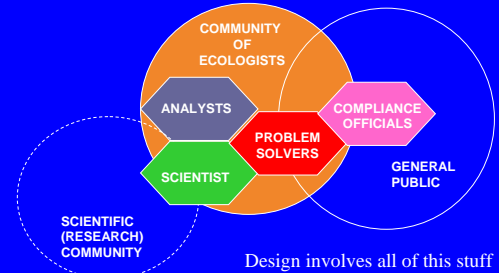


Appreciative Design

A stakeholder involvement based design process for ecological engineering

ESRM 302/590 Week 1 lecture 2
Spring Quarter 2007

Role of Practicing R-E's in Society



What is “design?”

- Probably more definitions than authors!
- “Design is the process of using knowledge to convert an idea (could be a “need”) into the information from which a product or system can be produced.”

adapted from Hales 1993

What is restoration design:

Student activity

Engineering *n.*

1. The application of scientific principles (from ecology maybe?) to practical ends as the design, construction (or installation) and operation (actively looking after) of efficient (has the desired effect) and economical (intelligent allocation of resources) structures, equipment and (or) systems (ecological systems, right?).

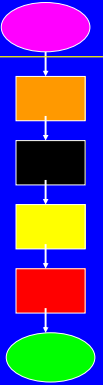
Engineer *v.* :

1. to plan, construct, or manage as an engineer
 2. (doing genetic engineering)
 3. to plan, manage and put through by skillful acts or contrivance; maneuver.
- “The essence of engineering is to design.”
 - Perhaps Restoration Design is the essence of Ecological Engineering?

The Design Process (model)

Dieter (1991)

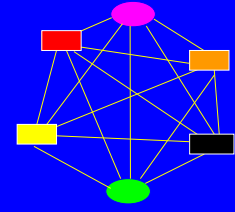
- Recognition of Need
- Definition of Problem
- Gathering of Information
- Conceptualization
- Evaluation
- Communication of Design



The Design Process (model)

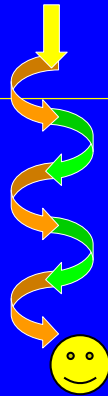
Dieter (1991)

- Recognition of Need
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Seven Stages of Appreciative Design

1. Identification of Need
2. Problem Framing
3. Design Requirements & Constraint Setting
4. Synthesis of Design Parameters
5. Approval & Acceptance
6. Implementation
7. Assessment & Adjustment



Appreciative Design Model Premises

- Design is a Social Process
- Perspectives Change over Time
 - Result of Events and Ideas
 - Result of Mutual Learning
 - Result of Engineering Science
- Structured Decision Processes Support Communication

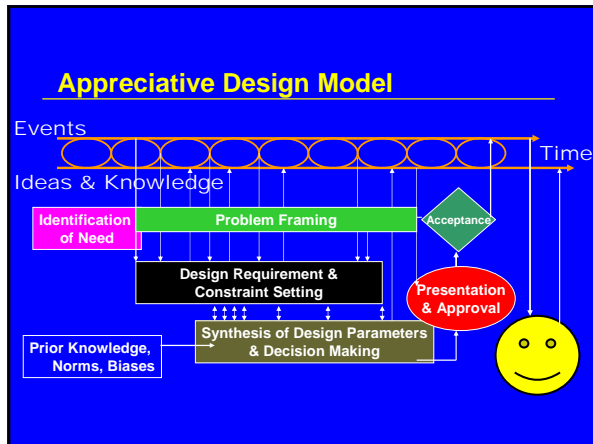
Restoration specific premises that you'd like for us to be acknowledging:

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Stakeholders

- Problem Owner (Client)
- Those Responsible for Proposing or Initiating Action (Designer / Design Team)
- Those who Implement Solutions (Doers)
- Those who may Benefit from, or be Injured by Proposed Actions (Affected Persons)
- Those who have Authority or Conviction and Resources to Block Unwanted Actions (Activists, Regulators, Bureaucrats, Managers)



- ### (Design Project Statements)
- Concise description of project in words of stakeholders
 - Concise restatement of project in words of design team (Active Listening)

- ### Identification of Need
- Self - Identified Problems
"Ah - Ha !!!"
 - Assigned Problems
"Hey You !!!"
-

- ### Problem Framing
- Dominating Perspective or Viewpoint
 - Establish Policy & System Level Functional Requirements and Constraints
 - Set Tolerance and Acceptance Criteria
 - Identify Top Level Constraint Owners (Stakeholders)
 - Identify Collaborators for Concurrent Design

Western Pond Turtle

Photos: Washington Dept. of Fish & Wildlife Story courtesy Jim Dooley, Jeff Bash, Justin Maschoff

- ### Problem Framing
- Reproductive success is reduced by lack of basking sites in ponds containing Western Pond Turtles
 - Need more basking structures in ponds where protected populations of WPT are being developed

Problem Framing: (Technical Re-Statement)



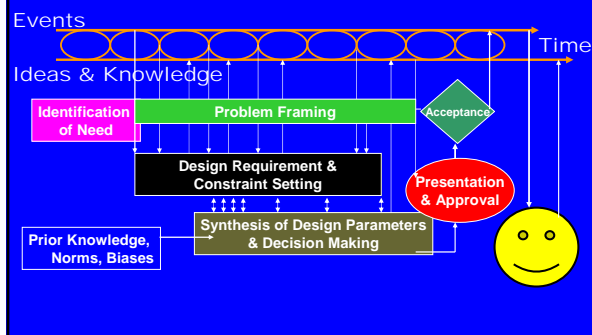
- Reproductive success is reduced by lack of basking sites in ponds containing Western Pond Turtles
- Reproductive success is a function of amount of solar energy absorbed by breeding-age females
- Time to sexual maturation is a function of cumulative solar energy
- Increased basking opportunity may improve reproductive success
- Provide more basking opportunity

Problem Framing: (Oh, by the Way!)



