CCA, IxD, MDes, Systems, 2024, Spring
Syllabus
http://www.dubberly.com/courses/systems_2024_spring/
(This is a draft; some assignments may change.)

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more info: http://systems.dubberly.com/

Weekly Schedule

1	T	01/16	Introduction Models
2	T	01/23	Levels of systems NUUMI
3	T	01/30	Communication Counting Systems
4	T	02/06	Information Communications Systems
5	T	02/13	Variation + evolution Application Data Model
6	T	02/20	Systems dynamics Templates: Poetic Forms / Structured Documents
7	T	02/27	Open-loop (transform function) Design Systems: Grid Systems + CMS
8	T	03/05	Control Information Structures: Interactive Models
9	T	03/12	Interaction Dynamic Systems: Modeling Stocks and Flows
	T	03/19	Spring Break (03/18-03/24)
10	T	03/26	Learning Automatic Control Systems: Modeling Feedback
11	T	04/02	Digital Twins User Conceptual Models: Home Thermostat
12	T	04/09	Intelligent Agents Final Project: Current State Model
13	T	04/16	Final Project: Proposed Future State Model
14	T	04/23	Final Project: Prototype of Future State
15	T	04/30	Final Project: Summary Presentation (last class meeting)
	T	05/07	Revisions + web site due (no class meeting)
	F	05/12	Grades due

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Description

This studio course introduces grad students to the basic language and frameworks of systems, in the context of interaction design. Please see the vocabulary below.

Objectives

Students will learn to
- Understand systems—recognize common system structures and use them to model a specific situation
- Represent systems—build models of systems and use the models to inform design of interfaces, services, and platforms
- Design systems—use common system structures to identify breakdowns, diagnose problems, and generate improvements

Requirements

Attendance is required for all class meetings. Students must construct a web site for their work, and they must post assignments before each class. Being late to class or late posting work will affect grades.

Grading

Weekly assignments will be graded plus/check/minus.
Assignments receiving a minus must be revised.
The overall course grade will be calculated as follows:
- In-class participation counts for 20%.
- Weekly assignments together count for a total of 20%; final web site with all assignments counts for 20%.
- Preparatory sketches for final project count for 20%; final project counts for 20%.

In-class participation is affected by contributing to discussion and critiques; missed readings and lack of preparation are self-evident. Participation will be summed and can shift the overall grade by one letter. No incomplete will be given except in extenuating and unforeseen circumstances, and you must have already completed a substantial portion of the course, with passing grades. Grade scale:
A = Outstanding achievement, A– = Less so
B = Good achievement, B+ = More so, B– = Less so
C = Satisfactory achievement, C+ = A little better, C– = A little worse
D = Poor achievement, D+ = Less so, D– = More so
F = Failure to meet course requirements

Required Readings

On Modeling

- Excerpts from Novak & Gowin, *Learning How to Learn*
http://www.dubberly.com/courses/design_theory_2016/01._a_Learning_How_To_Learn.pdf

- Dubberly, H., "Creating Concept Maps"
http://www.dubberly.com/courses/design_theory_2016/01._b_Creating_Concept_Maps.pdf

- Dubberly, H., "Models of Models"
http://www.dubberly.com/courses/design_theory_2016/01._c_Models_of_Models.pdf

On Systems Theory

- Boulding, K., "General Systems Theory—The Skeleton of Science"
https://www.panarchy.org/boulding/systems.1956.html

- Joi Ito, "Design and Science," http://www.pubpub.org/pub/designandscience

- Michael Porter, "How Smart, Connected Products Are Transforming Competition,"
https://hbr.org/2014/11/how-smart-connected-products-are-transforming-competition

- Capra, F., and Luisi, P. L., *The Systems View of Life: A Unifying Vision,* Cambridge University Press, Cambridge, 2014.

- Meadows, D., *Thinking in Systems,* Chelsea Green, 2008.
Chapter 1: The Basics

- Shannon, C., "A Theory of Communications," 1964, pages 31-35.
http://www.dubberly.com/courses/design_theory_2016/03._a_Shannon.pdf

- Ashby, W. R., *An Introduction to Cybernetics,* Chapman and Hall, 1957.
Chapter 1: What Is New, and Chapter 11: Requisite Variety.
http://pespmc1.vub.ac.be/books/introcyb.pdf

- Glanville, R., "Second-order Cybernetics,"
http://www.facstaff.bucknell.edu/jvt002/brainmind/Readings/SecondOrderCybernetics.pdf

- Pask, G., "The Architectural Relevance of Cybernetics," 1969.
http://www.dubberly.com/courses/design_theory_2017/10._a_Pask_Cybernetics.pdf

Suggested Additional Readings

On Systems and Design

- Gerstner, K., *Designing Programmes,* Hastings House, New York, 1964.

