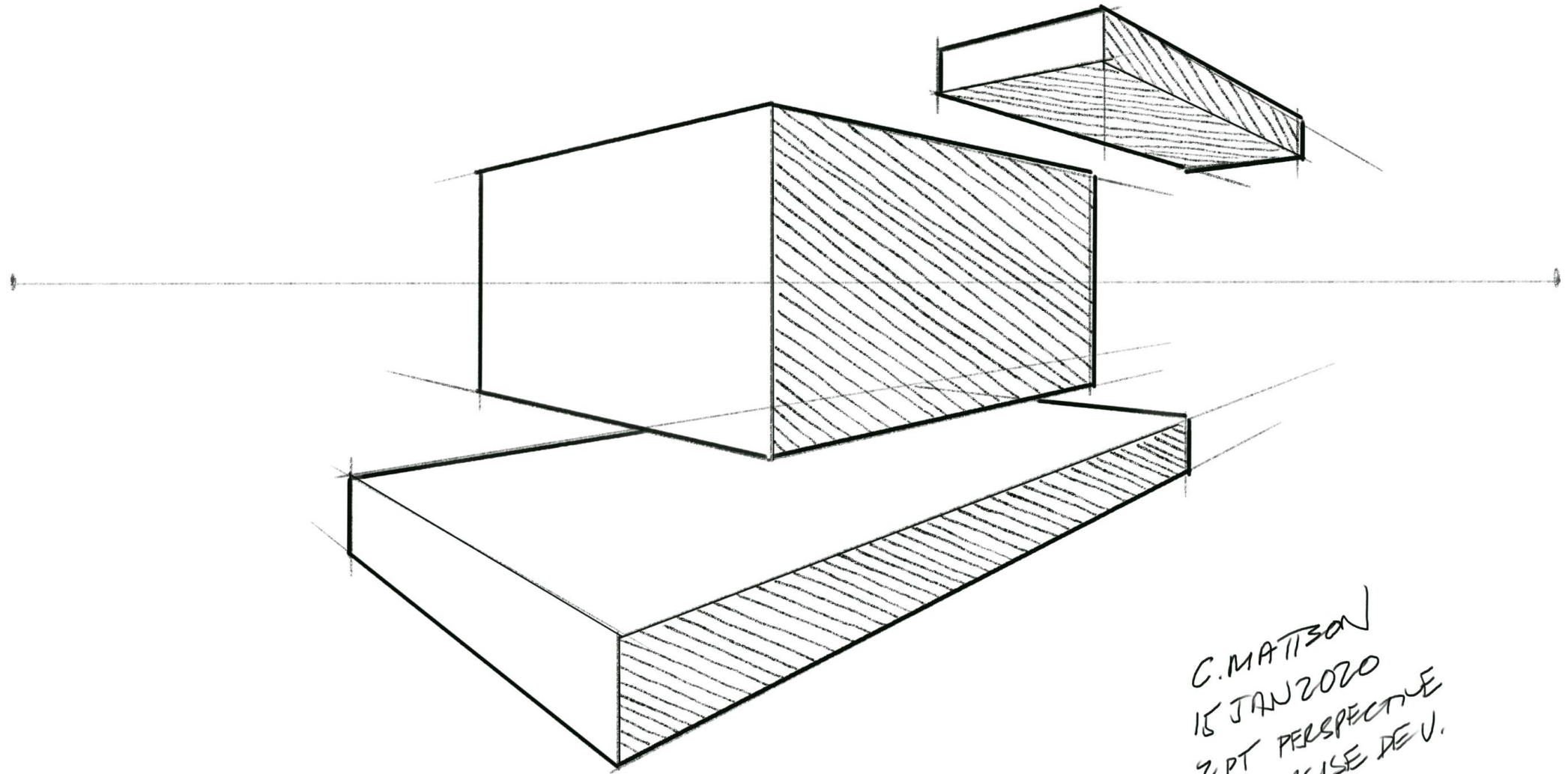


Nucor's Circles

Sketching

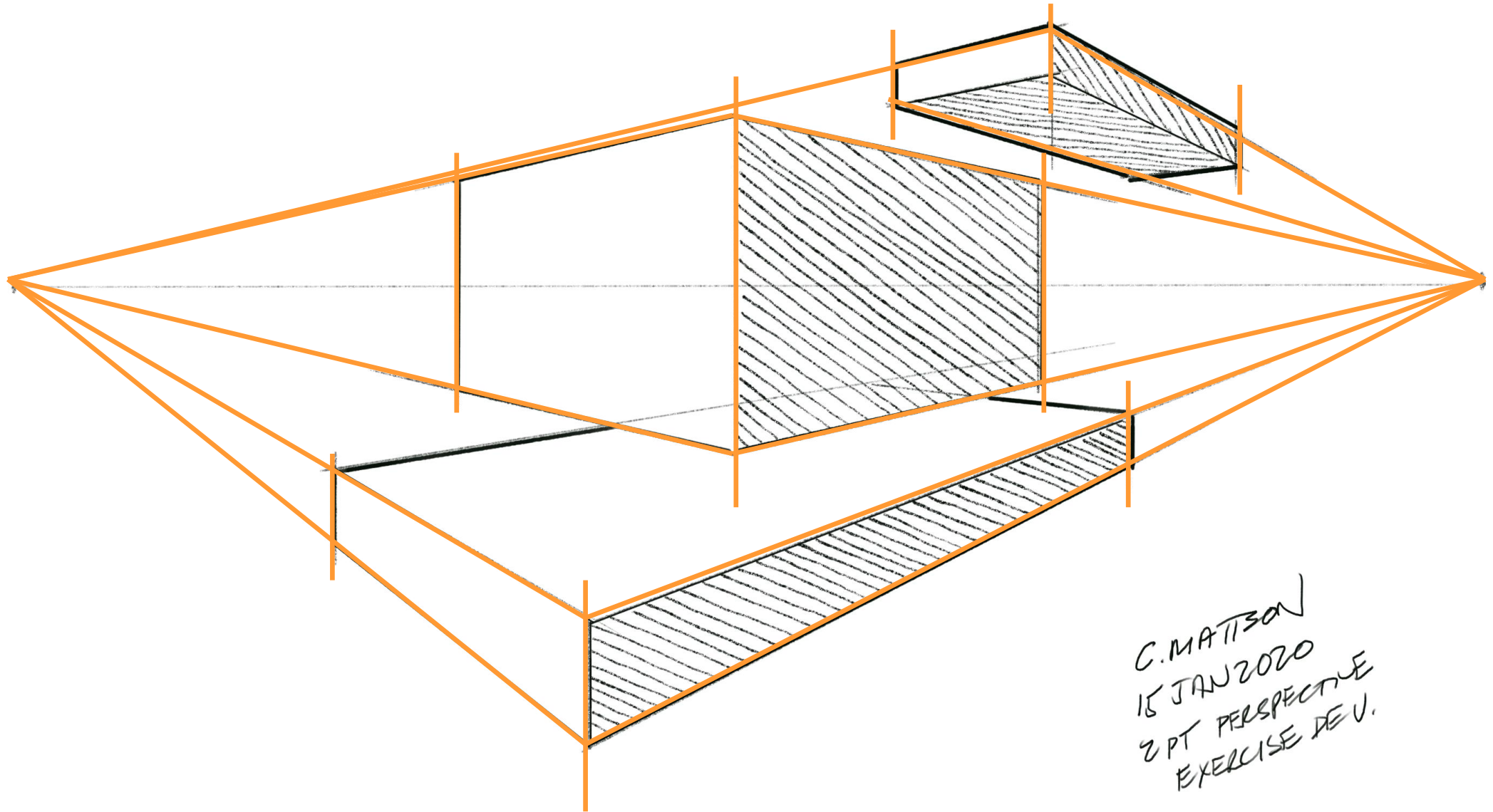
Two-point perspective

Sketch FULL of cuboids like this, above, below and at the horizon. 8-minutes in total



