Engi. 8700 Senior Civil Design Project Lecture Series Summary

COURSE
ENGI -8700
CIVIL
Design Project

INSTRUCTOR
Dr. Steve Bruneau
EN.4013
Ph 864-2119
Sbruneau @ mun.ca

TOPIC
Lecture 4:
Design
steps 3 & 4

REFERENCES.

FILES

WEB
http://www.engr.mun.ca/~sbruneau/teaching/8700project

Purpose: To provide immediately practical guidance for the professional execution of the design project for 8700.

As seen from above . . .

Method: One lecture per week with topics timed according to the approximate project phase. Total of 8 core lectures with 2 optional.

Topics:
1. Summary of the engineering design method, design steps 1 and 2, and record keeping - as required in 8700.
2. MS Project guidelines for use in 8700.
3. General project management . Teamwork, skills and tools.
4. Design steps 3 and 4 plus writing a project plan and project report .
5. Design steps 5 and 6 plus presenting and public speaking.
6. Life Cycle analysis and sustainability.
7. Probabilistic methods for cost estimating and load prediction.
8. Business, ethics, professional use of seal.

COURSE

ENGI -8700
CIVIL
Design Project

CAPSTONE

INSTRUCTOR
Dr. Steve Bruneau
EN.4013
Ph 864-2119
Sbruneau @ mun.ca

TOPIC

Lecture 4:
Design
steps 3 & 4
Chapters 6, 7, 8, 11

REFERENCES.

FILES

WEB

http://www.engr.mun.ca/~sbruneau/teaching/8700project

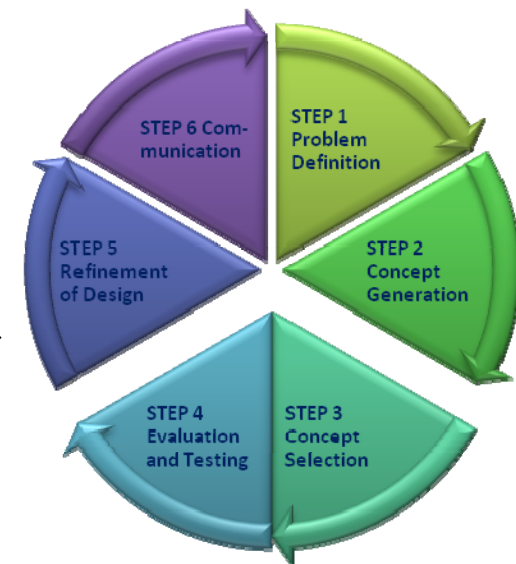## Problem Solving, Teamwork and the Engineering Design Method

From last day recall. . .

The *design process* is defined, described and illustrated in countless ways, but the core activities are always the same:

1. Definition   re-frame problem, ID needs, objectives, constraints
2. Generation   designer generates or creates various design concepts
3. Selection   designer selects the optimal design solution
4. Evaluation   designer tests or models the chosen design
5. Refinement   designer creates detailed design for implementation
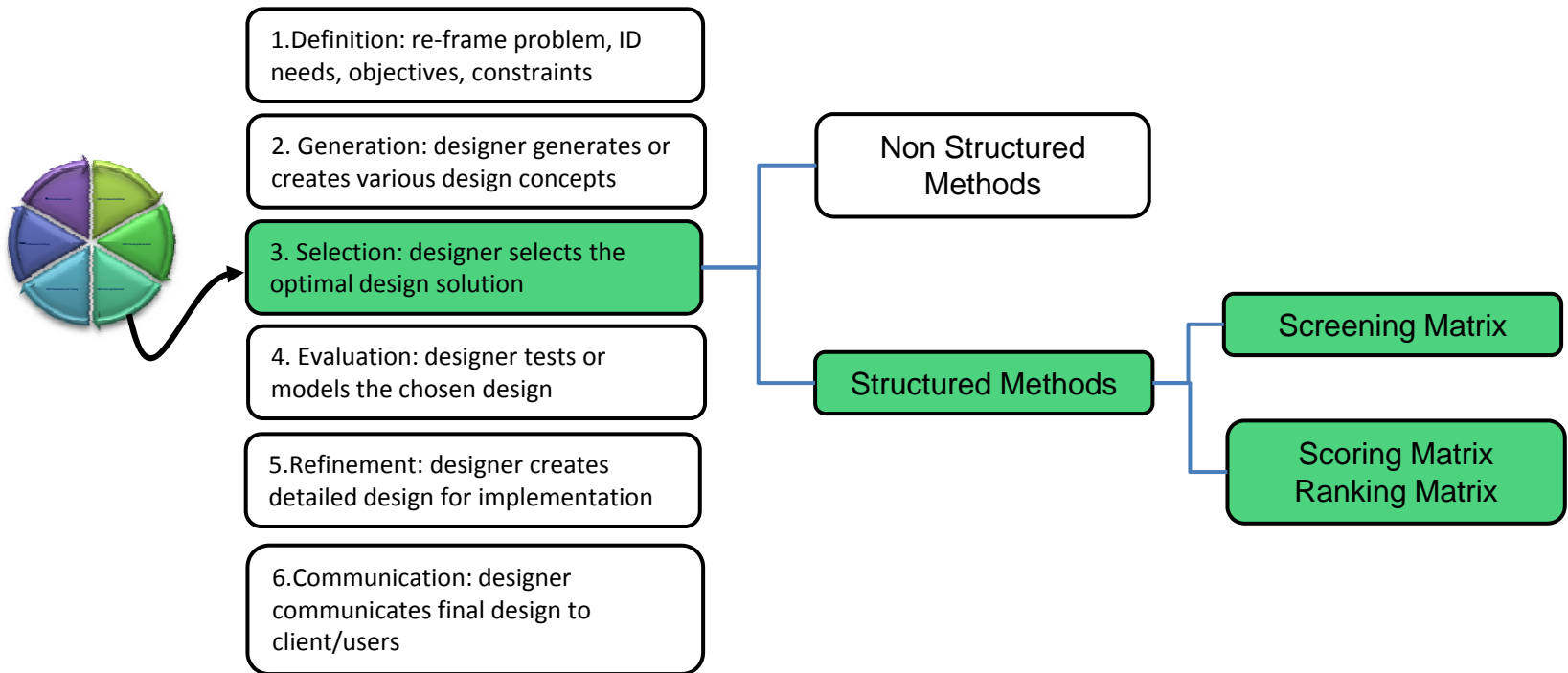6. Communication designer communicates final design to client/users

