A D-Lab Design Cycle

UC DAVIS HORTICULTURE AND D-LAB TOOLKIT

Class Notebook Prototype

ACKNOWLEDGEMENTS

The original D-Lab was founded at MIT by Amy Smith in 2002 based on a single course called the "Haiti Class." Dr. Kurt Kornbluth was involved in setting up MIT's D-Lab and founded Davis D-Lab in 2009.

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INTRODUCTION TO OUR DESIGN PROCESS

This document serves as a guide for the prototyping process in D-Lab II. It puts the class deliverables in the context of a cyclical design process:
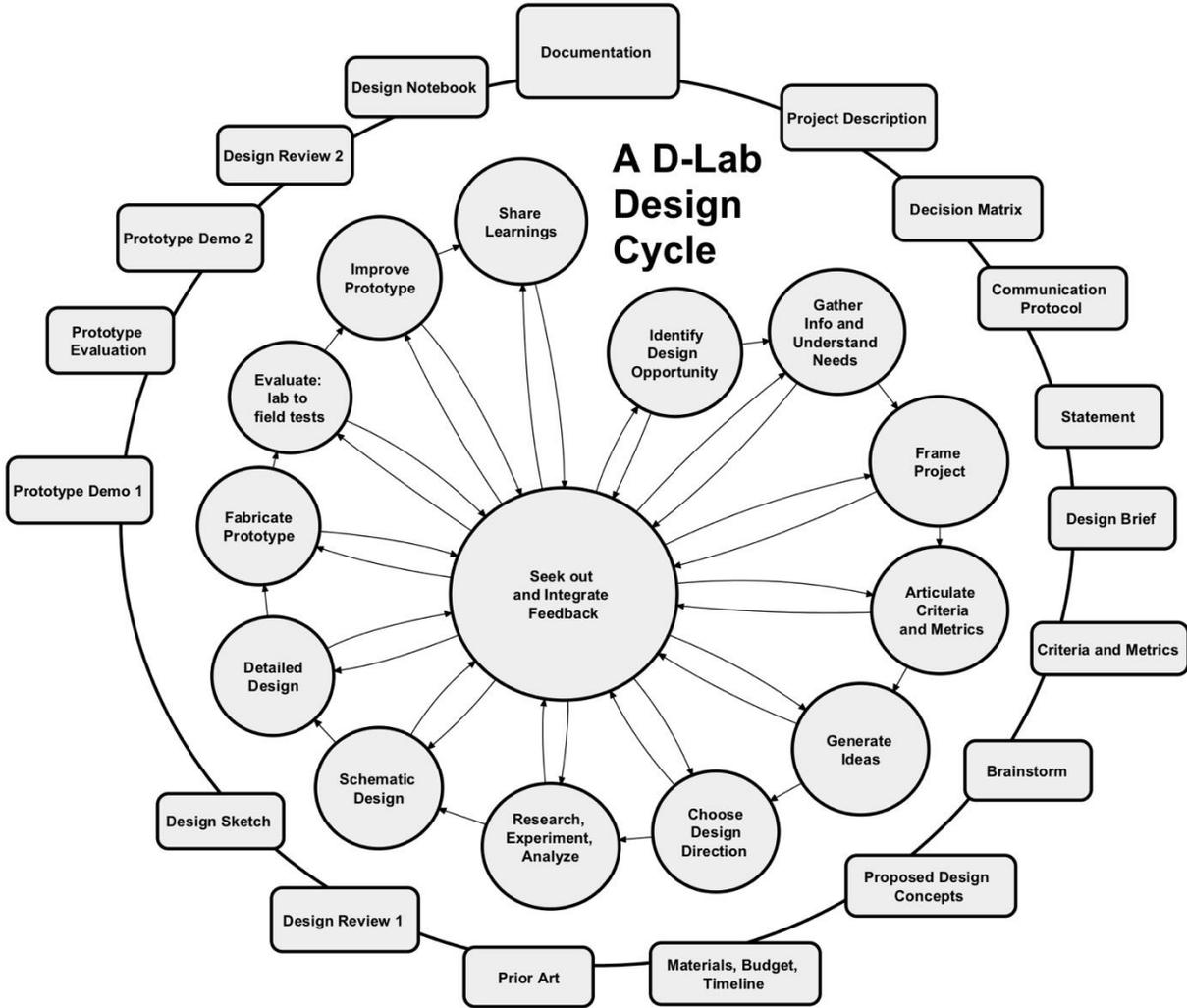
FEEDBACK AND DOCUMENTATION

Every step in the design process has a component of dialogue. Whether its speaking with the client, running things by a mentor or instructor, deliberating with teammates, or presenting before a review panel, feedback moves the process along, and each step of the way, pieces of documentation emerge, which we compile into a design notebook.

Each group should keep a design notebook including all rough work, deliverables, contact information, brochures, sketches, photographs, designs and so forth. This will be collected at the end of the course.