- Rittel, H., "On the Planning Crisis: Systems Analysis of the First and Second Generations," 1972. http://www.dubberly.com/courses/design_theory_2016/08._b_Rittel:_On_the_Planning_Crisis.pdf

- Haque, U., "On the Architectural Relevance of Gordon Pask," 2007. http://isites.harvard.edu/fs/docs/icb.topic983682.files/Week%2005/W05-2%20Usman%20Haque-%20The%20Architectural%20Relevance%20of%20Gordon%20Pask-.pdf

- Dubberly, Haque, & Pangaro, "What is Interaction?" 2009. http://www.dubberly.com/wp-content/uploads/2009/01/ddo_article_whatisinteraction.pdf

- Dubberly & Pangaro, "What is Conversation?" 2011 http://www.dubberly.com/wp-content/uploads/2009/07/ddo_article_whatisconversation.pdf

On Systems and Ethics

- Buchanan, R., "Design Ethics," 2005. http://www.dubberly.com/courses/design_theory_2016/03._b_Buchanan,%20Design%20Ethics.pdf

- von Foerster, H., "Ethics and Second-order Cybernetics," Stanford Humanities Review, Volume 4, Issue 2, 1995. http://dl.acm.org/citation.cfm?id=212248

- Maturana, H., "Meta-design," 1997. http://www.inteco.cl/articulos/006/texto_ing.htm

On the History of Systems Thinking

- Dubberly, H., "How cybernetics connects computing, counterculture, and design," 2015. http://www.dubberly.com/wp-content/uploads/2015/10/Cybernetics_and_Counterculture.pdf

Primary Systems Models and Related Terms
What you should learn in this course.

Levels of Systems,
- static *frameworks*, simple dynamic *clockworks*, control *thermostats*, self-maintaining *cells*, simple societies *plants*, self-aware *animals*, conscious *humans*, organizations *living in language*, transcendent (Kenneth Boulding)
- static rules, dynamic, feedback, self-organizing, learning, conversation

Combinations and Permutations
- theme and variations; also state diagram, phase space
- counting in base 2, 3, and 16 (hex)
- cellular automata, recursion, fractals

Basic Information Structures + Criteria
- name-value pair, array, matrix, tree, web (graph)
- principle of least means (Ockham's razor); principle of consistency (form + content)
- necessary and sufficient
- MECE (mutually exclusive, collectively exhaustive)
- CIPU (clear if previously understood)

Systems Dynamics, from Donella Meadows
- dynamic equilibrium—stocks, flows, lag, source, sink
- process, transform functions—proportional, inverse, S-curve, hockey stick, long tail
- resource cycles, tragedy of the commons, leverage points
- open loop, closed loop

Communications, from Shannon
- sender, code, message, channel, noise, receiver, entropy

Control Mechanisms
- system, environment, boundary, homeostasis
- feedback loop—goal (set-point, threshold), action, measure
- mechanism—sensor, comparator, actuator (effector)
- essential variable, range, resolution, frequency,
- virtuous and vicious cycles
- explosion, collapse
- negative feedback, positive feedback: dampening or balancing, reinforcing
- current state, desired state
- error, detection, correction
- circular processes, circular causality

User Conceptual Model, from Jeff Johnson & Austin Henderson
- object, link, action, attribute

Bootstrapping, from Douglas Engelbart
- basic process, improving the process, improving improving

Platform, API, modularity, smart-connected product, product-service ecology

More Advanced Systems Models

Requisite Variety
- stability, invariant organization
- disturbances, responses

Second-order Systems
- goal-means trees
- observer, observed, controller, controlled

Co-evolution
- population, trait, variation, selection
- cost, advantage
- cooperation and competition as evolutionary mechanisms
- drift

Models of Learning, e.g., Nonaka

Models of Conversation, from Pask
constructivism
agreement, (mis-)understanding
"an agreement over an understanding"
bio-cost, bio-gain

Other Systems Thinking Vocabulary Terms

servo-mechanism, governor, hunting, oscillation, prediction
control, communication, structure, organization,
teleology, purpose, goal-directed, self-regulating, co-ordination, regulation

emergence, feed-forward, back-talk
first order, second order

dissipative systems, self-sustaining
autopoiesis, allopoetic systems
- structural coupling
  (Behavior is structurally determined—history, individualism, learning.)
- "consensual co-ordination of consensual co-ordination"
- "conservation of a manner of living"

black box
explanatory principle "organizational closure" self-reference, reflexive

ethical imperative, "generosity in design", "aesthetiquette"

pace layers

Assignment for each week: Weekly reading concept maps

For *each* weekly reading, create a concept map —
describing the key ideas in the reading.