Concept Selection

Concept Selection Lesson will explain:

- Why concept selection processes exist
- Various Methods
- Structured Methods
- Concept SCREENING, SCORING and RANKING

1. Definition: re-frame problem, ID needs, objectives, constraints

2. Generation: designer generates or creates various design concepts

3. Selection: designer selects the optimal design solution

4. Evaluation: designer tests or models the chosen design

5. Refinement: designer creates detailed design for implementation

6. Communication: designer communicates final design to client/users

Non Structured Methods

Structured Methods

Screening Matrix

Scoring Matrix
Ranking Matrix

COURSE

ENGI -8700
CIVIL
Design Project

CAPSTONE

INSTRUCTOR
Dr. Steve Bruneau
EN.4013
Ph 864-2119
Sbruneau @ mun.ca

TOPIC

Lecture 4:
Design
steps 3 & 4

REFERENCES.

FILES

WEB

http://www.engr.mun.c
a/~sbruneau/teaching/
8700project

The need to select one concept from many raises several questions:

- How can the team choose the best concept, given that the designs are still quite abstract?

- How can a decision be made that is embraced by the whole team?

- How can desirable attributes of otherwise weak concepts be identified and used?

- How can the decision-making process be documented?

COURSE

ENGI -8700
CIVIL
Design Project

CAPSTONE

INSTRUCTOR
Dr. Steve Bruneau
EN.4013
Ph 864-2119
Sbruneau @ mun.ca

TOPIC

Lecture 4:
Design
steps 3 & 4

REFERENCES.

FILES

WEB

http://www.engr.mun.c
a/~sbruneau/teaching/
8700project

What is? Concept Selection

- ***Concept selection is the process of evaluating concepts with respect to customer needs and other criteria, comparing the relative strengths and weaknesses of the concepts, and selecting one or more concepts for further investigation, testing, or development***.

- The method presented is also useful later in the development process when the team must select subsystem concepts, components, and production processes.

- Although concept selection is a convergent process, it is frequently iterative and may not produce a dominant concept immediately.

- A large set of concepts is initially winnowed down to a smaller set, but these concepts may subsequently be combined and improved to temporarily enlarge the set of concepts under consideration.

- Through several iterations a dominant concept is finally chosen.

COURSE

ENGI -8700
CIVIL
Design Project

CAPSTONE

INSTRUCTOR
Dr. Steve Bruneau
EN.4013
Ph 864-2119
Sbruneau @ mun.ca

TOPIC

Lecture 4:
Design
steps 3 & 4

REFERENCES.

FILES

WEB

http://www.engr.mun.c
a/~sbruneau/teaching/
8700project

METHODS

- All teams use some method to choose among concepts. (Even those teams generating only one concept are using a method: choosing the first concept they think of.) Methods vary in effectiveness and include the following:

  - **External decision**: customer, client, or some external entity makes the decision.

