

22. DIMENSIONALITY

Developing measures from constructs is difficult because the properties of what we propose to measure are complex and interrelated. But these difficulties must be faced. How to proceed?

The first task is to consider how to deal with behavior. While we acknowledge that behavior is complex, we also recognize that we cannot advance the process of measurement by simultaneous attention to all aspects of complex behavior. There is no useful way to make measures of more than one variable at a time.

We have to isolate a single variable (dimension) and then develop it to the best level possible. When our thinking is muddled by considering two or more aspects of a variable simultaneously, then we only become confused.

We may recognize the multidimensionality of experience, but this multidimensionality cannot be addressed as a whole. For knowledge to develop, complex behavior has to be decomposed into single dimensions.

We begin by specifying a dimension as a variable. A variable is a single, unidimensional concept abstracted from the complexity of human behavior. Its successful abstraction results from a dialogue conducted between the abstract idea isolated and formed into a single concept and the wealth of sensory experiences that constitute the "real world." The former is conceptual and consists of the abstract idea we have gleaned from our experiences. The latter are elements of experience that have substance and constitute reality. The need for dialogue is to make our abstractions relate meaningfully to the real world. Our variable cannot be so abstract that it is devoid of reality. Nor can we clutter our thinking by such a bombardment of experiences that we cannot abstract a singular essence that stands out and separates the variable from all other experience.

This dialogue is not something which is done once and for all. The process continues indefinitely, inspiring a progression of further refinements.

As we satisfy the need for a single concept, it is necessary to recognize that the variable is posited as the unifying element between idea and experience. The variable is the focal point between experience taken from the real world and the abstraction of an idea. The idea of a variable embodies the projection of a line or arrow indicating the direction of "more" along the variable. The variable, i.e. line, is the representation of the experience abstracted and conceptualized as on a line. The experiences themselves are illustrations or examples taken selectively to arrange in a systematic fashion. The order in which they are arranged on the variable is the correspondence between our idea and our experience.

Figure 22.1

The variable.

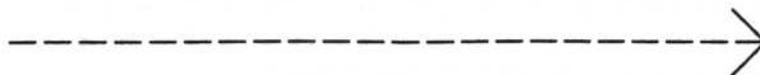


Figure 22.1 shows the idea of the variable as an arrow. What we locate along the variable are illustrations from experience that embody the unidimensional concept we have in mind.

Consider simple experiences from life like length and weight. A variable of length can be “seen” by using what we now know as a ruler. It begins with an implied zero at one end, the numerals along the ruler (variable) signifying equal units marked out as we proceed to the right. If we consider weight, then the units signify whatever units we select, say pounds. Each unit indicates an increase of one pound as we move across the variable.

The ruling idea of the variable needs to be fully impressed upon our mind even though the examples may seem trivial. When we proceed to construct more sophisticated variables, especially those that we do not fully understand, it is important to have our methodology clearly understood so that we will not become confused by experience or overwhelmed by complexity.

The idea of a variable is always an abstraction, a simplification of what we experience as reality. If we could think about all of reality at once, there would be no need to abstract. But when we want to determine its essence, then it is important to decide exactly what we want to “see” in the experience, what is useful for us to think about. It is also important to note that we must disregard all other aspects in the pursuit of this goal. We do not disregard these other considerations because they are not important, but because they are divisive to the task at hand.

Suppose, in going through the checkout line of a large supermarket, we place groceries on the checkout conveyor. The people in front of us are also checking out, and at the front of the line a man is paying for his purchases. If the customer or clerk departs from the process of checking, receiving and giving change, the entire operation comes to a standstill. Suppose in giving change, a clerk notices a rare two-dollar bill. “Do you have more of these?” she asks. The process of checkout breaks down as the process of “collecting rare two-dollar bills” takes precedence. How will you feel during this time while the “collectors” engage in their discussion? What will the manager do?