The first page of the notebook should have the following information:

- Group Member names and contacts

- Local Partner name and contact

- Local Mentor name and contact

- 1-page Project description

Following are the deliverables for the class and should be included in the notebook along with any other relevant information.
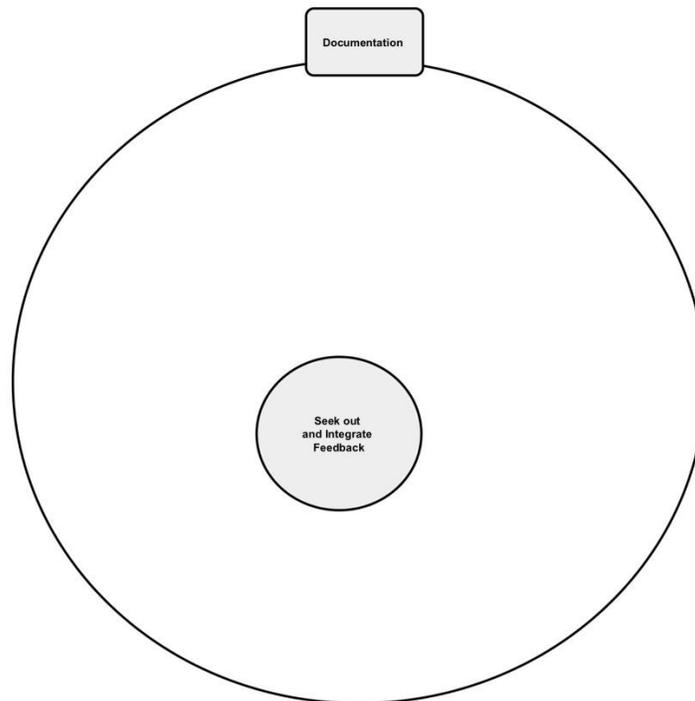
IDENTIFY A DESIGN OPPORTUNITY

The vetting process through which D-Lab selects clients and projects yields a short project description, which students receive on the first day of class. It is hard to predict which clients will make themselves thoroughly available and truly engage with the team, but many of the projects that make it to D-Lab II have come through D-Lab I in winter and in some cases even a D-lab Seminar in the fall.

Any problem can be thought of as a design opportunity. Any unmet need presents a chance to engage in a process to come up with a solution.
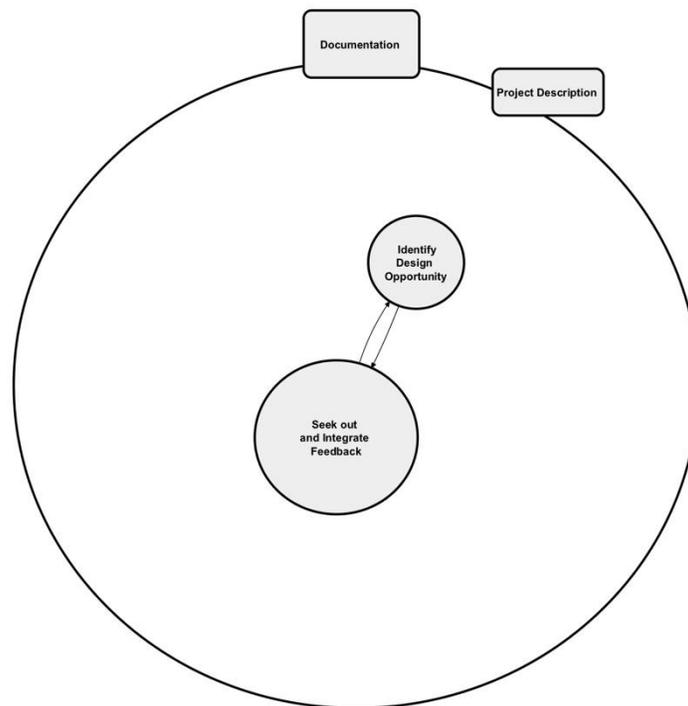
GATHER INFORMATION AND UNDERSTAND NEEDS

For projects that have been through D-Lab I, much effort is invested in understanding the context through thorough sector analyses and feasibility studies. At this stage in D-Lab II, groups are formed and contact is established with the client.

DELIVERABLE 1: CHOOSING A PROJECT

Due Wednesday, April 4

To form groups we need from each student a short bio including:

1. Background

2. Academic Program

3. Skills you have

4. Skills you want

5. A decision-making matrix to establish project preference using at least 3 criteria.

Make it all fit on one side of one sheet of paper.
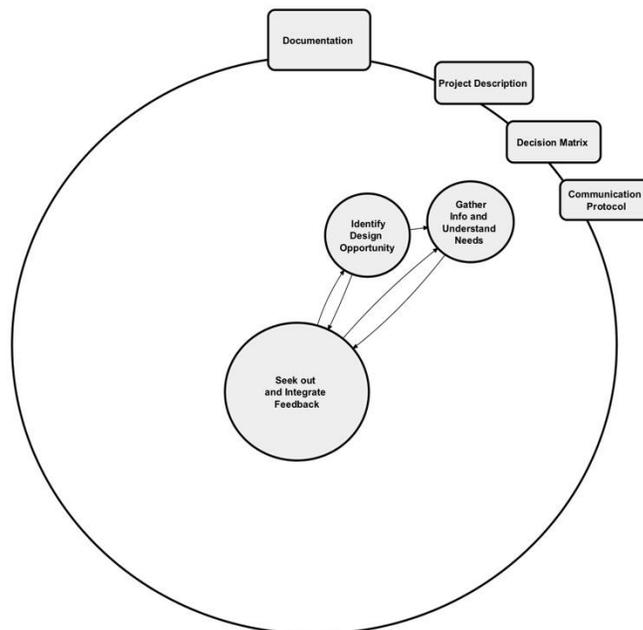
FRAME PROJECT

DELIVERABLE 2: INITIAL DESIGN BRIEF

Due Wednesday, April 11

To better understand the project answer the following questions:

- Who is the client and what is their business?

