L&T Expo Hong Kong 2024 - Innovation Classroom

From Farm to Fridge

Tackling (Milk's) Environmental Challenges through a Lifecycle Game

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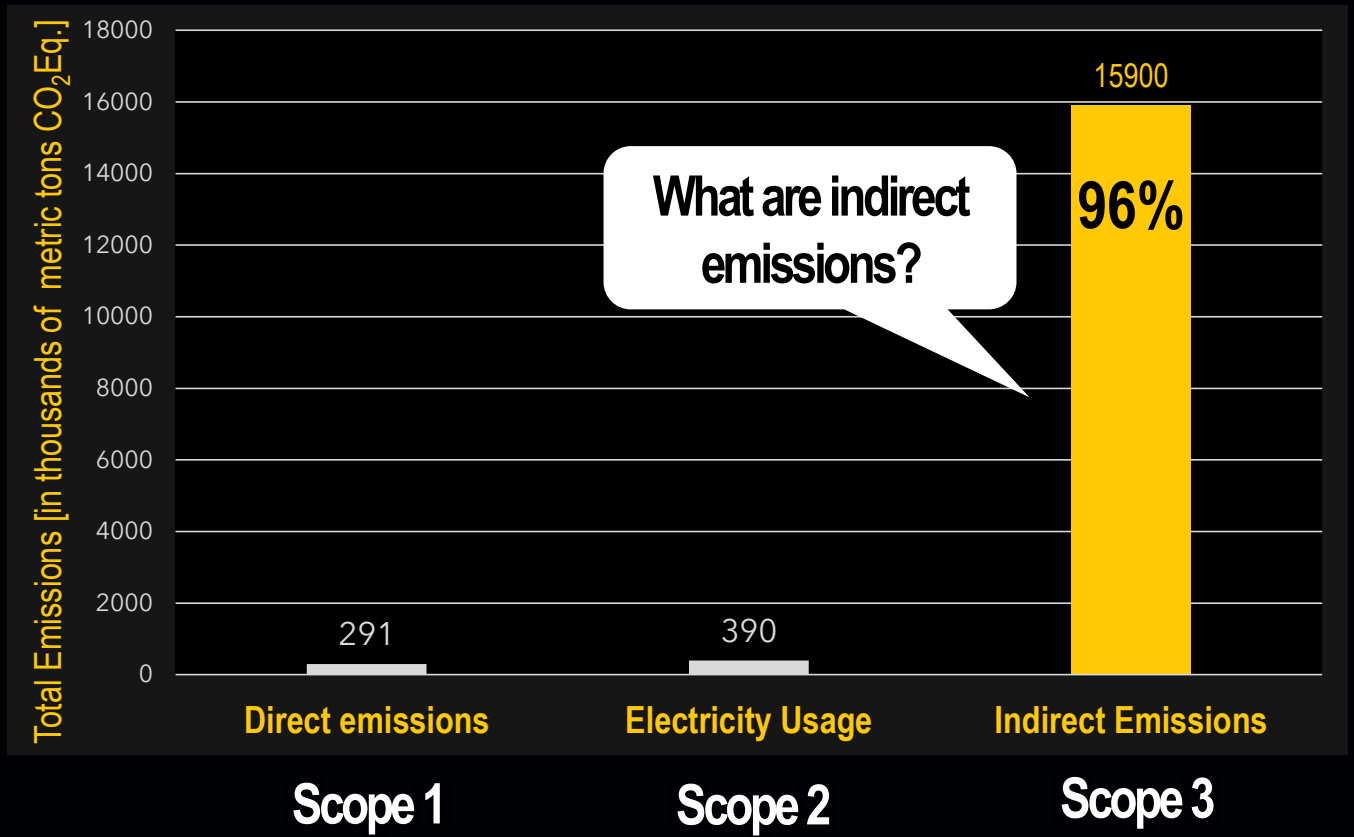
SUSTAINABILITY EDUCATION

