

Basic Terminology

A "Statistic"

Any *function* of data

- e.g. Proportion, Sum, Average, Minimum, Maximum, Count
- Useful to represent some aspect of the data in a simple, easy to understand way
- Is defined by an operation on data



Branches of Statistics

Descriptive Statistics

Statistical procedures to summarize, organize, and simplify the communication of data

Inferential Statistics

Statistical techniques that facilitate inferences about populations from data collected in samples

Descriptive Statistics	Inferential Statistics
<p>Obama received 53.4% of the vote in the 2008 Presidential Election</p> <p><i>66,882,230 votes out of 125,225,901 votes</i></p>	<p>Obama <i>is predicted</i> to receive 55% of the vote in the 2008 Presidential Election, $\pm 2.1\%$</p> <p><i>Gallup Poll of 2472 voters, 11/2/08</i></p>

"Data"

Data (plural) are measurements or observations

- Data set: collection of measurements or observations
- Datum (singular): is a single measurement or observation, aka. Score, or raw score

"Population"

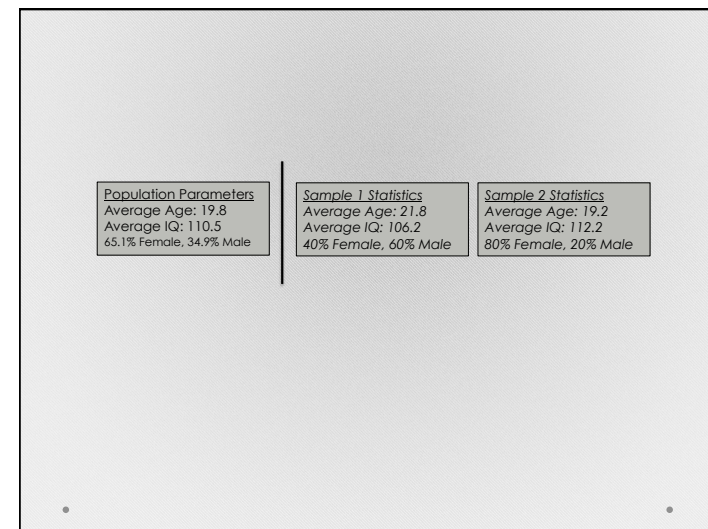
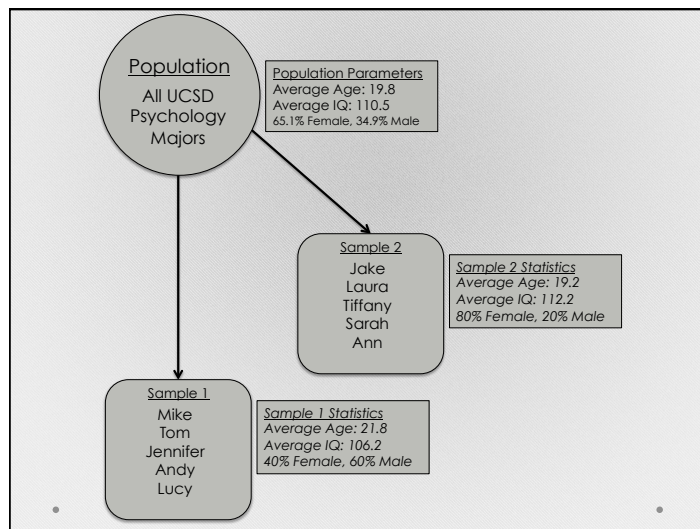
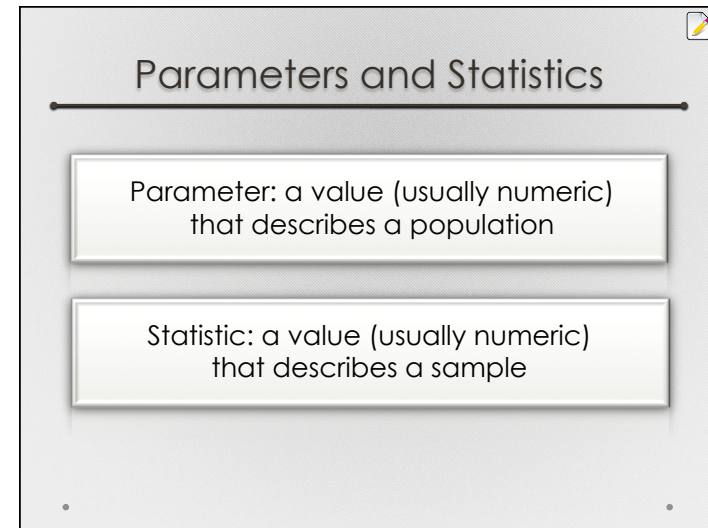
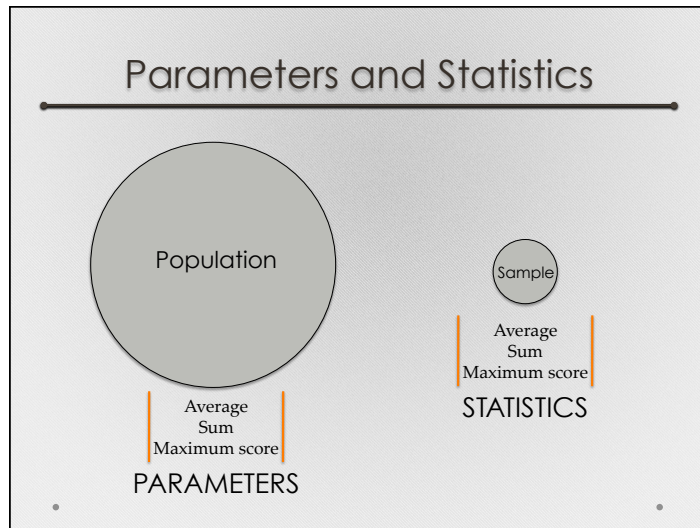
A population is the set of all individuals (units) of interest

- e.g. Plankton in the ocean, People in the world, People at UCSD, Dogs in San Diego

"Sample"

A sample is a set of individuals (units) selected from a population

- Usually intended to "represent" the population
 - Simple Random Sampling
- Usually much smaller than population



Sampling Error

The discrepancy (or amount of error) that exists between a sample statistic and the corresponding population parameter

Population Parameters	Sample 1 Statistics	Sample 2 Statistics
Average Age: 19.8	Average Age: 21.8	Average Age: 19.2
Average IQ: 110.5	Average IQ: 106.2	Average IQ: 112.2
65.1% Female, 34.9% Male	40% Female, 60% Male	80% Female, 20% Male

Random Assignment

The process of assigning treatments (levels of the IV) to subjects so that only chance is responsible for which treatment each subject receives

- Ensures that there are no *systematic* differences across groups before treatment (groups will only differ due to chance)

Sampling Error

The discrepancy (or amount of error) that exists between a sample statistic and the corresponding population parameter

Population Parameters	Sample 1 Statistics	Sample 2 Statistics
Average Age: 19.8	Average Age: 21.8	Average Age: 19.2
Average IQ: 110.5	Average IQ: 106.2	Average IQ: 112.2
65.1% Female, 34.9% Male	40% Female, 60% Male	80% Female, 20% Male

Population
All UCSD Students

Two Possible Explanations:

- There is actually no effect of caffeine on test scores and the 4-point difference is due to sampling error
- There is a real effect of caffeine on test performance

Random Assignment

No Caffeine Group
n = 50
82, 77, 79, 64,
81, 92, 74,
88, 91, 81,
79, 70...

Group 2 Statistics
Average test score: 75

Caffeine Group
n = 50
86, 76, 89,
91, 78, 89,
67, 54, 67,
88, 75, 90...

Group 1 Statistics
Average test score: 79

Measurement



Measurement

The process of assigning numbers or labels to physical phenomena according to some rule

Construct

Internal attributes or characteristics that cannot be directly observed

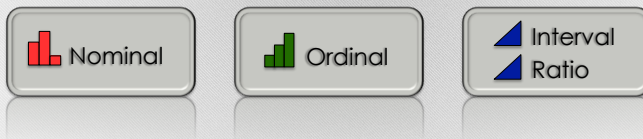
Operational Definition

A procedure for measuring an external behavior so that those measurements may be used to infer about the status of the underlying construct

what is *measured* in psychological science is often not the construct, but rather something physical we choose to *believe* indexes the presence or quantity of the construct

Scales of Measurement

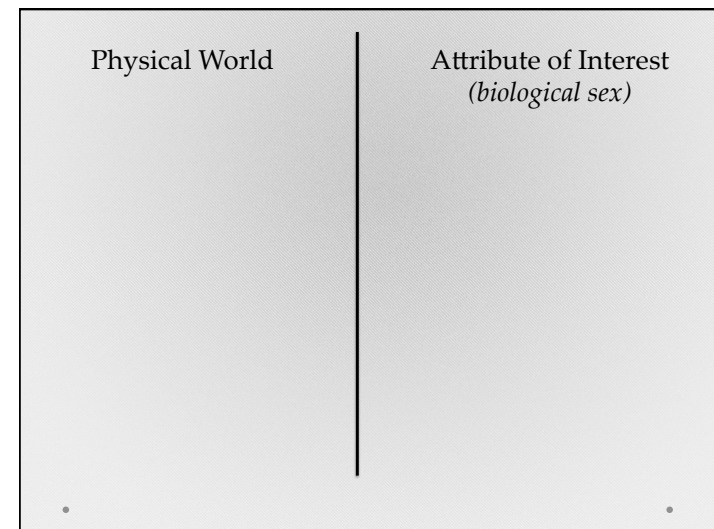
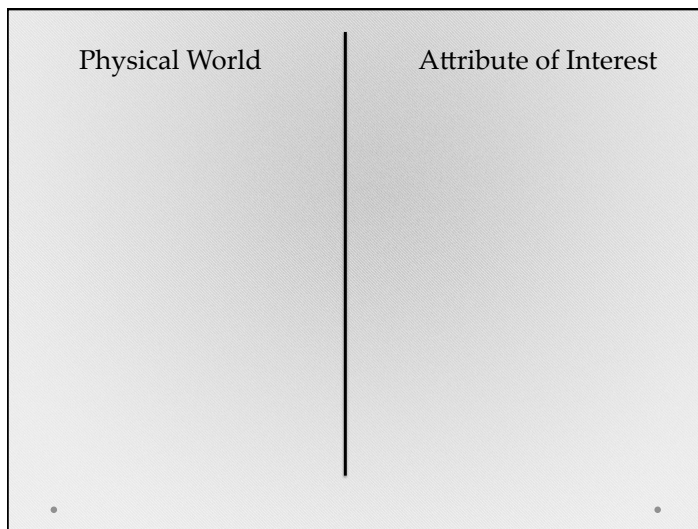
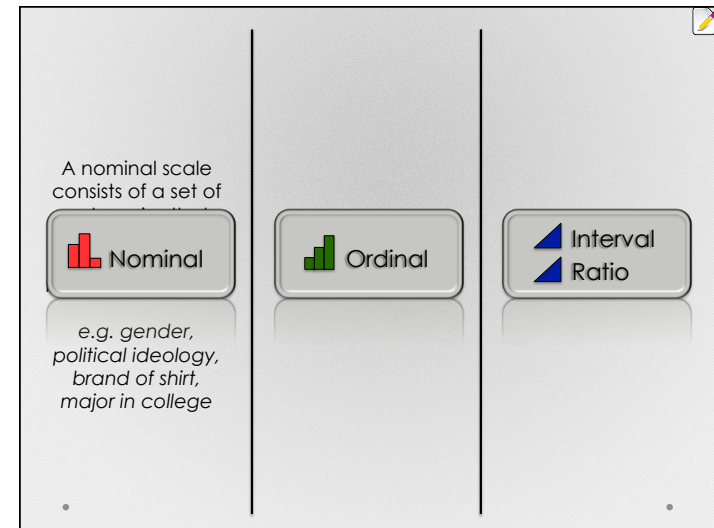
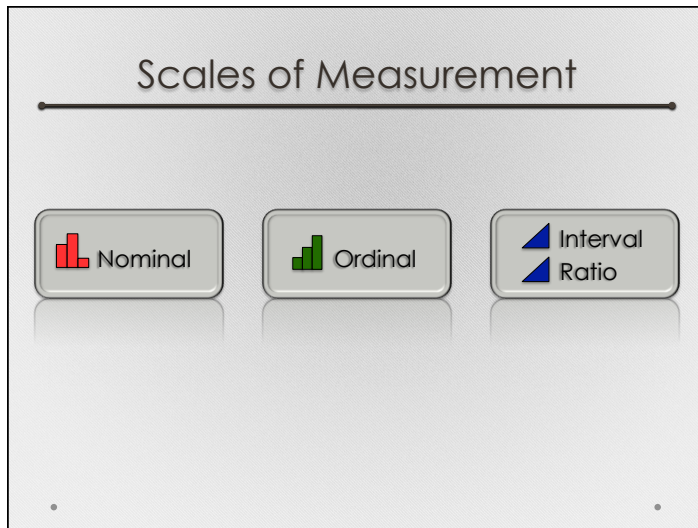
Scales of Measurement