Start by reading the text;
highlight key ideas;
make a list of terms to include;
and build a structure linking the terms.
Be sure to label all the links.

Some readings feature clear models.
Make sure to include any key models in your diagram.
You may also include key passages from the readings;
be sure to use quote marks and include a citation

Include your name, date, the title of the reading and its author or authors.
Also include a headline for your concept map, in the form of a sentence.
The headline should summarize the point of the reading as you see it.

Format: 11x17 inches.

Save all your weekly maps!
You will need them for a final project — a booklet collecting all your maps.

Suggestions:
- Keep it neat, but don't obsess over the form; the content is what's important.
- Adobe Illustrator is a good tool, but other drawing tools may be used.
- Paint programs, such as Photoshop, are not the right tools.
- Plan to spend 1-2 hours on each reading and 1 - 2 hours on each map.

Due:
Each Tuesday, bring a printed version of your concept map to class.

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Assignment for week 2 — Due: Tuesday, January 23,
Levels of systems

Infrastructure:
Create a "website" to host your work for this class — in a Figma page. Think of it as a 'zoomable information space;' design it so that the information hierarchy is clear from 'zoomed out' and progressively revealed as you 'zoom in.' Your space could be a matrix of 3 rows x 15 weeks, with a row for 1) readings, 2) main assignments, and 3) notes + models from class discussions. Each week should have a 'frame' in each row; build out blank 'frames' for each week. (Also, create GitHub & GPT accounts.)

Readings:
Boulding, K., "General Systems Theory—The Skeleton of Science"
https://www.panarchy.org/boulding/systems.1956.html
Plate 1. Create a diagram outlining Boulding's framework; add your own examples.
What other ways we might frame types of systems? Make a representation.

Dubberly, H., "Models of Models" (No diagram required for this reading.)
http://www.dubberly.com/courses/design_theory_2016/01._c_Models_of_Models.pdf

Exercise:
Listen to the "NUMMI" episode of "This American Life."
https://www.thisamericanlife.org/561/nummi-2015

Diagram the systems called out in the podcast and other systems implied in the story.

Suggested process:
- Download the transcript; https://www.thisamericanlife.org/561/transcript
  follow it while listening to the podcast; highlight named systems and note others.
- Turn your highlighted phrases into a list, and group related elements.
- Rank elements as primary, secondary, and tertiary in terms of importance to the story.
- Build a diagram showing how elements are related; start with the primary elements.
- Then add secondary elements.

Format:
11x17-inch sheet; landscape (horizontal); if you need more space, add plates.
Be sure to include a title, your name, and the date. Check spelling.
Keep the typography simple, e.g., Helvetica U&LC, 20 pt head (bold), 10/12 body (reg).
Either work in Figma or upload to your space. Also, bring printed versions to class.

See https://hiddenbrain.org/podcast/making-the-most-of-your-mistakes/ at 29:30-32:00
HBS's Amy Edmondson on intelligent failure and the Toyota assembly line cord.

And for fun, Tom Wujec, https://www.youtube.com/watch?v=_vS_b7cJn2A

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Assignment for week 3 — Due: Tuesday, January 30
Counting Systems

Readings:
Bonsiepe, G., "Interface an Approach To Design", selected excerpts
http://www.dubberly.com/courses/systems_2017_fall/05._Bonsiepe.pdf
Create sketch notes or a concept map of Bonsiepe's key ideas and models.

Novak & Gowin, *Learning How to Learn,* selected excerpts
http://www.dubberly.com/courses/design_theory_2016/01._a_Learning_How_To_Learn.pdf
(No diagram needed for this reading.)

Exercise:
Animate every combination of segments in a 7-segment LCD digital numeric display.
Each segment can be on (1) or off (0), creating 128 possible combinations of off + on.
Each combination is represented by a base 2 number, i.e., 000 0000 to 111 1111.
List the numbers 0 to 127 (in base 2) to create a "display list" to drive the animation.

Then create a second animation displaying the segmented numerals from 0 to 9.
For this, you will need to create a second display list (with only 10 lines).

In Adobe Illustrator or a similar app, draw a 7-segment grid for your numerals.
Each segment should be a filled polygon shape (not a line and not a rectangle).
Use the art board tool to shrink the art board to fit snugly around your configuration.
Save your file in SVG format.