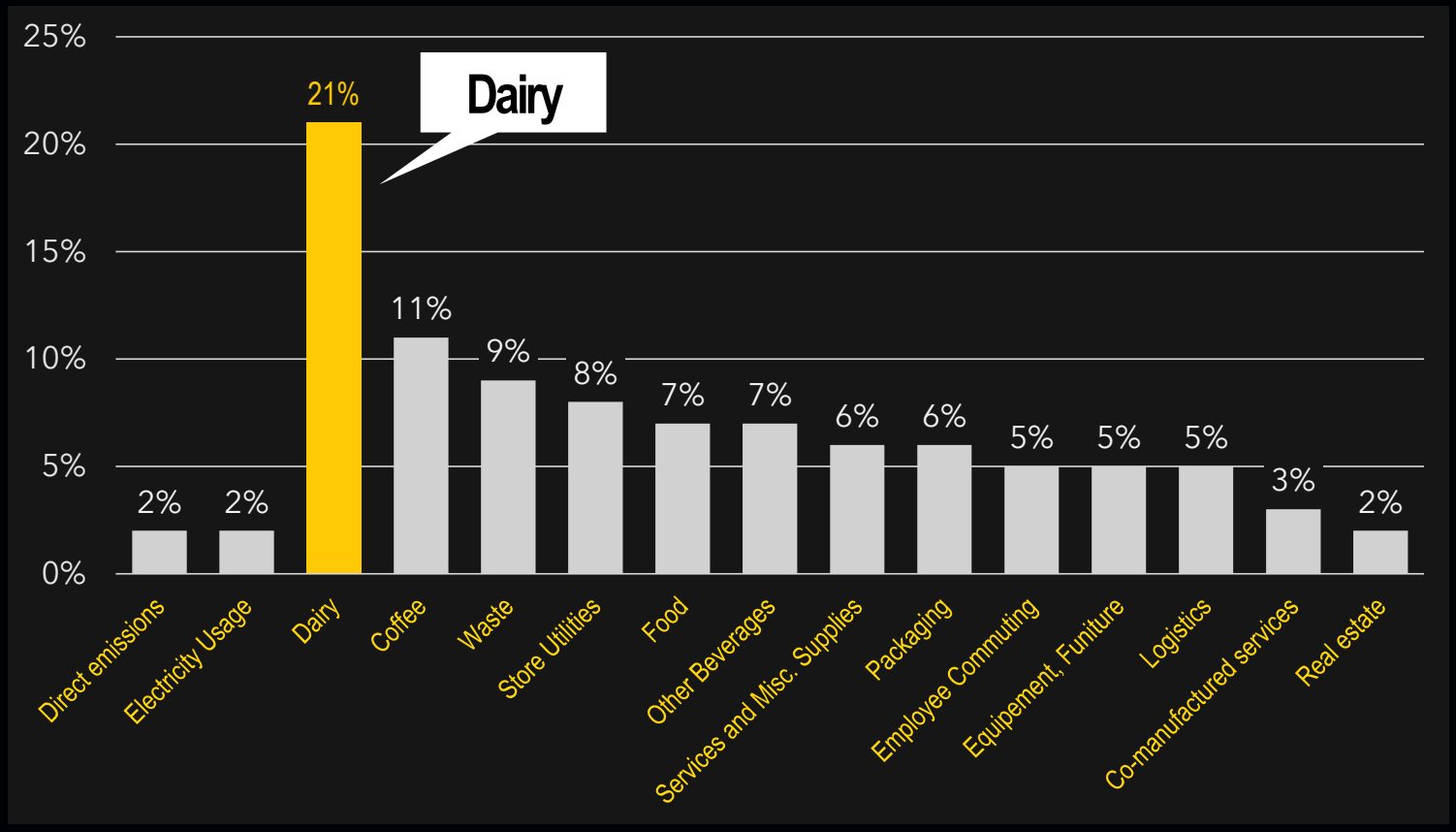
COMPANIES' CONTRIBUTION to climate change

Climate Strategy

The graph on the right shows typical scope 1-3 emissions of Starbucks (FY 2017)



COMPANIES' CONTRIBUTION to climate change



TM

Most of the greenhouse gas emissions come from milk and other dairy products.


MILK CO.
| The Life Cycle Challenge |
SQUEEZE THE LAST DROP
Processing & Packaging
Raw Material

Phase I

Game Tutorial

PHASE I

Centre Area Set Up

PHASE I

Player Area Set Up

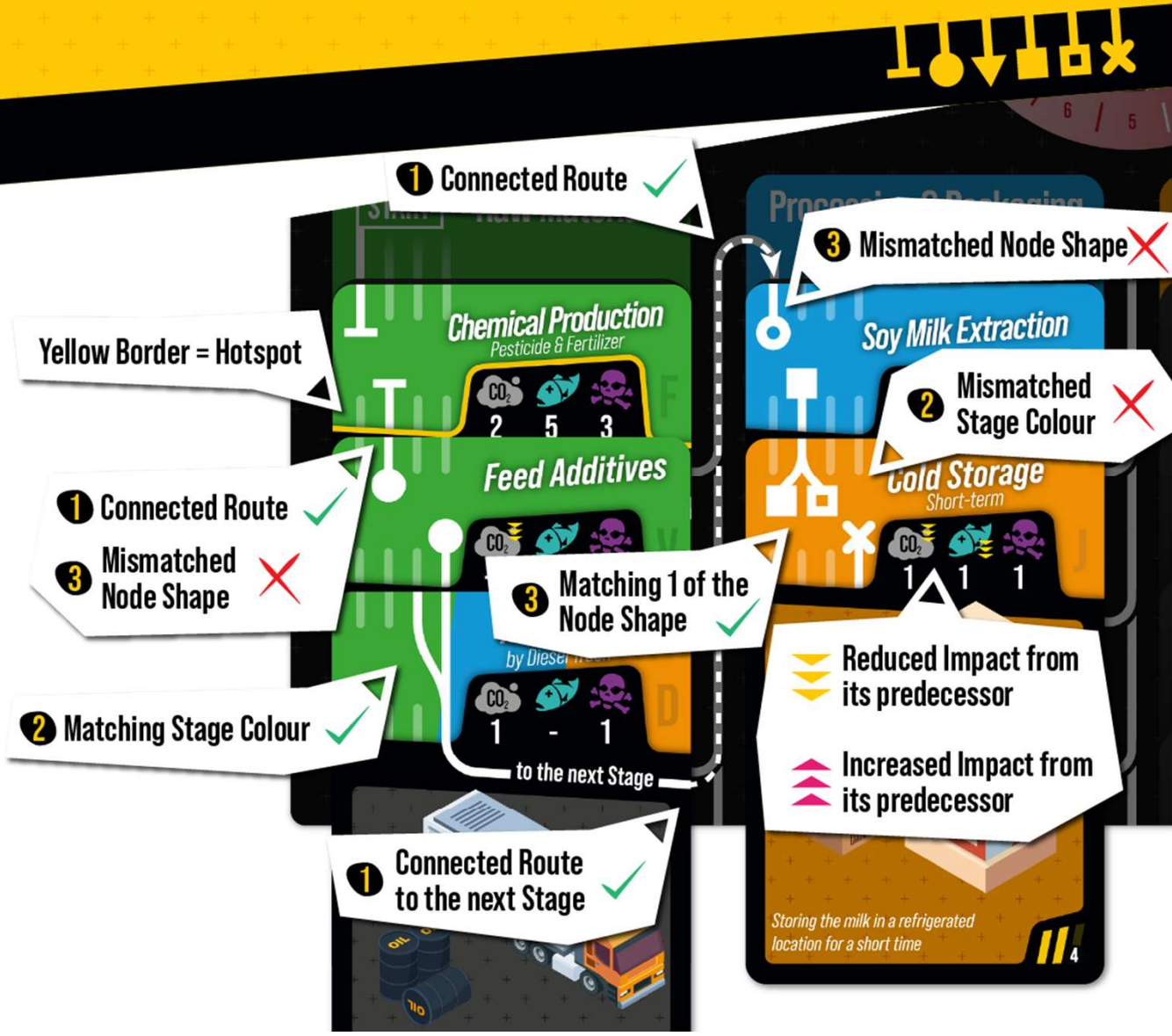
11 Lv1 Processes that match the Player's Colour