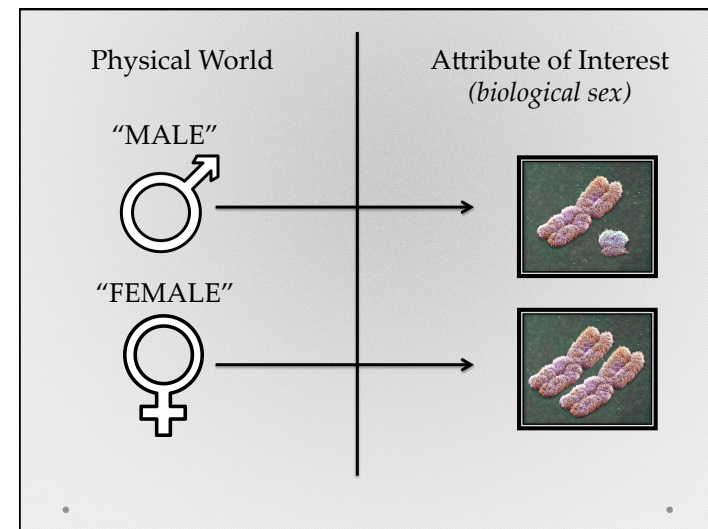
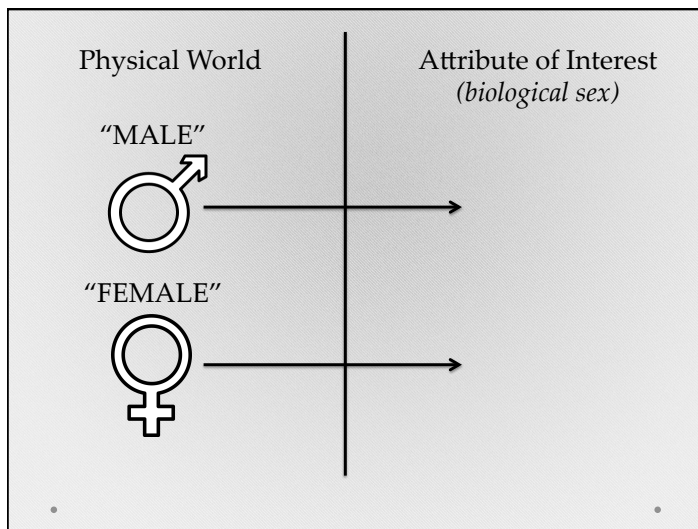
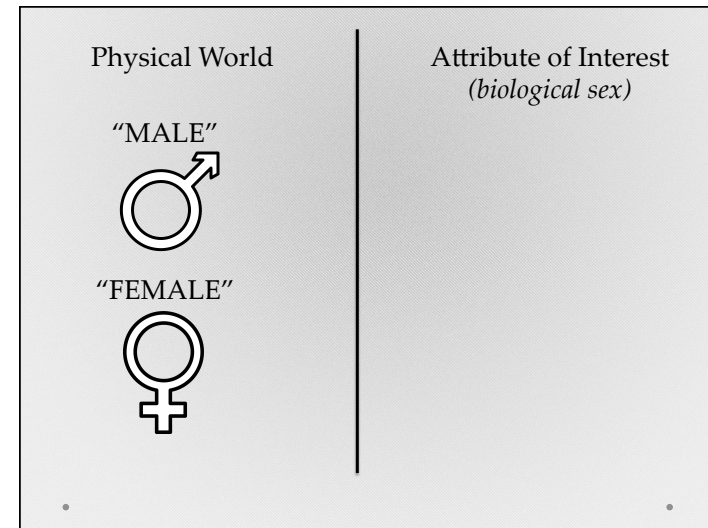
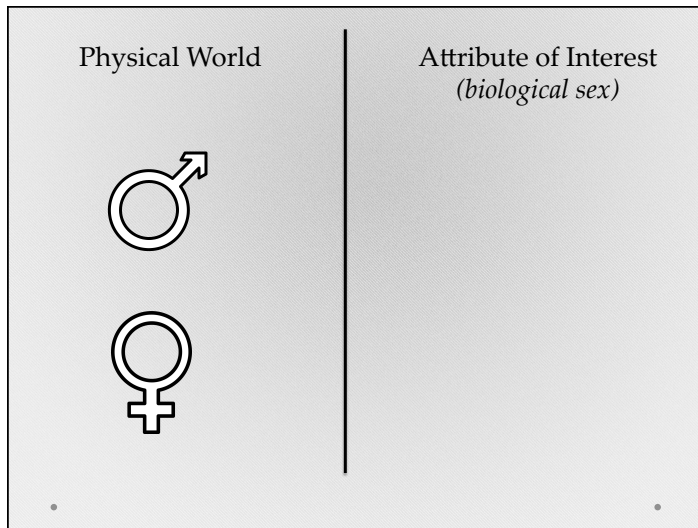