  - **Product champion**: influential member of the team chooses concept based on personal preference.

  - **Intuition**: Chosen by feel. Explicit criteria or trade-offs are not used. The concept just *seems* better.

  - **Multivoting**: Team votes for several concepts. The concepts with the most votes are selected to move forward.

  - **Pros and Cons**: Strength and weaknesses of each concept are listed, and the team makes a choice.

  - **Prototype and test**: Builds and tests prototypes of each concept, making a selection based on test data.

  - **Decision matrices: The team rates each concept against pre-specified selection criteria, which may be weighted.**

Structured Method

- A **structured concept selection process** helps to maintain objectivity throughout the concept phase of the development process and guides the product development team through a critical, difficult, and sometimes emotional process.

- A structured concept selection process offers the following potential benefits:

  - **A customer-focused product:** By use of customer-oriented criteria.

  - **A competitive design**: By benchmarking concepts with respect to existing designs, designers push the design to match or exceed their competitor's performance.

  - **Better product-process coordination**: Explicit evaluation of the product with respect to the manufacturing criteria improves the product's manufacturability.

  - **Reduced time** to manufacture: Use of structured method decreases ambiguity, resulting in faster communication, and few false starts.

  - **Effective group decision making**: Encourages decision making based on objective criteria and minimizes the likelihood that arbitrary or personal factors influence the product concept.

  - **Documentation** of the decision process: Results in readily understood archive of the rationale behind concept decisions. The record is useful for assimilating new team members and for quickly assessing the impact of changes in the customer needs or in the available alternatives.

Overview of Methodology

- A two-stage concept selection methodology will be presented, although the first stage may suffice for simple design decisions.

- The first stage is called **concept screening** and the second stage is called **concept scoring**.

- Each is supported by a decision matrix which is used by the team to rate, rank, and select the best concept(s).

- Although the method is structured, the role of group insight to improve and combine concepts is emphasized.

- Concept selection is often performed in two stages as a way to manage the complexity of evaluating dozens of product concepts.

- *Screening* is a quick, approximate evaluation aimed at producing a few viable alternatives.

- *Scoring* is a more careful analysis of these relatively few concepts in order to choose the single concept most likely to lead to product success.

Methodology continued:

- During concept screening, rough initial concepts are evaluated relative to a common reference concept using a screening matrix.

- At this preliminary stage, detailed quantitative comparisons are difficult to obtain and may be misleading, so a coarse comparative rating system is used.

- After some alternatives are eliminated, the team may choose to move on to concept scoring and conduct more detailed analyses and finer quantitative evaluation of the remaining concepts using a scoring matrix as a guide.

- Throughout the screening and scoring process, several iterations may be performed, with new alternatives arising from the combination of the features of several concepts.

Six Step Process – Screening and Scoring

- Both concept screening and scoring follow a 6 step process which leads the team through the concept selection activity:
    1. Prepare selection matrix
    2. Rate the concepts
    3. Rank the concepts
    4. Combine and improve the concepts
    5. Select one or more concepts
    6. Reflect on the results and the process
- Although the process is well-defined, the team , not the method, creates the concepts and makes the decisions that determine the quality of the product. All members of the team should take part in this activity.
- The matrices are visual guides for consensus building among the team members and help focus attention on the customer needs and other decision criteria and on the product concepts for explicit evaluation, improvement, and selection.

COURSE

ENGI -8700
CIVIL
Design Project

CAPSTONE

INSTRUCTOR
Dr. Steve Bruneau
EN.4013
Ph 864-2119
Sbruneau @ mun.ca

TOPIC

Lecture 4:
Design
steps 3 & 4

REFERENCES.

FILES

WEB

http://www.engr.mun.c
a/~sbruneau/teaching/
8700project

Concept Screening – Step 1

Concept screening is developed by Stuart Pugh in the 1980s and is often called Pugh concept selection. Purposes are to narrow the number of concepts quickly and to improve the concepts.

Step 1: Prepare the selection matrix.

– Can be done on paper, flip chart, or spreadsheet.

– Concepts and criteria are entered on the matrix. All concepts should be at the same level of detail (graphical and textual info) – no biases.

- A simple one-page sketch of each concept greatly facilitates communication of the key features of the concept.

- If there are more than about 12 concepts, a multivote method can be used to choose the dozen or so concepts to be evaluated with the screening matrix.

- A concept is chosen as a benchmark, or reference concept, against which all other concepts are rated: industry standard, familiar product, early generation product, etc.

