

Lecture 3, Sep 14, 2021

Arguments, Continued

- To make an argument an engineering argument, the key change will be in the evidence; the nature of the claim might also change
- Evidence should be testing and not example; testing through standard procedures as set out previously and determined through research
- Claims are made engineering claims when we realize that **opinions are not enough**

Defining Requirements

- Frame \iff Diverge \iff Converge
 - Framing: Understanding the situation (what do we want to do?)
 - Divergence: Come up with ideas, respond to the situation as framed
 - Convergence: Throw away the bad ideas and develop an argument for recommending a specific idea
 - Representations: sketch, model, prototype, report, argument, build, photograph, present, . . .
 - There is no starting point or ending point; you start at any point and continue until you have the idea that you want
- How do we select a design?
 - Is this alternative **viable** (what the design should or must not be)? (informed by *constraints*)
 - How does this alternative **measure**? (i.e. how do we measure whether this idea is good or not?) (based on *metrics*)
 - How do these alternatives **compare** (what the design should have more or less)? (informed by *criteria*)
 - * Criteria should specify what is better, while metrics specify how to measure quantitatively
 - * e.g. a metric might be cost, and a criterion might be lower cost is better
 - All are developed based on **objectives** (what the design should do or be; its function), which are interpreted from **stakeholders** (who impact or are impacted by the design)
 - * Is the designer or design team a stakeholder? We are **always** stakeholders, with our own voices, values and biases
 - * There needs to be a balance between bringing in what we think and meeting the requirements of the clients
- To codify requirements:
 1. Clarify your intention; e.g. if the client wants the device to be repairable, what does that mean?
 2. Create objectives based on the clarified intentions, through common themes; e.g. repairable \rightarrow openable without special tools, with few tools, without too much effort and in a reasonable amount of time
 3. Identify metrics: Metrics have two core components: characteristic and unit, and a measurement process
 - e.g. if the driving objective is “I want a backpack that’s big enough to carry my school stuff”, the characteristic would be volume, and unit could be litres; but in this context just volume is not enough, convenience also matters
 - In selection-style design, alternatives come from pre-existing off-the-shelf designs