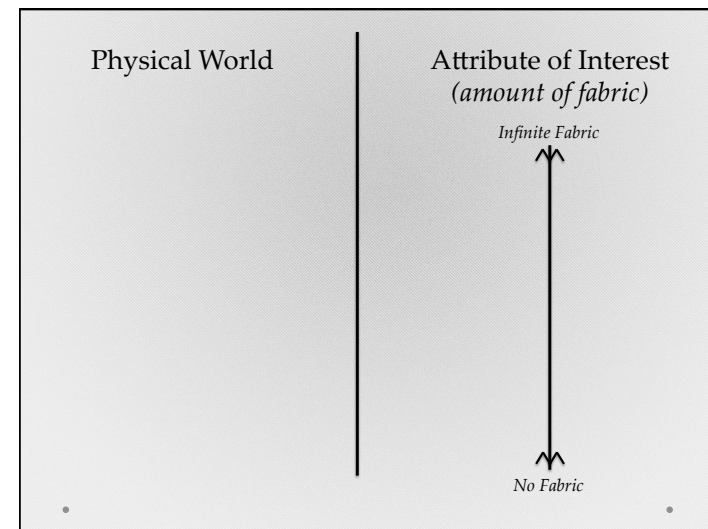
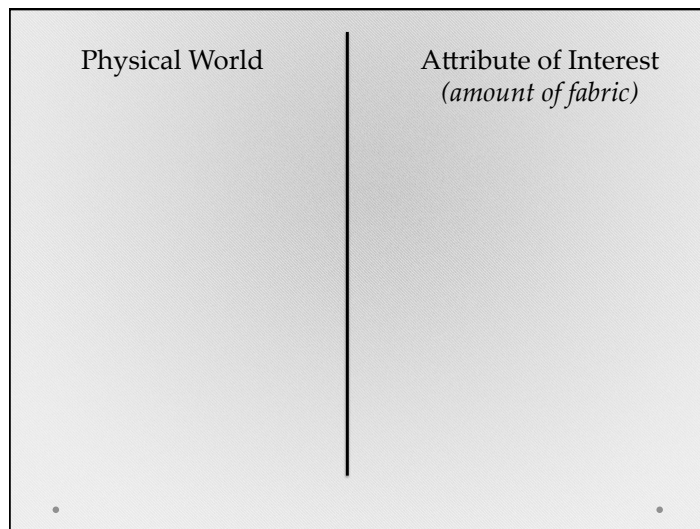
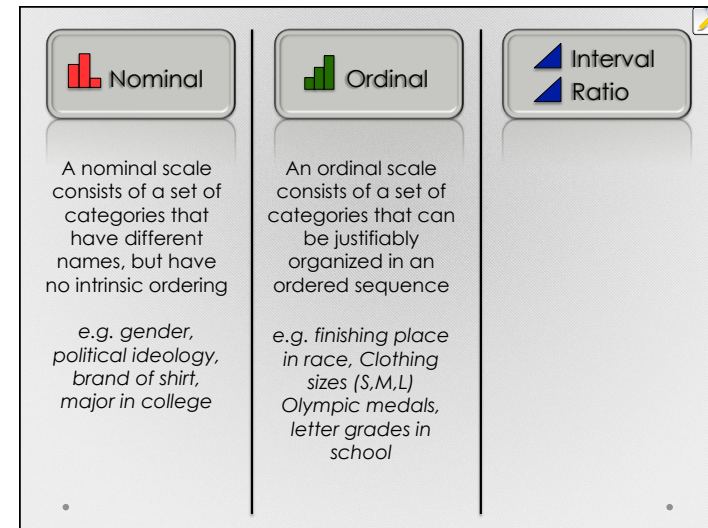
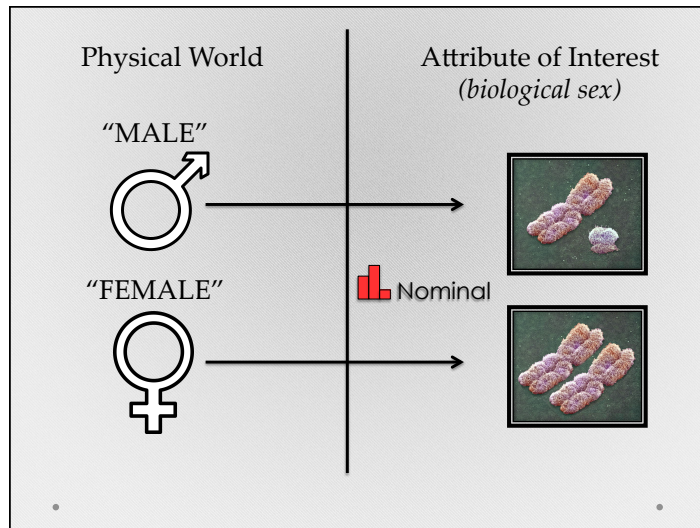
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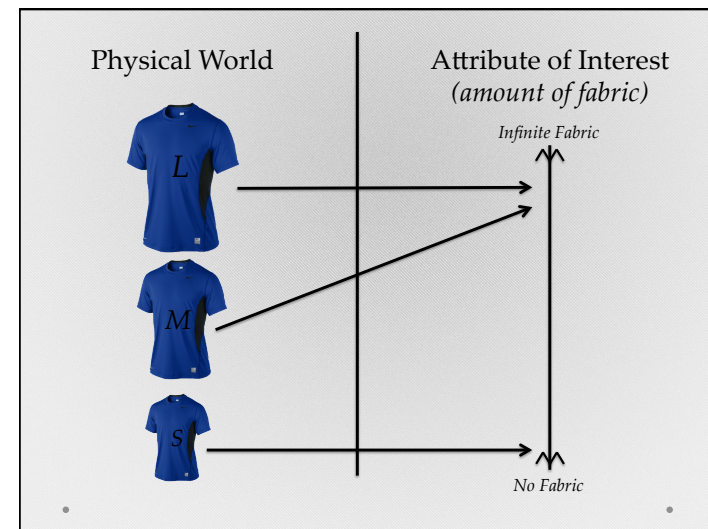
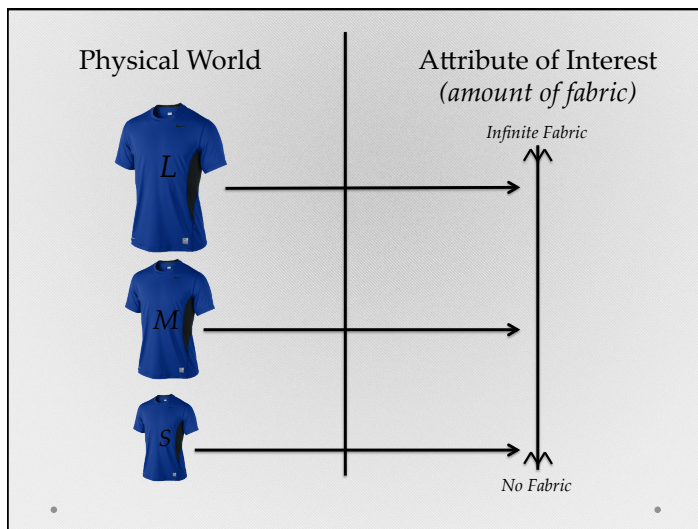
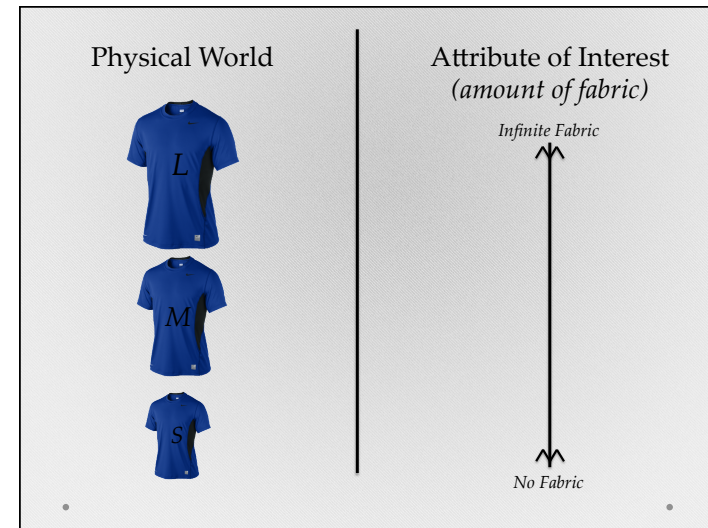
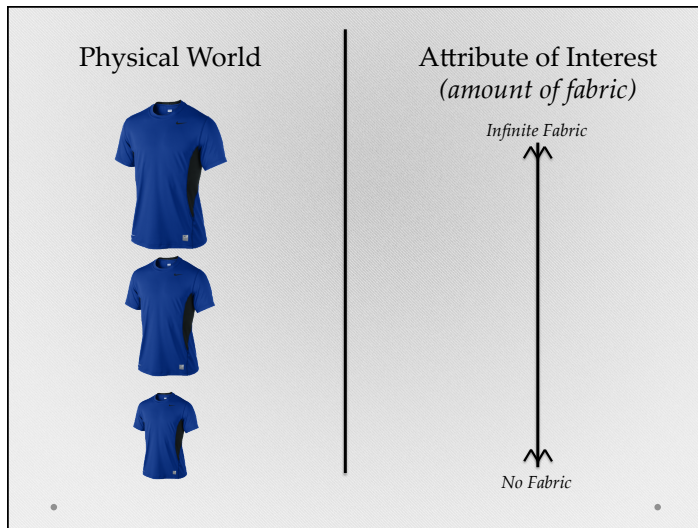
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- Editors:** Hal Pashler PhD, John Wixted PhD
- ASIN:** 0780471650171
- Price:** \$126.72 (14% off the list price of \$148.00)
- Availability:** Only 2 left in stock (more on the way). Ships from and sold by Amazon.com. Gift-wrap available.
- Formats:**

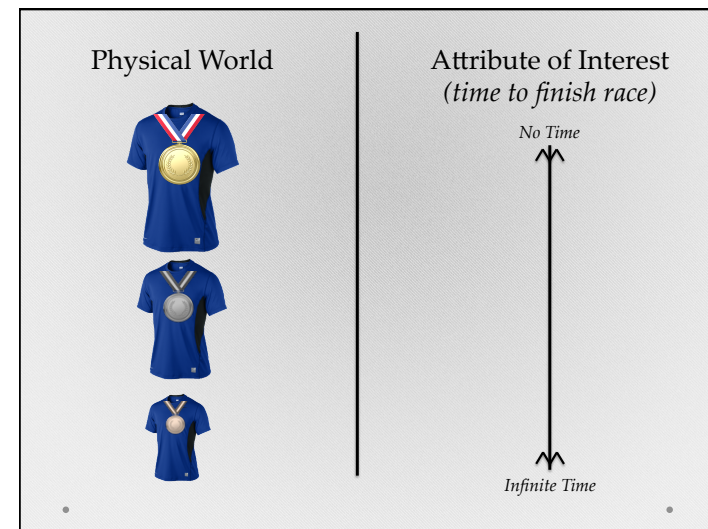
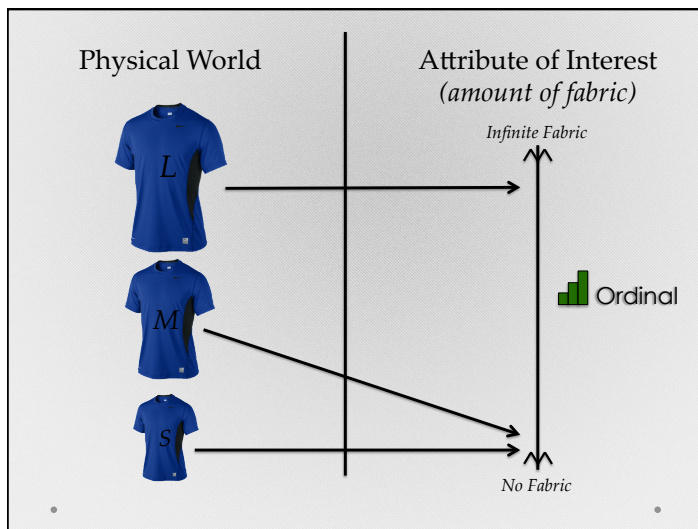
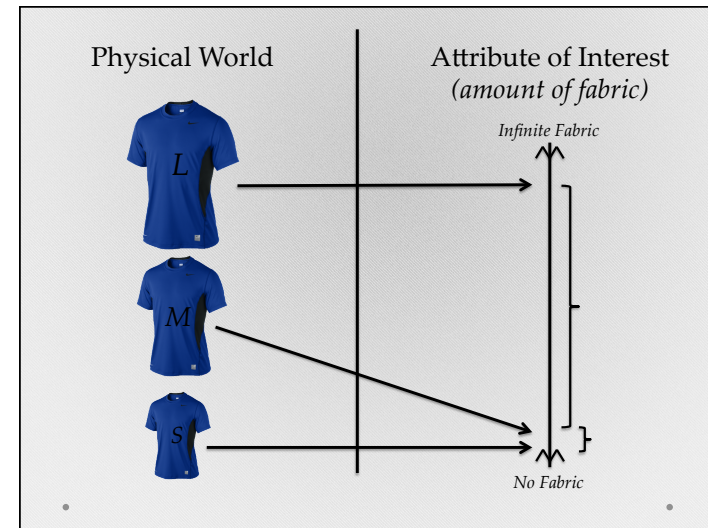
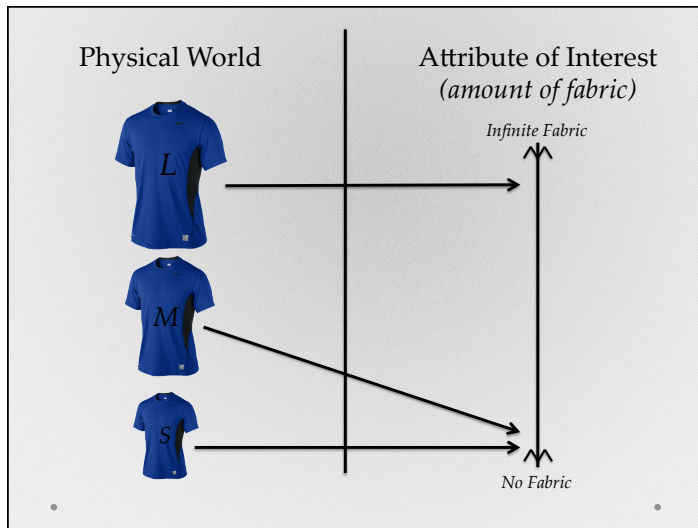
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Hardcover	\$320.00	\$120.00	\$80.00
Paperback	\$126.72	\$110.01	\$84.94
- Prime:** Prime members can save more with Prime.
- Shipping:** Free shipping with Amazon Prime.
- More Buying Choices:** 17 used & new from \$84.94.
- Refer a Friend:** Earn \$10 for each friend you refer to Amazon Student.

