

Transforming Concepts into Variables

Operationalization and
Measurement

Issues of Validity and Reliability

Concepts

- **What is a concept?**
 - A mental image that summarizes a set of similar observations, feelings, or ideas.
 - All theories, ideas, are based on concepts

Introduction: normal science vs. social science

- A key difference is that normal science deals with concepts that are well defined and to great extent standardized measures (e.g. speed, distance, volume, weight, size, etc.)

Introduction: normal science vs. social science

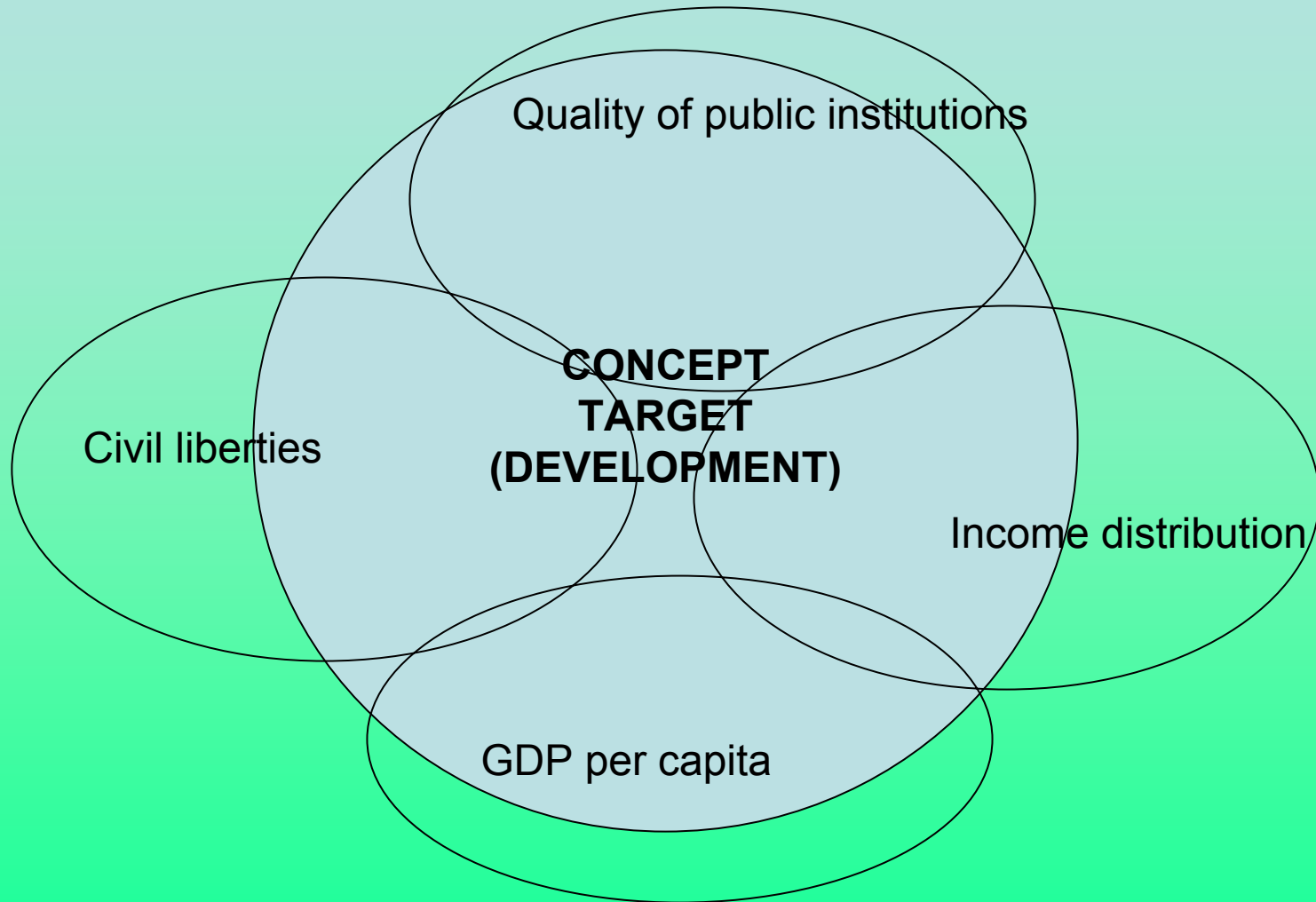
- On the contrary, social sciences often use concepts that are more abstract and therefore the standardization in measurement varies or there is little agreement (e.g. social class, development, poverty, etc.)
- Thus, our goal is that our measurements of the different concepts are valid or *match* as much as possible the “real” world

