The Art of Explaining
“Intuitive Reflections”

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Outline

- introduction
- setting
- strategies
- pitfalls
- exercise
- wrap-up

Settings

Class

- » large group
- » planned lecture
- » spontaneous - response to question

Small Group

- » informal gathering

Question and Answer Session

- » test imperative

Key distinction - peer pressure associated with large group.

Strategies

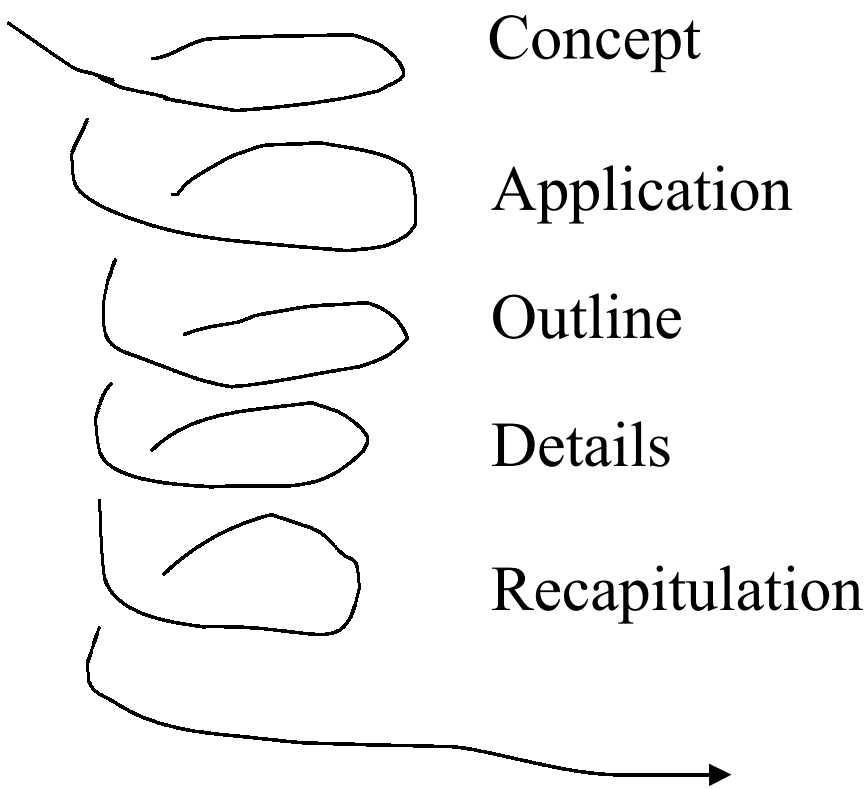
Analogy

- examples
- to knowledge base
  - link to specialty - knowledge of audience
- to experience base
  - link to familiar experience - e.g., shower
- scout out familiar framework, then link to this
  - take the time to sense this and prepare - control the pace

Strategies

Spiral

- » vulture approach
- » circle around, increasing detail progressively



Strategies

Spiral cont…

Points

- progression of detail
  - informal -> formal
  - abstract -> concrete -> abstract…
- refinement of ideas
- introduction of rigour in measured amounts
- solicit feedback between phases
  - “does this make sense”?

Example - types of process control

Strategies

Images

- » visual component to explanation
- » reduce degree of abstraction by grounding in visual cue
- » Example - notion of a statistic/sampling distribution
  - how variation propagates through a computation

Prepared vs. Spontaneous

- » prepared slides - inherently more passive
- » spontaneous - images and development evolve during the course of the explanation
- » opportunity for “revelation”

Strategies

Interaction

- draw students into explanation - induce participation

Take Your Time

- take the time to frame your explanation before beginning
- control the pace

Close the Loop

- solicit feedback regularly, particularly at reasonable break points
- don’t build on a weak initial understanding

Pitfalls

- Tangents (!)
  - » relative term
  - » class situation - tangent represents time well off the beaten track - remainder of students left hanging
  - » small group - excessive detail that obscures the primary concepts
  - » reign in
  - » defer to an additional session?