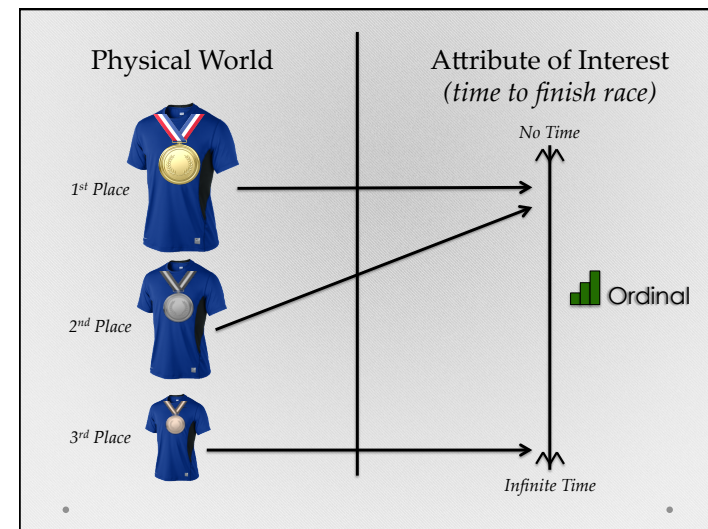
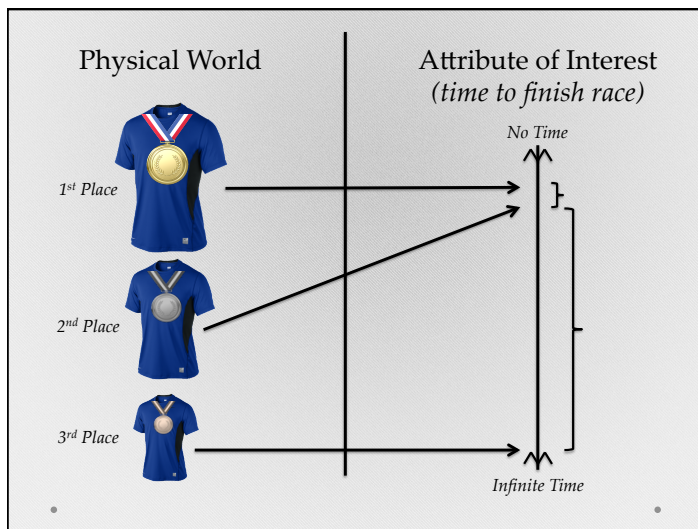
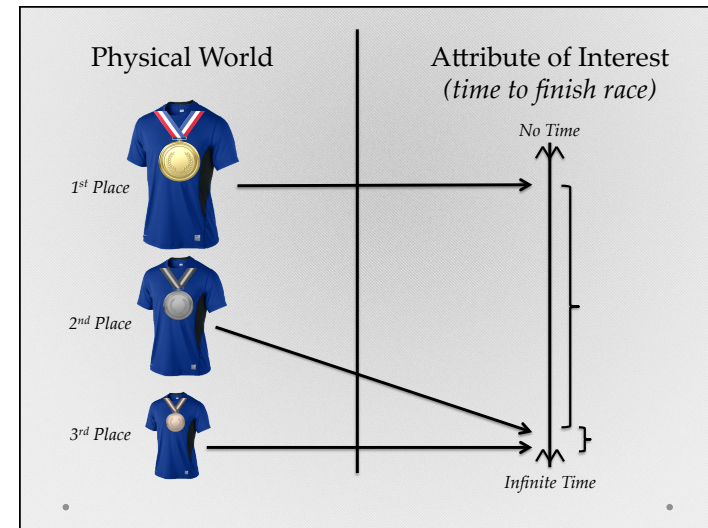
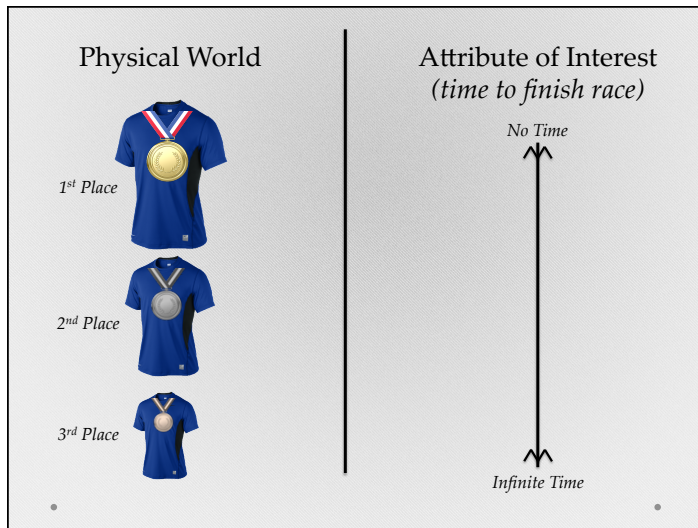


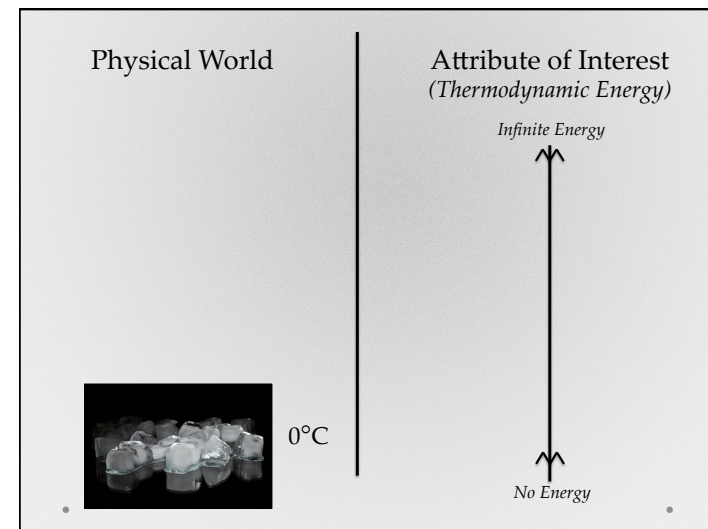
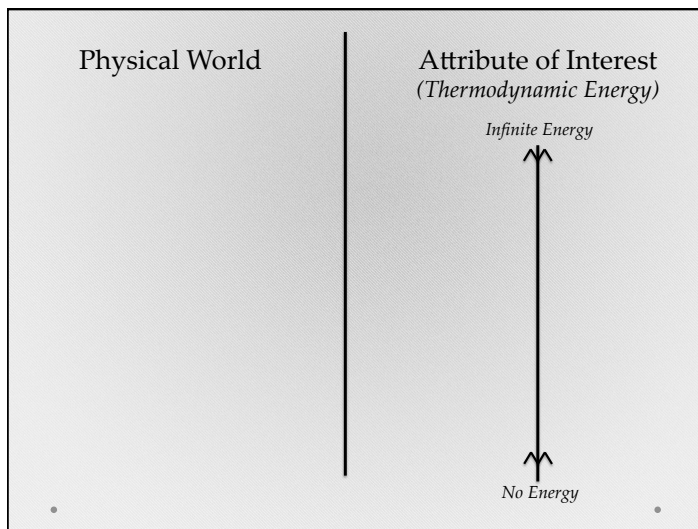
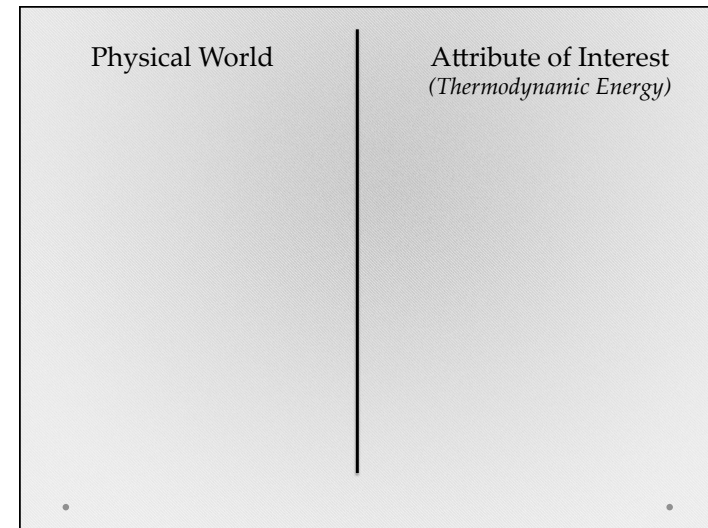
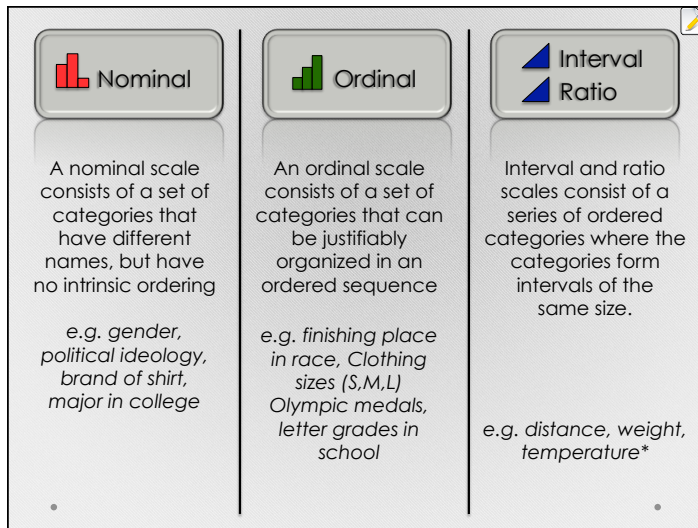


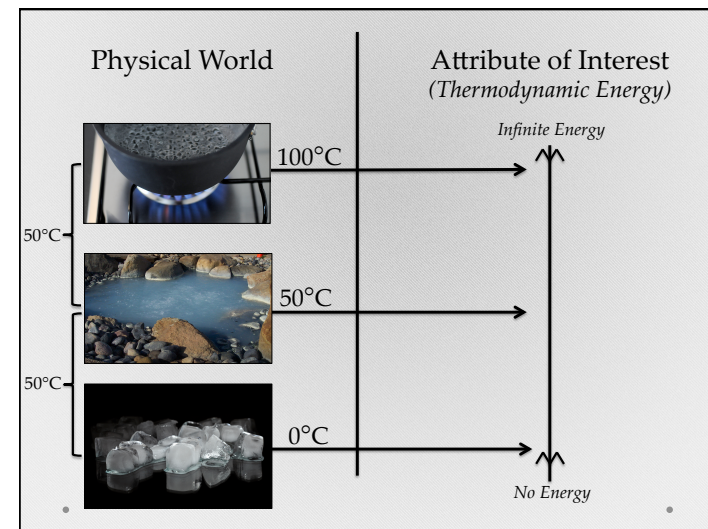
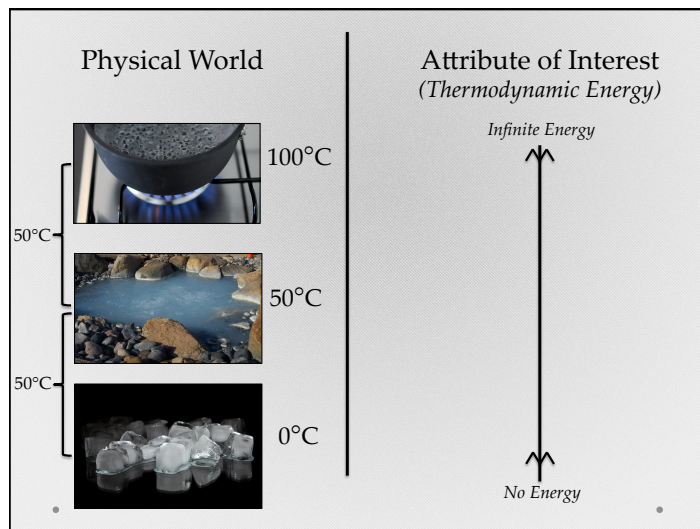
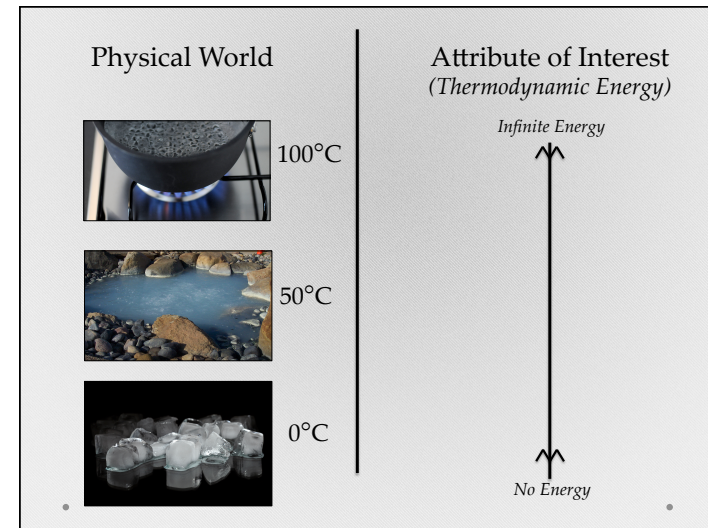
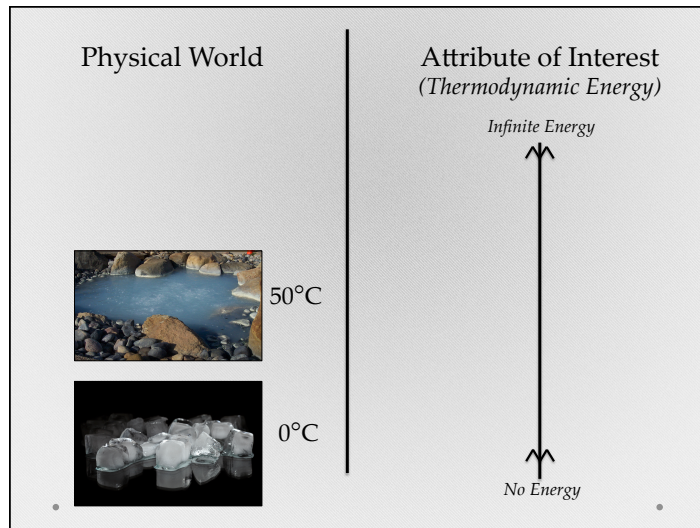