The case of development

According to Michael Todaro (1994:18) development is both a physical reality and a state of mind in which society has, through some combination of social, economic, and institutional processes, secure the means for obtaining a better life, development in all societies must have a least the following three objectives:

1. To increase the availability and widen the distribution of basic life sustaining goods
2. To rise levels of living
3. To expand the range of economic and social choices

Concept, conceptualization, operationalization & construct validity



Creating Variables

- Our goal is to create measurable variables out of our concepts.
- We first must nominally define our concepts.
- We are moving from the abstract to the concrete.

Creating Variables

- We must be able to observe our variables!
- We link our variables to data.
- When we link our variables to data, this is operationalization. (a word that always comes up as misspelled in a spell check)

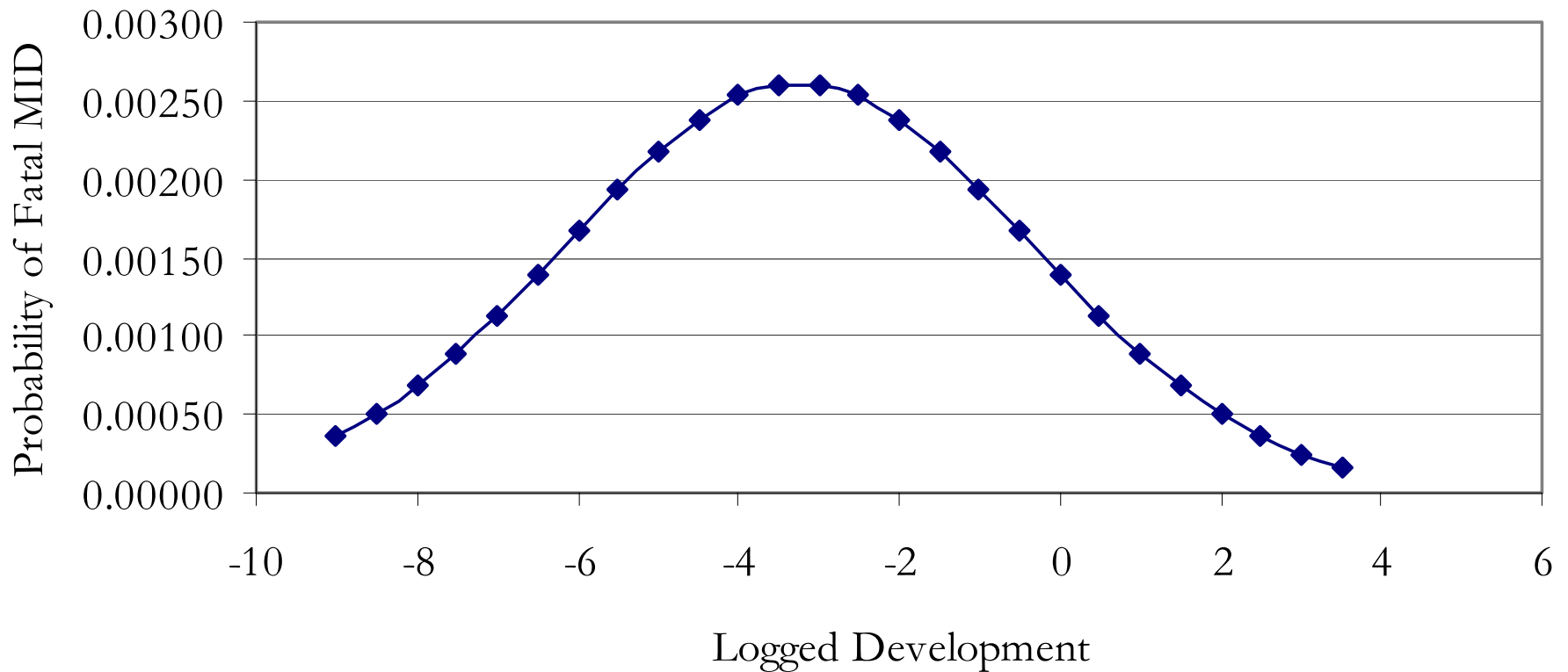
Creating Variables

- Example of Development in my work.
- I define development in economic terms as the degree to which a state has progressed into industrialization and possess a modern consumer market.
- I measure this as energy consumption per capita.