- What is the Project Goal Statement? This speaks to the need your design addresses. It should be concise (1 0r 2 sentences).

- What are the specific project goals? Why?

- Who is the target market/customer?

- Any known benchmarks?

- What is the approximate budget?

- What is the approximate timeline?

- What are the final deliverables?

Project Goal Statement Elevator Pitch

Refine your project statement into a speech that you can give in under a minute that briefly and in the most engaging way possible covers: Who Are You? What is the Problem or Need? Who are you addressing it for? Why is it important?

ARTICULATE CRITERIA AND METRICS

DELIVERABLE 3: EXPANDING THE DESIGN BRIEF AND BRAINSTORM PROJECT CONSIDERATIONS

Due Monday, April 16

To expand the design brief answer the following questions:

- Who is the client? Who are you designing the technology for?
- Who is the target customer? Who will actually be using the device? Be specific.
- What are the specifications if any given for the technology?
- What are the technical, social, environmental, and financial considerations?
- What are other existing designs?
- What will a successful design do?
- What is the timeline?
- What is the project budget? What is the cost and quantity of products needed?
- What is the end deliverable?
- What skills and information will you need to design a successful product?

Based on your answers to these questions brainstorm design considerations and write down 10 to 20 of them.

Project goal statement and design considerations will be refined as you gather more information.

DELIVERABLE 4: SPECIFIC DESIGN CRITERIA AND METRICS

Due Wednesday, April 18

- Has your project goal statement changed since learning more information? Update if needed.

- What are the important design considerations? Narrow down to 5 from the previous deliverable and refine them into criteria (see table below!)

- How you will evaluate and test the design? Will these be qualitative or quantitative?

- What are the metrics (the unit of measurement)?

- What are the target values for each metric and in what are the units?

- Make a Testing Table with this information
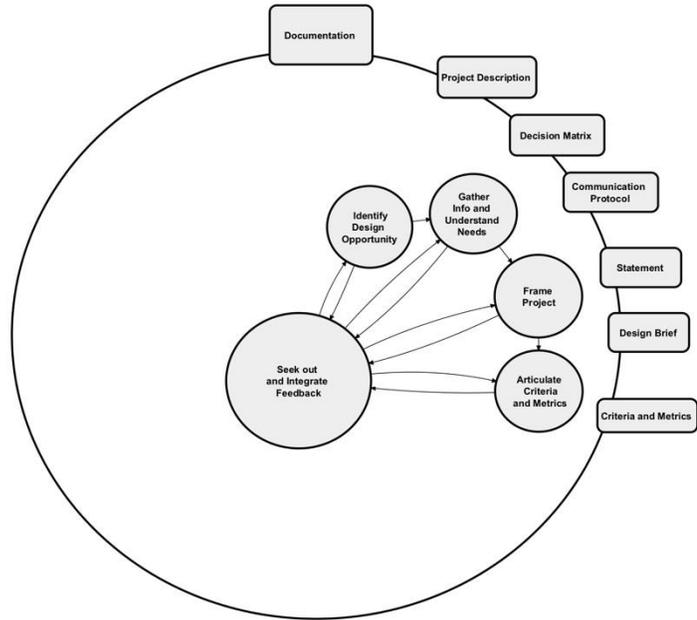
Criteria	Qualitative/ Quantitative	Testing Procedure	Target Value	Metric
If the consideration was "**it must be light**," the specific criterion is "**weight**"	Quantitative	Scale	>50	lbs.
weight	Qualitative	Focus Group reporting on ability to pick it up with ease	4/5	People say its "light enough"

GENERATE IDEAS

When brainstorming: Leave aside all judgement. Go for quantity. Replace all "buts" with "ands." No idea is too farfetched... yet.

