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# How Psychology Got Its Variables<sup>1</sup>

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## Abstract

A content analysis of four psychological journals for 1938, 1948, and 1958 showed that over this period there was a considerable increase in the use of the term "variable", especially in the domain of social psychological and personality research. Some of this increase is attributable to a growing tendency to describe psychological research in terms of the manipulation of variables. However, there was also a transposition of the term from the description of procedure to the description of that which was being investigated. Functions and limitations of this process of reification are discussed in terms of the cohesion of the research community and the consequences of a non-reflective research style.

The term "variable" is woven into the very fabric of contemporary psychological discourse. When they speak of the things that they investigate, psychologists are very likely to refer to them as "variables." Whether it is a matter of specifying features of the social or physical environment, or a matter of categorizing dispositions, actions or attributes of individuals, the psychological research literature can be relied upon to define them all as "variables." A.S. Winston (1988) reports a survey of 66 introductory text books of psychology published between 1960 and 1986; all but one of them described psychological experiments in terms of independent and dependent variables.

Like all concepts that are deeply embedded in our everyday practice the notion of "psychological variable" has a self-evident, taken for granted, quality that is incompatible with viewing it as a product of history. Yet a product of history it is, for modern experimental psychology seems to have flourished for at least half a century before much was heard of "psychological variables." Only in very rare instances does the term "independent variable" occur in psychological texts published before 1930, and there certainly is no hint of systematic usage. The ultimate source of the concept of a variable lies in nineteenth century mathematics, but how it got from there into mid-twentieth century Psychology, and what happened to it along the way, remains something of

a mystery.

What has been established (Winston, 1988; 1990) is that variables first began to play a significant role in psychological discourse in the early 1930's, when the term made its appearance in the writings of prominent figures like Tolman (1932), Boring, (1933), and Woodworth (1934). Among these Tolman was not only the first, but also the one who used the concept of a variable in the most systematic way. In the final section of his *Purposive Behavior in Animal and Men* he uses the concept as the basis for a framework within which to compare his own neo-behaviourist system with the theories of the Gestaltists, Titchener, and Spearman. In other words, the linked concepts of independent, dependent and intervening variables provide him with a conceptual scaffolding for metatheoretical comparison. (In parenthesis we might note that it was not a neutral scaffolding but one that clearly favoured his own system.) In the years following publication of Tolman's book the metatheoretical discussions of neo-behaviourism increasingly adopted his usage, especially the new term "intervening variable", which he had introduced.

The background and the ramifications of Tolman's deployment of "variable" as a metatheoretical construct are of considerable historical interest and have been explored elsewhere (Danziger, 1997). In this paper, however, we will follow another part of the historical trail left by the concept of the variable. Psychologists were also engaged in other activities than "theory construction"; more particularly, they were engaged in empirical research. As we know from studies in the history of science, developments in the practices of empirical research do not simply reflect changes in theoretical discourse but are relatively autonomous (Hacking, 1983; Lenoir, 1988). So the fact that the language of variables came to dominate theoretical discourse in psychology does not tell us anything about its role in investigative practice. It is quite possible that at that level there were factors at work which are not so obvious at the level of "theory construction". To find out about such factors we need to look at the empirical discourse of the discipline as it appears in the pages of psychological journals devoted to the publication of research reports.

Of course, the *technical* term "variable" had been known to research practitioners for some time, insofar as

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TABLE 1  
Percentage of Empirical Articles That Use "Variable"

	1938	1948	1958
American Journal of Psychology	21	18	39
Journal of Experimental Psychology	33	38	59
Journal of Abnormal & Social Psych.	24	19	74
Journal of Personality	13	51	74

they were familiar with certain statistical procedures. The term had entered psychological statistics via Karl Pearson's biometric procedures quite early in the century. Subsequently, psychologists would learn about correlational techniques from texts that presented these techniques in the framework of a "theory of variables" (Yule, 1911). By the 1920's psychological statistics was being given a much more prominent place in the curriculum (Walker, 1929) and a number of specialized texts that followed in Yule's footsteps were published. Increasingly, these texts (e.g. Kelley, 1923; Holzinger, 1928) would be cited in research papers. By the middle of the 1930's psychological researchers were certainly familiar with the term "variable" as used in the description of commonly used statistical techniques. However, being a technical statistical rather than a psychological term, it seldom occurs in psychological publications. That soon changes, and the change is both quantitative and qualitative. In this paper we will document this change and suggest some reasons for its occurrence.