C. MATISON
15 JAN 2020
2 PT PERSPECTIVE
EXERCISE DE U.

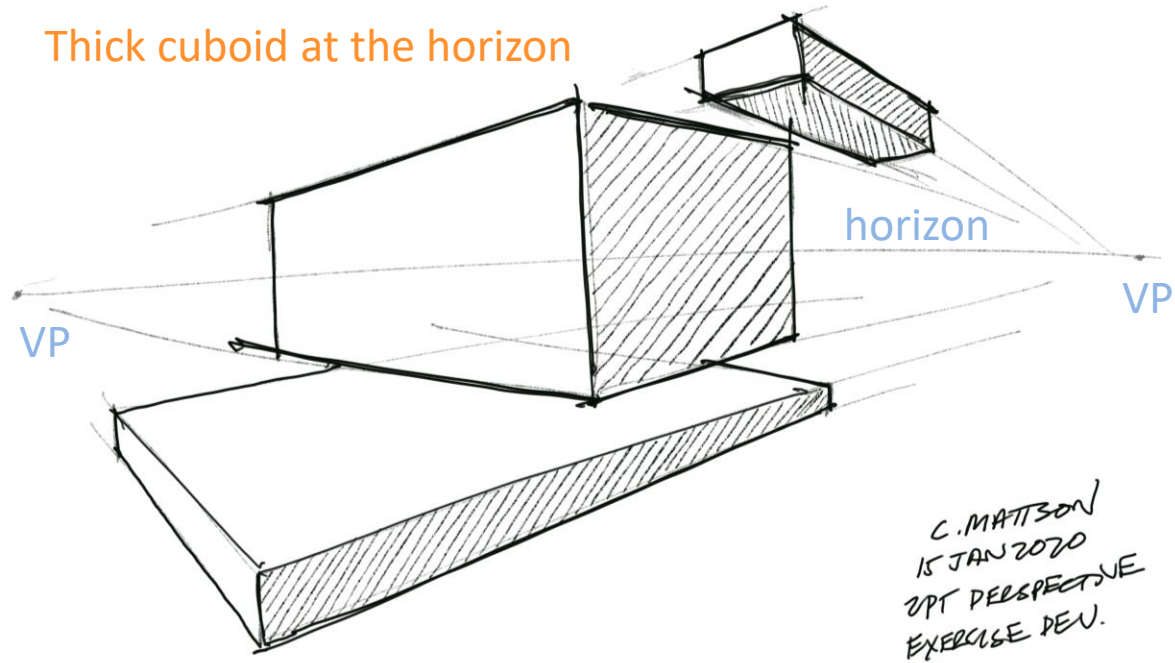
Sketch FULL of cuboids like this, above, below and at the horizon. 8-minutes in total