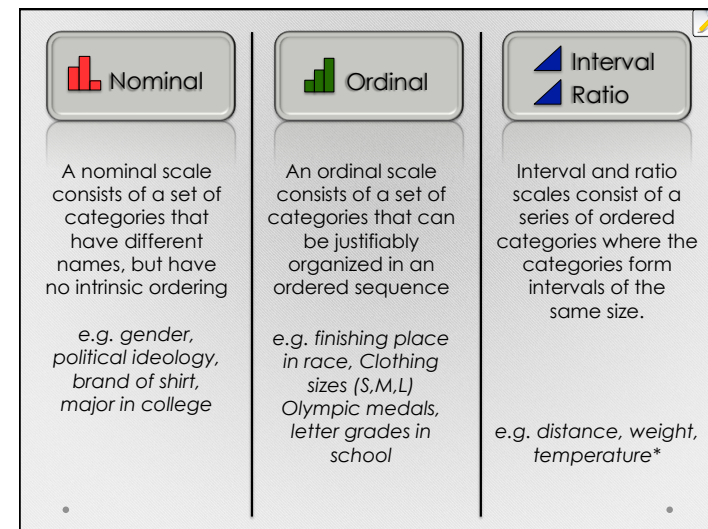
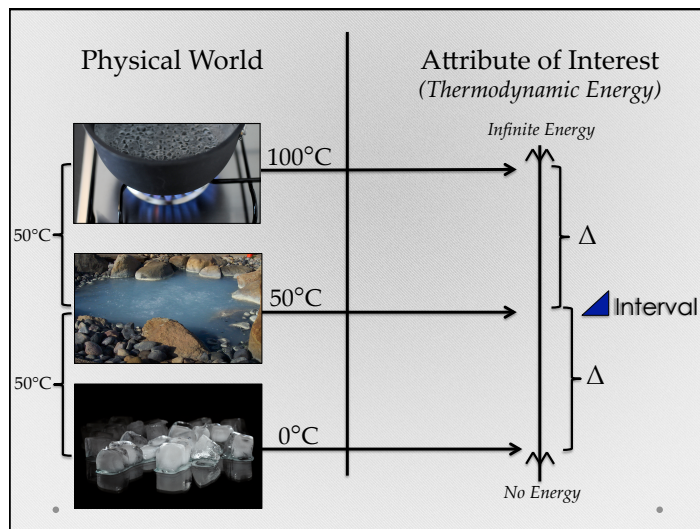
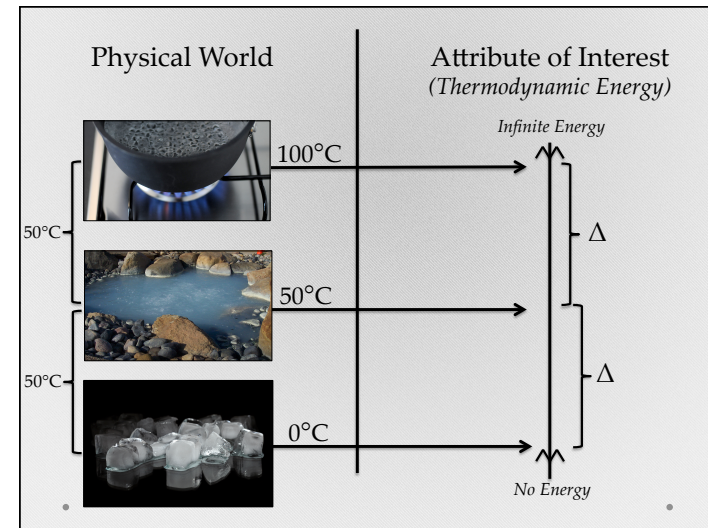
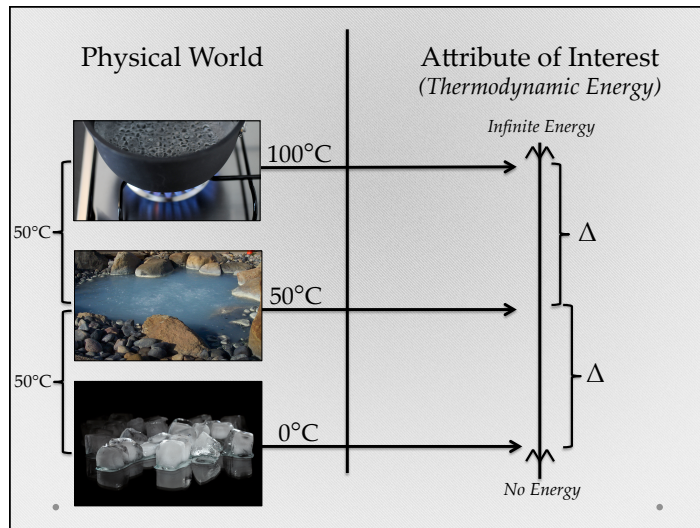


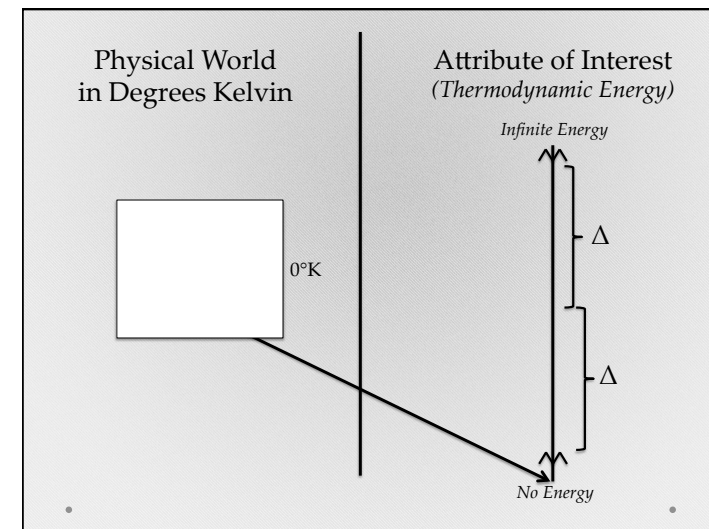
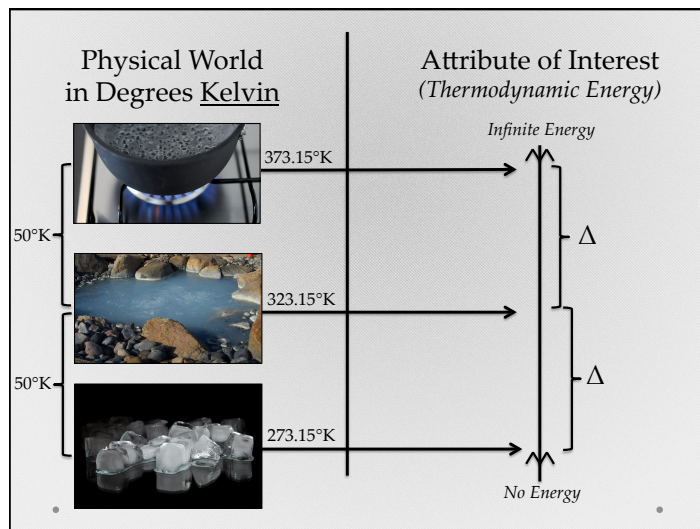
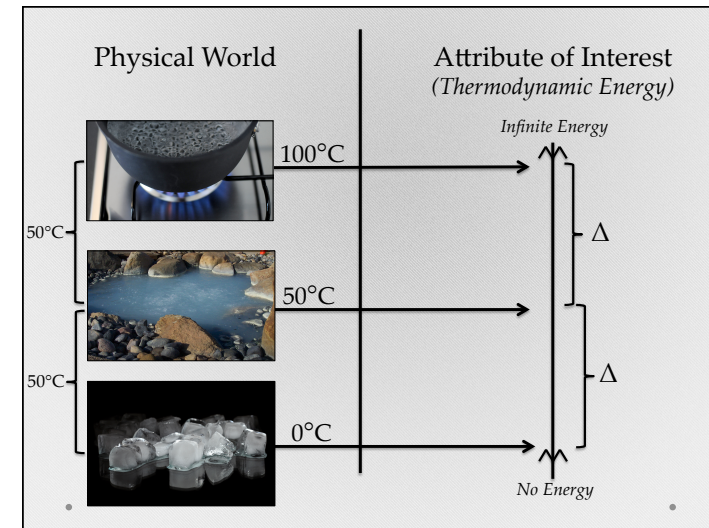
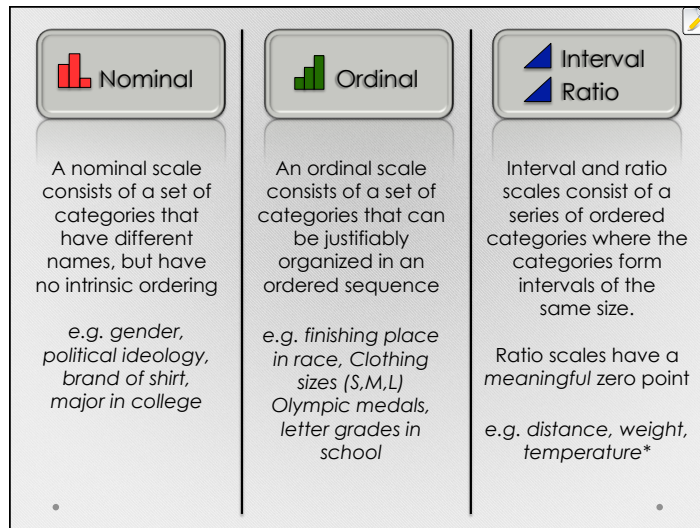