#### Quantitative Analysis

In the quantitative part of our analysis we examined all the empirical articles published in volumes of four psychological journals for the years 1938, 1948 and 1958. We chose two journals representing the "hard" areas of experimental psychology (*Journal of Experimental Psychology* and *American Journal of Psychology*), and two journals representing the areas of personality and social psychology (*Journal of Personality* and *Journal of Abnormal and Social Psychology*). We counted the number of articles that used the term "variable" or its plural in a substantive, not an adjectival, sense, as in "among the variables investigated", or, "variables the test was intended to tap". No distinction was made between papers in which the term occurred only once and papers in which it occurred several times.

As indicated in Table 1, the percentage of empirical papers that refer to "variables" shows an unmistakable increase over the twenty year period.

There is significant use of the term "variable" by 1938,

especially in the *Journal of Experimental Psychology*. Then the term undergoes a rapid increase in popularity in the "softer" areas, first of all in the personality area, and after a short while also in the areas covered by the *Journal of Abnormal and Social Psychology*. Increases in the core areas of experimental psychology are not as pronounced.

What might account for the overall increase? In light of our previous discussion two possibilities immediately suggest themselves, but they can both be eliminated. The first possibility is that our finding simply reflects an increase in the proportion of papers employing statistical procedures that involved variables in the mathematical sense. However, there does not appear to have been such an increase because by 1938 the proportion of empirical papers using such procedures was already close to 100%. The undoubted increase in the sophistication and variety of these procedures is unlikely to have affected our count which was based on the minimal criterion of one mention of the term "variable".

A second possibility that must be considered is that reference to variables in empirical papers was affected by the burgeoning theoretical discourse about "intervening variables" to which we have already referred. We therefore looked for any occurrence of this term in our entire sample of empirical papers. However, we virtually drew a blank. In 1938 the term does not occur at all, and in 1948 it is used in a single paper. By 1958 there are signs of a small effect, but even then only 7 out of a sample of 390 empirical papers make any mention of "intervening variables". We have to conclude that during this period "intervening variables" remained essentially a term reserved for metatheoretical and purely theoretical discussion. At this stage most research is conducted with little or no explicit interest in so-called intervening variables. It does not necessarily follow that discussion of abstract theoretical issues had no effect on empirical research, but if there was such an influence it was quite subtle.

Another interpretation of our finding would focus on a new language of psychological experimentation that was being introduced during our period. Briefly, this was the language of independent and dependent variables which began to be advocated by influential experimentalists like R.S. Woodworth (1938) as a substitute for the stimulus-response language he had previously favoured (Danziger, 1996; Winston, 1990). In the post-World War II period the new way of describing psychological experiments was adopted by other influential textbook writers (e.g. Underwood, 1949; Festinger, 1953) and so achieved wide dissemination. It is possible that authors of empirical papers were taking their cue from this trend and were increasingly describing their investigations in terms of independent and dependent vari-

ables. This would of course result in higher use of the term "variable" in later years.

To check on this possibility we counted the occurrence of the terms "independent variable" and "dependent variable" in our sample of empirical papers. The results indicate the likely existence of an effect. In 1938 these terms do not occur at all, in 1948 they occur in under 2% of all papers, but in 1958 in 14.6%. The new style of describing experiments seems to be asserting itself during the 1950's.

However, the overall figure hides considerable variation among the journals sampled. Contrary to what one might have expected, it was not the traditional areas of experimental psychology that were most affected by the change. In 1958 only 5% of the papers in the *American Journal of Psychology* were using the language of independent and dependent variables whereas 27% of the papers in the *Journal of Abnormal and Social Psychology* were doing so. In this respect the *Journal of Experimental Psychology* falls at about the mean for the entire sample (14%) and the *Journal of Personality* a little above (17%). Perhaps there was a temptation to make up for the shallowness of one's experimental tradition by an enthusiastic adoption of the new experimental rhetoric. Areas with the oldest experimental tradition, strongly represented in the *American Journal of Psychology*, would not have been tempted in this way.

Such an interpretation is supported by the fact that talk of variables was also becoming fashionable in the neighbouring discipline of sociology. We included the volumes of the *American Journal of Sociology* for 1938, 1948, and 1958 in our analysis. There was indeed a marked and steady increase in references to variables over this twenty year period - from 10% to 58%. Because the proportion of theoretical papers in this sociological journal was much higher than in the psychological journals, we included them in our analysis, however this means that the figures for this publication cannot be directly compared to those in the psychological journals. Nevertheless, they do show that we are dealing with a trend that was not unique to the discipline of psychology. In fact, a prominent school of sociological thought had for some years been advocating a search for "variables which influence behavior", as part of a programme that would make it possible for "the social sciences (to) obtain what is an approximation of the controlled experiment in the method of the physical sciences." (Burgess, 1929: 47). It was thought that by adopting a model of experimentation as the study of the effects of manipulated on dependent variables the social sciences could successfully imitate the admired model of the established sciences.