Practice 2-point Perspective Sketching

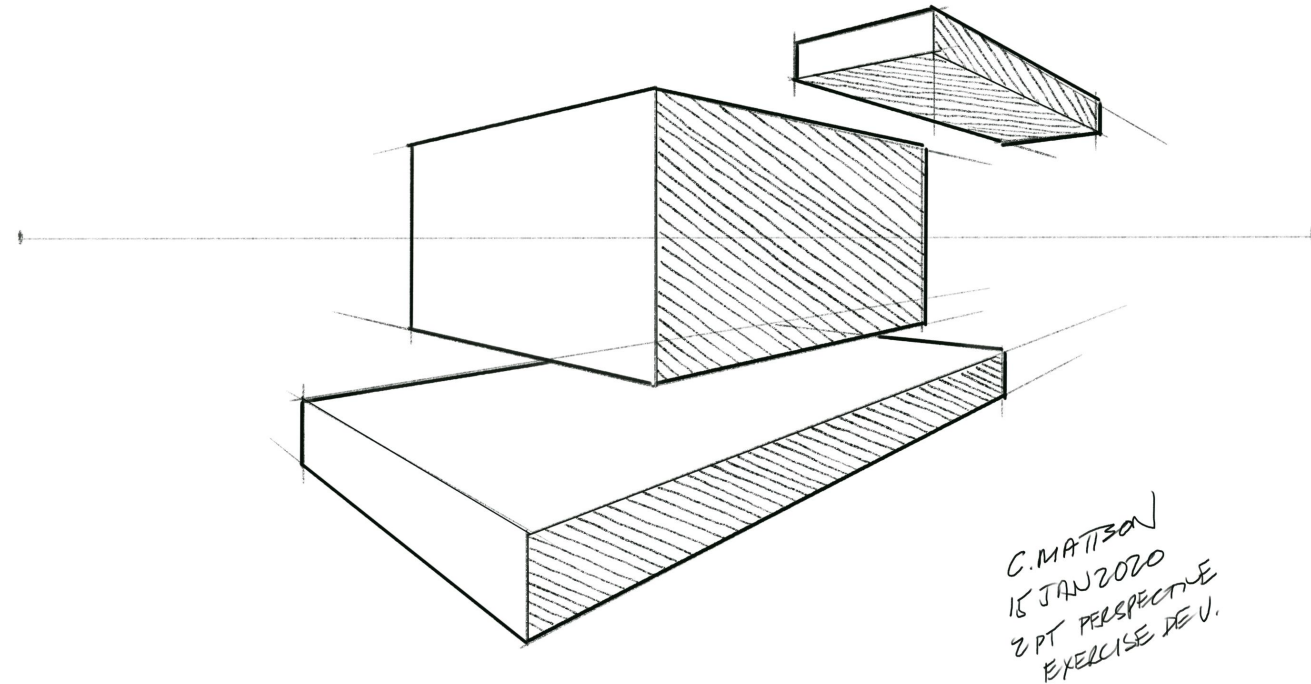
Thin cuboid above the horizon

Thick cuboid at the horizon