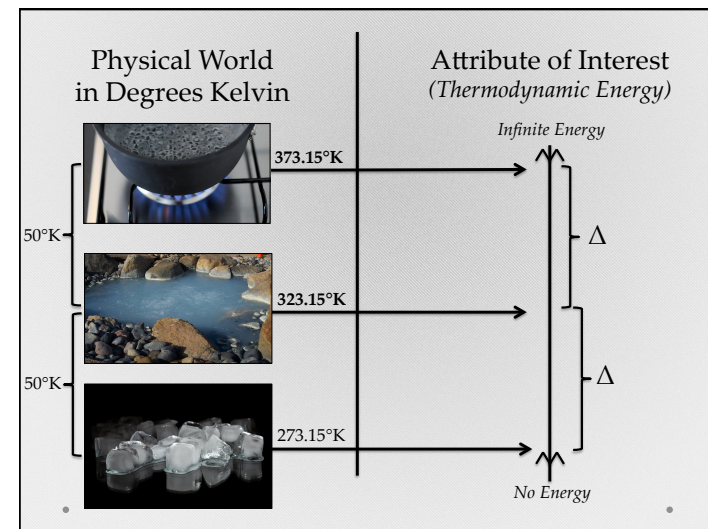
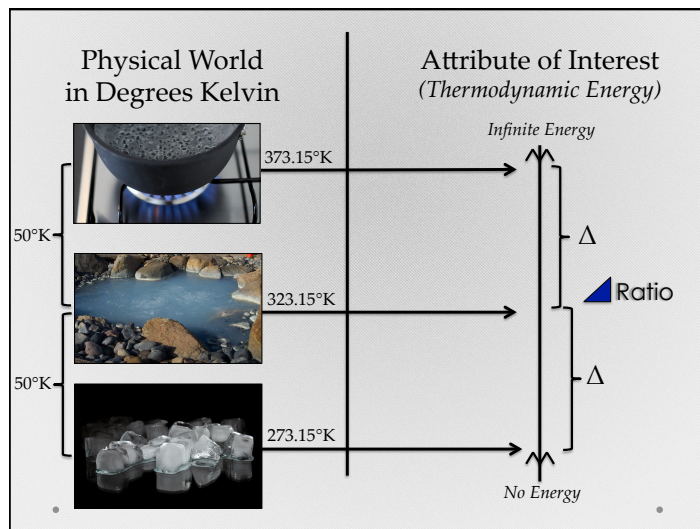
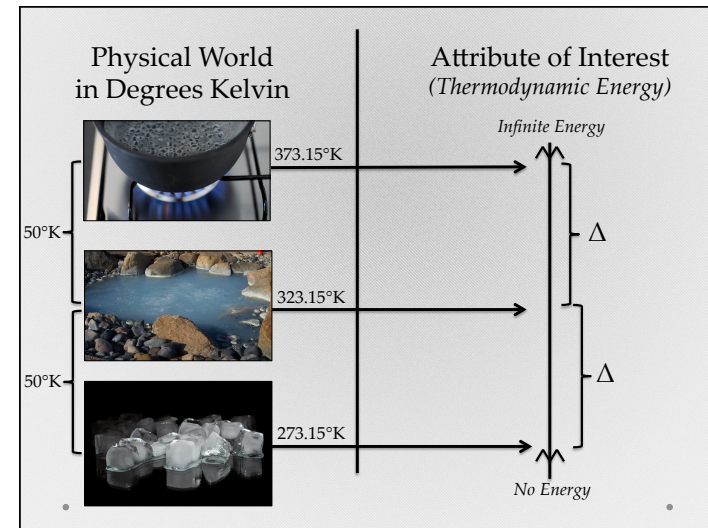
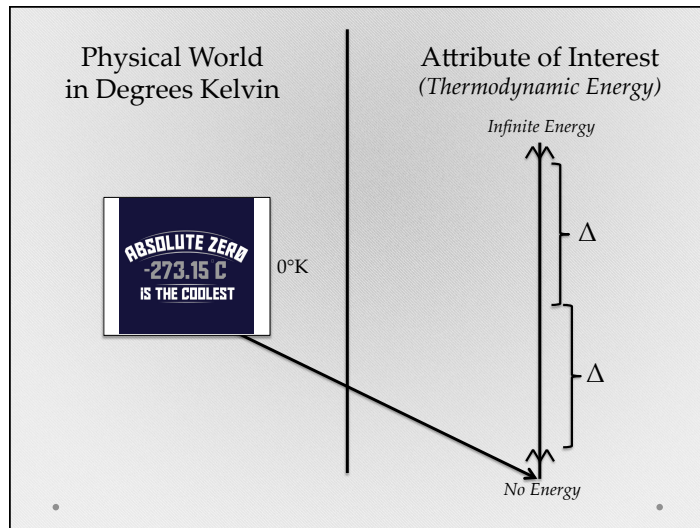


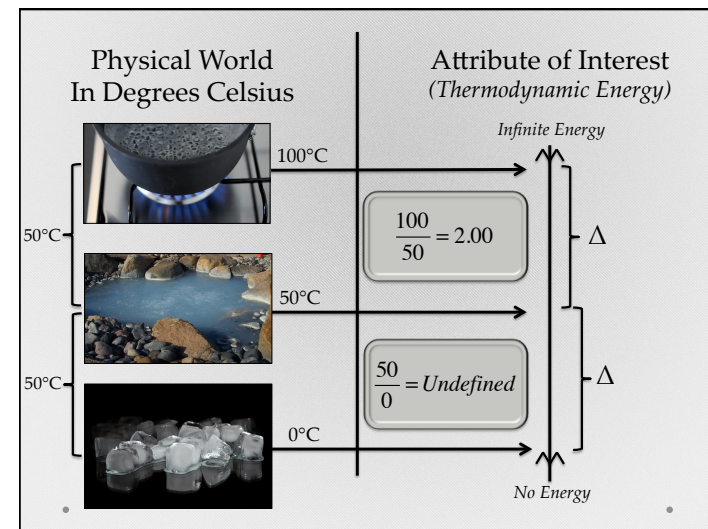
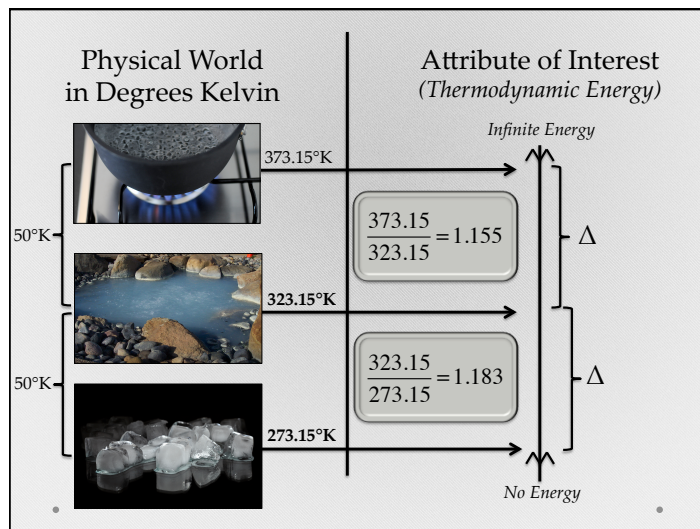
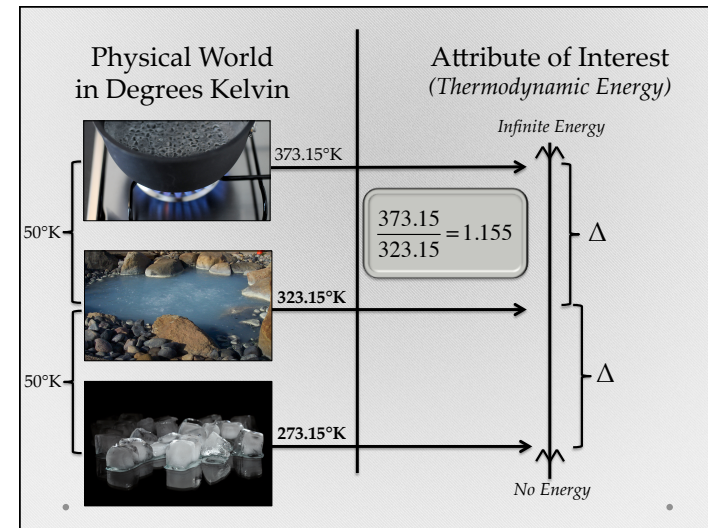
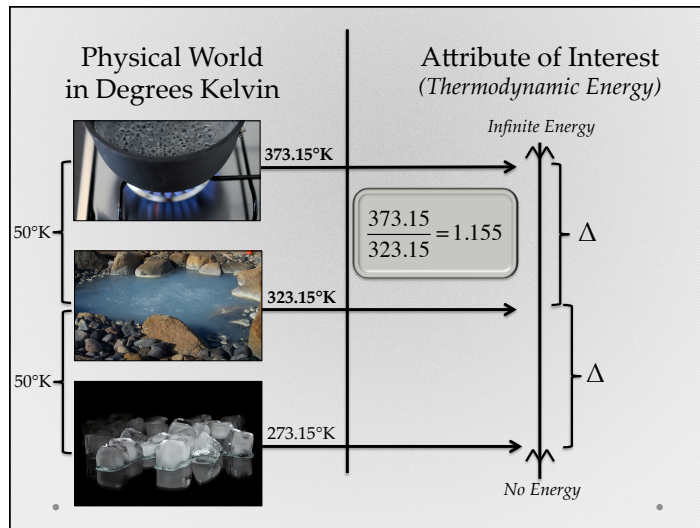