COURSE

ENGI -8700
CIVIL
Design Project

CAPSTONE

INSTRUCTOR
Dr. Steve Bruneau
EN.4013
Ph 864-2119
Sbruneau @ mun.ca

TOPIC

Lecture 4:
Design
steps 3 & 4

REFERENCES.

FILES

WEB

http://www.engr.mun.c
a/~sbruneau/teaching/
8700project

Step 2: Rate the Concepts

- A relative score of "better than" (+), "same as" (0) or "worse than" (-) is placed in each cell of the matrix to represent how each concept rates in comparison to the reference concept relative to the particular criterion. It's usually best to rate every concept on one criterion before moving to the next criterion.

- Objective metrics are best for rating concepts. Eg. # of parts as approximation for assembly cost, # of operations as approximation for ease of use, etc. Subjective metrics can be based on team consensus.

- Use hierarchical decomposition of selection criteria if necessary.

Step 3: Rank the Concepts

- After rating all the concepts, the team sums the number of "better than", "same as", and "worse than" scores and enters the sum for each category in the lower rows of the matrix.

- A net score can be calculated, and the team can then rank-order the concepts. Obviously the concepts with more pluses than minuses are ranked higher.

- Often at this point the team can identify one or two criteria which really seem to differentiate the concepts.

Step 4: Combine and Improve the Concepts

- Having rated and ranked the concepts, the team should verify that the results make sense and then consider if there are ways to combine and improve certain concepts.
  - Is there a generally good concept which is degraded by one bad feature? Can a minor modification improve the overall concept and yet preserve a distinction from the other concepts?
  - Are there two concepts which can be combined to preserve the "better than" qualities while annulling the "worse than" qualities?
- Combined and improved concepts are then added to the matrix, rated by the team, and ranked along with the original concepts in the next iteration.

COURSE

ENGI -8700
CIVIL
Design Project

CAPSTONE

INSTRUCTOR
Dr. Steve Bruneau
EN.4013
Ph 864-2119
Sbruneau @ mun.ca

TOPIC

Lecture 4:
Design
steps 3 & 4

REFERENCES.

FILES

WEB

http://www.engr.mun.c
a/~sbruneau/teaching/
8700project

Step 5: Select One or More Concepts

- Based on the previous steps, the team will most likely develop a clear sense of which are the most promising concepts.

- The number of concepts selected for further review will be limited by team resources (personnel, money, and time).

- Having determined the concepts for further analysis, the team must clarify which issues need to be investigated further before a final selection can be made.

- The team must also decide whether another round of concept screening will be performed or whether concept scoring will be applied next.

- If concept screening is not seen to provide sufficient resolution for the next step of evaluation and selection, then the concept-scoring stage with its weighted selection criteria and more detailed rating scheme would be used.

COURSE

ENGI -8700
CIVIL
Design Project

INSTRUCTOR

Dr. Steve Bruneau
EN.4013
Ph 864-2119
Sbruneau @ mun.ca

TOPIC

Lecture 4:
Design
steps 3 & 4

REFERENCES.

FILES

WEB

http://www.engr.mun.c
a/~sbruneau/teaching/
8700project

Example of a Concept Screening Matrix

	Concepts						
Selection Criteria	**A**	**B**	**C**	**D (REF)**	**E**	**F**	**G**
Ease of handling	0	0	-	0	0	-	-
Ease of use	0	-	-	0	0	+	0
Readability of settings	0	0	+	0	+	0	+
Accuracy	0	0	0	0	-	0	0
Durability	0	0	0	0	0	+	0
Ease of manufacture	+	-	-	0	0	-	0
Portability	+	+	0	0	+	0	0
Sum of +'s	2	1	1	0	2	2	1
Sum of 0's	5	4	3	7	4	3	5
Sum of -'s	0	2	3	0	1	2	1
Net score	2	-1	-2	0	1	0	0
Rank	1	6	7	3	2	3	3
Continue?	Yes	No	No	Combine with F	Yes	Combine with D	Revise

COURSE

ENGI -8700
CIVIL
Design Project

CAPSTONE

INSTRUCTOR

Dr. Steve Bruneau
EN.4013
Ph 864-2119
Sbruneau @ mun.ca

TOPIC

Lecture 4:
Design
steps 3 & 4

REFERENCES.

FILES

WEB

http://www.engr.mun.c
a/~sbruneau/teaching/
8700project

Step 6: Reflect on the Results and Process

- All team members should be comfortable with the outcome. If someone is not in agreement with the decision of the team, then perhaps one or more important criteria are missing from the screening matrix, or a particular rating is in error, or at least is not clear.

- Has a mistake been made? Do the results make sense to everyone on the team? Anything else need to be resolved?