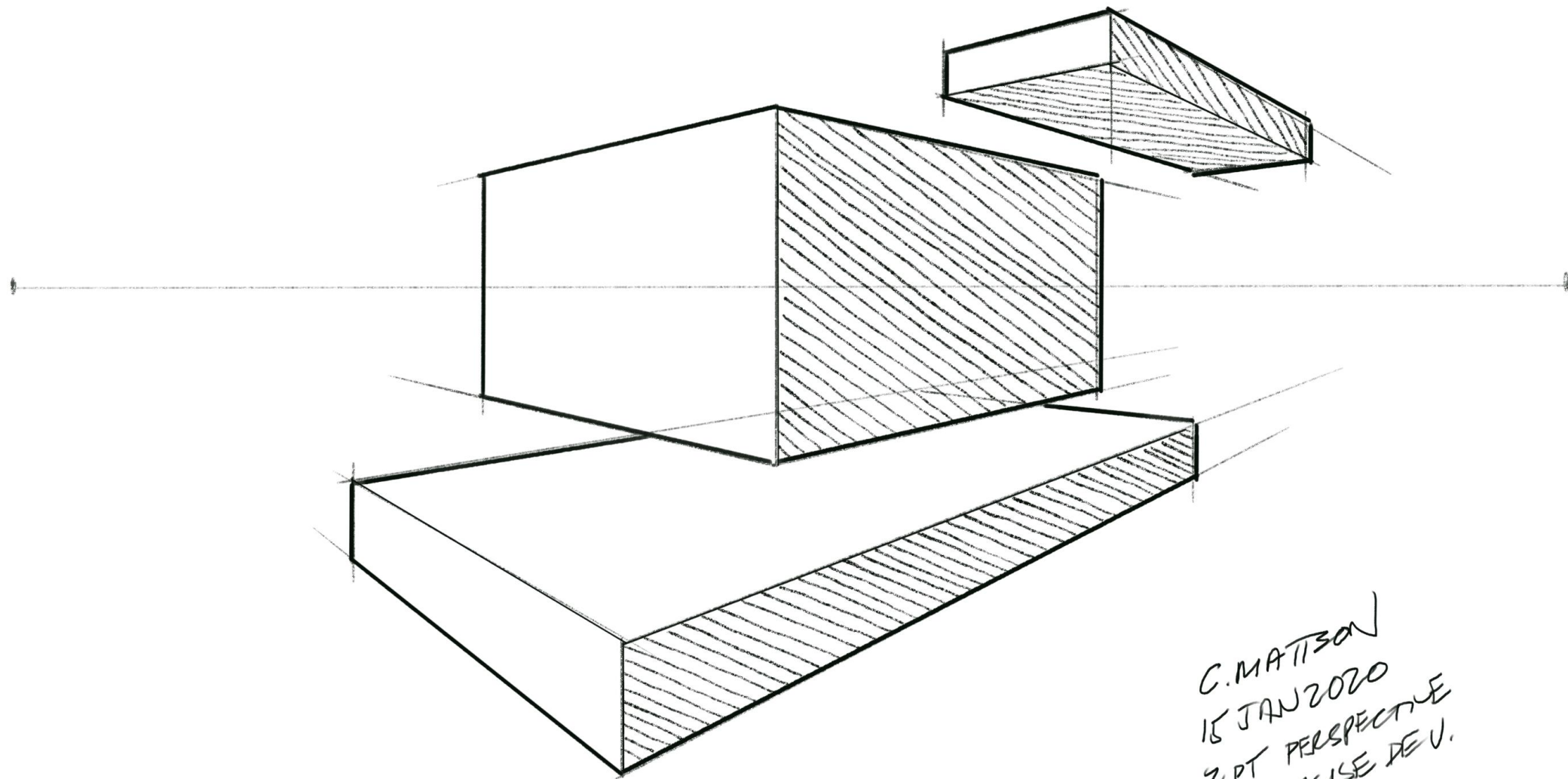


Thin cuboid under the horizon

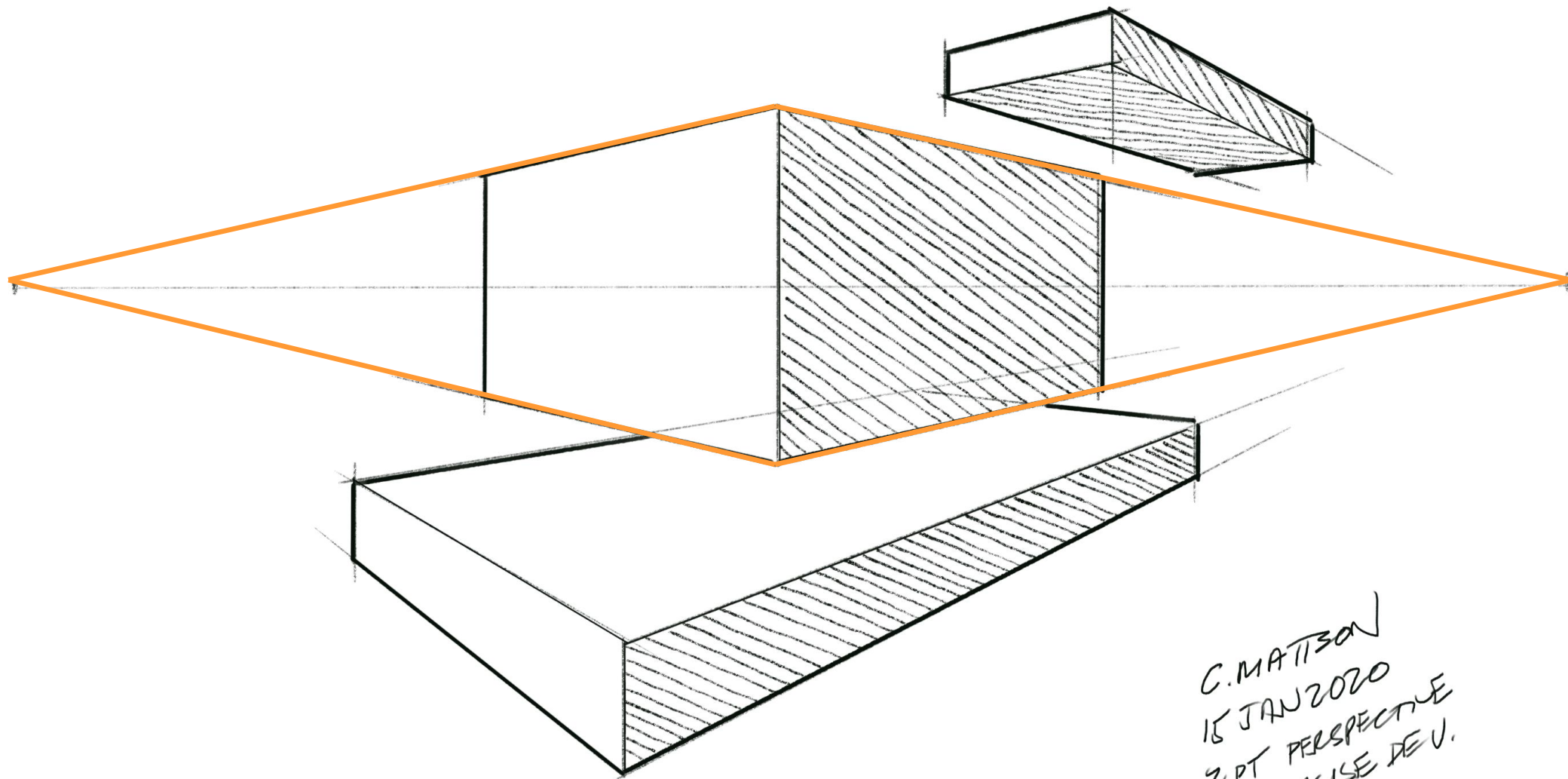
Freehand, Quick



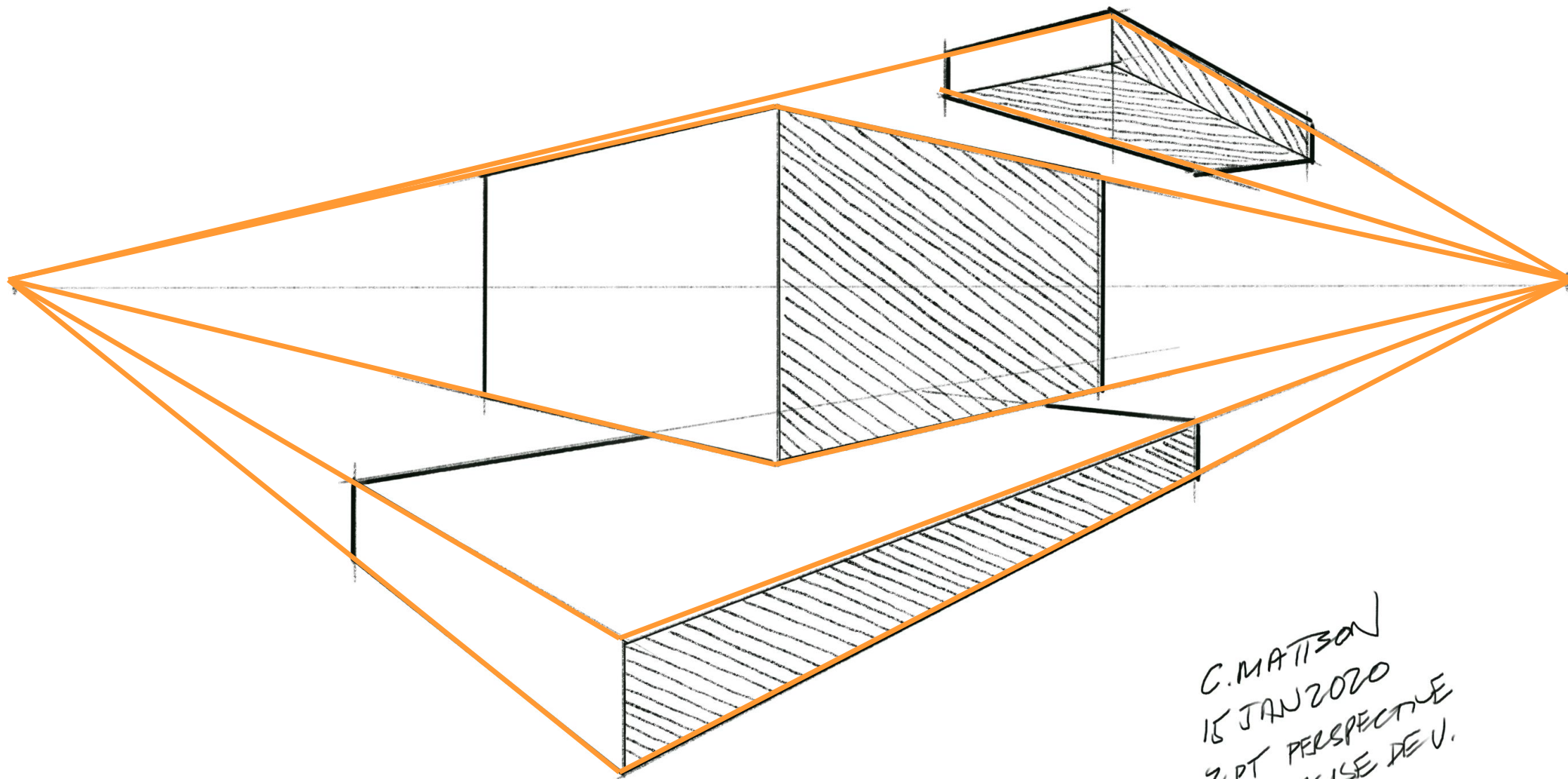