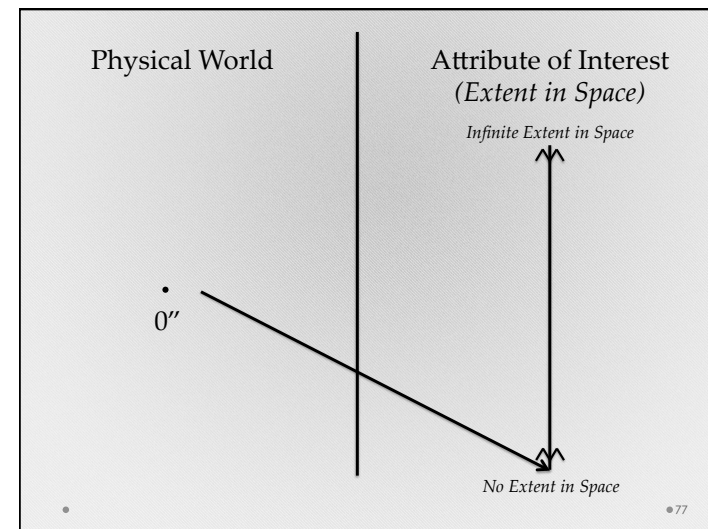
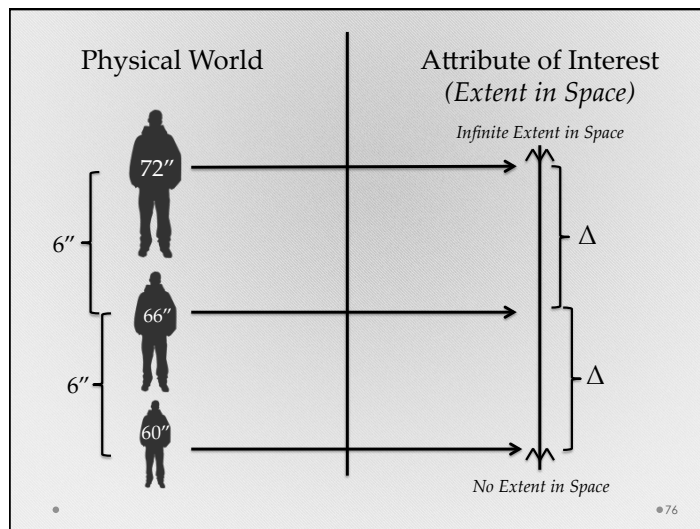
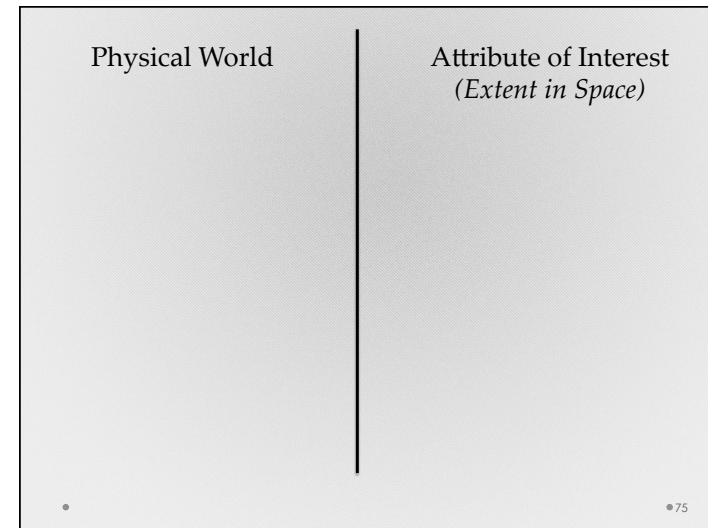
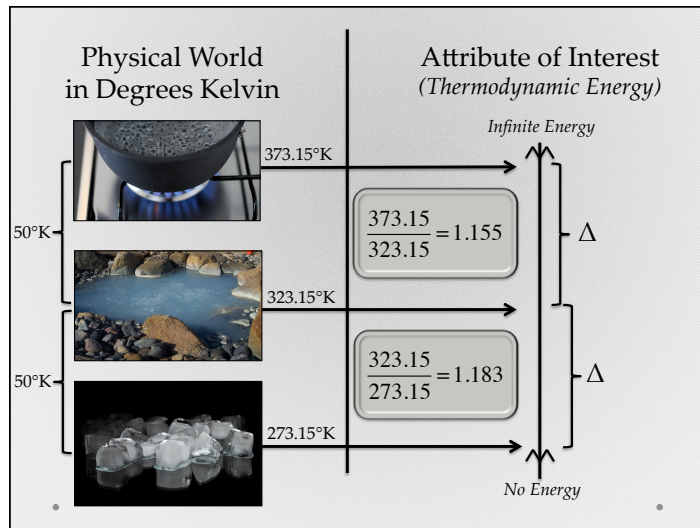


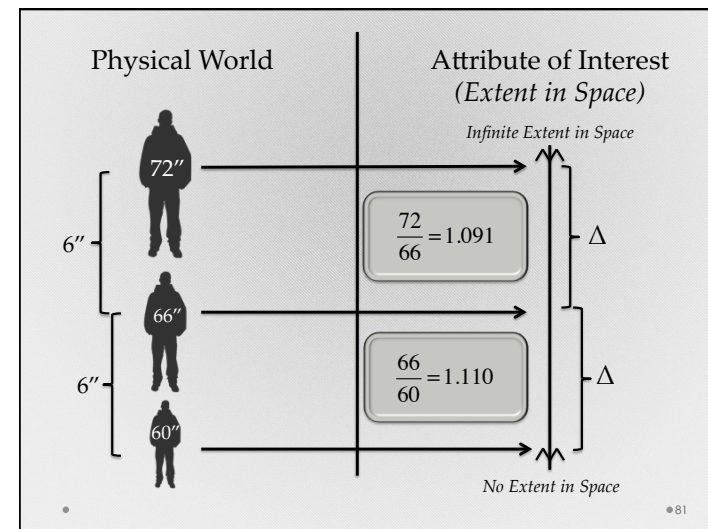
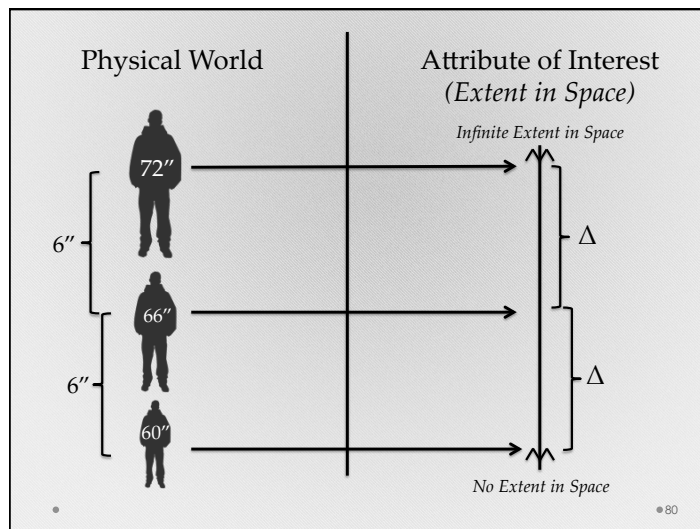
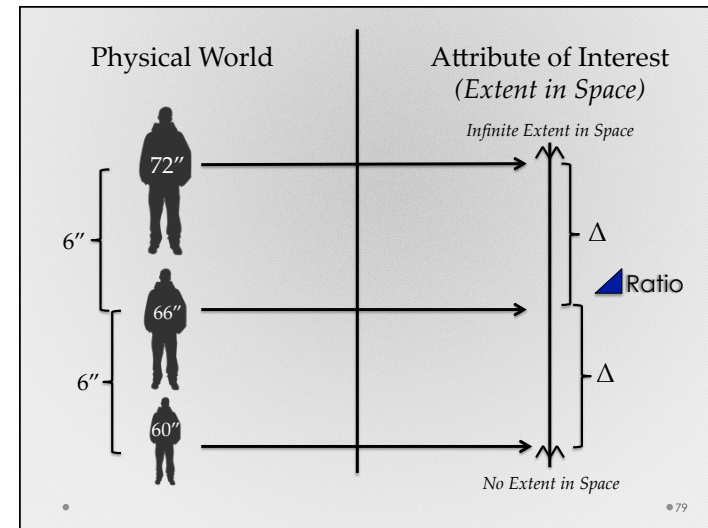
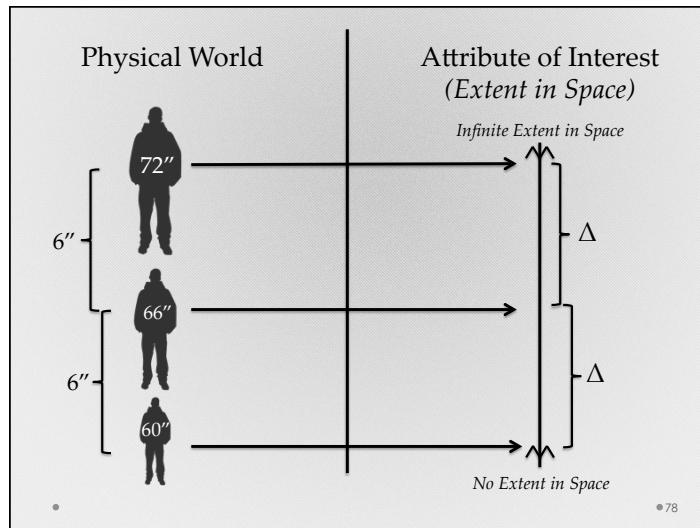












Nominal	Ordinal	Interval Ratio
<p>A nominal scale consists of a set of categories that have different names, but have no intrinsic ordering</p> <p><i>e.g. gender, political ideology, brand of shirt, major in college</i></p>	<p>An ordinal scale consists of a set of categories that can be justifiably organized in an ordered sequence</p> <p><i>e.g. finishing place in race, Clothing sizes (S,M,L) Olympic medals, letter grades in school</i></p>	<p>Interval and ratio scales consist of a series of ordered categories where the categories form intervals of the same size.</p> <p>Ratio scales have a meaningful zero point</p> <p><i>e.g. distance, weight, temperature*</i></p>

Physical World	Attribute of Interest (<i>Amount of Fear</i>)
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The diagram consists of two vertical lines. The left line is labeled "Physical World" at the top. The right line is labeled "Attribute of Interest (Amount of Fear)" at the top. Below the right line, the text "Most Possible Fear" is positioned near the top, and "No Fear" is positioned near the bottom. A small black dot is located at the bottom left of the slide.

Physical World


Attribute of Interest
(Amount of Fear)