Player's Colour

PHASE I

3 Rules to build Life Cycle

1. Connecting Routes
2. Matching Stage Colour
3. Matching Shape of End Nodes



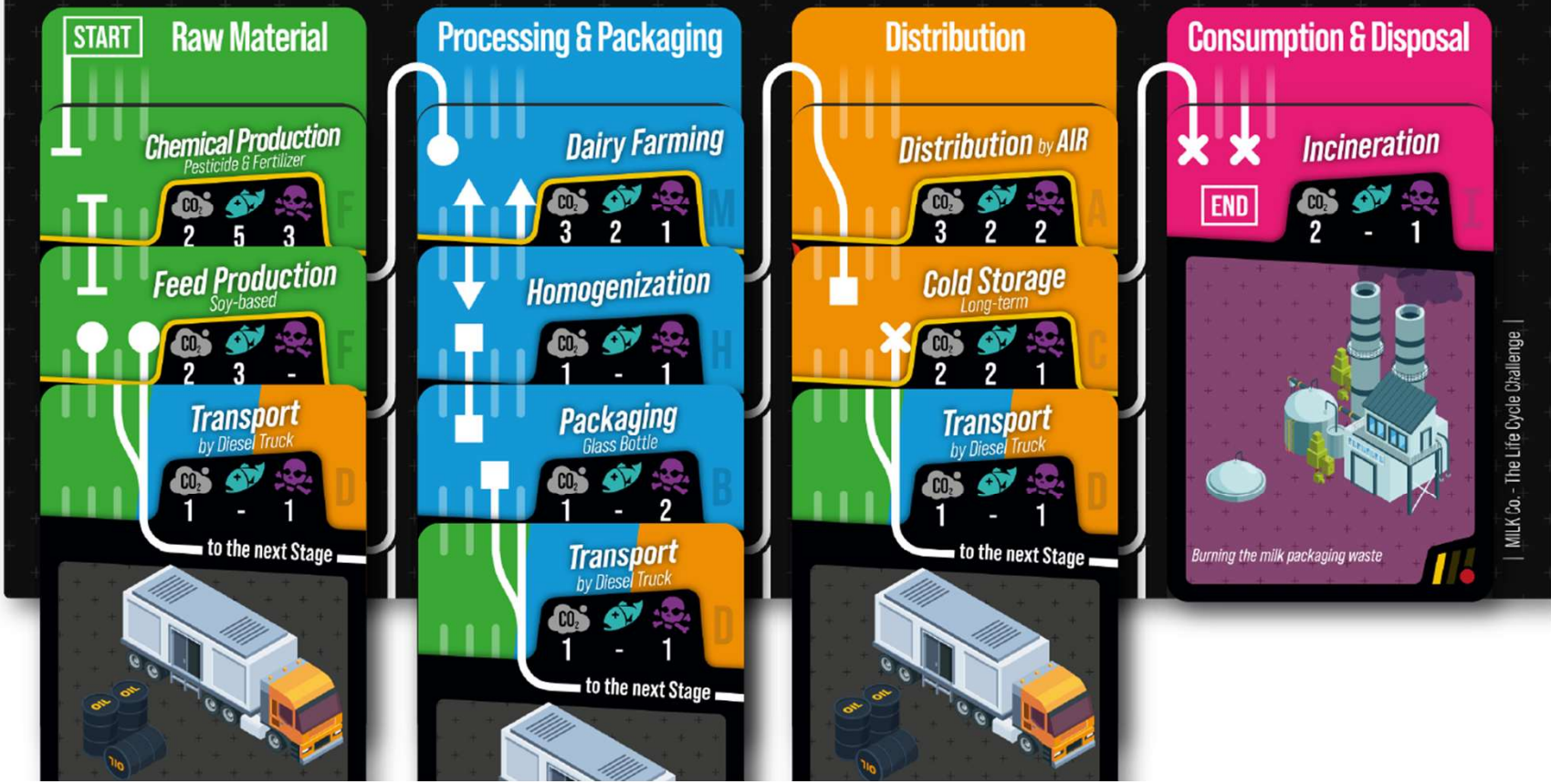
Phase I

- The 1st Player gains 1 Reputation -

PHASE I

The Complete Life Cycle

*At the end of your turn, discard to no more than **3** **Processes** in **Hand**, then shift and flip over new **Processes** on the **Timeline**.*



LIFE CYCLE STAGES

Any product goes through some or all LC stages

Raw material Production

Ingredient Manufacturing & Processing

Production

Packaging & Distribution

