

# **URB401: Systems Approaches for Urban Transitions**

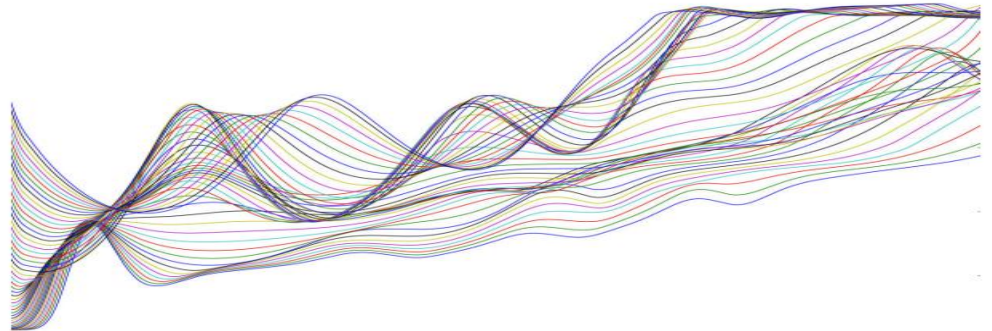
**System dynamics**  
Simón Ladino Cano  
Hanbit Lee



# Learning objectives

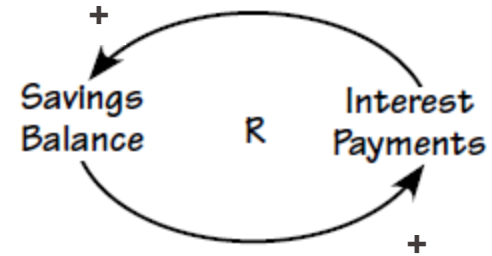
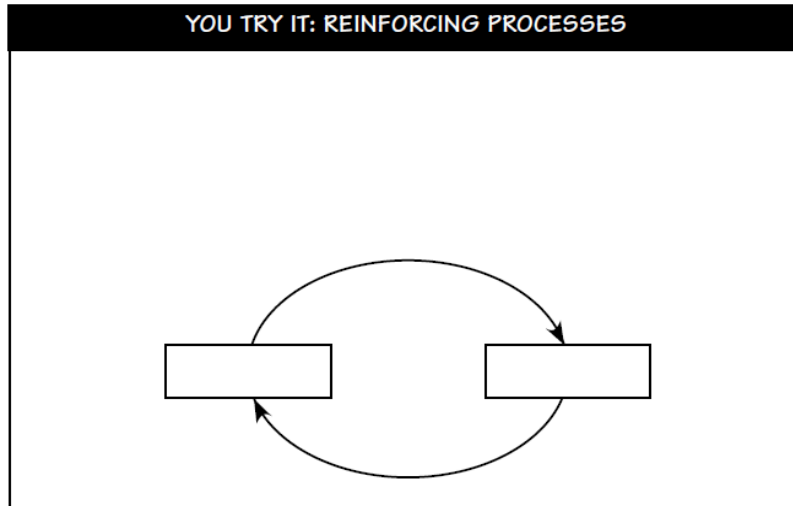
- Introduce **system dynamics** as an approach to studying complex urban systems and sustainability transitions.
- Learn how **causal loop diagrams (CLDs)** help visualize feedback loops, interactions, and unintended consequences.
- Support your project work by applying CLDs to **analyze dynamic causal relationships** in your city (Step 4).

- Urban sustainability is a complex, requiring solutions that account for **dynamic interactions** between social, economic, and environmental factors.
- System dynamics helps us understand how variables influence each other over time and how **feedback loops** shape system behavior.
- It is key to identifying **unintended consequences** and **leverage points** for change.

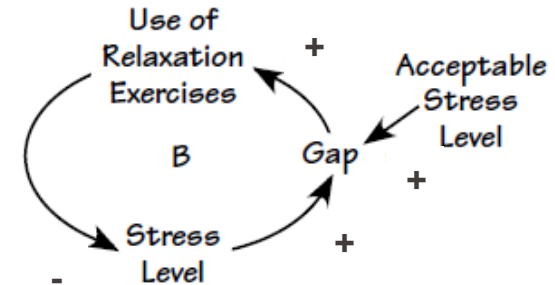
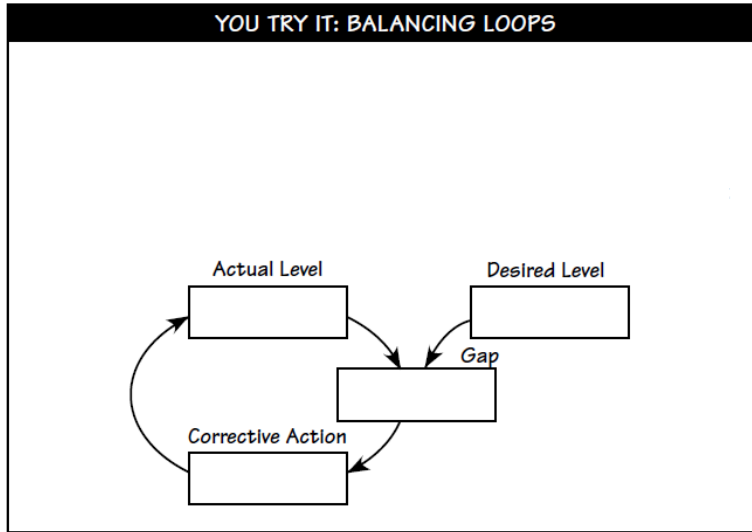