Most Possible Fear

No Fear

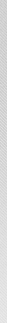
● 84

Physical World

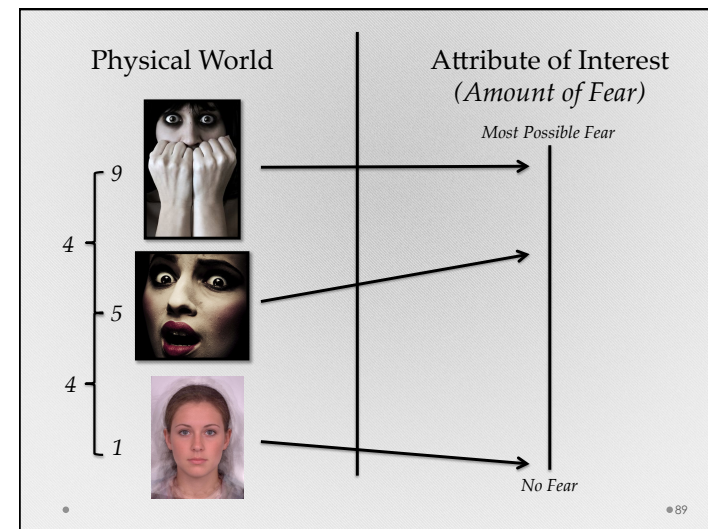
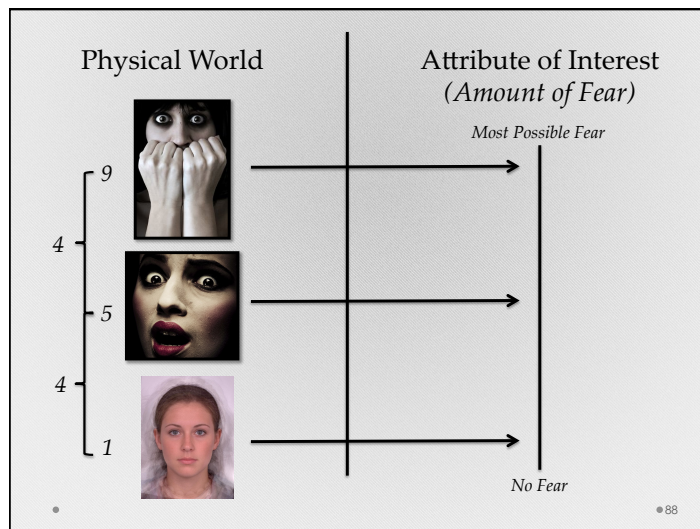
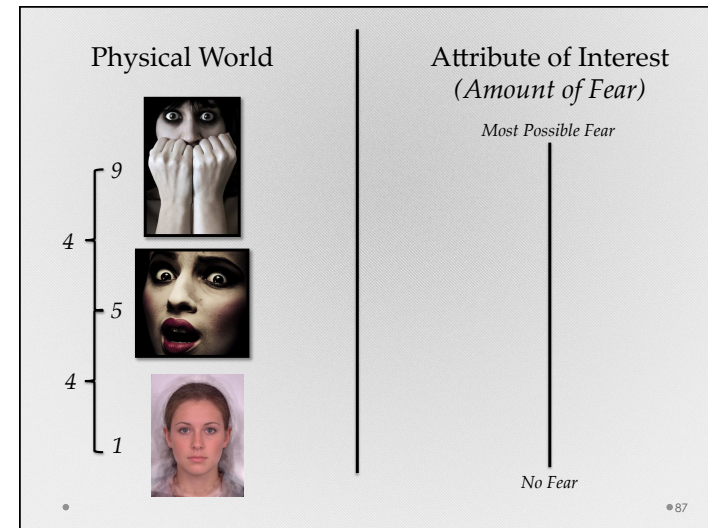
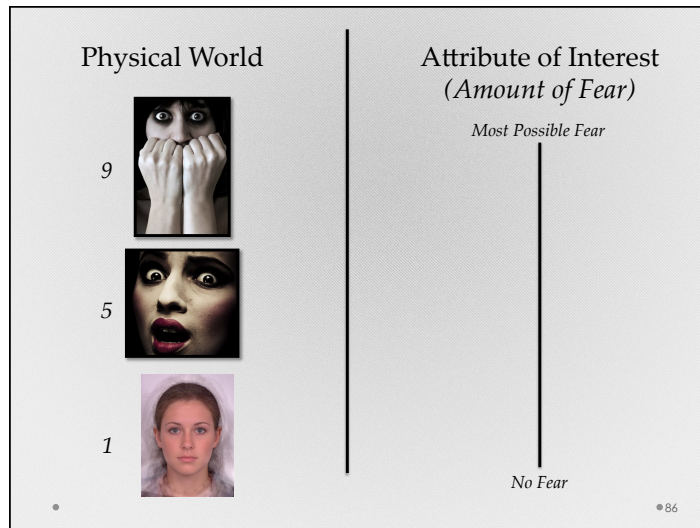


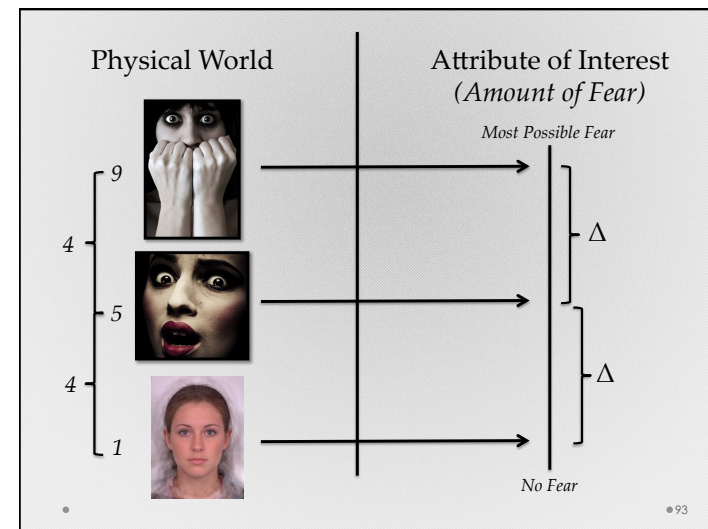
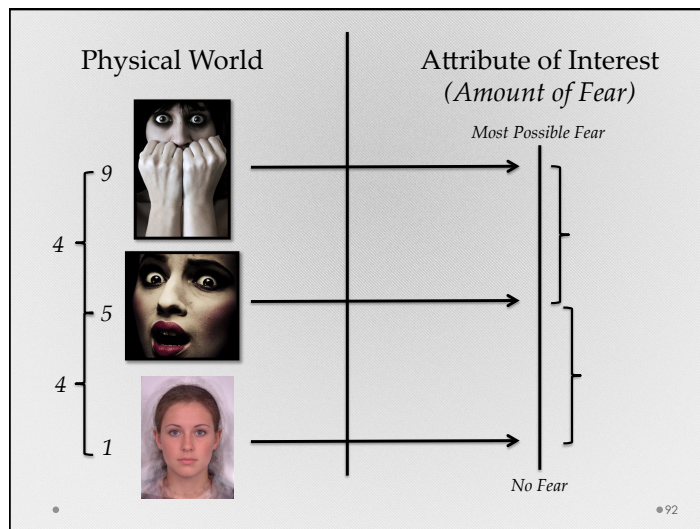
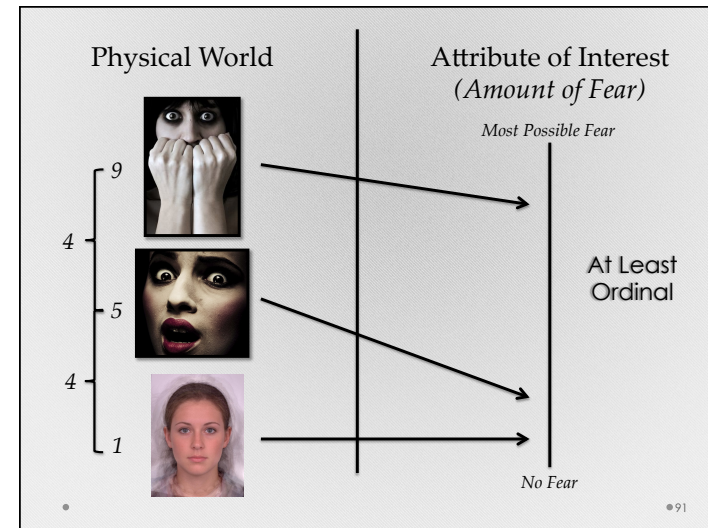
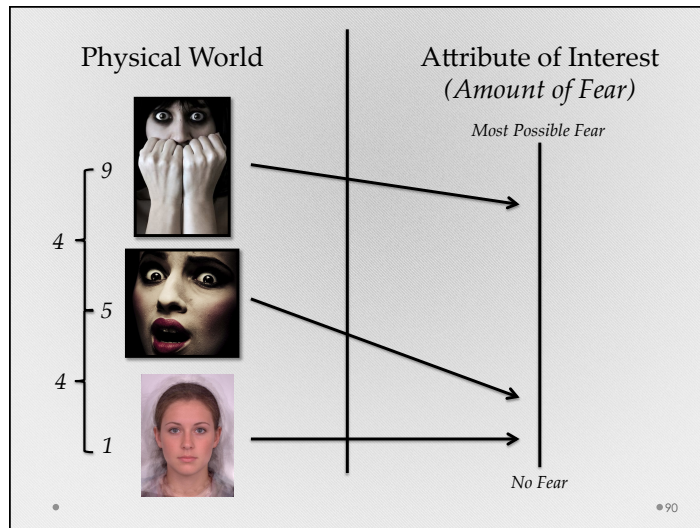
Attribute of Interest
(Amount of Fear)

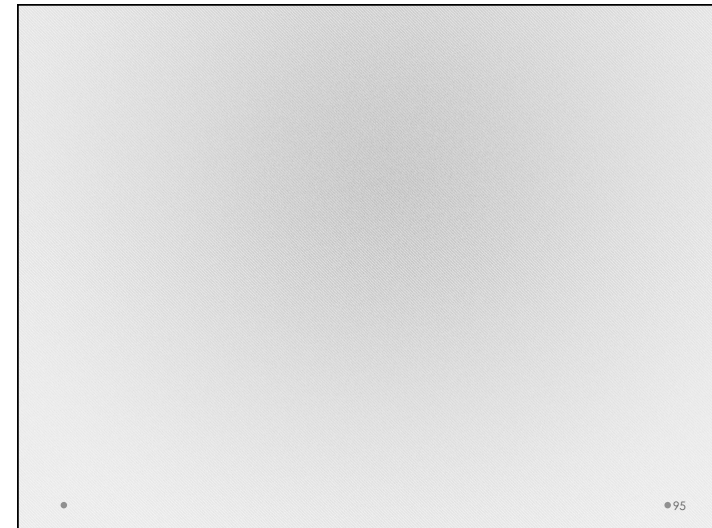
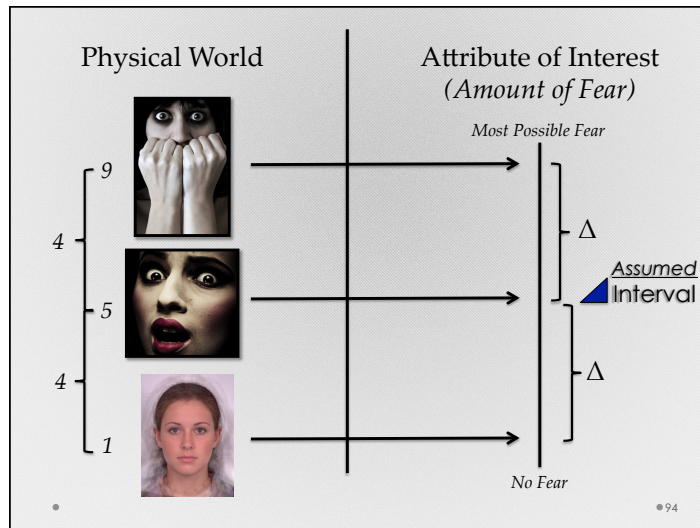
Most Possible Fear



No Fear











Scale	Labels for observations	Ordered Categories	Equal Intervals	Meaningful Zero point
Nominal				
Ordinal				
Interval				
Ratio				

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Scale	Labels for observations	Ordered Categories	Equal Intervals	Meaningful Zero point
Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ordinal				
Interval				
Ratio				




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Scale	Labels for observations	Ordered Categories	Equal Intervals	Meaningful Zero point
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Ordinal 	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Interval 				
Ratio 				

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Scale	Labels for observations	Ordered Categories	Equal Intervals	Meaningful Zero point
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Interval 	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Ratio 				

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Scale	Labels for observations	Ordered Categories	Equal Intervals	Meaningful Zero point
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Interval 	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Ratio 	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

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<i>Quality of Measurement</i>				
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Reliability

Reliability of a measurement procedure refers to how consistent the measurements are of the same entity under the same conditions

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Reliability

$$X_i = \tau_i + \varepsilon$$

$$\text{Measured Score} = \text{True Score} + \text{Random Error}$$

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Validity

Validity of a measurement procedure refers to how *accurately* the measurements relate to the construct being measured

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