Disposal (End of Life)

Disposal (End of Life)

Use

Retail

LIFE CYCLE PROCESSES

Processes in each LC stage can differ between products

Raw material Production

Processes: e.g., Farming, Oil extraction, …

Ingredient Manufacturing & Processing

Production

e.g., Food Processing, Chemical Processing, …

Packaging & Distribution

Disposal (End of Life)

e.g., Landfill, Recycling, …

Disposal (End of Life)

e.g., Wastewater Treatment

Use

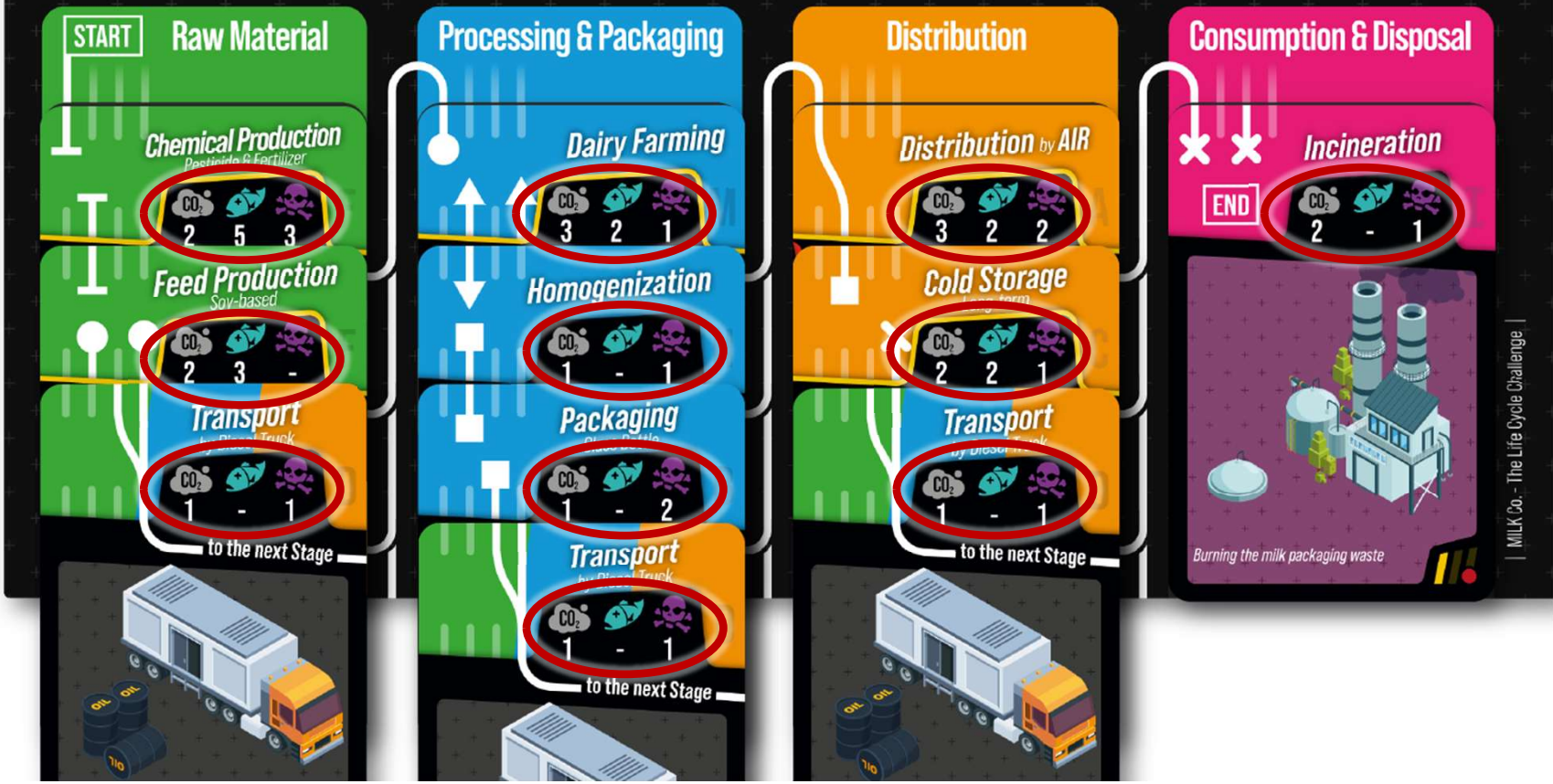
e.g., Eating & Drinking, Doing laundry, …

Retail

ENVIRONMENTAL IMPACTS...