DELIVERABLE 5: BRAINSTORMING FOR DESIGN CONCEPTS

Due Monday, April 23

- Revise your statement based on any new information

- Brainstorm at least 20 design ideas

- Write them down and sketch
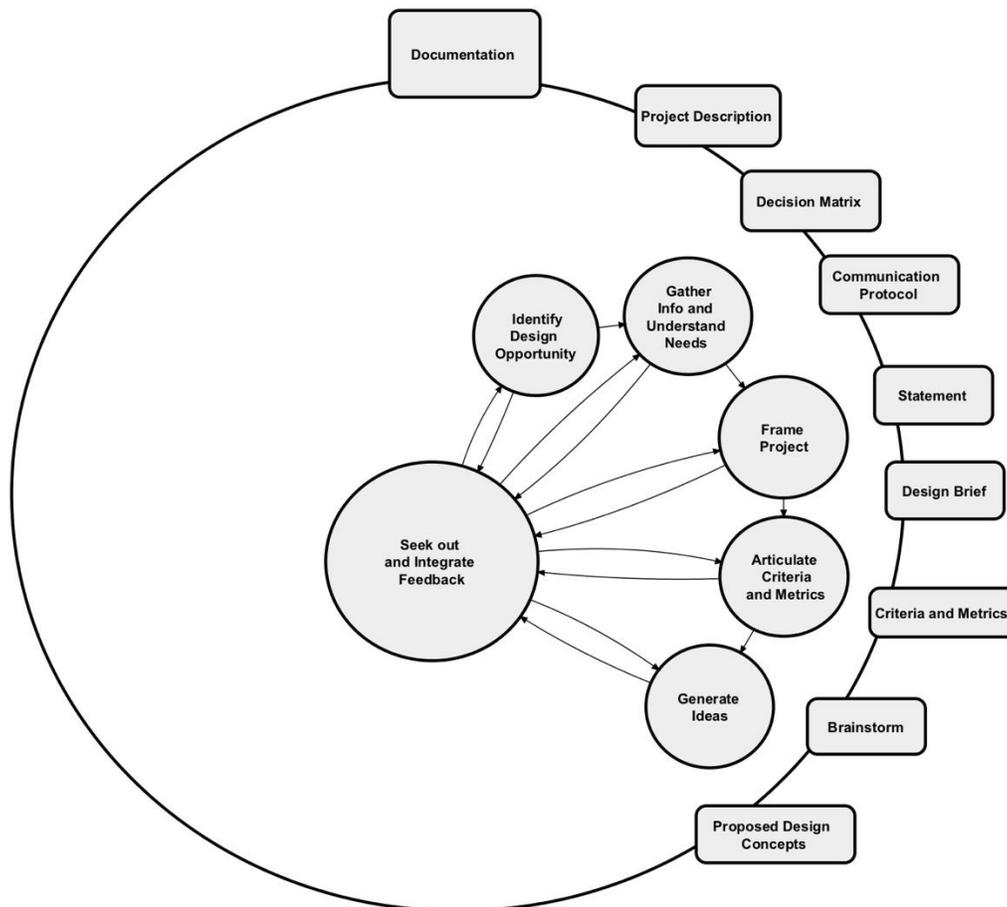
CHOOSE A DESIGN DIRECTION

DELIVERABLE 6: PROPOSED DESIGN CONCEPTS, IDEA EVALUATION, PROJECT TIMELINE, AND BUDGET

Due Wednesday, April 25

- Investigate your top 5 design concepts using your evaluative matrix

- As a group, select your top 3 ideas. Use you Design Criteria (deliverable #3) to understand strengths and weaknesses

- Write down in words pros and cons of each possible direction. How do they compare to the benchmarks you have found?
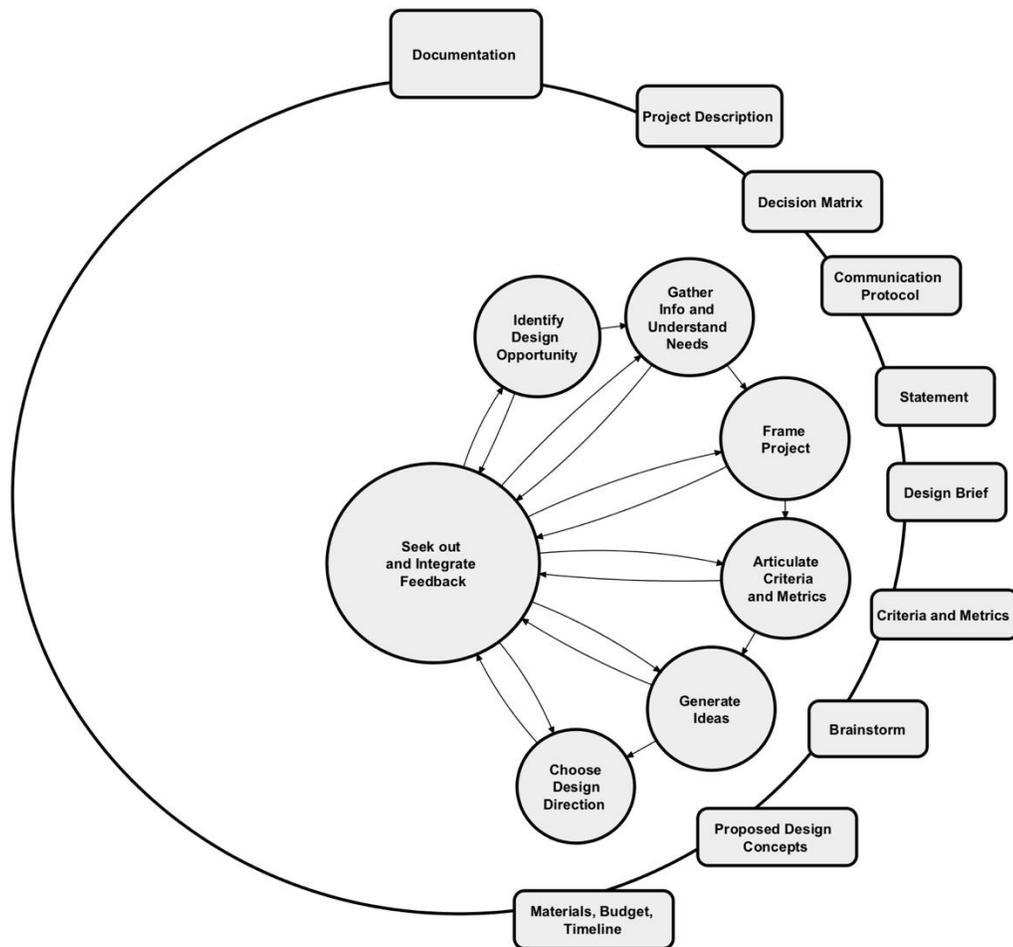
RESEARCH, EXPERIMENT, ANALYZE

DELIVERABLE 7: PRIOR ART SURVEY

Due Wednesday, April 30

Create an annotated bibliography for benchmarks and project background using Endnote or similar. One per group member, bring 2 copies, one for grading and the other to include in notebook)

Use your design brief to guide your research. Prior art survey could include:

- Existing designs and products, benchmarks?