Download http://www.dubberly.com/courses/systems_2017_fall/Hexagon.zip
It includes 3 files: index.html, main.js, and main.css — you will edit these.
First, open a modern browser; drag index.html into the window to play the animation.

Set-up a text editor, such as Text Wrangler. (Text Edit and MS Word won't work.)
In a text editor, open your SVG file; copy the "polygon" information.
Open the index.html file; delete the lines that begin with "polygon".
In the same place, paste in your seven lines of new polygon data.
Likewise update the "viewbox" data in index.html with your new data.
Save your file. Drag the index file into your window; your animation should run.
If the polygons display out of order, re-arrange them in the index.html file.

Re-order your display list to create a second animation.
In a text editor, open the main.css file, find a string of binary numbers from 0 to 63.
Edit that list to create a new sequence; save your file; and play it.
Put both animations on your web site; if necessary, link to a new page.

Diagram how your second animation "works". How are the "data" stored?
What does the "user" see? What transformations link the two?

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Assignment for week 4 — Due: Tuesday, February 6
Communications Systems

Reading
Shannon + Weaver, "A Mathematical Theory of Communication."
http://www.dubberly.com/courses/design_theory_2016/03._a_Shannon.pdf

Create sketch notes or a concept map of the key ideas and models.

Exercise
Design and make a system capable of sending a message across the classroom without using traditional text or speech.

Design a new code that can transmit any English text message.
(You cannot use existing codes, such as Morse.)

Find a partner from the class; together co-create your system + code. Test!

Document your code on an 11 x 17 page (horizontal format).
This will be your code table.

With your partner, practice sending and receiving messages using your code.
We will run a "test" during class; test messages will be about 20 characters.

Develop strategies to ensure messages are accurately received.

How could a message be made more "secure"?

Create a diagram of how message transmission by telegraph works.
Consider the actors, objects, processes, and transformations.
Map the "layers" or "stack" required in a transmission.

Format: 11 x 17 inches; landscape (horizontal format).
Be sure to add a title and your name to both sheets.
Post to your web site.

###

Assignment for week 5 — Due: Tuesday, February 13
Application Data Model

Reading:
Vannevar Bush, "As We May Think," *Atlantic Monthly,* July, 1945.
https://www.theatlantic.com/magazine/archive/1945/07/as-we-may-think/303881/
Create sketch notes or a concept map of the key ideas and models.

Exercise:
Create a diagram explaining how a desktop application "works":
- How are the "data" stored? What is the "shape" of the data?
- What intermediary forms do the data take (if any)?
- What does the "user" see?
- What transformations link the stored data to what the user sees?

Choose any application that is focused on one data type, such as word processor, spreadsheet, paint program, object-oriented drawing program, sound editing app.

Imagine your audience is a bright fifth grader (a ten-year-old).

Create an example data set (or file); keep it as simple as possible;
include enough detail to convey the basic function of the app.
In addition, describe what an empty data set looks like.

Create a representation of your example data set at each "levels" of the system.
Show at least three levels and how they map to each other.
- Data as displayed
- Conceptual or high-level data format behind what the user sees
- Any intermediate levels, such as hex
- Binary

Describe and show how data is created (input), selected, and updated (changed).
What key tools are involved?

Include your name, a title, captions, and brief explanations as needed.
Consider content, writing, and typography.
Format: 11 x 17 inches; landscape (horizontal format).
Post to your web site.

###

Assignment for week 6 — Due: Tuesday, February 20
Templates: Recipes / Structured Documents

Reading:
Licklider + Taylor (1968), "The Computer as a Communications Device."
http://worrydream.com/refs/Licklider%20-%20The%20Computer%20as%20Communication%20Device.pdf
Create sketch notes or a concept map of the key ideas and models.

Please also read the *Vignelli Canon*. This is for you; no notes are required.
http://www.dubberly.com/courses/systems_2019_fall/CANON-7-2018.pdf

Exercise:
Analyze The New York Times Cooking Section online.
https://cooking.nytimes.com/ for access, see https://sfpl.libanswers.com/faq/166904
- Explore the site, and take 'screen shots' of each page type.
- Deconstruct the section into constituent parts (sub-sections and elements)
  - Home page
    - Featured recipe, What to cook this week, Recipes we think you'll love, More from our editors, Master the basics, Search results, Weeknight Grocery list, Recipe box, etc.
      - then any sub-sub sections under each or page type (templates)
- Organize the screen shots into a 'user flow map', starting from the main logged in section page, link to each sub-section page.
- Create an abstraction summarizing the flow as an outline (an IA table)
- Create a map of the back-end system that supports the section, e.g. recipe data base, search engine, search index, subscriber DB, CMS, templates, etc.
- List the major page type (templates), hint:
  - Home pages, Search results, Curated lists, Preview list widgets, How-to-guides, Recipes, etc.