- Juveniles are subject to excessive predation by large mouth bass and bull frogs
- Design the basking structures to provide refuge for juveniles as well as basking sites

Appreciative Design Model



Design Requirement and Constraint Setting

- Functional Requirements (FR's)
- Functional Objectives Stated in Solution-Neutral Terms
- Aesthetic requirements (we've made them FR's)
- Constraints (C's)
- Limitations on Designer Freedom
 - All C's Must Be Owned by a Stakeholder

Design Requirement Source

- FR's come from the "problem owner"
 - Problem owner can "commission" the design
 - "Ah-ha" or "Hey-you"
 - Problem owner can get FR's from other Stakeholders ("I'll have what she's having")
 - Other stakeholders can only "constrain" the design

Constraint Ownership

- All Constraints are "Owned"
 - Ownership may be Shared
 - Coalitions of Stakeholders
 - Multiple Stakeholders with Different Weights
 - Ownership may be Conditional
 - If some data "D" is true, then constraint "C" is invoked.

(After McIntyre and Higgins, 1989)

Design Requirement and Constraint Setting (documentation approach)

Functional Requirements	Constraints
<ul style="list-style-type: none"> • Provide ... • Increase ... • Decrease ... Don't have but want or need	<ul style="list-style-type: none"> • No more than... • At least... • Without... Limits, bounds
Problem Owner	Constraint Owner

Functional Requirements



FR1.0 Provide aquatic perches for WPT of all ages

FR2.0 Provide means for juveniles to avoid being eaten by predatory bass and frogs

Constraints for FR1.0

FR1.0 Provide aquatic perches for WPT of all ages

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Constraints for FR1.0

FR1.0 Provide aquatic perches for WPT of all ages

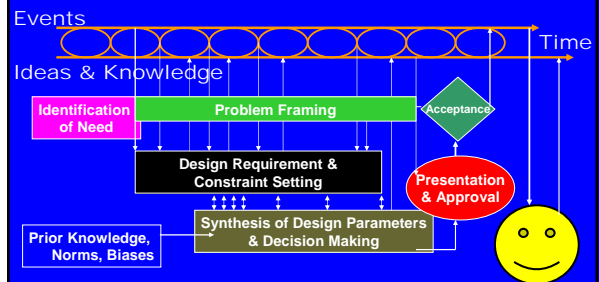
- C1.1 WPT are social – not territorial
- C1.2 Adults are over 300 mm wide
- C1.3 Juveniles are less than 50 mm wide
- C1.4 Align Structures N – S for better solar energy
- C1.5 Juveniles cannot climb slick surfaces
- C1.6 Submerge a shallow edge to ease climbing
- C1.7 Radius of basking surface must be >300 mm
- C1.8 Locate within 3 m of vegetation and food

Constraints for FR2.0

FR2.0 Provide means for juveniles to avoid being eaten by predatory bass and frogs

- C2.1 Openings must be 55-75 mm wide by 20-25 mm tall. Volume must be > 50 x 75 x 25 mm
- C2.2 Bass and Bullfrogs big enough to eat juvenile WPT cannot get into small spaces
- C2.3 Refuge needs to be within 0.5 m of basking space
- C2.4 Bass and Bullfrogs are faster than WPT
- C2.5 B & B cannot capture WPT at least 100 mm inboard from edge of basking structure

Appreciative Design Model



Design Parameters and Decision making

Design Parameters

- Features of the Solution
- Represent physical properties, objects, processes
- Directly "settable" by the designer and implementer

Design Parameters



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Chosen Solution



Design Decision Tracking Matrix

Functional Requirements	Design Parameters	Constraints
(Problem Owner)	(Designers)	(Constraint Owner)
Provide ... Increase ... Decrease ... Don't have but want or need	Materials Methods Shape Size Choice	No more than... At least... Without... Limits, bounds

When is Design Done?

When the product or process is sufficiently characterized by Design Parameters that persons of ordinary skill can:

- Implement the solution such that it performs the desired function(s)
- Solution does not violate constraints in its operation

Appreciative Design - Conclusions

- Built Upon Base of Axiomatic Design (Suh)
- Provides Opportunity to Identify and Address Stakeholder Beliefs, Values and Roles Throughout the Design Process
- Provides Structured Tracking of FRs, DPs, Cs and Decision Logic
- Provides Rational Bridge Between Engineering Processes, Biological Systems and Social Processes
- Enables Concurrent Design of Products & Processes