COURSE

ENGI -8700
CIVIL
Design Project

CAPSTONE

INSTRUCTOR
Dr. Steve Bruneau
EN.4013
Ph 864-2119
Sbruneau @ mun.ca

TOPIC

Lecture 4:
Design
steps 3 & 4

REFERENCES.

FILES

WEB

http://www.engr.mun.c
a/~sbruneau/teaching/
8700project

Concept Scoring: Step 1

Is used when increased resolution will better differentiate among competing concepts. The team weighs the relative importance of the selection criteria and focuses on more refined comparisons with respect to each criterion.

- **Step 1: Prepare the Selection Matrix**
  - Best to use a spreadsheet for this part.
  - More detailed selection criteria may be added.
  - Importance weights are added to the matrix – this can be done by consensus or based on customer needs.

COURSE

ENGI -8700
CIVIL
Design Project

INSTRUCTOR
Dr. Steve Bruneau
EN.4013
Ph 864-2119
Sbruneau @ mun.ca

TOPIC

Lecture 4:
Design
steps 3 & 4

REFERENCES.

FILES

WEB

http://www.engr.mun.c
a/~sbruneau/teaching/
8700project

Step 2: Rate the Concepts

- A scale of 1 to 5 is recommended:
  - **Relative Performance   Rating**
  - Much worse than reference   1
  - Worse than reference   2
  - Same as reference   3
  - Better than reference   4
  - Much better than reference   5
- Reference points need not be the same for all criteria.

Step 3: Rank the Concepts

- Once the ratings are entered for each concept, weighted scores are calculated by multiplying the raw scores by the criteria weight.

- The total score is the sum of the weighted scores.

- Finally each concept is given a rank corresponding to its total score.

- Another approach is to use a pair-wise ranking approach (as used by the CIA)

Example: Concept Scoring Matrix

		Concept							
		A (Reference)		DF		E		G+	
Selection Criteria	Weight	Rating	Weighted Score	Rating	Weighted Score	Rating	Weighted Score	Rating	Weighted Score
Ease of handling	5%	3	0.15	3	0.15	4	0.2	4	0.2
Ease of use	15%	3	0.45	4	0.6	4	0.6	3	0.45
Readability of settings	10%	2	0.2	3	0.3	5	0.5	5	0.5
Accuracy	25%	3	0.75	3	0.75	2	0.5	3	0.75
Durability	15%	2	0.3	5	0.75	4	0.6	3	0.45
Ease of manufacture	20%	3	0.6	3	0.6	2	0.4	2	0.4
Portability	10%	3	0.3	3	0.3	3	0.3	3	0.3
	Total Score	2.75		3.45		3.1		3.05	
	Rank	4		1		2		3	
	Continue?	No		Yes		No		No	

COURSE

ENGI -8700
CIVIL
Design Project

INSTRUCTOR
Dr. Steve Bruneau
EN.4013
Ph 864-2119
Sbruneau @ mun.ca

TOPIC

Lecture 4:
Design
steps 3 & 4

REFERENCES.

FILES

WEB

http://www.engr.mun.c
a/~sbruneau/teaching/
8700project

PAIRWISE RANKING

What it is:

Pairwise ranking is a structured method for ranking a small list of items in priority order. It can help you:

• Prioritize a small list.

• Make decisions in a consensus-oriented manner.

How to do it:

Construct a pairwise matrix.

Each box in the matrix represents the intersection (or pairing) of two items. If your list has five items, the pairwise matrix would look like this, with the top box representing idea 1 paired with idea 2:

COURSE

ENGI -8700
CIVIL
Design Project

INSTRUCTOR
Dr. Steve Bruneau
EN.4013
Ph 864-2119
Sbruneau @ mun.ca

TOPIC

Lecture 4:
Design
steps 3 & 4

REFERENCES.

FILES

WEB

http://www.engr.mun.c
a/~sbruneau/teaching/
8700project

Rank each pair. For each pair, have the group (using a consensus-oriented discussion) determine which of the two ideas is preferred. Then, for each pair, write the number of the preferable idea in the appropriate box. Repeat this process until the matrix is filled.

1 and 2 compared:
2 is better.

1 and 3 compared:
1 is better.

4 and 5 compared:
5 is better.

... and so on
until...

COURSE

ENGI -8700
CIVIL
Design Project

INSTRUCTOR
Dr. Steve Bruneau
EN.4013
Ph 864-2119
Sbruneau @ mun.ca

TOPIC

Lecture 4:
Design
steps 3 & 4

REFERENCES.

FILES

WEB

http://www.engr.mun.c
a/~sbruneau/teaching/
8700project

Count the number of times each alternative appears in the matrix.

Alternative 5 appears 4 times in the matrix.