Make a series of diagrams or "maps" representing "the system":
- User flow map
- Information architecture (IA) table
- System map
- What are the key scenarios of use?

Include your name, a title, captions, and brief explanations as needed.
Consider content, writing, and typography.
Format: 11 x 17 inches, landscape (horizontal format) or larger for the flow map.
Post to your web site.

###

Assignment for week 7 — Due: Tuesday, February 27
Design Systems: Grid Systems + CMS

Reading:
Kay, Alan (1972), "A Personal Computer for Children of All Ages."
https://mprove.de/diplom/gui/Kay72a.pdf
Create sketch notes or a concept map of the key ideas and models.

Exercise:
Referring back to cooking.nytimes.com, create a Design System Guidelines booklet describing the template system.
Imagine an audience of other designers; provide all the information they will need.

Begin by cataloging all the page types:
- How many basic types are there? Collect screen shots of 3 examples of each.
- What's the "grid" for each page type?
- What unifies all the basic page types?
- What information appears on each page type? (What are the content "widgets"?)
- How is each content widget constrained? (e.g., maximum size or length)
- What elements are reused?
- How do the guides help readers navigate the contents?

Then catalog the content:
- How many "items" are included? (under each template)
- How are they classified? (what is the information structure?)
- How could the content be represented as a database?

Finally, create a diagram or map explaining the design system.
Place your diagrams in a clearly organized Design Systems Guideline booklet.
Add dimensions, annotations for typefaces, size, color, etc.

Include your name, a title, captions, and brief explanations as needed.
Consider content, writing, and typography.
Format: 11 x 17 inches; landscape (horizontal format).
Post to your web site.

(Extra credit for suggesting improvements to the recipe template
and giving an example.)

###

Assignment for week 8 — Due: Tuesday, March 5
Information Structures: Interactive Models

Reading:
Meadows, D., *Thinking in Systems,* Chapter 1: The Basics
Create sketch notes or a concept map of the key ideas and models.

Exercise:
Represent a family (yours or a different one), going back to great grandparents.
Include first + last name, dates of birth + death, location, portrait, connections.
A person is a "node;" each "node" will be a "slide" or "card" or "page".
Create three interactive structures with connections as hyperlinks:

Family List
Create an index or directory slide listing everyone alphabetically.
(Extra credit for enabling alternate orderings of the list, e.g., sorting by birthday.)
Link to a "Rolodex" with a slide for each family member; enable page linking.

Family Timeline
Create a slide sequence of births and deaths starting from today, going backwards.
Users should also be able to navigate forwards in time. Add a summary page.

Family Tree
Start with yourself (your slide); link to each of your parents; link to their parents; and so forth. Links should be "bi-directional," e.g., users need a way to get back to you from your parents. Your "system" should be extensible for many more generations.
You may want to consider marriages as nodes (single slides or pages etc.).

Include a title slide with your name and a TOC.
Use transitions (animations) between slides to enhance navigation.
Keep your typography and layout simple.
Illustrations are fine in lieu of photos; however, this is not an illustration assignment.

Format: You may use Keynote, PowerPoint, Prezi, InVision, FramerX, or similar apps, or you may code in HTML/CSS/JS.
Post your file or a link to it on your web site.

(Extra credit for integrating the structures more deeply;
for example, can you have just one "slide" per person? (instead of three)
Or can you drive the whole system out of a database?)

###

Assignment for week 9 — Due: Tuesday, March 12
Dynamic Systems: Modeling Stocks and Flows

Reading:
Pask, Gordon (1969) "The Architectural Relevance of Cybernetics"
http://www.dubberly.com/courses/design_theory_2017/10._a_Pask_Cybernetics.pdf
Create sketch notes or a concept map of the key ideas and models.

Exercise:
Create a diagram depicting a person in terms of at least six stocks.
Consider yourself in terms of stocks and flows, sources and sinks, and lag.

At least one stock should come from each of these categories:
physical, emotional, social and economic.

For each stock, indicate its immediate source and sink, average volume, likely range of volume, danger zones (if any) and likely flow rate.

For at least two stocks, indicate at least three prior steps in the source chain and at least three subsequent steps in the sink chain.
Do the source and sink chains ever meet?
How do the stocks affect one another?

(For extra credit, make an interactive model of one or more stocks and flows.)

Format: 11 x 17 inches; landscape (horizontal format).

Be sure to add a title and your name.
Post to your web site.