Development and Deadly Conflicts

MID is acronym for Militarized Interstate Dispute

Figure 3: The Effect of Development on a State's Involvement in a Fatal MID



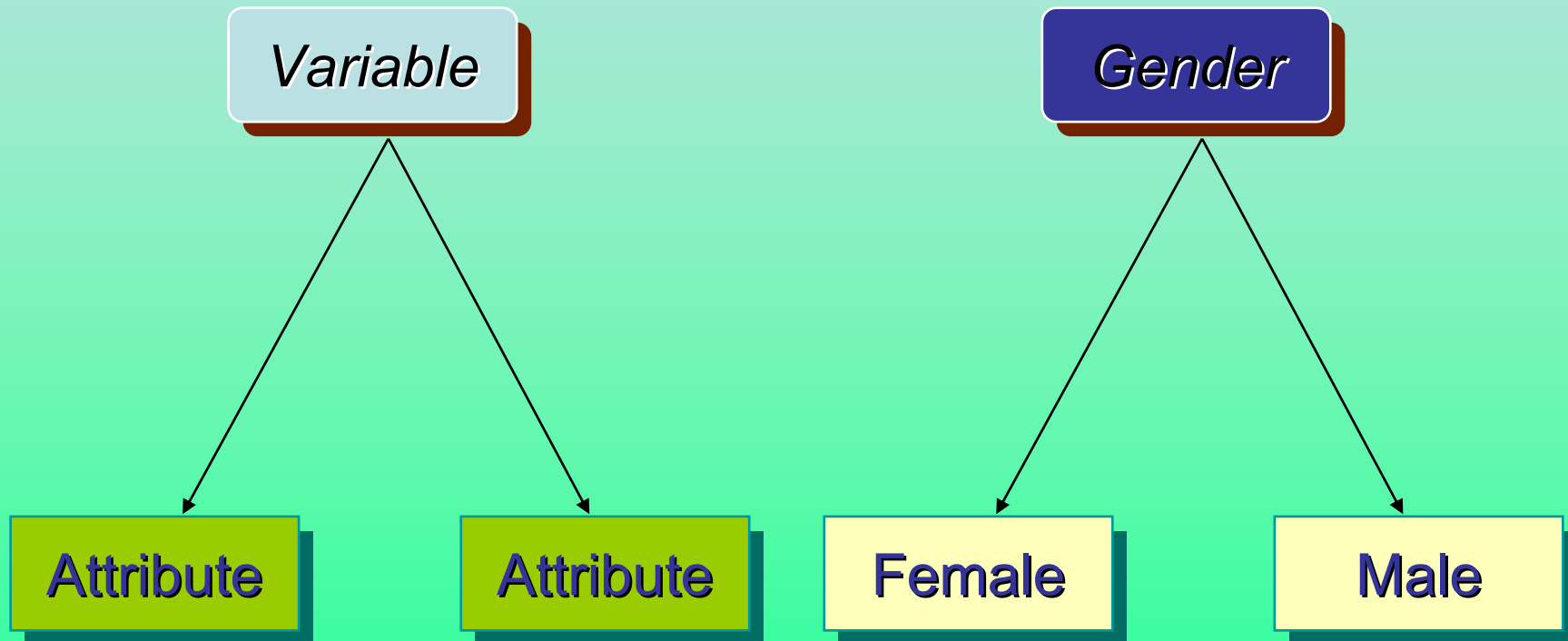
Measurement

- If our studies do not allow us to measure variation in the dependent variable as related to variation in our X variables, then we cannot do any scientific testing.
 1. We measure whether certain variables are meaningful – individually significant.
 2. We measure the variation in our variables.