Ruler, careful, hatching by hand



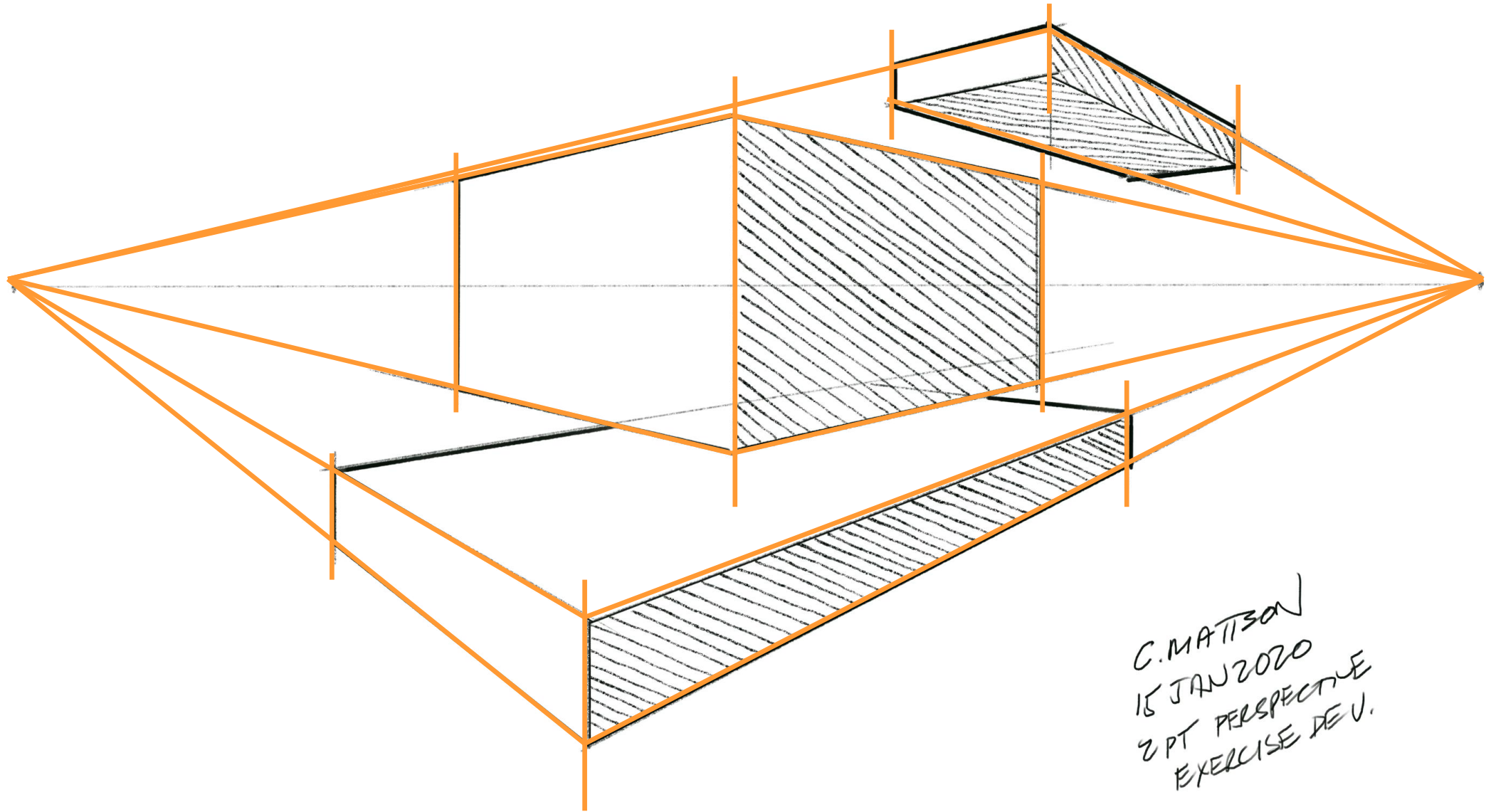
C. MATISON
15 JAN 2020
2 PT PERSPECTIVE
EXERCISE DE U.