###

Assignment for week 10 — Due: Tuesday, March 26 (03/19 is spring break)
Automatic Control Systems: Modeling Feedback

Reading:
Morozov, Evgeny (2014), "The Planning Machine: Project Cybersyn… Big Data…"
https://www.newyorker.com/magazine/2014/10/13/planning-machine
Create sketch notes or a concept map of the key ideas and models.

Exercise:
Identify a system that includes automatic feedback.
- The system should automatically close the feedback loop (without human input).
- Do not use a thermostat as your example.

Create a realistic illustration of the system and its operation, e.g, a photo.
- Identify the specific components of the system (the mechanism) and their functions (e.g., lever, height indicator).
- Label the components in cybernetic terms (e.g., significant variable, goal, sensor, comparator, actuator, disturbances).

Create a diagram of the system, "abstracted" in terms of feedback.
- Include all the components of the feedback loop (e.g., significant variable, goal, sensor, comparator, actuator, disturbances).
- Represent the relationships between components visually.
- Label each cybernetic component and note the corresponding physical part.

Your diagram should help the audience answer these questions:
- What are the relevant components of the system?
- How is information transmitted between components? In what form?
- What is the goal (desired state) of the system? How is the goal set?
- What forces typically disturb the system or push it away from its goal?
- What does the system measure (to create feedback)? How?
- What part of the system matches feedback (current state) to goal (desired state)?
- How does the system respond to disturbances?

Format: 11 x 17 inches; landscape (horizontal format).
The illustration and diagram should be on the same page.
Post to your web site.

###

Assignment for week 11 — Due: Tuesday, April 2
User Conceptual Models: Home Thermostat

Reading:
"Conceptual Models in a Nutshell." http://rivcons.com/wp-content/uploads/2015/07/Conceptual-Models-in-a-Nutshell-«-Boxes-and-Arrows.pdf

"Conceptual Models: Core to Good Design"
https://www.youtube.com/watch?v=i_DWYYZD31w&noredirect=1

Kempton, Willett (1986) "Two Theories of Home Heat Control"
http://www.dubberly.com/courses/systems_2017_fall/10._Kempton.pdf
Create sketch notes or a concept map of the key ideas and models.

Exercise:
Design a new user interface for thermostat; create 3 UI options.

To begin, create a diagram of a home HVAC system
- What are the physical components of the system? (artifacts, stocks, + flows)
- What are the information elements of the system? (information + feedback)

Create a "user conceptual model" of a thermostat that controls the system.
- What does the user need to know in order to successfully use the system?
- What "tasks" do users undertake when using it?
- What (data) "objects" do users encounter?
- What "actions" can users take on the objects?
- What "properties" do the objects have?
- What are the "relations" between the objects?

Write out a list of user tasks and create a table of objects, actions, and properties.
Your model should NOT include presentation issues or implementation issues.

Create 3 thermostat UI options (sets of displays and controls).
The physical form factor is up to you (e.g., 1.94 x 2.91 inches, touch screen is OK).
The 3 UI options should be as different as you can make them.

Your UI should map directly to your "user conceptual model".
Once you start designing your UI, you may find that you need to modify your model.

Create a mock-up of the displays and controls (what users see + change).
Specify how users will interact with the thermostat.

Format: 11 x 17 inches; landscape (horizontal format).
Post to your web site.

###

Final Project — Due: Part 1, 04/09; Part 2, 04/16; Part 3, 04/23; Part 4, 04/30
Product-Service Ecology — Wellness

Exercise:
Find someone, who has a chronic health condition, with whom you can talk;
e.g., arthritis, asthma, CAD, CHF, Chrons's, COPD, diabetes, HIV, hypertension, etc.

Imagine sensors that monitor body chemistry painlessly and connect to "the cloud".
Imagine other cloud-connected devices that deliver therapies.
How could such technology be integrated into people's lives to help them *and* their caregivers better manage chronic conditions? Design an integrated "ecology".
Consider how ML (e.g., CV), digital twins, and LLMs might contribute.

Part 1 — Model the current state — due 04/09
Create a model of the condition and care — in terms of maintaining homeostasis.
What does the person measure? e.g., blood glucose, blood pressure, weight, etc.
How do they "manage" that variable? (lower or raise it?) What is the feedback loop?
Create a model of the person's care-giving network. Who supports them? When? How? Include family, friends, paid services, healthcare professionals, etc.
Create a journey map showing how the person manages the condition during a week.
Include doses and timing of medications, food, exercise, interactions with caregivers.