 3. We also measure the significance and explanatory power of our models and the relationships between variables.
 4. If it can be quantified, then you should do so.

Qualities of Variables

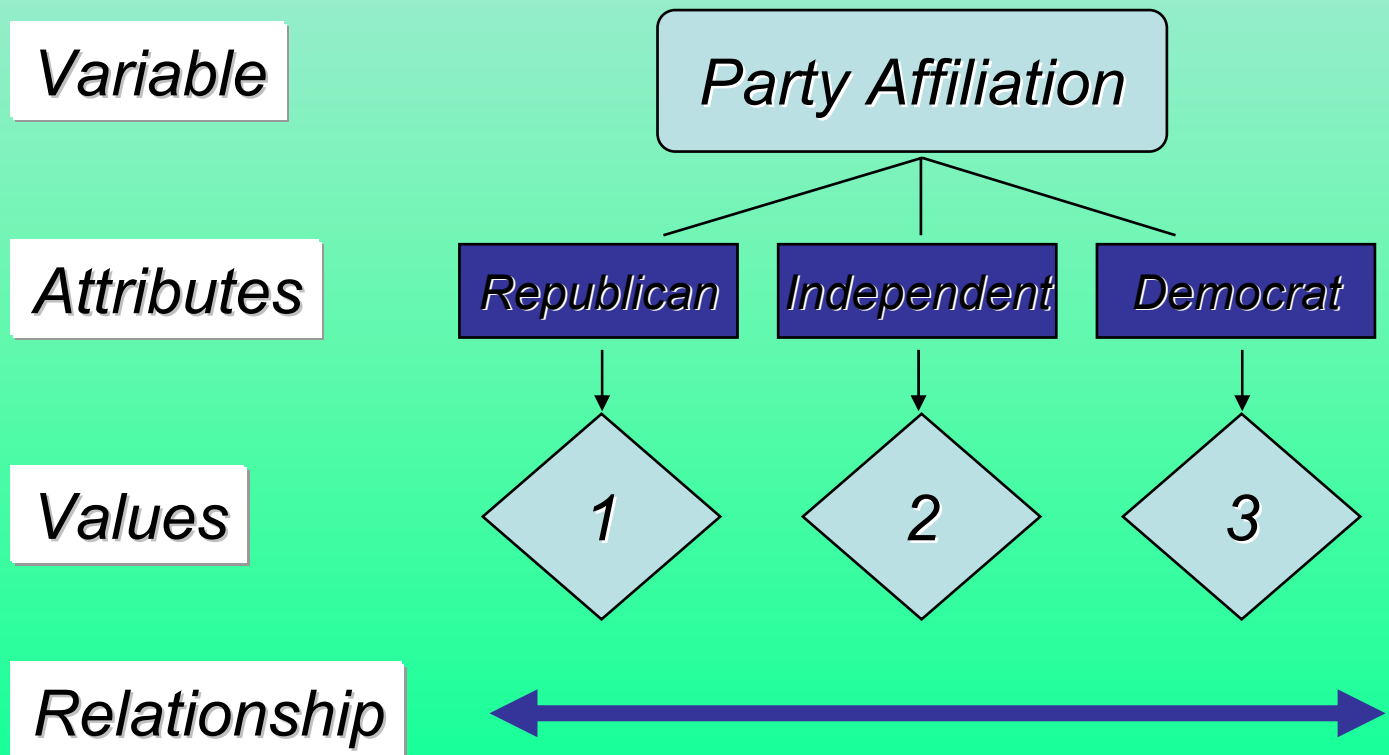
- **Exhaustive** -- Should include all possible answerable responses.
- **Mutually exclusive** -- No respondent should be able to have two attributes simultaneously (for example, employed vs. unemployed -- it is possible to be both if looking for a second job while employed).