- Please Release Me
  - » temper the need for feedback - avoid stalling because you are waiting for some indication from the class

Pitfalls

- “Talk at” vs. “Discuss with”
- Is the analogy approach patronizing?
  - gauge the reaction

Things to Avoid

- “simple”, “can be easily shown”
  - statements that prejudge the development of understanding
    - » each individual has a “difficulty profile”
    - » encourage comfort about exchanging ideas - level of trust

Exercise

Choose a topic from your field of specialization, and explain it to your group

- consider strategies
- prepare approach
- present
- review with group

Wrap-up

- use collection of approaches
  - » be versatile
- adapt on the run
- close the loop
- watch for tangents
- take chances

Random Samples

Scenario -

- » we have an underlying pattern of variability for a process which we would like to characterize -- the population
- » we perform a series of experiments on the process in such a way that the results are independent - outcome of one experiment has no influence on any other experiment
- » the underlying distribution in place during each experimental run is identical to that of the population
- » when we run each experiment, we are collecting a value from the random variable X_i - which has uncertainty
- » X_i represents the “i-th” act of sampling - referred to as a sample random variable

Definition - Random Sample

A random sample of size "n" of a population random variable is a collection of random variables $X_1, \ldots X_n$ such that

- » the X_i's are independent
- » the X_i's have distributions identical to that of X, i.e.,

$$F_{X_i}(x) = F_X(x)$$

Each X_i represents a snapshot of the process. The X_i's are referred to as sample random variables.

What do we do with these sample values?...

Sample Average

- used to estimate the mean
- given "n" samples, X_1, …, X_n, compute

$$\overline{X} = \frac{1}{n}\sum_{i=1}^{n} X_i$$

- interpretation - a rule for computing the sample average, involving sampling
- $\overline{X}$ is a random variable
- observed value $\overline{x} = \frac{1}{n}\sum_{i=1}^{n} x_i$

Lower case is used to denote observed values of the sample random variables and average.

Statistics

- Sample average is an example of a “statistic”

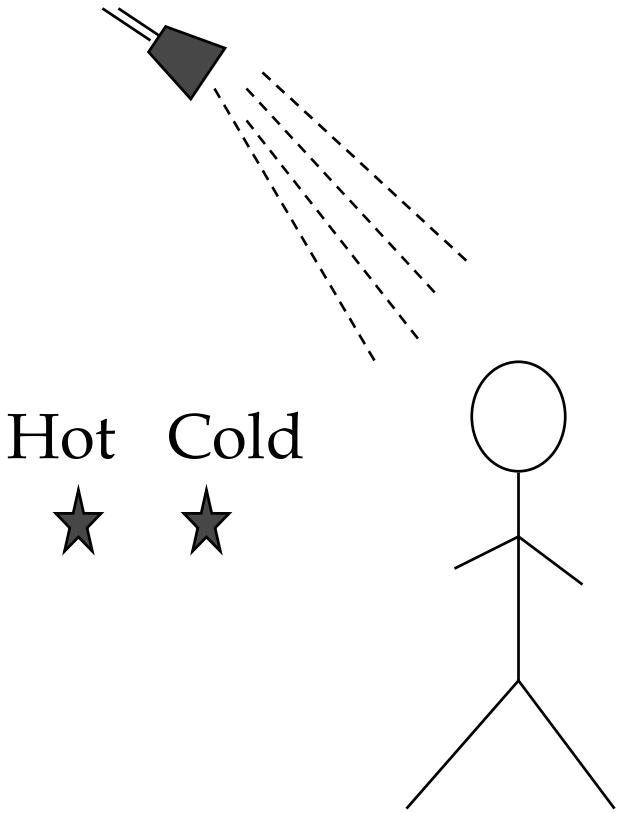
Definition

A statistic is a function of sample random variables that is used to estimate a value of a parameter, and does not depend on any unknown parameters.

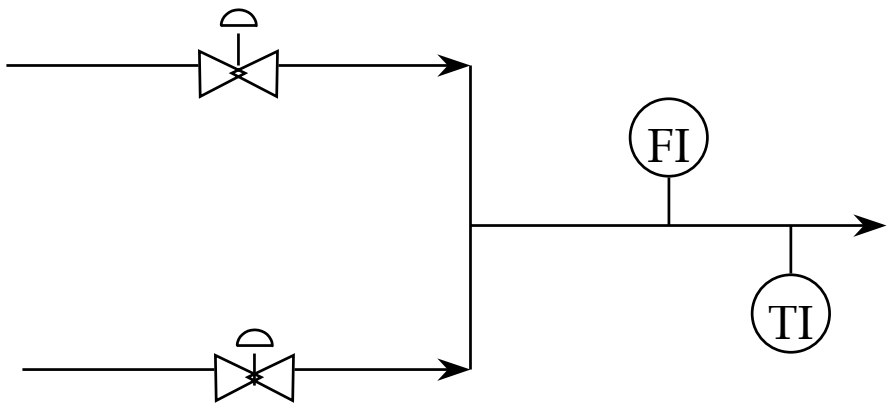
  - e.g., sample average estimates mean μ and doesn’t depend on unknown parameters