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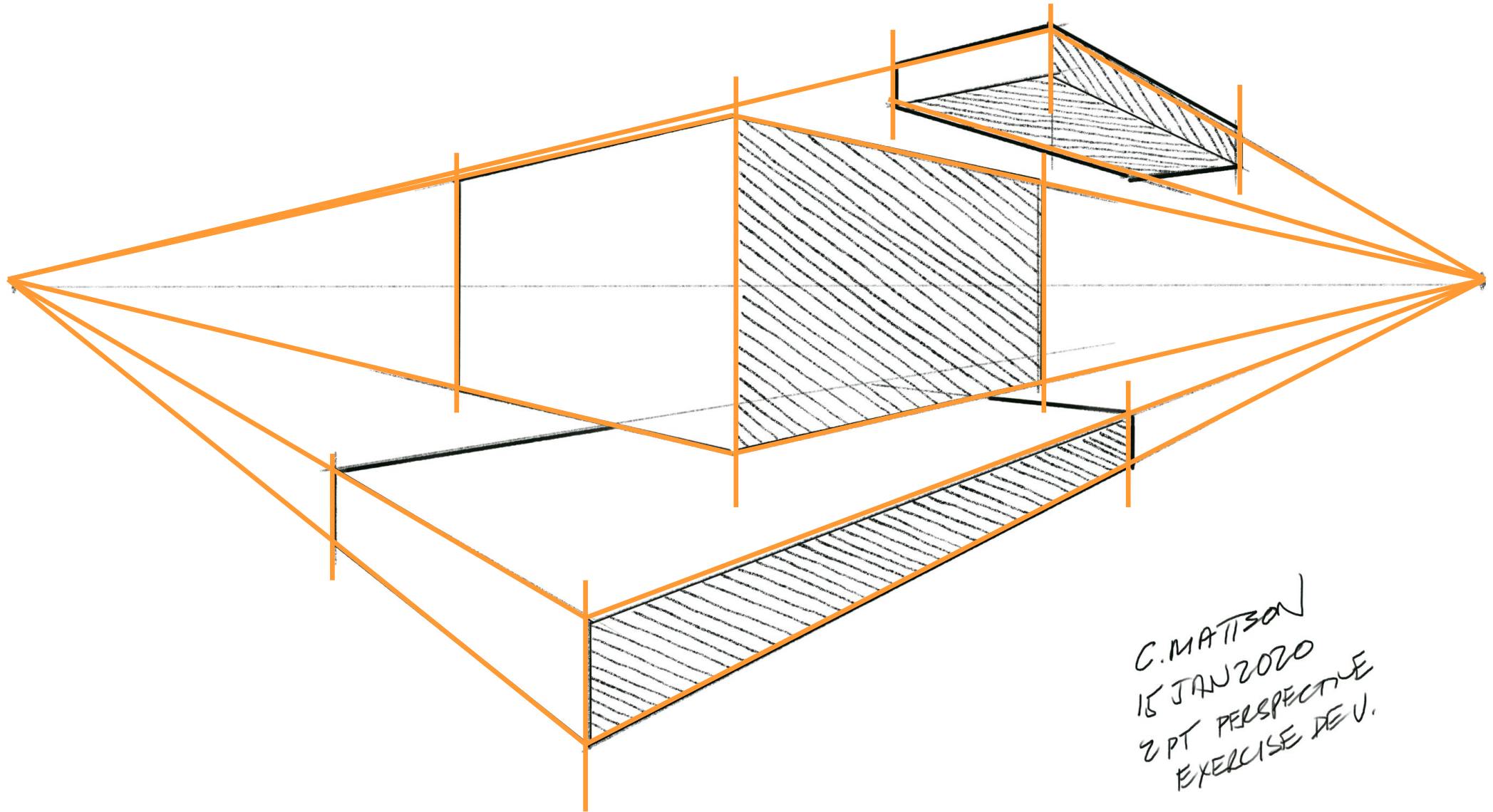


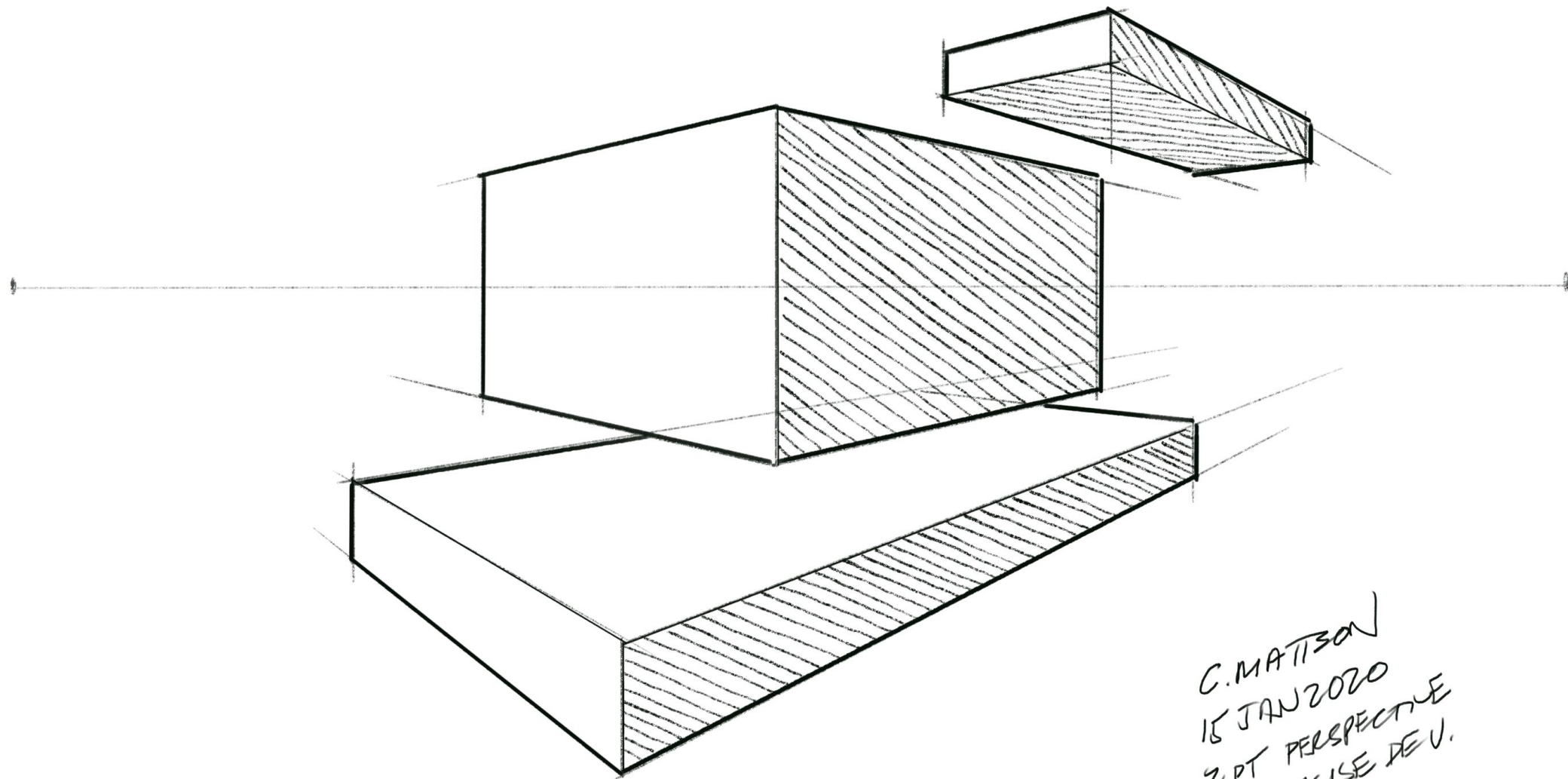
C. MATISON
15 JAN 2020
2 PT PERSPECTIVE
EXERCISE DE V.