- More information about the "problem." What is it and why is it a problem? What are the unmet needs that are behind it?

- More insight on the Target Customer (Who will be using the product? What is important to them?

- Considerations through Technical, Social, Environmental and Economic Lenses

Each team member must find 5 (2 references can be websites) relevant articles, books, reports to help frame your project. This will include technical (prior art, etc.) as well as contextual (country, climate, cultural, economic, etc.) literature. Include the reference and a summary of the important points. List each team member's contribution. For example, 1 student researches existing designs and products, 1 student researches the problem, 1 student researchers the technical considerations, etc.
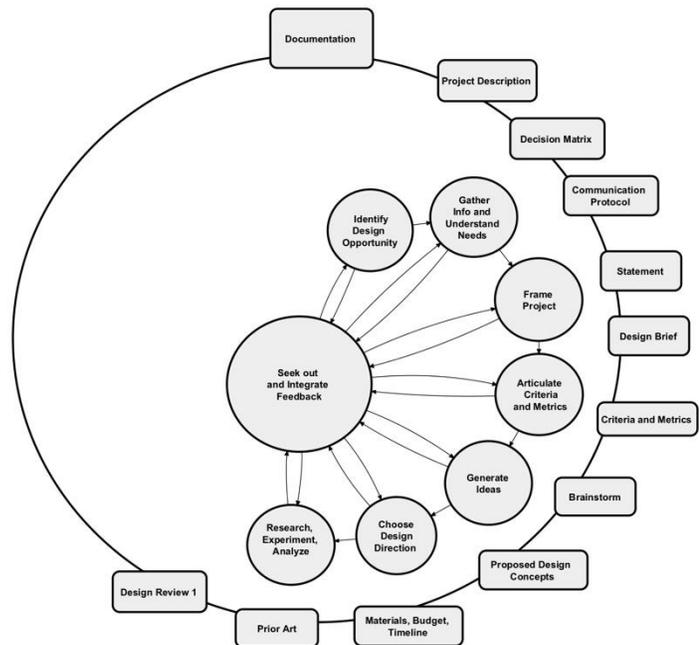
SCHEMATIC DESIGN

Schematic designs seek to illustrate how things work and how the elements in the system relate to one another. They are may or may not include detailed measurements and are more about communicating concepts. It can also be 3-Dimensional Sketch Model or mock up.

DELIVERABLE 8: DESIGN REVIEWS

Due Wednesday, May 2

Make a brief presentation (7 minutes) to the class on your project background, design process, proposed design concepts, and timeline. **No PowerPoint allowed**, just make a clear presentation. Use drawings and props. Be prepared to answer questions on the proposed design as well as your process. You will be evaluated by a review panel based on clarity, content and style.

Presentation needs to cover:

1. Elevator Pitch

2. Relevant Prior Art

3. Considerations and Table with Criteria and Evaluation Methods

4. Budget and Timeline

5. Current Design Concepts
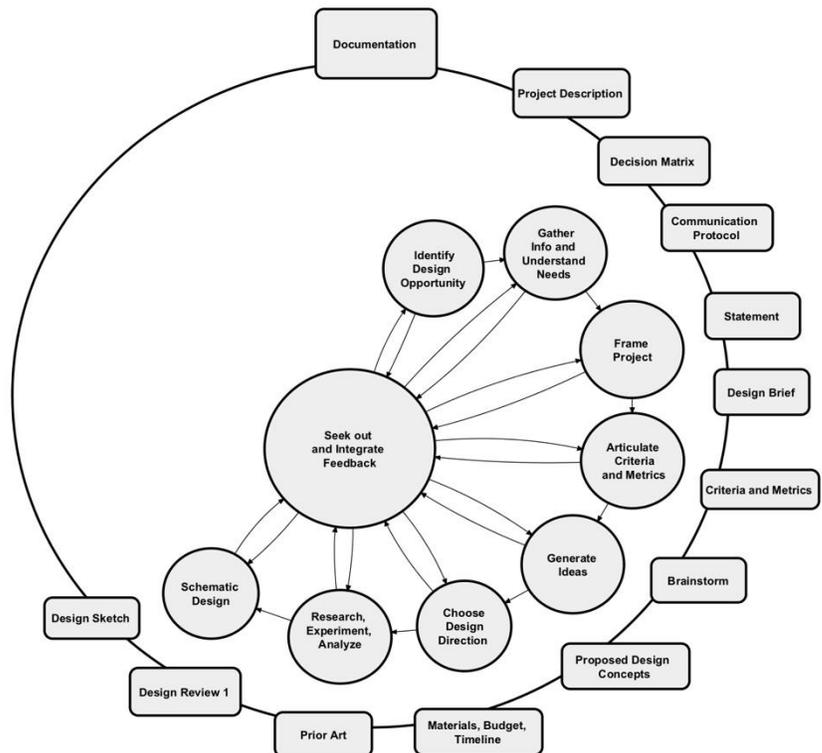
DETAILED DESIGN

Detailed designs may be drawn to scale or at least include measurements, though technical digital drawings are not a necessary step to creating a prototype, this maybe an appropriate moment to take that leap.
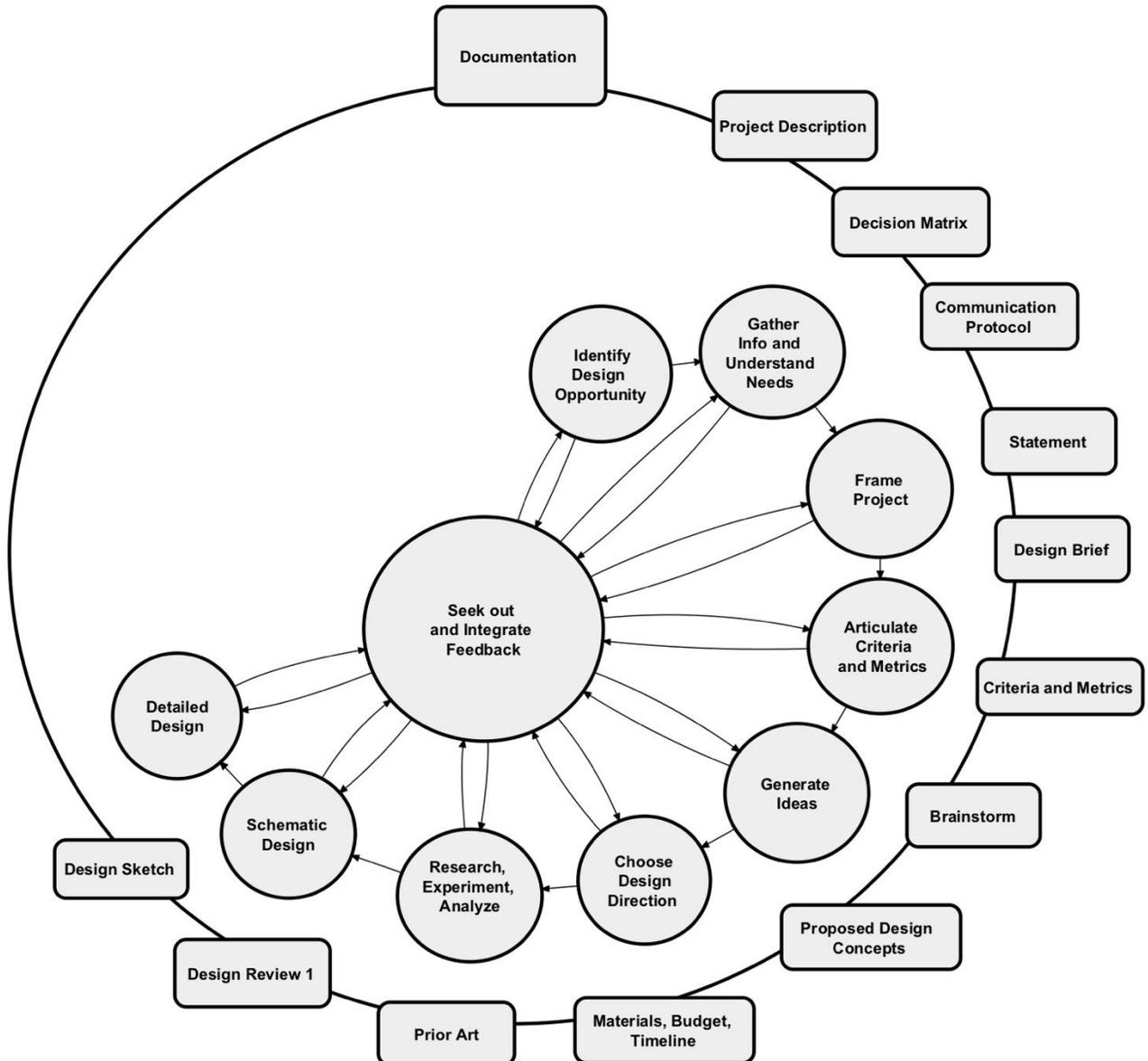
FABRICATE PROTOTYPE

DELIVERABLE 9: FIRST PROTOTYPE DEMO

Due Monday, May 21

Be prepared to show you first prototype:

- In groups, demonstrate prototype to the class

- Show the class how it works (or doesn't!)