Alternative	1	2	3	4	
Count	2	3	1	0	
Rank					

Rank all items. Rank the alternatives by the total number of times they appear in the matrix. To break a tie (where two ideas appear the same number of times), look at the box in which those two ideas are compared. The idea appearing in *that* box receives the higher ranking.

Alternative 5 ranks 1st overall.

Alternative	1	2	3	4	
Count	2	3	1	0	
Rank	3rd	2nd	4th	5th	

COURSE

ENGI -8700
CIVIL
Design Project

CAPSTONE

INSTRUCTOR
Dr. Steve Bruneau
EN.4013
Ph 864-2119
Sbruneau @ mun.ca

TOPIC

Lecture 4:
Design
steps 3 & 4

REFERENCES.

FILES

WEB

http://www.engr.mun.c
a/~sbruneau/teaching/
8700project

Step 4: Combine and Improve the Concepts

- Some of the most creative refinements and improvements occur during the concept selection process as the team realizes the inherent strengths and weaknesses of certain features of the product concepts.

- Don't have tunnel vision … keep an open mind.

COURSE

ENGI -8700
CIVIL
Design Project

CAPSTONE

INSTRUCTOR
Dr. Steve Bruneau
EN.4013
Ph 864-2119
Sbruneau @ mun.ca

TOPIC

Lecture 4:
Design
steps 3 & 4

REFERENCES.

FILES

WEB

http://www.engr.mun.c
a/~sbruneau/teaching/
8700project

Step 5: Select One or More Concepts

- The final selection is not simply a question of choosing the concept that achieves the highest ranking after the first pass through the process.

- The team should explore this initial evaluation by conducting a sensitivity analysis. Weights and ratings can be varied to determine their effect on the ranking.

- Uncertainty about a particular rating can be assessed and may affect the choice.

- The top two concepts may be further developed, prototyped, and tested to elicit customer feedback – next part of lecture.

COURSE

ENGI -8700
CIVIL
Design Project

CAPSTONE

INSTRUCTOR
Dr. Steve Bruneau
EN.4013
Ph 864-2119
Sbruneau @ mun.ca

TOPIC

Lecture 4:
Design
steps 3 & 4

REFERENCES.

FILES

WEB

http://www.engr.mun.c
a/~sbruneau/teaching/
8700project

Step 6: Reflect on the Results and the Process

- This is the "point of no return" for the concept development process, so everyone on the team should feel comfortable that all of the relevant issues have been discussed and that the selected concept(s) have greatest potential to satisfy customers and be economically successful.

- A useful reality check is to review concepts that have been eliminated. Has a mistake been made?

- Did the concept selection method facilitate team decision making?

- How can the method be modified to improve team performance?

Summary of Concept Selection

- Concept selection is the process of evaluating concepts with respect to customer needs and other criteria, comparing the relative strengths and weaknesses of the concepts, and selecting one or more concepts for further investigation or development.

- A two stage approach, concept screening and concept scoring, is recommended.

- Both approaches have 6 steps: prepare matrix, rate, rank, combine and improve, select, and reflect.