Although the texts of these sciences lend no support to this view (Winston and Blais, 1996) it was seldom

criticized within the social sciences. In sociology the doubts expressed by Blumer (1956) eventually became quite influential, but in psychology critical voices like those of Cantril (1950) and Holzkamp (Tolman & Maiers, 1991) were largely ignored. The conceptualization of psychological experiments in terms of the manipulation of variables became methodological orthodoxy during the period covered by our study and probably accounts for much of the increase in the use of the term "variable".

However, in some of the research papers the term appears to have a reference that goes beyond a particular conception of correct methodology. In these cases it seems to express a certain conception, not just of methodology, but of the nature of psychological reality.

Psychologists had first become acquainted with the term "variables" through their large scale adoption of statistical procedures that operated with such mathematical entities. In order to become objects for the type of research that psychologists increasingly engaged in, psychological phenomena had to be reconstructed as statistical variables. Perhaps it was inevitable that the originally clear distinction between the psychological substance and its statistical representation would become blurred. If such blurring occurred and was not considered objectionable it may well have played a role in the burgeoning talk about "variables". In the following section we describe the textual evidence that points to the existence of such an effect.

### Qualitative Analysis

Whereas many of the research papers limit themselves to using the term "variable" (or its plural) in a strictly descriptive procedural context others go further. In these cases the term is used not simply to refer to certain elements in well defined procedures, it now stands for causally active entities that have a real psychological existence independently of the psychologists' investigative practice. In procedural accounts and in the presentation of statistical results the term "variable" has an unproblematic descriptive function. But when these variables are given psychologically meaningful labels they are assigned to a particular category of events sharing some psychologically relevant attribute. Some of these events have been given a certain form by psychological investigation and others have not. Although the relationship between the two is not obvious there is a temptation to assume that all such events already exist preformed in the shape of variables before the intervention of psychological research practice. When that happens, statements about variables entail theoretically freighted assertions about the constitution of psychological reality.

Such assertions are often signalled by two kinds of

textual practices: Firstly, statements that attribute the status of a variable to all and any aspects of psychological reality, including unmeasured and hypothetical aspects; secondly, statements that attribute causal efficacy to these aspects. In the first category are statements that unreflectively pair any psychological quality with the word "variable". Some authors seem unable to discuss personality without speaking of "personality variables", even when they are referring to aspects of personality that have never been measured. In other cases the use of such terms as "motivational variables" or "emotional variables" slides between the labelling of specific empirical measures and a more general reference to motivation or emotion as such (e.g. Eiduson, 1958). Similarly, one encounters "clinical variables" that do not refer to any existing measure but to phenomena that might one day be "objectified" (Zubin, 1948). The notion that psychological reality is prestructured in the form of variables is also implied when a phenomenon like anxiety is introduced as "the anxiety variable" and then resolved into "many different constituent variables" (Mandler, Mandler & Uviller, 1958). Similar preconceptions are also evident when unmeasured (and perhaps unmeasurable) aspects of individual subjectivity like "the perceived world", or "experienced interests and means-end relationships" are described as "experiential variables" (Ryan, 1958).

The attribution of a supra-empirical meaning to the term "variables" also becomes apparent in texts that appear to endow them with causal powers. Thus, responses to projective tests are said to be due to "variables that influence projection" (Sherriffs, 1948) or to "those variables which are generally assumed to give rise to projective behavior" (Weingarten, 1948). In a similar vein the existence of individual differences on a measure of impulsivity, for example, is discussed in terms of a "variable of impulsivity-inhibition" that "controls" one kind of individual response, exerts "direct influence" on another, and "indirect influence" on a third (Dunn, Bliss & Shipola, 1958). It is fatally easy for discussions of statistical effects to slide imperceptibly into talk about the "effects" of real psychological variables with causal powers. Sometimes, these powers even take a physical form, so that "these variables make themselves felt in perception and behavior through the mechanisms of neuromuscular adjustment" (Hoisington & Spencer, 1958). Non-observance of the distinction between experimenters' manipulation of specific conditions and the postulated operation of psychological processes also makes it possible to refer to such things as "motivation and reinforcement" as "basic variables that govern behavior" (Kendler & Kendler, 1958).

Instances of such usage occurred in every journal volume we examined. That may point to a fairly wide-

spread, though implicit and unexamined, belief that any psychologically relevant part of reality was already prestructured in the form of distinct variables, and that psychological research techniques merely held up a mirror to this structure. Statements like "rigidity is a much more complicated variable than has hitherto been assumed" (Fisher, 1948), or "the complex interpretive variables which are involved in any full clinical figure drawing analysis" (Fisher & Fisher, 1950) seem to be based on an assumption that everything that exists exists as a variable. This makes it possible to slide without comment (or apparently without reflection) from a strictly descriptive use of "variable" to a speculative interpretive use.