- Explain how you built it

- Describe the parts of the prototype that are important for your project
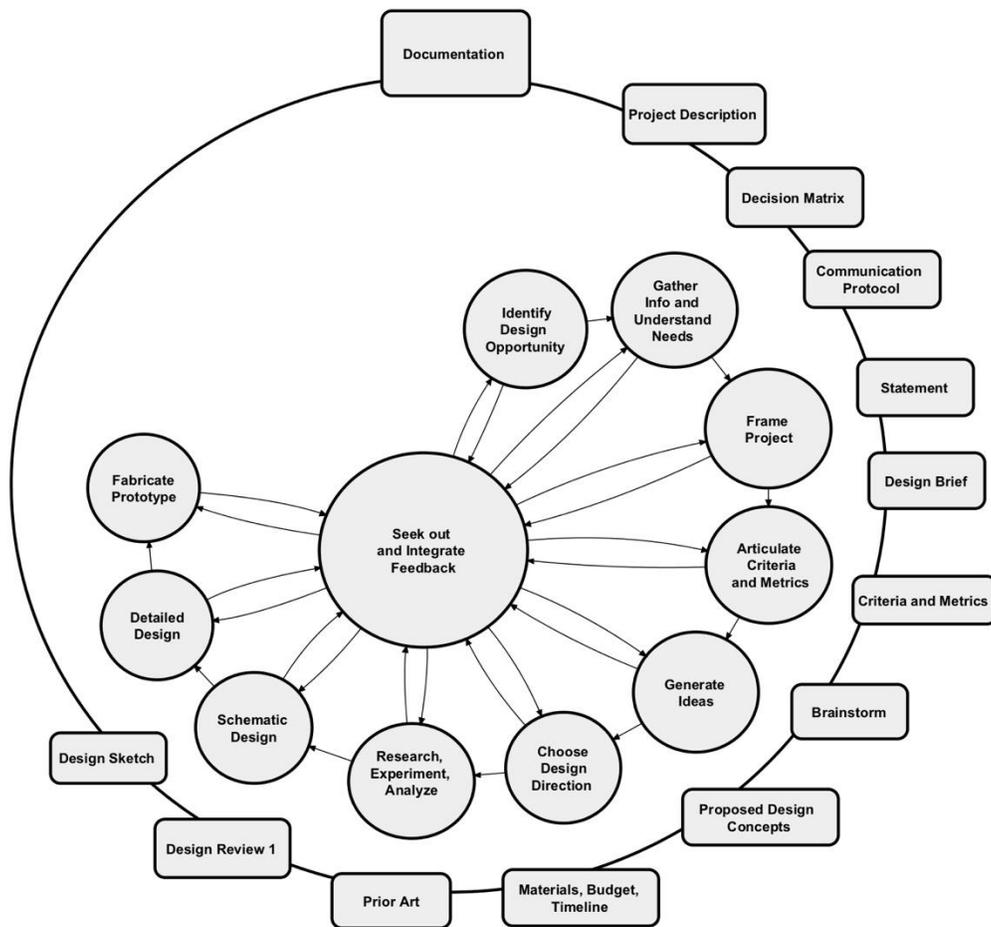
EVALUATE: LAB AND FIELD TESTS

DELIVERABLE 10: PROTOTYPE EVALUATION

Due Wednesday, May 23

With your group, evaluate/test your prototype based on your design criteria, using the table you created for testing.

Answer the following:

- Does your prototype work?

- How do you know?

- What could be done to improve it?

- What will you do to modify it?

- Does it satisfy your Project Goal Statement?

- Does it meet the client's needs?
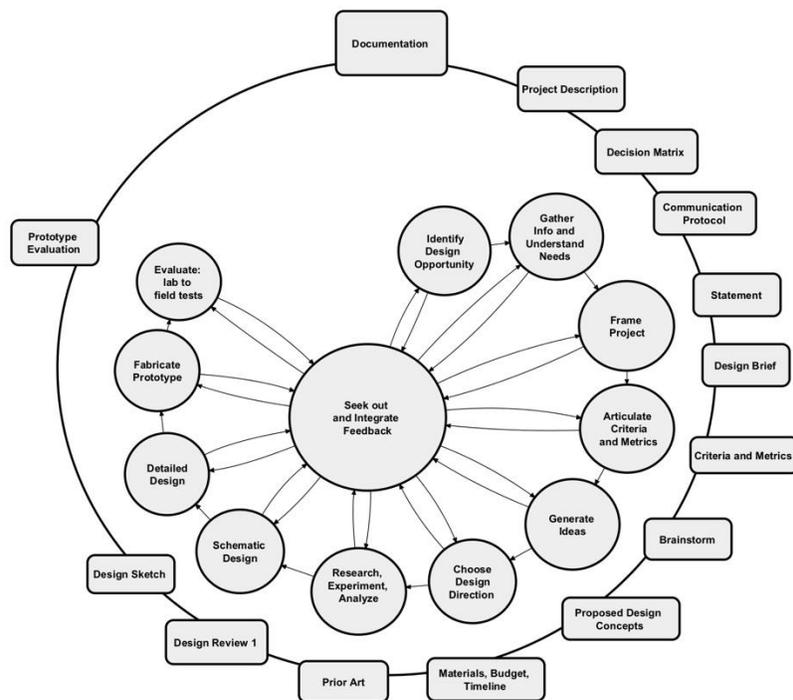
IMPROVE PROTOTYPES