...happen in every single life cycle stage

*At the end of your turn, discard to no more than **3** **Processes** in **Hand**, then shift and flip over new **Processes** on the **Timeline**.*



PHASE I

Scoring: Add up the Impacts of each Category

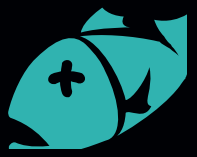
ENVIRONMENTAL IMPACTS

3 Categories

ENVIRONMENTAL IMPACTS

3 Categories

Climate Change

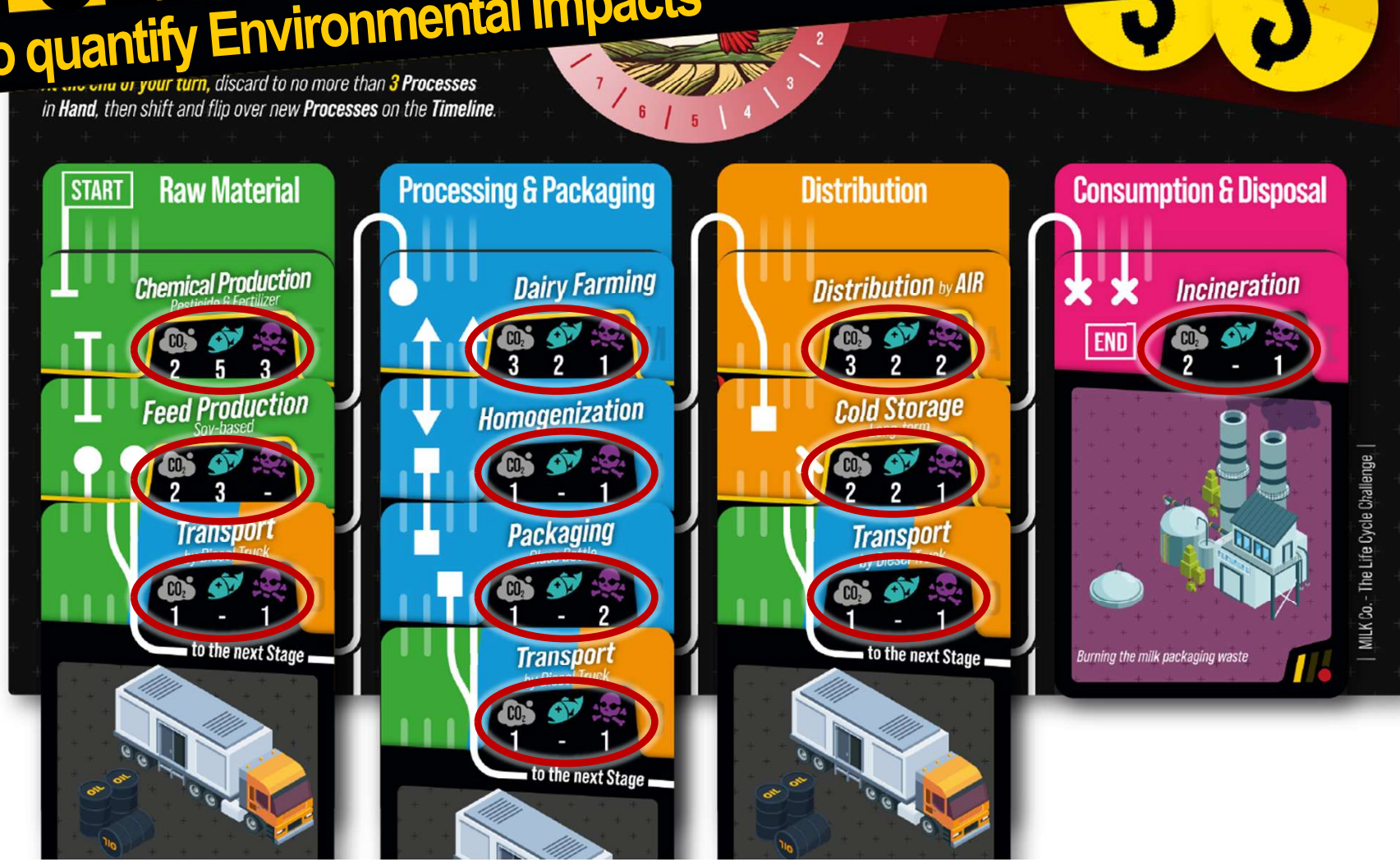


Eutrophication

Toxicity

LIFE CYCLE ASSESSMENT

Standard Tool to quantify Environmental Impacts



Life Cycle Assessment helps to systematically quantify a product's total

- **resource use** &
- **emissions** (waste) to the environment.