C. MATISON
15 JAN 2020
2 PT PERSPECTIVE
EXERCISE DE V.

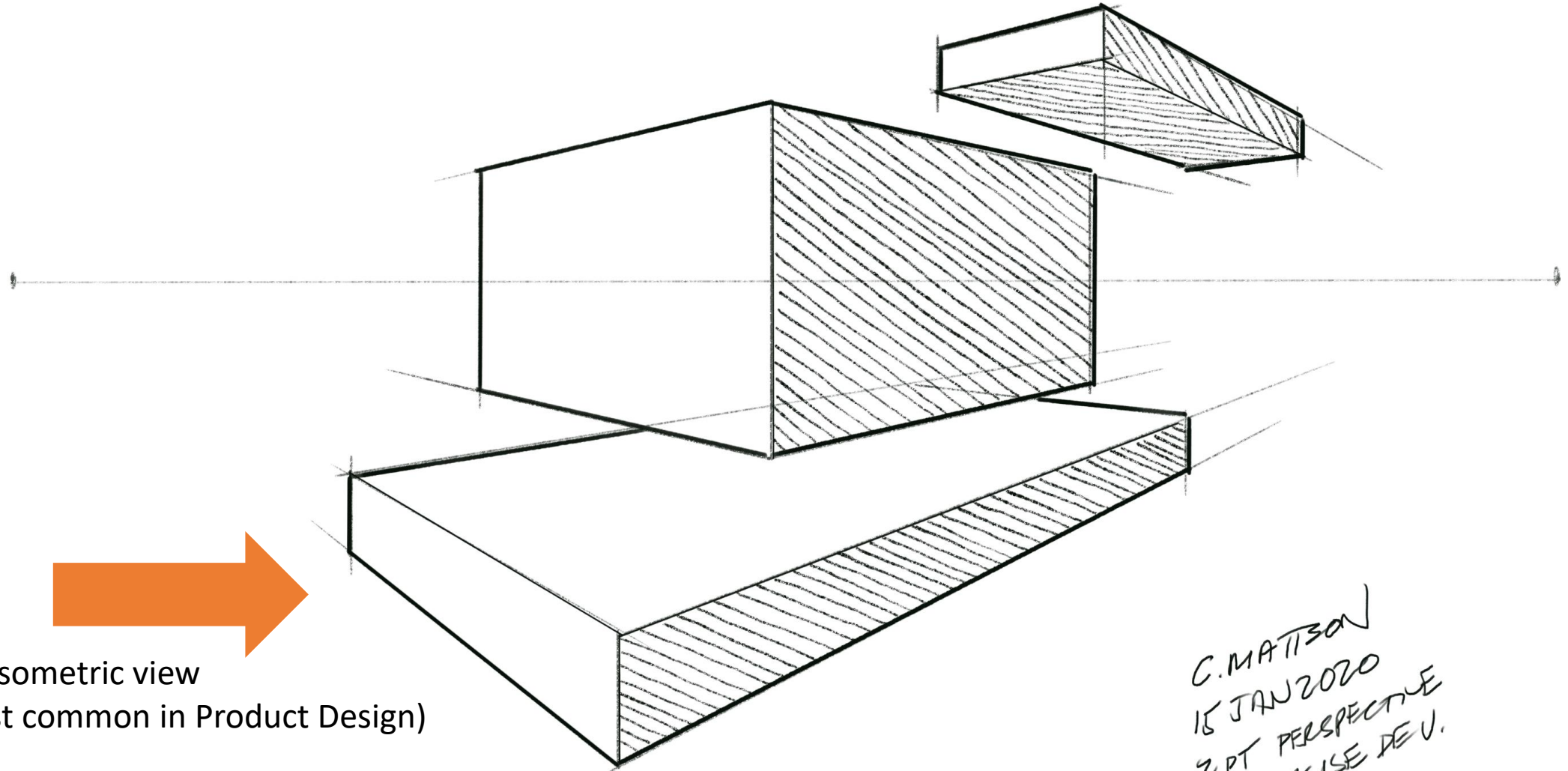
Sketch FULL of cuboids like this, above, below and at the horizon. 8-minutes in total





C. MATISON
15 JAN 2020
2 PT PERSPECTIVE
EXERCISE DE U.

Sketch FULL of cuboids like this, above, below and at the horizon. 8-minutes in total



3/4 Isometric view
(most common in Product Design)

C. MATISON
15 JAN 2020
2 PT PERSPECTIVE
EXERCISE DE U.

Designette

A short, focused design challenge

Designette (15 minutes)

Subject: Milwaukee Fastback Knife

Purpose: To integrate observational insights with principled design critique

Tasks:

1. With a new partner. Take out your observations, redesign, and justification.
2. Spend **4 minutes** presenting your observation and redesign to your partner.
3. Partner spends **4 minutes** critiquing the work based on **Rams' Principles**.
 - Which of Rams' principles does the proposed change support or neglect?
 - Is the observation specific and the improvement idea clearly justified?
 - Could the idea be reframed to better serve long-term value, honesty, or usability?
4. Flip roles and repeat steps 2–3.