Some Definitions



What Is Level of Measurement?

*The relationship of the values that are assigned to the attributes **for a variable***



The Levels of Measurement

- Nominal
- Ordinal
- Interval
- Ratio

Nominal Measurement

- The values “**name**” the attribute uniquely (classification).
- The value does **not** imply any ordering of the cases, for example, jersey numbers in football.
- Even though player 32 has **higher number** than player 19, you can't say from the data that he's **greater than or more than** the other.



Nominal continued

- Nominal: These variables consist of categories that are non-ordered. For example, race or ethnicity is one variable used to classify people.
 - A simple categorical variable is binary or dichotomous (1/0 or yes/no). For example, did a councilwomen vote for the ordinance change or not?
 - When used as an independent variable, it is often referred to as a “dummy” variable.
 - When used as a dependent variable, the outcome of some phenomenon is either present or not.

Types of Variable Constructions

- Ordinal: These variables are also categorical, but we can say that some categories are higher than others. For example, income tax brackets or levels of education.
 - However, we cannot measure the distance between categories, only which is higher or lower.
 - Hence, we cannot say that someone is twice as educated as someone else.
 - Can also be used as a dependent variable.

Ordinal Measurement

When attributes can be **rank-ordered**...

- Distances between attributes **do not have any meaning**, for example, code Educational Attainment as 0=less than H.S.; 1=some H.S.; 2=H.S. degree; 3=some college; 4=college degree; 5=post college



Is the distance from 0 to 1 the same as 3 to 4?

Types of Variable Constructions

- Interval: Variables of this type are called scalar or index variables in the sense they provide a scale or index that allows us to measure between levels. We can not only measure which is higher or lower, but how much so.
 - Distance is measured between points on a scale with even units.
 - Good example is temperature based on Fahrenheit or his evil twin Celsius.

Interval Measurement

When **distance** between attributes has meaning, for example, temperature (in Fahrenheit) -- distance from 30-40 is same as distance from 70-80

- Note that **ratios don't make any sense** -- 80 degrees is not **twice** as hot as 40 degrees (although the attribute values are).