# The building blocks of system behavior



# The building blocks of system behavior

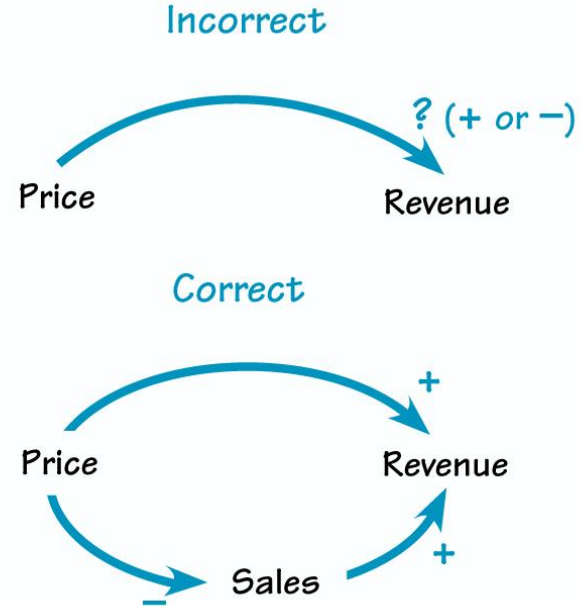


# How to fine-tune your CLD?

## Avoid ambiguity in labeling causal links

To be effective, your CLD should not include any ambiguous causal links. Ambiguous polarities usually mean there are multiple causal pathways that you should show separately.

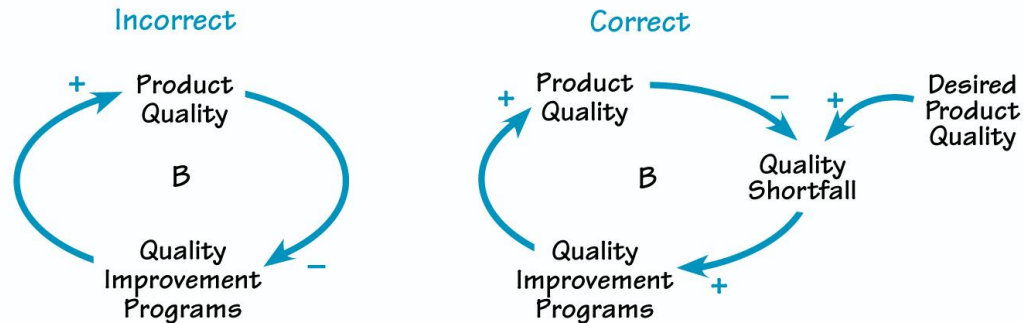
- ✓ This is crucial for determining whether a loop is reinforcing or balancing.



# How to fine-tune your CLD?

## Make the goals of balancing loops explicit

Making goals explicit in balancing loops encourages people to ask questions about how the goals are formed. For example, what drives a company's desired level of quality?

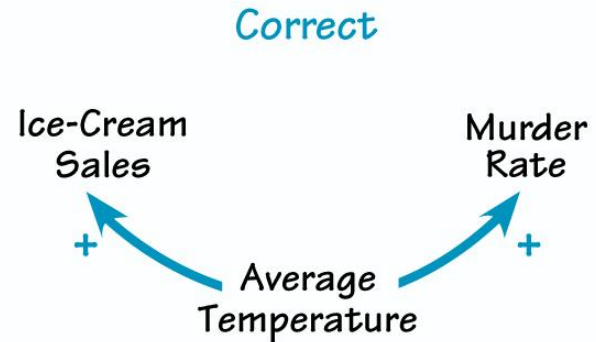
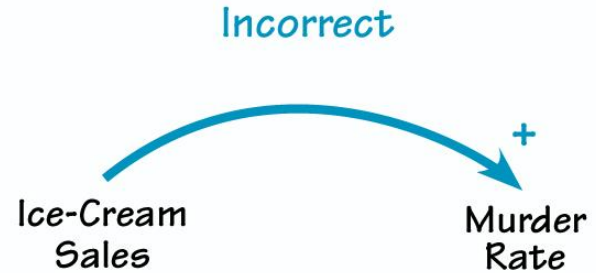


