THE SEMI-PERMEABLE MEMBRANE: LANGUAGE MIGRATIONS BETWEEN THE HUMANITIES AND TECHNOLOGY

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Science and technology have provided everyday speech with new and often useful words-- quark, quasar, and stress, for example, and ordinary and literary speech has found its way into the laboratory with words like moment, slope, and charm. These migrations allow for the enhancement of communication between the two cultures, as well as often humorous misunderstandings.

For the purpose of this paper I have somewhat arbitrarily divided language borrowings and migrations into three categories, recognizing that, at the boundaries, the discriminations are difficult to justify and that others might classify a given word or phrase differently.

Type I. Those involving the direct appropriation of both word and meaning.

Type II. Those involving the appropriation of a word and at least one commonly held denotation or connotation, but with some modification of the original meaning.

Type III. Those involving the appropriation of a word, but the assignment of an essentially new meaning to it.

I shall address the enhancement of communication through Type II (and to some extent through Type I) migrations in the context of teaching statistics and research methodology to humanities and social science students and miscommunication, both actual and hypothetical, through the use of Type III words.

As the resident quantifier in the psychology department, I have taught statistics, research methodology, and tests and measurement to usually reluctant and often terrified students. In attempts to reduce their anxiety, I have resorted to many pedagogical ploys, ruses, and stratagems, with varying degrees of success. I have used behavioral strategies, attempted humor, conducted yoga classes, and simplified the material in a number of ways. I have invented, borrowed, and stolen mnemonic devices, relevant examples, and ways of rewarding excellence.

One way of making novel and often technical subject matter accessible is, of course, to explain it in already familiar terms. Those conversant with the literature on the transfer of learning will recognize that one must exercise caution in the choice of such terms. Too facile an explanation can lure unsuspecting novices into believing that they have apprehended a concept when they have merely responded to an already comfortable denotation or connotation without making the necessary shift to the new and more technical context. Some commonplace words (Type II) transfer only marginally, and others (Type III) are used in radically different ways.

Types I and II words that have made life easier for my students and me include bias, correlation, frequency distribution, median, power, reliability, sample, significance, slope, validity, and variability, among others.

In teaching the rudiments of descriptive statistics it is common to start with the elements of grouping and graphing data, moving on to measures of central tendency or averages (Type II). To the novice statistics or measurement student, a term such as frequency distribution sounds abstruse, if not threatening, but becomes easily accessible when broken down into its components. It is made up of frequency, a Type I word, that means exactly what it does in ordinary speech, combined with distribution (a Type II word). It simply denotes a set of scores placed in numerical order with their frequencies -- the number of times each occurs--indicated. In graphing data, students are introduced to the concepts of co-ordinates (Type II), slopes (Type I), and intercepts (Type II).

Most students, however sheltered from quantitative terminology they might have been, have encountered (I think I show admirable restraint in not saying intercepted) the notion of an average, an inclusive term for several measures of central tendency, three of which are typically presented in elementary statistics and measurement courses: the arithmetic mean, the median, and the mode. The arithmetic mean usually poses no conceptual difficulty, save that of convincing the neophyte statistician that it is not the average, simply one of many. The median is a mathematically unsophisticated measure defined as the middle score in a distribution. Its mnemonic is the concept of a median strip in a highway.

Understanding the mode, defined as the most frequently occurring value in a distribution, relies on the student's familiarity with an obsolescent, if not already obsolete, word, modish in the sense of fashionable. The payoff here is two-fold, if successful--a useful mnemonic and the preservation of a classy, if no longer popular word.

The paramount utility of statistics in the social and physical sciences is in making inferences (Type II) from samples (Type I) to populations or universes (Type II). The opportunities for relating familiar terminology to the esoteric concepts of inferential statistics and research methodology are both numerous and heady.

One tests null hypotheses, partitions and pools variances, calculates the power of a statistical technique, and insists that measures be both valid and reliable. Those that stand up to the test of time are said to have high coefficients of stability. The samples used in testing hypotheses are selected in a manner that minimizes bias.

We calculate coefficients of correlation and their concomitant coefficients of determination and alienation. In factor analysis we look for uniqueness as well as commonality. We construct lines of best fit and refer to their forecasting efficiency.

In these examples the commonality of meaning in technical and common usage is sufficient to allow the student to grasp at an intuitive level some portion of the underlying concept. Unfortunately for pedagogy and the bridging of the infamous two-culture gap, the list of Type III words that exacerbate miscommunication is even longer.

Even within a discipline, sub-specialties often use the same word to mean different things. The clinical psychologist who hears the word alienation thinks immediately of a psychic state, and the more experimentally oriented think of the statistical term mentioned above, the coefficient of alienation.