DELIVERABLE 11: SECOND PROTOTYPE DEMO & EVALUATION

Due Wednesday, May 30

Demonstrate and evaluate your second prototype or the improvements and changes you made on your first. Again, use your Testing Table.
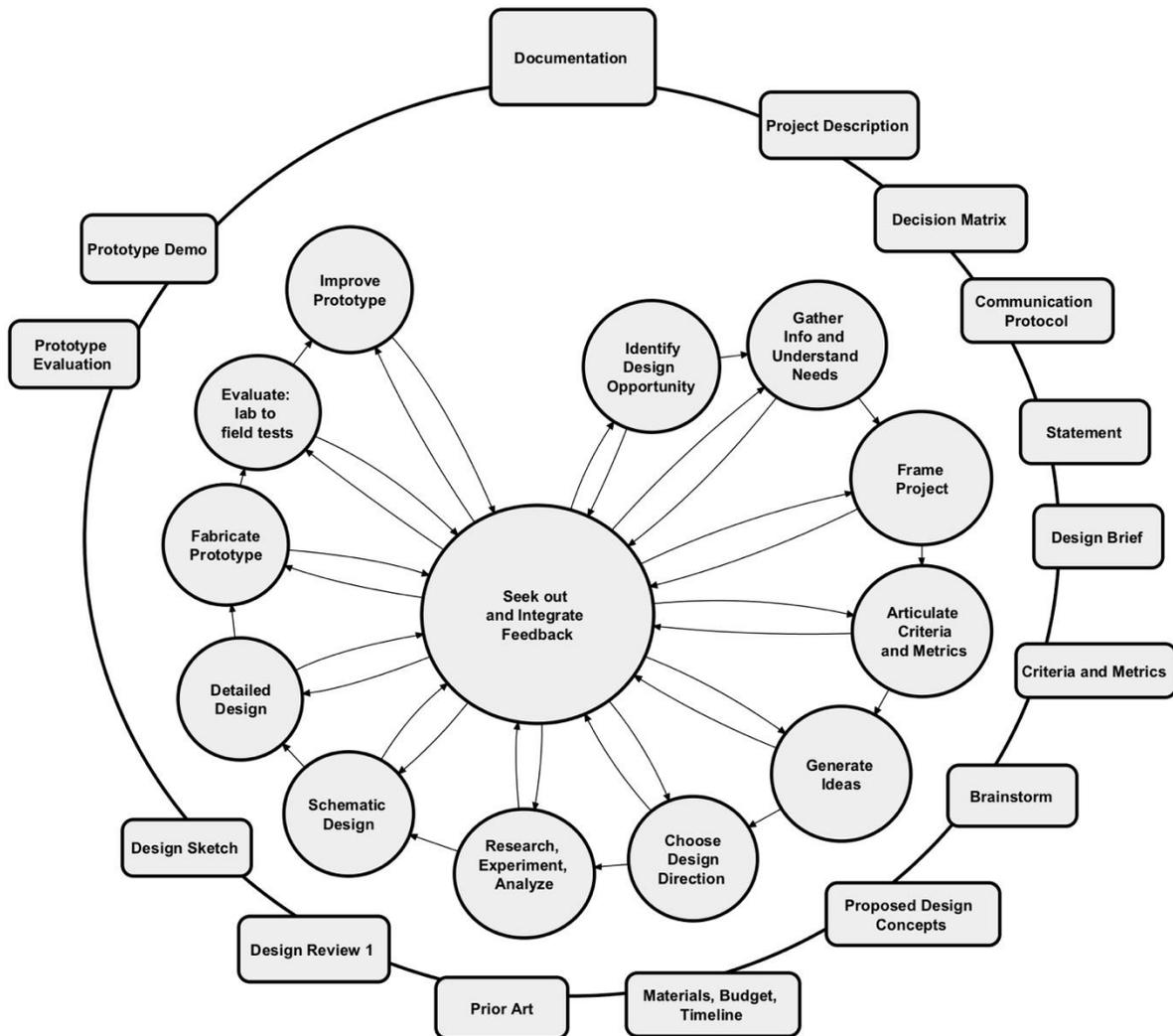
SHARE LEARNINGS

DELIVERABLE 12: PROTOTYPE REVIEWS

Wednesday, June 6

Make a brief 7 minute presentation to the class and external reviewers on:

1. Background: Your design brief

2. Design Criteria, Metrics, and Testing Methods, as expressed in table

3. What You Built: Description of prototypes, using drawings and props

4. How it Fared, Results and Discussion

5. Next Steps towards continuity.

Prototype Evaluation Guidelines:

- Problem statement-has it Changed?

- Is the project still with the time line?

- Which criteria will you test for (I.e. the 5 most important ?)

     o   Metric/units

     o   Which are qualitative? Quantitative?

     o   How will you evaluate/measure for these?

     o   What are the special constraints/conditions?

     o   Testing equipment /procedure (sketch)

- Discussion/conclusion

- Recommended revisions

DELIVERABLE 13: PROJECT SUMMARY OF METHODS AND RESULTS & DESIGN NOTEBOOK

Due Wednesday, June 6th by noon in D-Lab

1 Project Summary Report per team. 5 pages (not including graphics) including:

1. Design Brief: Project and Client Background(short and to the point) and Statement

2. Design Process and Methodology: Criteria and metrics

3. Results and Discussion: Include photographs, drawings

4. and Conclusions: What works well or does not. How it relates to prior art.

5. Recommendations: Specific Next Steps

6. Bibliography: Does not count toward pages

7. Appendix: Design Notebook Documents

OPTIONAL DELIVERABLE 14: POST A ONE-MINUTE VIDEO OF YOUR DESIGN PROCESS AND RESULTING PROTOTYPE ONLINE BY WEDNESDAY, JUNE 6TH AT NOON.

A D-Lab Design Cycle

Documentation

Design Notebook

Design Review 2

Prototype Demo 2

Prototype Evaluation

Prototype Demo 1

Design Sketch

Design Review 1

Prior Art

Materials, Budget, Timeline

Proposed Design Concepts

Brainstorm

Criteria and Metrics

Design Brief

Statement

Communication Protocol

Decision Matrix

Project Description

Share Learnings

Improve Prototype

Evaluate: lab to field tests

Fabricate Prototype

Detailed Design

Schematic Design

Research, Experiment, Analyze

Choose Design Direction

Generate Ideas

Articulate Criteria and Metrics

Frame Project

Gather Info and Understand Needs

Identify Design Opportunity

Seek out and Integrate Feedback