# How to fine-tune your CLD?

## Represent causation rather than correlation

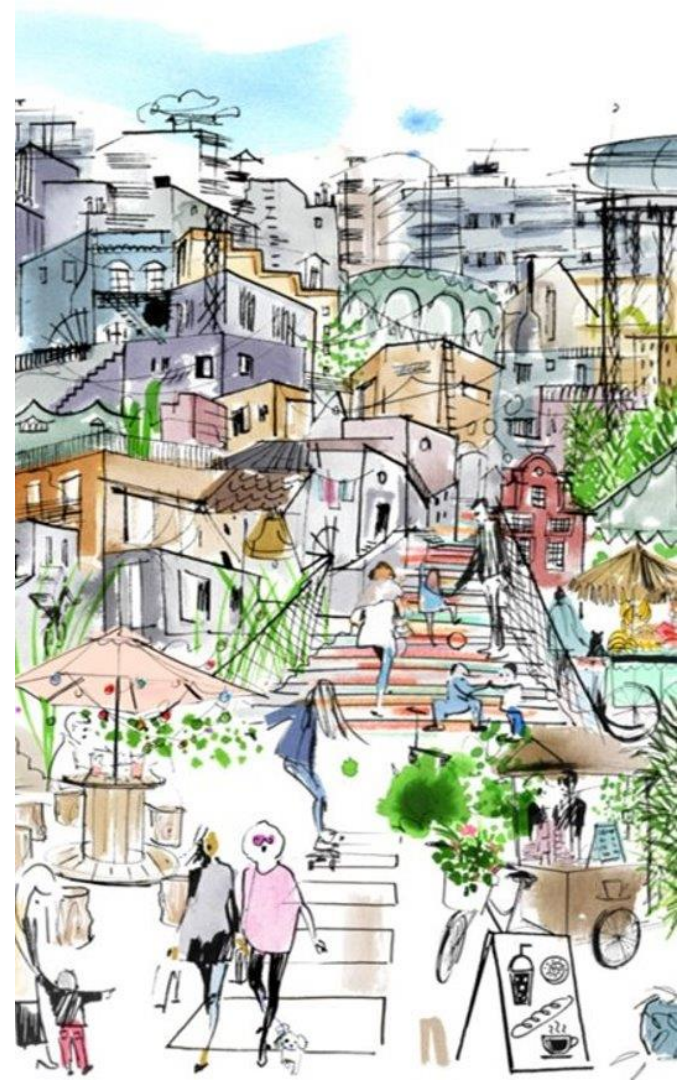
CLDs must include only what you believe to be genuine causal relationships, never correlations, no matter how strong.

- × Correlation analysis might *suggest* causal links and is a good starting point for a CLD but it is **not** enough to determine causality.
- ✓ Use scientific literature and qualitative data to validate your causal claims.



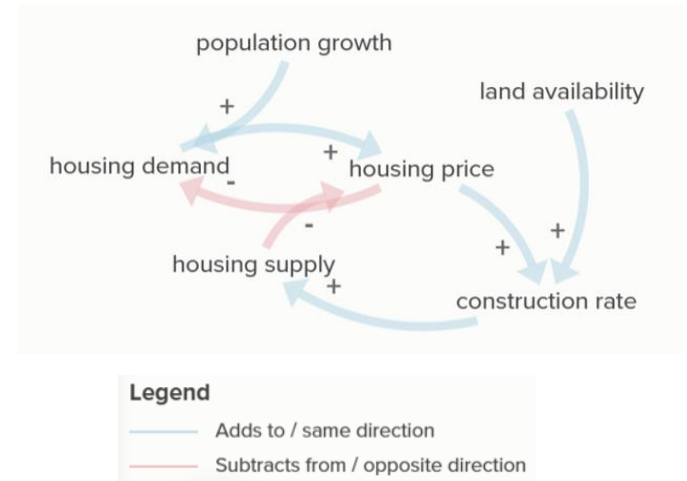
# City Lab: Part I

- In your group, use your collective knowledge to list 5-8 key variables relevant to a pressing societal issue in modern cities (**housing supply**).
- Discuss how these variables influence one another and whether each causal relationship is reinforcing (R) or balancing (B).
- Create a [Kumu](#) account and build a first version of your CLD that visualizes these interactions.
- Keep it simple and focused; aim to capture the core structure of the system, not every detail.
- **What feedback loops emerge? What does the structure reveal about system behavior?**