- Concept selection is applied not only during concept development but throughout the subsequent design and development process.
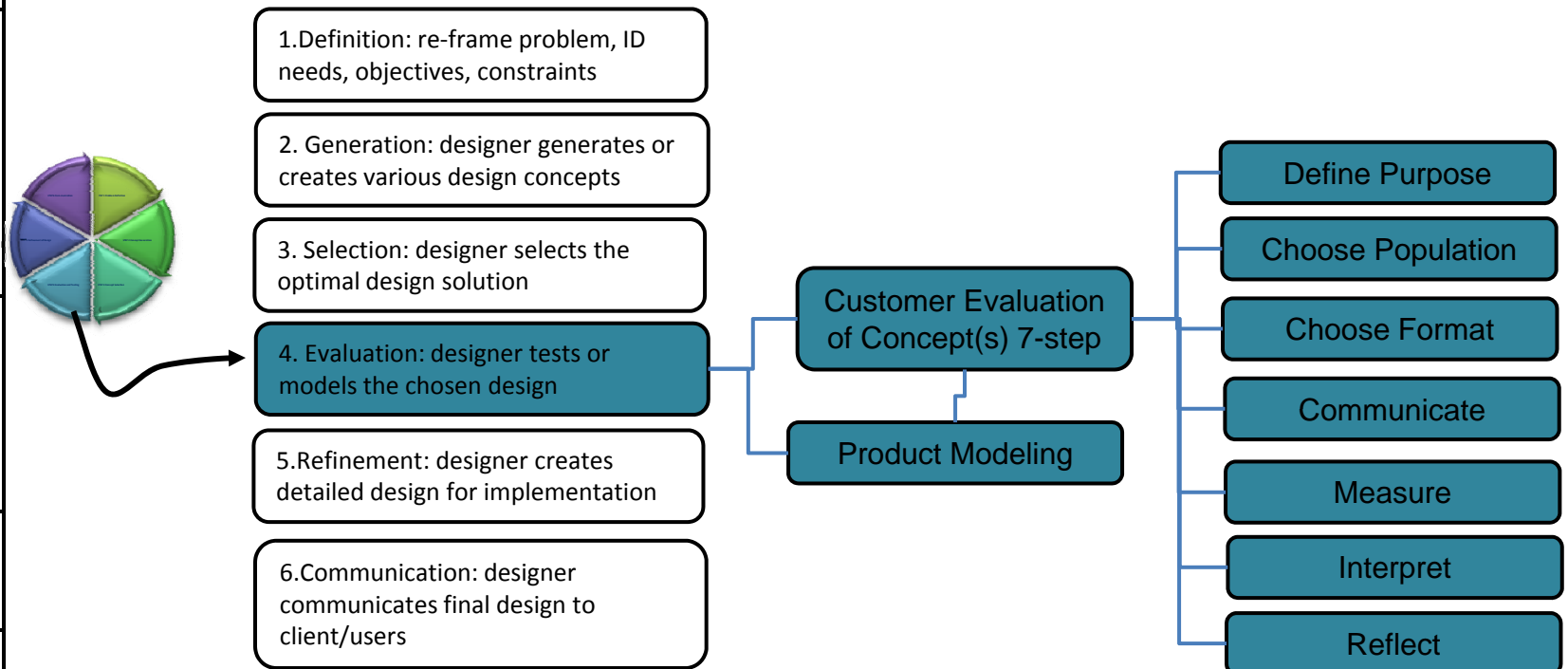
Evaluation and Testing

Evaluation and Testing

Evaluation and Testing:
- Customer Evaluation
- Product Modeling (will not detail this in tutorials)

1.Definition: re-frame problem, ID needs, objectives, constraints

2. Generation: designer generates or creates various design concepts

3. Selection: designer selects the optimal design solution

4. Evaluation: designer tests or models the chosen design

5.Refinement: designer creates detailed design for implementation

6.Communication: designer communicates final design to client/users

Customer Evaluation of Concept(s) 7-step

Product Modeling

Define Purpose

Choose Population

Choose Format

Communicate

Measure

Interpret

Reflect

Introduction to Evaluation and Testing

- We will focus on concept testing done during the concept development phase.

- In a concept test, the development team solicits a response to a description of the product concept from potential customers in the target market.

- This type of testing may be used to select which of two or more concepts should be pursued, to gather information from potential customers on how to improve a concept, and to estimate the sales potential of the product.

- Concept testing is closely related to concept selection in that both activities aim to further narrow the set of concepts under consideration.

- Concept testing is distinct in that it is based on data gathered directly from potential customers and relies to a lesser degree on judgments made by the team.

- Concept testing is also closely related to prototyping, because concept testing invariably involves some kind of representation of the product concept, often a prototype.

Concept Testing

A seven-step method for testing product concepts:

1. Define the purpose of the concept test

2. Choose a survey population

3. Choose a survey format

4. Communicate the concept

5. Measure customer response

6. Interpret the results

7. Reflect on the results and the process

Step 1: Define the purpose of the test

- It is recommended that the team explicitly articulate in writing the questions that the team wishes to answer with the test.

- Concept testing is an experimental activity, as with any experiment, knowing the purpose of the experiment is essential to designing an effective experimental method.

- What questions do you want to answer?

- Questions addressed in concept testing are typically:
  – Which of several alternative concepts should be pursued?
  – How can the concept be improved to better meet customer needs?
  – Approximately how many units are likely to be sold?
  – Should development be continued?

COURSE

ENGI -8700
CIVIL
Design Project

CAPSTONE

INSTRUCTOR

Dr. Steve Bruneau
EN.4013
Ph 864-2119
Sbruneau @ mun.ca

TOPIC

Lecture 4:
Design
steps 3 & 4

REFERENCES.

FILES

WEB

http://www.engr.mun.c
a/~sbruneau/teaching/
8700project

Step 2: Choose a Survey Population

- Assumption: population of potential customers surveyed reflects that of the target market for the product or problem solution.

- Team should choose survey population that mirrors the target market in as many ways as possible.

- Often a product addresses multiple market segments or serves many needs. An accurate concept test requires that potential customers from each target segment be surveyed.

- Sample size should be large enough that the team's confidence in the results is high enough to guide decision making. Can be as small as 10 to as large as 1000.