Suppose the clerk is more interested in checking all the cash and silver for rare currency and coins for his collection than in making change and rendering service. Does this mean that coin collecting is wrong or not useful. Of course not, but in a busy supermarket you cannot mix the two processes without bringing the system to a standstill. Likewise with measurement. If you cannot identify a variable and focus upon it, then it will be impossible to achieve success because you will become distracted by all of the additional aspects that are possible to study.

When we identify one aspect for study, it is not because we believe that the other aspects are unimportant, it is because we cannot focus upon one aspect unless we treat the others “as if” they were not relevant. We know that they have impact, but we cannot consider their input relevant at this time. When we try to make measures by addressing all matters at once, it becomes impossible to sort out what is occurring.

It is important to distinguish between the procedures for developing measures and that of studying the relationship between measures. The former is a task of measurement, i.e. of building a variable. The latter is a task of statistical analysis, i.e. determining the relationship between variables. The statistical process can overwhelm the measurement process, if we do not pay attention to what problem we are addressing and inadvertently get the cart before the horse.

MULTIDIMENSIONALITY

The way to proceed in understanding multidimensionality is first to construct unidimensional variables upon which to make measures and then to evaluate the relationships among the measures generated from these singular variables.

It is often said, in explicating the idea of "multidimensionality," that the variables must embody all of the behavior that can be expected to be observed in the experience. This is not the way to proceed. The problem is not to see how complex we can make the experience, but instead, how simply we can abstract from an experience an essence of what we want to make observations on and measure. What is a single dimension that we want to construct as a variable that will allow us to focus successfully on that one aspect of experience? When we realize that there are other aspects left over from building a variable, then the next task is to get started on a new adventure - building another variable. The process goes on and on.

It is not the goal of measurement to be multidimensional. Measurement can only address one aspect of experience at a time. If we do the job of building a variable well and can quantify it usefully, then we can proceed to do it again and again with the construction of additional variables.

In social science, the word "multidimensionality" usually implies that there are multiple dimensions, i.e. separate dimensions. But consider volume. We have three applications of the same dimension, not three "different" dimensions. Length, width, and height, measured in the same units for utility, give us the three "applications" of a single dimension needed to compute volume.

THE ORGANIZING PRINCIPLES OF VARIABLE CONSTRUCTION

Variables are constructed out of experience. From experience, initially encountered, we notice similarities and differences. The first step is to be able to segregate from the experience some single aspect that can be found in each instance of observation, some element that can be abstracted from each instance. This abstraction is the unifying idea from the experience. It is the first step in the construction of a variable. The unifying element is this single idea. The variable signifies focus upon a single aspect of experience, an experience elements of which are useful to focus upon and so become the basis for a variable.

The next step is to illustrate this aspect of experience by a scheme of graduated experiences. That is, have we found a variable that can be abstracted usefully from the experience?

We observe a large pack of horses. Observation suggests a way to group them. They can be arranged by height. Markings may also allow us to re-group them according to whatever characteristics are suggested. It can be by their behavior in running or according to some other skill. The same pack of horses can produce many variables to use in describing animals. And each abstraction of this complex experience is itself a simple and single representation of an idea that may be useful to subgroup the experience.

It frequently follows that the invention of a good variable eventually becomes useful to everyone. This is the hallmark of a good variable. Having become an extraction of experience, the newly constructed variable is recognized as so self-evident that everyone begins to use it. Some

may even remark, "Why didn't I see that." The analogy is like an optical illusion, when the alternatives are pointed out, they can usually be seen, but before that we tend not to observe the alternatives. A good variable operates in a similar way. The variables, so identified, become recognized and useful. This is the history of good variable construction.

Application of the Rasch model and associated fit statistics can be used to identify items that define a single dimension. Scale development proceeds by successive variable definition. Items that fit contribute to a single, interval, sample-free scale. Locations of items, persons, and related attributes produce a definitive mapping of the variable. See Variable Mapping, Chapter 14, page 119.

MEASUREMENT ESSENTIALS

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