Part 2 — Model the future state — due 04/16
Propose a system to help the person *and* caregivers better manage their wellbeing.
What elements are needed? How do they work together? How are they controlled?
How do components, services, and people connect? Outline key user tasks,
create a user conceptual model of the system, and wireframes for control screens.

Part 3 — Prototype the future state — due 04/23
Create detailed mock-ups of key screens in the primary user task.
Annotate your mock-ups to show how the user interacts with the controls.
Create a draft presentation introducing the problem, "ecology", and controls.

Part 4 — Create a presentation — due 04/30 (posted on web site)
Refine your work from parts 1, 2, and 3 and create a complete presentation.
Be sure to include a cover, introduction, process, solution, and your name.

Format: 11 x 17 inches; landscape (horizontal format).
Post on your web site.

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Readings for last four classes:

04/09
Michael Porter, “How Smart, Connected Products Are Transforming Competition,”
https://hbr.org/2014/11/how-smart-connected-products-are-transforming-competition
Create sketch notes or a concept map of the key ideas and models.

04/16
Yegge, Steven (2011), “Yegge's Rant.” (On the need for platforms at Google)
https://plus.google.com/+RipRowan/posts/eVeouesvaVX

04/23
Lanchester, John (2017), “You are the product” (understanding Facebook)
https://www.lrb.co.uk/v39/n16/john-lanchester/you-are-the-product

04/30
Friedman, Ken (2012) “Models of Design: Envisioning a Future Design Education”
https://s3-us-west-2.amazonaws.com/visiblelanguage/pdf/V46N1N2_2012_E.pdf

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Reading schedule

01 01/16 Novak + Gowin

02 01/23 Boulding, Dubberly

03 01/30 Bonsiepe

04 02/06 Shannon + Weaver

05 02/13 Bush

06 02/20 Licklider + Taylor

07 02/27 Kay

08 03/05 Meadows

09 03/12 Pask

03/19 Spring Break

10 03/26 Morozov (Project Cybersyn)

11 04/02 Henderson + Johnson, Thermostat article

12 04/09 Porter (Smart, connected products)

13 04/16 Yegge

14 04/23 Lanchester (Understanding Facebook)

15 04/30 Friedman

Not assigned

- Licklider, JCR (1960), "Man-Computer Symbiosis."

- Raymond, Eric (1997), "The Cathedral and the Bazaar." http://www.unterstein.net/su/docs/CathBaz.pdf

- Andreesen, Mark (2007), "The Three Kinds of Platforms You Meet on the Internet." http://pmarchive.com/three_kinds_of_platforms_you_meet_on_the_internet.html

- Davis, Meredith (2017) "AIGA Designer of 2025: Why Design Education Should Pay Attention to Trends," https://educators.aiga.org/wp-content/uploads/2017/08/DESIGNER-2025-SUMMARY.pdf

- WSJ *"Models will Run the World," WSJ*

- Kissinger, Henry, "How the Enlightenment May End," *The Atlantic,*

- Carr, Nicholas, "Is Google Making Us Stupid?" *The Atlantic,*

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Assignment xx — Due: Tuesday, xx,
Visual Systems + Construction Sets

Exercise:
Choose an existing visual system (e.g., typeface, numbers, or Olympics icons, etc.)

Plate 1. Document the system:
- Identify major elements (components), name them, and represent them
- Describe rules for using or combining the components; illustrate the rules
- Show examples of the system in use

Plate 2. Design three additions to the system (e.g., new letters, numbers, or icons):
- Combine existing elements in new configurations
- Be sure they follow the spirit of the existing system
- Describe and represent each addition

For example, if you choose icons, make new ones following the rules of the system.
Or if you choose lower-case letters, make new letters out of the existing parts.
Pay attention to craft; design your plates so that they are clear and well organized.

Format for reading summary + exercises:
11x17-inch sheet; landscape (horizontal); if you need more space, add plates.
Be sure to add a title, your name, and the date to both sheets. Check spelling.
Keep the typography simple, e.g., Helvetica U&LC, 20 pt head (bold), 10/12 body (reg).
Either work in Figma or upload to your space. Also, bring printed versions to class.

###

Assignment xx — Due: Tuesday, xx
Templates / Structured Documents / Grid Systems + CMS

Reading:
Licklider & Taylor (1968), "The Computer as a Communications Device."
http://worrydream.com/refs/Licklider%20-%20The%20Computer%20as%20Communication%20Device.pdf
Create sketch notes or a concept map of the key ideas and models.

Please also read the *Vignelli Canon*. This is for you; no notes are required.
http://www.dubberly.com/courses/systems_2019_fall/CANON-7-2018.pdf

Exercise 1
Deconstruct Massimo Vignelli's design for the original Audubon Field Guides.
Make a diagram or "map" representing "the system" behind the guides.