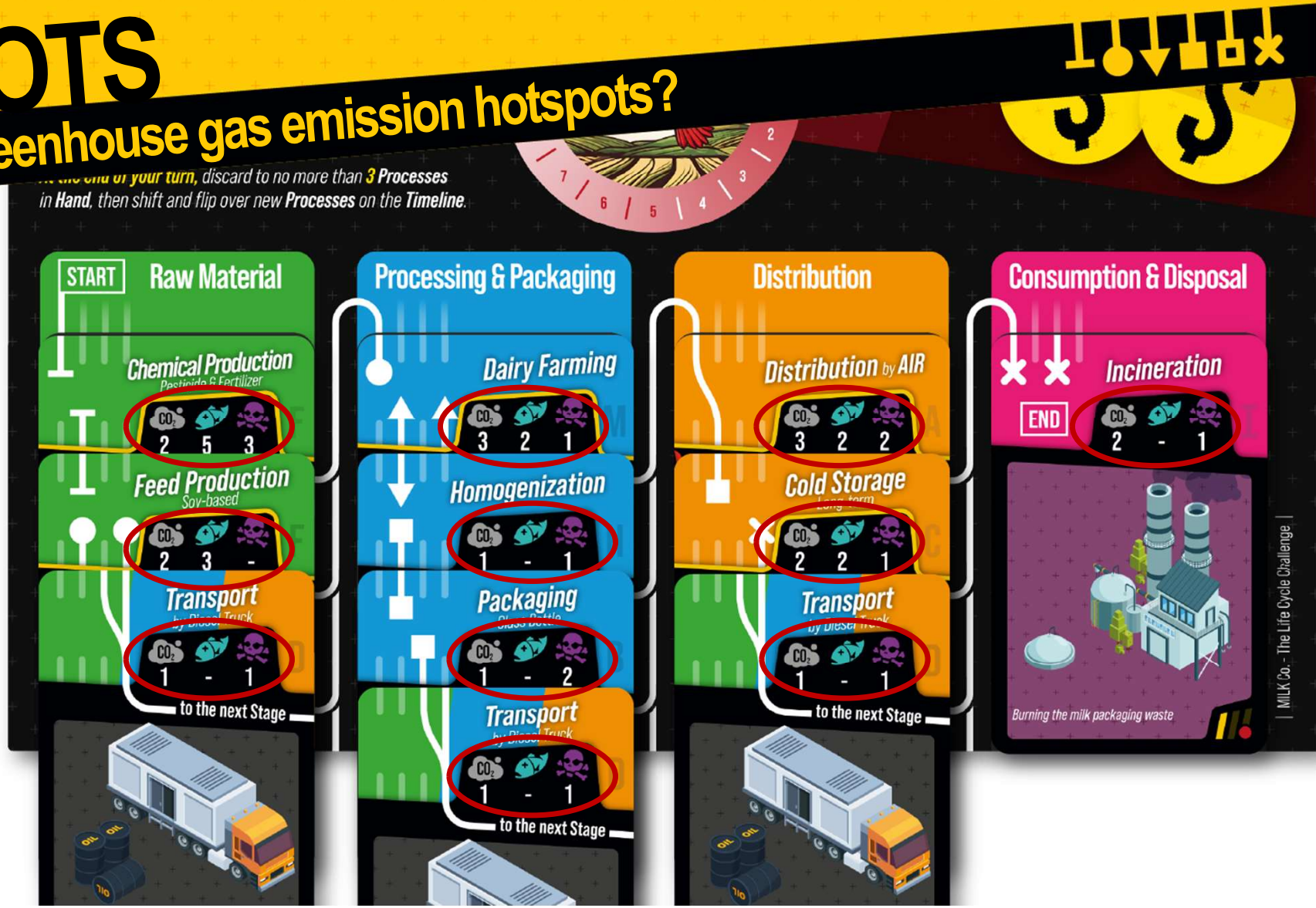
CO2 Carbon footprint

HOTSPOTS

What are the greenhouse gas emission hotspots?

HOT SPOT

An activity or process within a product's life cycle that has the largest environmental impacts



Phase II

Playthrough demonstration

GAMEPLAY DEMO

ROUND 1

Turn Start

Action #1 Fundraise

Action #2 Sell Off

Turn Start

Action #1 Fundraise

Action #2 Sell Off

Action #3 R&D

Turn Start

Action #1 Fundraise

Action #2 Sell Off

Action #3 R&D

Build Life Cycle

Turn Start

Action #1 Fundraise

Action #2 Sell Off

Action #3 R&D

Build Life Cycle

Turn End

continue...

ROUND 2

Turn Start

Action #1 R&D

Action #2 Sell Off

Turn Start

Action #1 R&D

Action #2 Sell Off

Action #3 R&D

Turn Start

Action #1 R&D

Action #2 Sell Off

Action #3 R&D

Build Life Cycle

Turn Start

Action #1 R&D

Action #2 Sell Off

Action #3 R&D

Build Life Cycle

Turn End

GAME END

End Condition & Final Scoring

Turn End

If the Future Deck is empty, the game ends immediately.

Final Scoring: Player with the least Impact per track gains 1 Victory Point.