Several years ago a colleague asked me to sit in on a discussion of several clinicians who were in the process of designing a study to evaluate two counseling methods. One turned to me and asked my opinion. Since I had been invited to provide statistical help, I responded that I should predict an interaction, that is, that the methods would perform one

way with one personality type and differently with another. The clinician said, rather derisively, "Well, of course, there will be an interaction. We're talking about counseling."

Between disciplines, even closely related ones, the possibilities for misunderstanding multiply. Consider the following scenario. Two psychologists are talking about manipulating variables affecting the covert activities of naive subjects in the hearing of a political scientist. They continue their conversation by lamenting the high mortality rate among their blind colleagues and their subjects' resistance to extinction when engaged in a pursuit task. They speculate about whether subjects trained by the anticipation method will have greater savings than a control group. Should they rely on a phenomenal report or insist on an unobtrusive measure? They move on to a discussion of the relative merits of plaid square and tailored yoke designs. After an hour or so one accuses the other of a lack of parsimony in her theoretical formulation and says that she had better use Occam's Razor if she expects to obtain the Bishop's approval.

What are these people talking about? Have they gone mad? Are they plotting nefarious schemes leading to the demise of innocent undergraduate volunteers? Are their colleagues meeting untimely deaths, having lost their sight? Why are their subjects anticipating money in the bank? What makes the report so phenomenal and why not use it in preference to something unobtrusive? Are the psychologists talking about making clothing, then about spending and grooming habits? Who is the Bishop, and why is his approval important? Are they speaking in code? Has the political scientist fallen through a magical hole in the ground?

Not at all. The psychologists' reference in the beginning of their discussion to covert activities of naive subjects refers not to spying by ingenuous operatives, but to internal reactions of persons being studied who are unaware of the nature of the experiment. The mortality rate of blind colleagues refers not to physical death and blindness, but to the fact that experimenters who are not fully informed by senior investigators of all aspects of their research are moving on to other projects. A pursuit task is one in which a subject attempts to keep a cursor on a moving target, and resistance to extinction refers to the phenomenon that a habit once established through the use of rewards continues even after the behavior is no longer rewarded.

The anticipation method is a verbal learning method in which one in a series of verbal items to be learned serves as a cue for other members of the series. Savings in this context refers to the amount of time saved in re-learning material previously learned and forgotten compared with the amount of time required by a control group to learn the material de novo. The control group in this situation is a group of subjects who have not previously learned the material.

A phenomenal report is not necessarily stupendous; it is merely a subjective account of emotions, sensations, or thoughts experienced by a subject during a specified period. An unobtrusive measure, in contrast, involves the objective measurement of a subject's behavior in ways designed to minimize the subject's awareness of being observed.

Both plaid squares and tailored yoking are experimental designs. A plaid square is one of several so-called confounded designs that intentionally or otherwise omit one or more combinations of variables, so that some results are impossible to interpret. Tailored yoking involves pairing experimental and control subjects by matching them on one or more dimensions.

The Bishop of Occam was responsible for formulating a law of parsimony known as Occam's Razor, which states that new or more complex explanations for

phenomena should not be substituted for older or simpler ones unless the latter can be shown to be inadequate.

The possibilities for misunderstanding between members of different social sciences are wonderfully various, but pale in comparison with those generated by the different languages of the natural scientist, the social scientist, and the humanist.

In his delightful collection of essays, Mayonnaise and the Origin of Life, Harold Morowitz (1985) relates an anecdote about four graduate students who were dining together. One, a microbiologist, announced that he had to go back to the lab to get a culture started. The two social scientists at the table were first puzzled, then mightily amused by the wildly different meanings their disciplines attach to the same word.

Consider the possibilities for confusion generated by the physicist's appropriation of charm and color as attributes of sub-atomic particles, degenerate as a description of a system, and the meaning of stress as used by the psychologist. The non-scientist's understanding of quantum, as in quantum leap, is essentially an antonym of the physicist's. In common speech light-year is erroneously used to designate time, although it is a measure of distance.

The topic of another paper might be the deliberate word-play indulged in by certain members of the academic community. As I labored over a hot computer in my study the other day, I received a telephone call from a colleague. As we talked, one of my cats approached with the unmistakable swaggering gait of a victorious hunter. I asked my colleague to excuse me while I closed the door to my study, because I didn't want a live mouse in my computer room. He replied that he was under the impression that I was in the market for one. With that, I end my tale.

Reference

Morowitz, H. J. (1985). Mayonnaise and the Origin of Life. New York: The Berkley Publishing Group.