The textual evidence suggests a climate of extreme permissiveness in the discursive employment of the term "variable". Contributors of empirical papers were apparently not required to define or clarify what they meant by a variable. Only in theoretical contributions was there any attempt to do that. An early statement by P.E. Vernon (1938) is exceptional for this literature. In describing the essential features of what he calls "the psychometric approach" he mentions "the conception of traits or abilities as discrete variables, whose variations among different individuals are purely quantitative" (p. 100). He makes explicit the model of psychological reality that implicitly underlies the more speculative use of "variables" in a part of the research literature of the time. One reason for the extensive textual use of "variables", we suggest, is that they were seen, not just as a technical feature of methodology, but as an attribute of the reality being investigated. In the concluding section of this paper we will mention some aspects of the broader historical context which may help to account for this development.

### Conclusions

It is necessary to distinguish between two kinds of context in which the term "variable" occurs in these journal publications. One context is statistical and methodological, the other theoretical and substantive. In the one case the term is part of a description of actual procedures employed by the authors of these papers, in the other case it serves to refer to that which these authors believe themselves to be investigating. Our suggestion is that much of the increase in the use of the term is attributable to the pervasive appeal of the second type of usage during the period covered by our analysis.

This appeal derived from the role which methodology had come to play in the American psychological community. The period we looked at, from 1938 to 1958, was a period during which a remarkable degree of uniformity was achieved in technologies of data analysis and re-

search design. Yet this uniformity co-existed with considerable theoretical diversity. Agreement about the necessary employment of a certain kind of statistical procedure was often the only kind of agreement that could be relied upon within the research community. These procedures therefore came to take on functions that went far beyond their purely instrumental role in individual investigations. They became the source of a theoretically neutral language that enabled effective communication among researchers that might differ widely in background and theoretical commitment.

The Harvard Psychological Clinic provides an instructive illustration of this process. A volume devoted to its research (Murray, 1938) represents an early historical instance of massive employment of the term "variable" in a substantive rather than a statistical sense. It contains a hundred page chapter entitled "Variables of Personality", and its research objective is summed up in the question: "What are the fundamental variables in terms of which a personality may be comprehensively and adequately described?" (Murray, 1938: x). This theoretically modest formulation was effective in introducing a modicum of coherence into a work that was the product of a group which its spokesperson described as follows: "A group composed of poets, physicists, sociologists, anthropologists, criminologists, physicians; of democrats, fascists, communists, anarchists; of Jews, Protestants, Agnostics, Atheists; of pluralists, monists, solipsists; of behaviourists, configurationists, dynamicists, psycho-analysts; of Freudians, Jungians, Rankians, Adlerians, Lewinians, and Allportians" (Murray, 1938, xi). In the face of this kind of diversity the description of the object of research in terms of variables constituted a kind of lowest common denominator, a *lingua franca* into which elements from various theoretical languages could be translated and made mutually intelligible.

The function of research tools is not limited to their explicit technical role (Danziger, 1990). They have often been the source of the models on which psychological theories have been based, for example, methods of statistical inference have provided a metaphor for explanations of cognitive processes (Gigerenzer, 1991). Our historical evidence suggests that certain research tools have also provided a way of communicating about, and hence describing, the object of investigation. What these functions have in common is that in both cases there is a transposition of categories derived from procedures of research to the cognitive representation of the reality being investigated. It would not be inappropriate to describe this process as a *reification* of research practice.

Such a process may have both positive and negative consequences. It may lead to fruitful heuristics of re-

search and it may help to give cohesion to research communities. On the other hand, it may be an unnoticed, insidious, source of bias. Categories derived from technical procedures embody assumptions about the nature of reality. When some of the texts we have examined here proceeded as if everything that exists psychologically exists as a variable they were not only taking a metaphysical position, they were also foreclosing further discussion about the appropriateness of their procedures to the reality being investigated. These effects were exacerbated by a professional ethos that did not require such assumptions and their implications to be made explicit in the research literature. A few prominent methodologists, like Holzinger, Thurstone, and Vernon, were aware of the issues. Unfortunately, their insights were not reflected in the "normal science" of the period.

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### Résumé

Une analyse de contenu portant sur quatre revues de psychologie, publiées en 1938, 1948 et 1958, révèle que, au cours de cette période, l'utilisation du terme "variable" a considérablement augmenté, principalement dans les recherches sur la psychologie sociale et la personnalité. Une partie de cette augmentation peut être attribuée à une tendance croissante à décrire la recherche en psychologie comme la modification des variables. Il s'est également produit une transposition du terme, lequel est passé de la description d'une procédure à la description du sujet étudié. Les fonctions et les limites de ce processus de réification sont en discussion pour ce qui est de la cohésion parmi les chercheurs et des conséquences d'un style de recherche non réfléchi.

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