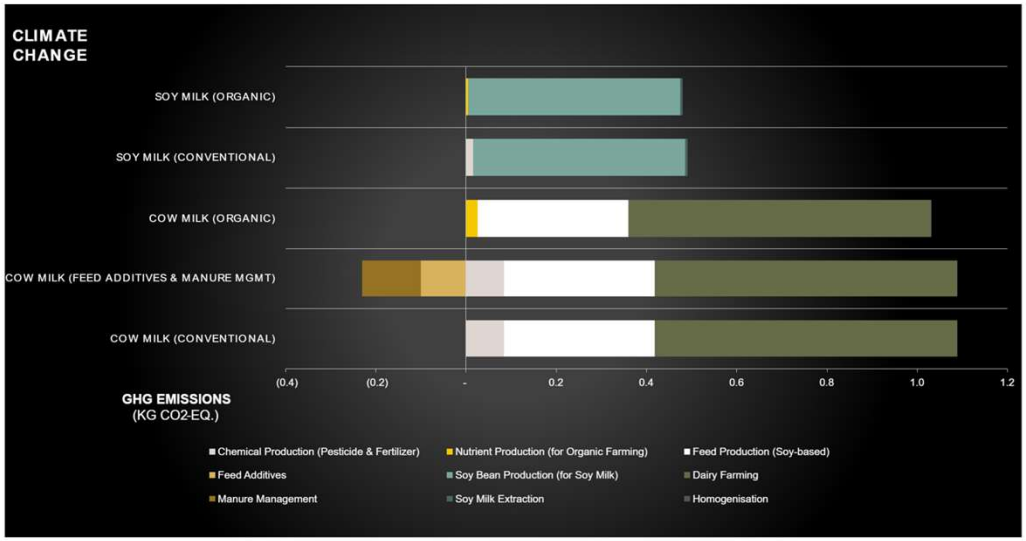
Every player adds up the 3 types of Impacts of their Life Cycle and compare.

Phase III

Overview

PHASE III

- Conversion of Game outcomes into actual data
- student groups explore effectiveness of strategies to reduce environmental impacts and pitch their strategies



Category	Process	ID	GHG Emissions (kg CO_2-eq.)	Eutrophication (kg PO_4-eq.)	Toxicity (kg 1,4 DCB-eq.)
Fetilizer Production	Chemical Production (Pesticide & Fertilizer)	F	-	-	-
Fetilizer Production	Nutrient Production (for Organic Farming)	O	0.027	0.000	-
Farming	Feed Production (Soy-based)	P	0.334	0.334	0.334
Farming	Feed Additives	V	-	-	-
Farming	Soy Bean Production (for Soy Milk)	Y	-	-	-
Short distance transport	Transport (by Diesel Truck)	D	0.013	0.000	0.106
Short distance transport	Transport (by Gas Truck)	G	-	-	-
Short distance transport	Transport (by EV Truck (RE))	E	-	-	-
Milk Production & Processi	Dairy Farming	M	0.670	0.003	0.001
Milk Production & Processi	Manure Management	Q	-	-	-
Milk Production & Processi	Homogenisation	H	0.001	0.000	0.002
Milk Production & Processi	UHT Processing	U	-	-	-
Packaging	Packaging (Glass Bottle)	B	0.405	-	0.017
Packaging	Packaging (Beverage Carton)	K	-	-	-
Short distance transport	Transport (by Diesel Truck)	D	0.013	0.000	0.106
Short distance transport	Transport (by Gas Truck)	G	-	-	-
Short distance transport	Transport (by EV Truck (RE))	E	-	-	-
Long distance transport	Distribution (by AIR)	A	7.610	0.000	60.000
Long distance transport	Distribution (by SEA)	S	-	-	-
Long distance transport	Distribution (by TRAIN)	T	-	-	-
Long distance transport	Local Distribution	L	-	-	-
Storage and Cooling	Cold Storage (Long-term)	C	0.340	0.000	-
Storage and Cooling	Cold Storage (Short-term)	J	-	-	-
Storage and Cooling	General storage (no cooling)	Z	-	-	-
Short distance transport	Transport (by Diesel Truck)	D	0.013	0.000	0.106
Short distance transport	Transport (by Gas Truck)	G	-	-	-
Short distance transport	Transport (by EV Truck (RE))	E	-	-	-
Packaging End of Life	Incineration	I	0.449	(0.000)	(0.330)
Packaging End of Life	Landfill (with Energy Recovery)	N	-	-	-
Packaging End of Life	Landfill (without Energy Recovery)	R	-	-	-
Packaging End of Life	Recycling	W	-	-	-


REFLECTION

REFLECTION

Gameplay Classroom Observations – University Context

Opportunities/ Advantages

- Game concept applicable to a wide range of subjects and settings (engineering, green finance, circular economy)
- Game design in phases
  - allows for flexible use (workshops, regular classes, 45min – 3 hours)
  - good mix of gaming and debriefing (after phase 1, after phase 2)
- Strong class engagement and interest (70% of students found the game fascinating, n=56)
- Sparks interest beyond class (80% of students found the game content useful, 50% wanted to learn more about the topic, n=56)

Challenges

- Resource intensive (man-power, training facilitators/colleagues, maintaining games)