$$\overline{X} = \frac{1}{n}\sum_{i=1}^{n} X_i$$

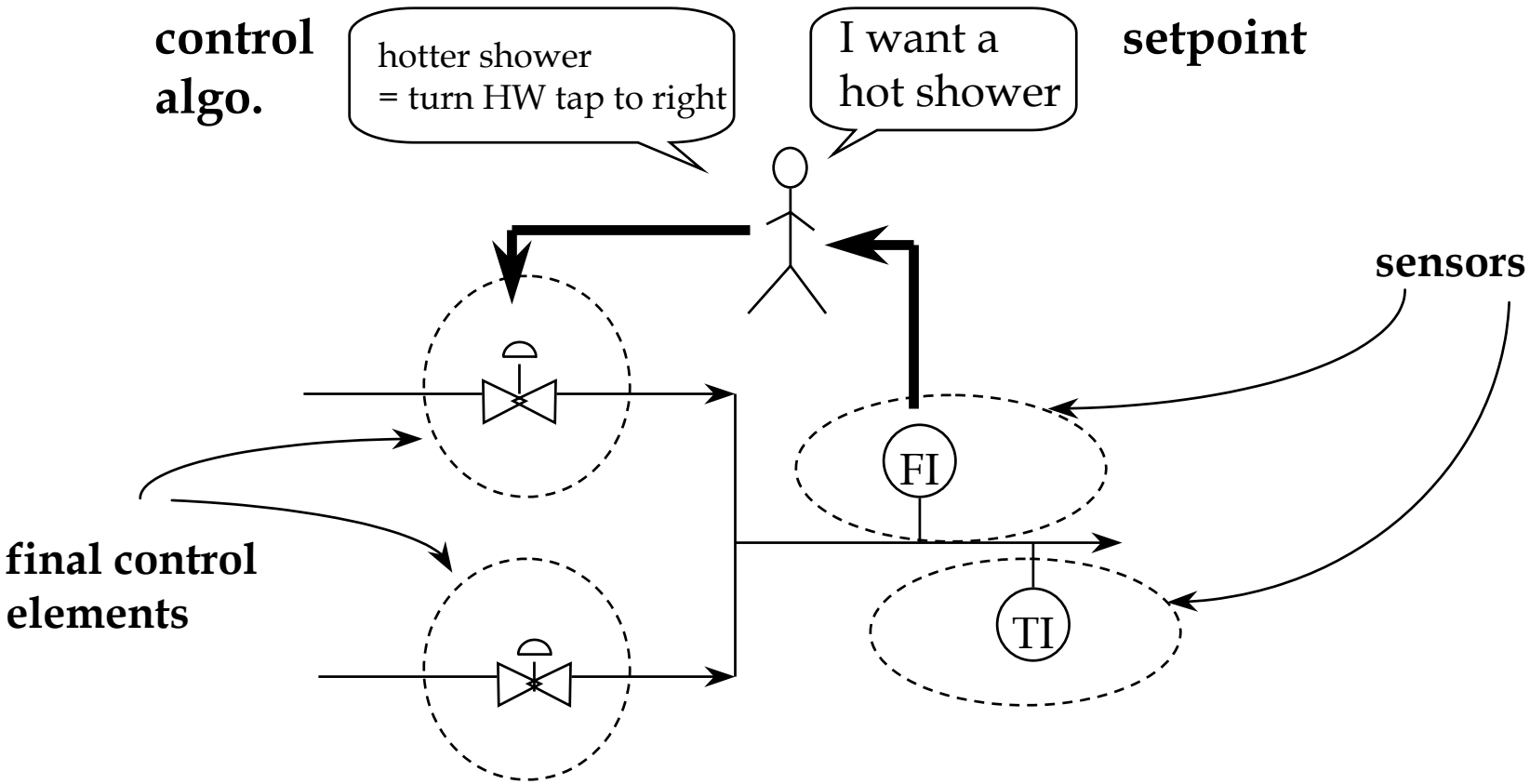
Example - Shower



Example - Shower



Example - Shower



Example - Shower