- Purchase-intent surveys can be separate from those seeking design improvements.

- Consult widely with potential users to ensure buy-in for problem solving that does not involve product development.

COURSE

ENGI -8700
CIVIL
Design Project

CAPSTONE

INSTRUCTOR
Dr. Steve Bruneau
EN.4013
Ph 864-2119
Sbruneau @ mun.ca

TOPIC

Lecture 4:
Design
steps 3 & 4

REFERENCES.

FILES

WEB

http://www.engr.mun.c
a/~sbruneau/teaching/
8700project

Step 3: Choose a Survey Format

- Face-to-face interaction: malls, park, city streets, pre-arranged telephone interviews, trade-show, or focus groups. Beware of sympathy responses.

- Telephone: Prearranged and targeted at very specific individuals.

- Mail: Concept testing material are sent and respondents are asked to return a completed form. Slow and poor response rate. May have to provide a free gift.

- E-mail: Maybe treated as Spam!

- Internet: Create a virtual concept testing site in which participants can observe concepts and provide responses. Use email to recruit respondents to visit site. Use "survey monkey".

- Each format has its advantages and disadvantages.

- Any other formats??

Step 4: Communicate the Concept

- ## This is linked to choice of survey format.
  - Verbal description: short paragraph or collection of bullet points summarizing the product concept – useful in telephone interviews
  - Sketch: Line drawings showing the product in perspective, perhaps with annotations of key features.
  - Photos and Rendering: If prototype available, photos can be used. Renderings are created with pens and markers or CAD.
  - Storyboard: Series of images that communicates a temporal sequence of actions involving the product. Similar to comic strips.

COURSE
ENGI -8700
CIVIL
Design Project

INSTRUCTOR
Dr. Steve Bruneau
EN.4013
Ph 864-2119
Sbruneau @ mun.ca

TOPIC
Lecture 4:
Design
steps 3 & 4

REFERENCES.

FILES

WEB
http://www.engr.mun.ca/~sbruneau/teaching/8700project

Step 4: Communicate the Concept (cont.)

- Communication Techniques (cont.)
  - Video: Allows even more dynamism than the storyboard. More features can be communicated.
  - Simulation: Good for electronic devices. E.g. Flight simulators.
  - Interactive multimedia: Video + simulation + user interaction. Expensive.
  - Physical appearance models: "Looks-like" models, vividly display the form and appearance of a product. Wood or foams and painted to look like real products.
  - Working prototypes: Works-like models. May think it is the final product.

COURSE

ENGI -8700
CIVIL
Design Project

CAPSTONE

INSTRUCTOR
Dr. Steve Bruneau
EN.4013
Ph 864-2119
Sbruneau @ mun.ca

TOPIC

Lecture 4:
Design
steps 3 & 4

REFERENCES.

FILES

WEB

http://www.engr.mun.c
a/~sbruneau/teaching/
8700project

Step 5: Measure Customer Response

- Most concept test surveys first communicate the product concept and then elicit customer response.
  - Choice of alternative concepts
  - Improvements to concepts
  - Purchase-intent
    - Definitely would buy
    - Probably would buy
    - Might or might not buy
    - Probably would not buy
    - Definitely would not buy

COURSE

ENGI -8700
CIVIL
Design Project

INSTRUCTOR
Dr. Steve Bruneau
EN.4013
Ph 864-2119
Sbruneau @ mun.ca

TOPIC

Lecture 4:
Design
steps 3 & 4

REFERENCES.

FILES

WEB

http://www.engr.mun.c
a/~sbruneau/teaching/
8700project

Step 6: Interpret the Results

- Interpretation is straightforward if comparing two or more concepts, especially if one concept dominates.

- Sales forecast is subject to a great deal of uncertainty and exhibits notoriously high errors.

- Customer purchase-intent surveys can provide some estimates if the sample size is large. Mostly guesswork.

Step 7: Reflect on the Results and the Process

- Was the concept communicated in a way that is likely to elicit customer response that reflects true intent? E.g. if one of the primary benefits of the concept is its aesthetic appeal, was this made clear to the respondent?

- Were enough potential customers surveyed?

- Can we forecast future sales a bit better?

Summary

- Concept testing can verify that customer needs have been adequately met by the product concept, assess the sales potential of a product concept, and/or gather information for refining the product concept.

- Seven-step approach is recommended:
  - Define purpose
  - Choose survey population
  - Choose survey format
  - Communicate the concept
  - Measure customer response
  - Interpret the results
  - Reflect on the results and process

Engi. 8700 Senior Civil Design Project

Next Lecture

General project management .
Teamwork, skills and tools.
MS Project guidelines for use in 8700.