REFLECTION

Gameplay Classroom Observations – University Context

Target Audience	Effectiveness	Challenges	Ways to address
High School Students	• Offers variety in learning tools for different learners in class • Use with 15+ years for richer discussions • Applicable in illustrating concepts in General Science/ Geography/ Biology/Chemistry subjects	• Provide suitable context	• Spend time building up 'story'
		• Ensure achievement of student learning outcomes	• Prepare guiding questions for small group discussions • Design worksheets with Q&A to highlight terminology and basic concepts
		• Big class size	• Run game with additional facilitators
Adults	• Fun and educational team bonding activity • Relevant for discussing product design, supply chain and stakeholder engagement issues	• Less familiar with play or cannot remember all rules	• Demonstrate player actions • Allow paired work

REFLECTION

Game Design Process

- Design learning first, then mechanics
  - Fewer but clearer key learnings
    - Embed more simple messages
      - Learnings align with player's intrinsic behaviours
        - Curate "Learning from Failures"
          - Respect & Leverage on existing Game Standards
            - Minimize Rules, then Maximize Options
              - Design "Onboarding Experience"
                - A "Good Serious Game" must be a "Good Game" first

REFLECTION

Workshop Facilitation

- "Primary Rules" over "Secondary Rules"
  - "Demonstration" over "Description"
    - "Actions" over "Strategies"
      - "Game first, Learn later" over "Game and Learn together"
        - "Rationale" over "Outcome"
          - Learn through Addressing the Limits
            - Game the "game"

Q&A

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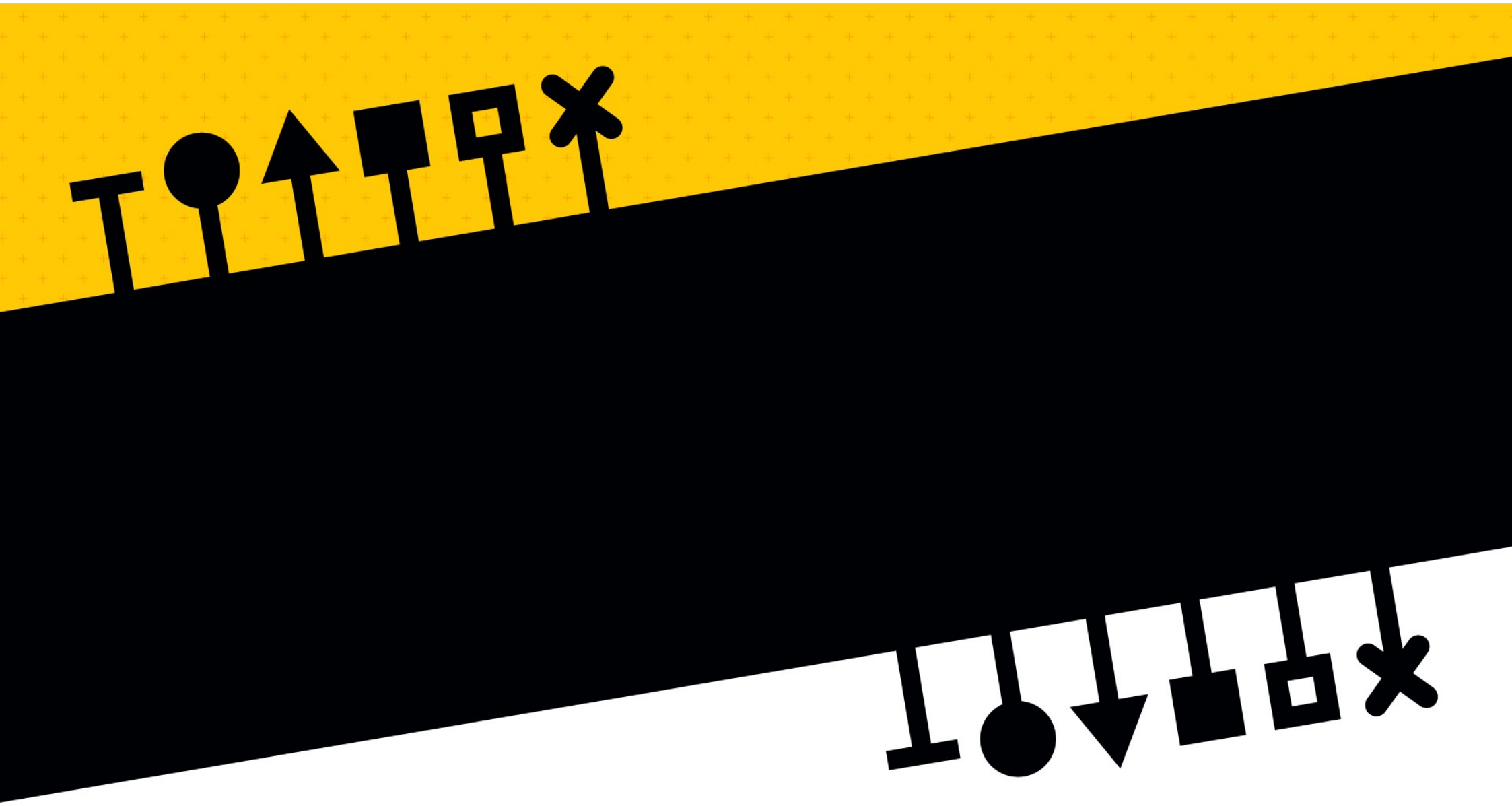

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