Rams' Principles

"Less but Better"

1. *Good design is innovative*
2. *Good design makes a product useful*
3. *Good design is aesthetic*
4. *Good design makes a product understandable*
5. Good design is honest
6. Good design is unobtrusive
7. Good design is long-lasting
8. Good design is thorough down to the last detail
9. Good design is environmentally friendly
10. Good design is as little design as possible

Closing

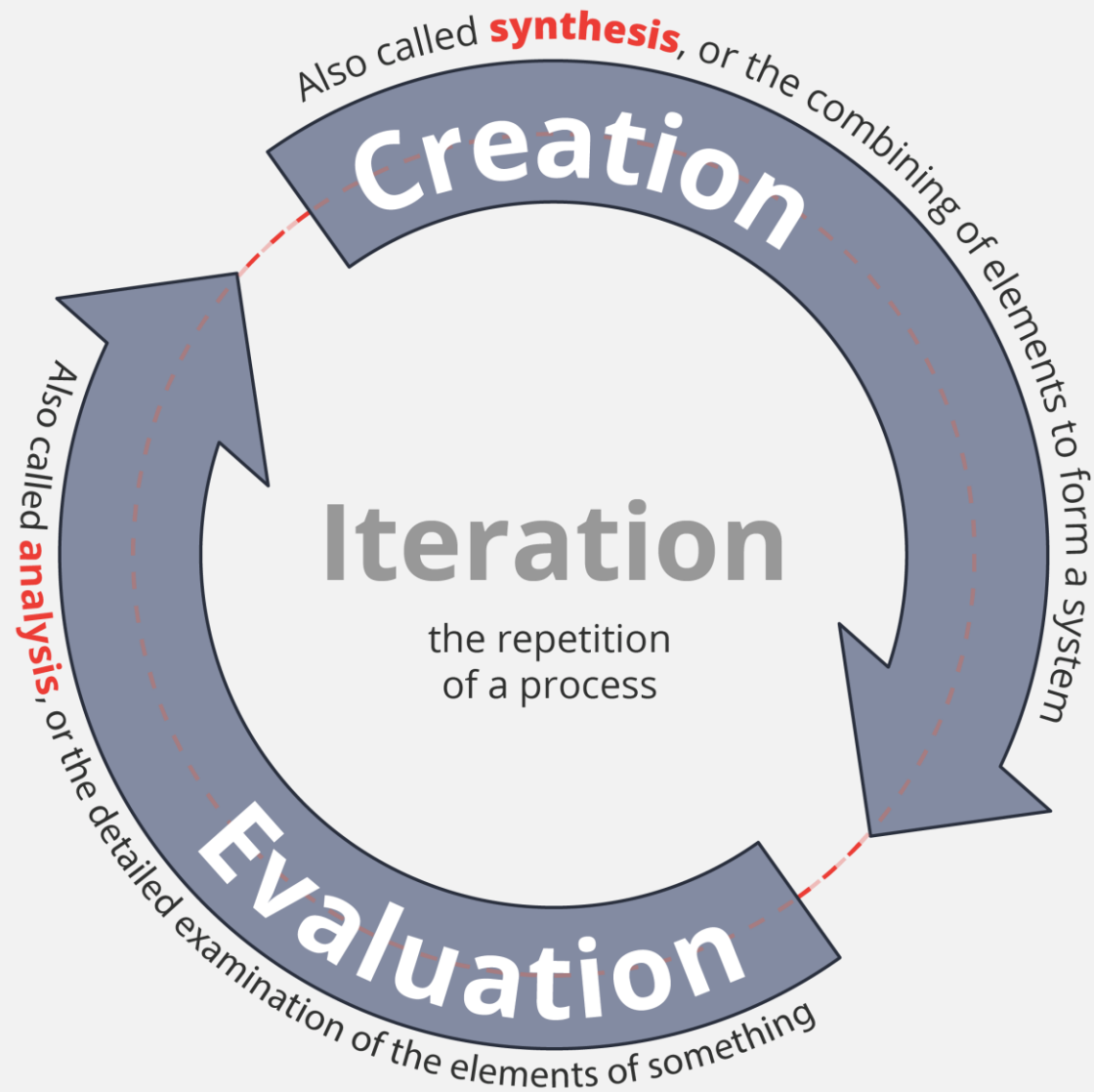
What is the **Role of the
Product / Engineering
Designer?**

The Role of the Product / Engineering Designer

The product or engineering designer sits at the intersection of human need and technical possibility.

Their primary role is to identify opportunities, generate concepts, and develop solutions that are both desirable to people and feasible within engineering and manufacturing constraints.

This requires balancing creativity with responsibility.



Understanding needs: Engaging with users, stakeholders, and markets to uncover unmet needs and translate them into design requirements.

Creating concepts: Generating and refining ideas that address those needs, applying design thinking and engineering principles.

Engineering feasibility: Ensuring that concepts can be realized through sound mechanics, materials, and processes while meeting safety and reliability standards.

Decision-making: Weighing tradeoffs in performance, cost, manufacturability, sustainability, and usability.

Iterating and validating: Using prototypes, simulations, and tests to refine solutions and build confidence in the design.

Communicating: Clearly presenting ideas through sketches, CAD, prototypes, and documentation so teams and stakeholders can align.

In short, the role of the product/engineering designer is to act as a responsible creator: not just producing artifacts, but stewarding ideas into real products that serve people, perform reliably, and contribute positively to society.

What to do now

- Use the Study Guide
- Work on the Project
- Submit the Opportunity Framing Page
Saturday Night
- **Monday open the study guide and
simply do the work**



	Su	M	T	W	Th	F	S	
Week 0								Design Philosophy & Engineering Design Essentials
Week 1					L			
Week 2			L	D	L			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