Begin by cataloging all the page types:
- How many basic types are there?
- What's the "grid"?
- What information appears on each page type? (What are the content "widgets"?)
- How is each content widget constrained? (e.g., maximum size or length)
- What elements are reused?

Then catalog the content:
- How many "items" are included? (under each template)
- How are they classified? (what is the information structure?)
- How could the content be represented as a database?

Deliverable: Create a diagram or map explaining Vignelli's design system.

Finally: Turn the design system into a Figma Library.
- What components can be reused?
- How might components be nested? (i.e., use "slotted components")

For Fun
Download the free Audubon Bird Guide App, http://www.audubon.org/apps
Compare the app, website, and book. Consider how you might map the app.

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Assignment xx — Due: Tuesday, xx
Design Systems: Grid Systems + CMS

Reading:
Kay, Alan (1972), "A Personal Computer for Children of All Ages."
https://mprove.de/diplom/gui/Kay72a.pdf
Create sketch notes or a concept map of the key ideas and models.

Exercise:
Refer back to the Audubon guides and the design system components that you developed last week; let's call that your component library.
Pull together your own version of the component library,
borrowing any missing elements from your classmates.

Then create a new file linked to the library — an "instance" for your specific guide.
And create at least one example page for each template in the library.
Lay out the pages in a clear and orderly way.
Provide annotations (specifications).
Add dimensions, annotations for typefaces, size, color, etc.

Consider these related ideas (theme and variation; type and token):
- library of components, divided into two parts: appearance and function
- appearance libraries (style sheets) can be brand libraries (multiple)
- each brand library may have a night mode
- functional components need variants, and may also need to be "slotted"
- components have a default smallest size, but also need to be made expandable, for different sized device screens (responsive design), which may have breakpoints with different organization
- may need to have variations for iOS and Android
- may also be other variations, such as large fonts
- internationalization and localization

All that is the set up:
- then you actually compose a book, magazine issue, or app out of the components
- but you have to do that in a careful + structured way so that the components can be changed globally, should the need arise later
- an "instance" is what we call a collection of screens, based on a set of components + a brand library)
- you also need to annotate the pages (screens) in the instance to make a specification
- the pages need to be laid out in an "architecture" with flows and signposts
- on top of that you can then drop in path arrows to build a demo
- all that can be hooked up to a database to make CMS (cf. Framer)
- eventually, Figima will add "tokens" so that you can do real development

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Assignment xx — Due: Tuesday, xx
Dynamic Systems: Modeling Stocks and Flows

Reading:
Pask, Gordon (1969) "The Architectural Relevance of Cybernetics"
http://www.dubberly.com/courses/design_theory_2017/10._a_Pask_Cybernetics.pdf
Create sketch notes or a concept map of the key ideas and models.

Exercise:
Watch the BBC short documentary on re-introducing wolves to Yellowstone.
https://www.bbc.com/future/article/20140128-how-wolves-saved-a-famous-park

Part 1 — Create a concept map of the ecosystem described in the documentary:
- Who are the actors? i.e., animals, plants, and other elements of the ecosystem
- How are the actors related? i.e., describe the structure as nodes and links
- What actions do the actors take? i.e., how does actor A relate to actor B?
- What special properties do the actors have?

The concept map should include names of the actors (nodes),
and lines should be labeled to define relationships (links), e.g., ELK—eat—>GRASS.

Part 2 — Create a second diagram representing the ecosystem as stocks and flows.
See Donella Meadow's, *Thinking in Systems*.
How does one element (a stock) affect the quantities of others? (create a +/- flow)
Use the flows to organize your diagram—by showing relationships between stocks.
A first version should represent the stocks of each animal before wolves return.
A second version should represent the stocks of each animal after re-intro.
You could try the Loopy app found here … https://ncase.me/loopy/

Part 1 should be on one page.
Part 2 should be on a second page (with 2 versions of the stocks + flows diagram).
Be sure to add a title and your name.
Post to your web site.

Part 3 — Design an interactive version of your diagrams (a simulation) and create a "clickable prototype" demonstrating how a user might interact with the simulation.
The audience is students in grade 5 using an online educational app.
Illustrate how changing at least one stock change other stocks in the system:
- Student encounters the simulation. (What is its initial state?)
- Student realizes that simulation is interactive. (What indicates potential for action?)
- Student quadruples the number of wolves. (How do users provide input?)
- Student sees the number of elk decrease. (What is the resulting state?)
- Student halves the number of wolves. (What is the resulting state?)

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