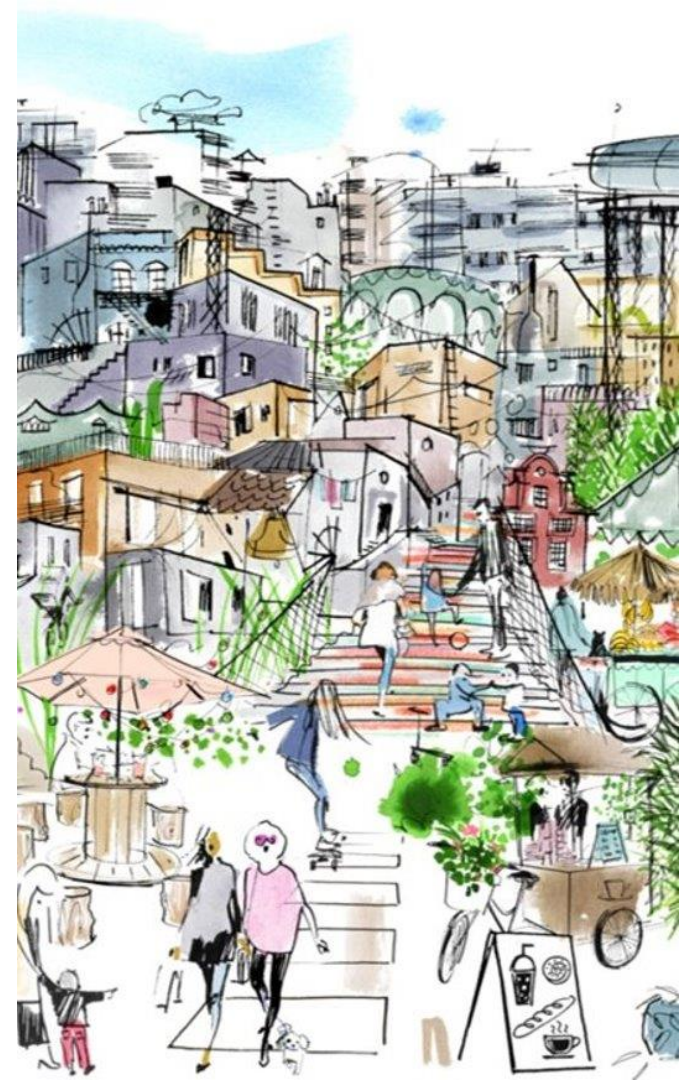
# City Lab: Part I

- In your group, use your collective knowledge to list 5-8 key variables relevant to a pressing societal issue in modern cities (**housing supply**).
- Discuss how these variables influence one another and whether each causal relationship is reinforcing (R) or balancing (B).
- Create a [Kumu](#) account and build a first version of your CLD that visualizes these interactions.
- Keep it simple and focused; aim to capture the core structure of the system, not every detail.
- **What feedback loops emerge? What does the structure reveal about system behavior?**



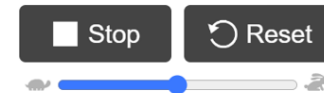
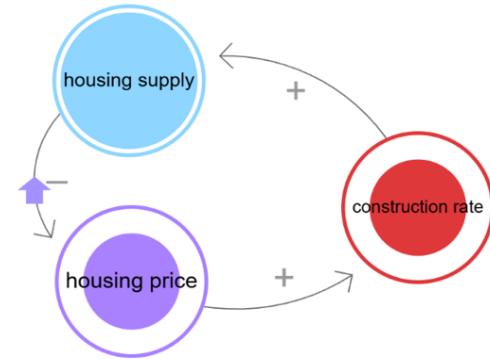
# City Lab: Part II

- Select one important feedback loop from your CLD that illustrates the core dynamic of your chosen problem.
- Recreate this loop using [Loopy](#) to simulate how variables interact over time.
- Experiment: Change one or two variables simulating the expected effect of an intervention and observe how the system's behavior shifts.
- Focus on telling a concise story: **What system behavior does this loop capture? Why is it important for understanding the problem? What does this reveal about potential leverage points for intervention?**
- Prepare to briefly present your CLD and the chosen loop, explaining the problem it depicts and the key insights from your mapping.



# City Lab: Part II

- Select one important feedback loop from your CLD that illustrates the core dynamic of your chosen problem.
- Recreate this loop using [Loopy](#) to simulate how variables interact over time.
- Experiment: Change one or two variables simulating the expected effect of an intervention and observe how the system's behavior shifts.
- Focus on telling a concise story: **What system behavior does this loop capture? Why is it important for understanding the problem? What does this reveal about potential leverage points for intervention?**
- Prepare to briefly present your CLD and the chosen loop, explaining the problem it depicts and the key insights from your mapping.





## Contact

[simon.ladinocano@epfl.ch](mailto:simon.ladinocano@epfl.ch)

[hanbit.lee@epfl.ch](mailto:hanbit.lee@epfl.ch)