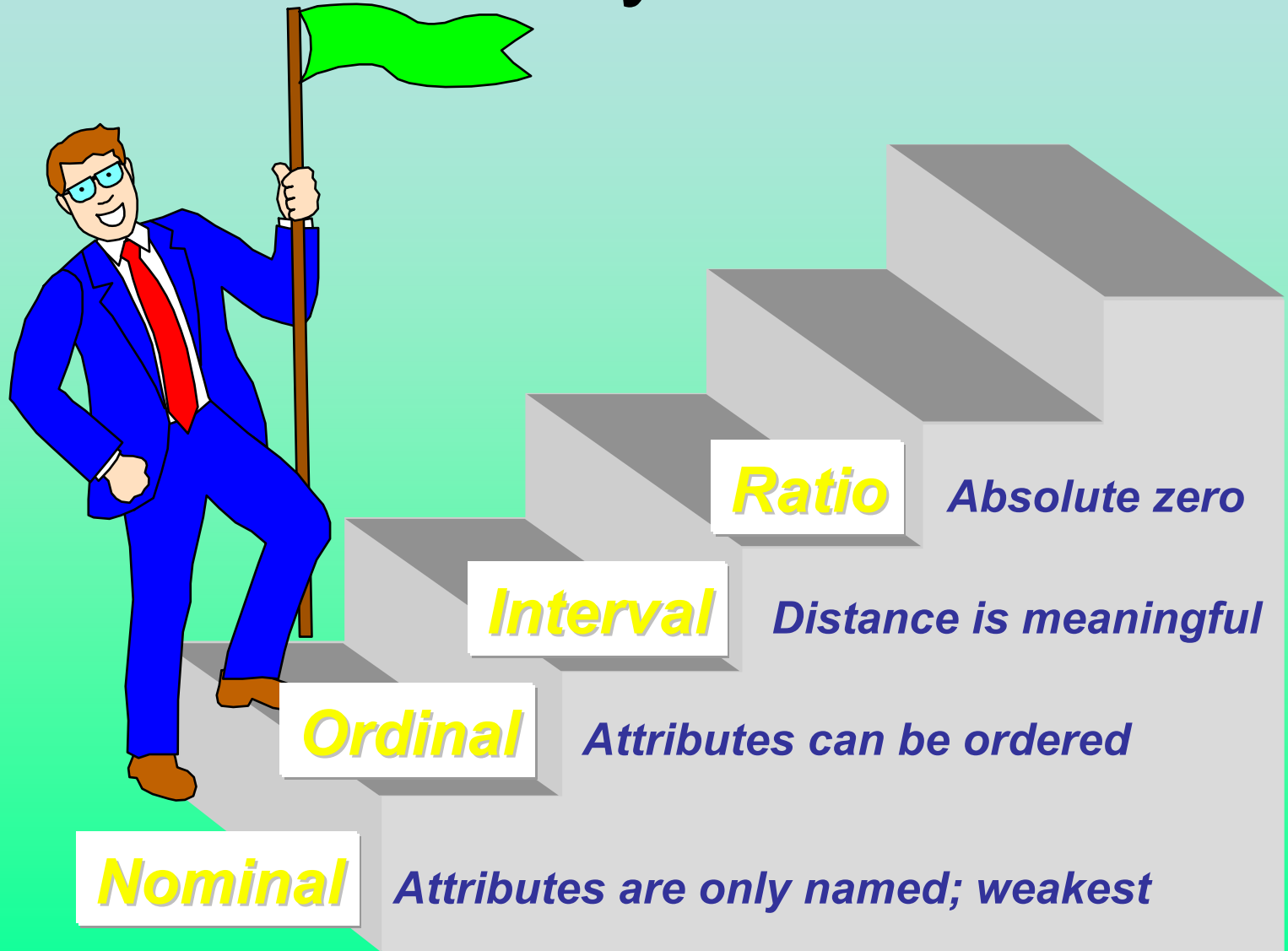
Types of Variable Constructions

- Ratio: Similar to interval level variables in that it can measure the distance between two points, but can do so in absolute terms.
 - Ratio measures have a true zero, unlike interval measures.
 - For example, one can say that someone is twice as rich as someone else based on the value of their assets since to have no money is based on a starting point of zero.

Ratio Measurement

- Has an **absolute zero** that is meaningful
- Can construct a meaningful **ratio** (fraction), for example, number of clients in past six months
- It is meaningful to say that “...we had **twice** as many clients in this period as we did in the previous six months.

The Hierarchy of Levels



Transforming Variables

- Note that some concepts could be operationalized with various constructions.
 - For example, democracy has been measured as either present or not (1/0) or as a scale ranging from 0 to 10. Both measures perform similarly.
 - Wealth could be measured as a dummy variable (wealthy or not) as ordered categories (income brackets) or as a ratio (wealth in absolute terms).
 - Note though that some variable constructions might be more valid than others.