Chapter 7

The methodology of concomitant variations

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7.1 Introduction

The progress of scientific research has always relied on intuition and subjective experience as it has on objective experiments and theories. Only in the last two centuries subjectivity has been progressively excluded from the practice of science. However the discoveries on retrocausality and anticipation and the studies which can be traced back to the negative solution of energy and its implications on the properties of life and consciousness, are beginning to suggest that this sterilization of science may ultimately limit its cultural relevance. The experimental method, upon which the majority of research is now based, limits science to the entropic cause→effect phenomena, governed by the positive solution of energy. The increasingly central role of emotions and subjectivity in the studies on retrocausality and anticipation, show the need for a new methodology capable of handling the complexity of the subjective and objective aspects together (Jahn, 1997).

7.2 The scientific dogma

A dogma is a belief imposed by an authority and held true even if no or little evidence supports it. Dogmas are typical of the religious world, but it is possible to find them also in other fields. When *truths* are enforced by an authority which says that it is using the only scientific method, the risk of facing dogmas is high.

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Progress in clinical psychology stems principally from the application of the experimental method in neuropsychology and in behavioral psychology, whereas the vast number of scientific results produced by sociologists and social-psychologists regarding the quality of life, the subjective perception of well-being and satisfaction and its clinical applications, are practically ignored.

Why are these results overlooked? In his article *"Challenging Dogma in Neuropsychology and Related Disciplines"* Prigatano points to the notion of "scientific dogma".

- Randomization versus clinical observation

Prigatano starts challenging one of the pillars of neuropsychology: experimental studies which use randomized groups offer the most convincing evidence of the effectiveness of a treatment. Prigatano believes that the tendency to stress only the methodological aspects which assure that a study is experimental (and therefore scientific), leads to the production of studies which disregard clinical observations and the understanding of phenomena, and contain little theoretical and practical applications. On the contrary, the breakthroughs of important scientists such as John Hughlings-Jackson and Lurija were based on careful clinical observations and a deep understanding of phenomena, and they lead to findings which have lately been proved true, thanks to modern neuro-image techniques. Prigatano states that, in order to produce scientific knowledge, useful for clinical purposes, it is necessary to make use of quality clinical observations and not only randomized studies. The study of patients who improve thanks to rehabilitation programs, compared to those who do not improve, is, according to Prigatano, the method which mostly permits expansion of knowledge in this field. The careful observation of the phenomena under study is the first step towards any scientific discovery, as it was shown by the fathers of the experimental method: Galileo Galilei, Bacon and Newton; but it is also necessary to be able to control and repeat observations. Nowadays a polarization exists: on one side a dogmatic use of the experimental method, which Prigatano calls "scientism", on the other side a qualitative/clinical approach, which has lead to

highly important results, but which is widely based on personal intuition which frequently cannot be controlled.

7.3 Does an other scientific methodology exist?

John Stuart Mill, in "*A System of Logic*", first published in 1843, showed that relations can be investigated in two ways:

- Using the methodology of differences, upon which the experimental method is based;
- Using the methodology of concomitances, upon which the relational method is based.

The methodology of differences requires homogeneous randomized groups, and quantitative measures, while the methodology of concomitances uses heterogeneous groups, qualitative/quantitative measures, and objective/subjective information. The advantages of the methodology of concomitances are:

- it permits the study of any kind of relation;
- it provides information on the strength of the relations;
- it permits the study of many relations at the same time, producing global and analytical information;
- it handles an unlimited number of qualitative and quantitative variables at the same time;
- it uses "a-poteriori" controls which consent to develop information which can reproduce the complexity of natural phenomena;
- it can simultaneously study different phenomena, enabling interdisciplinary studies;
- it does not require a controlled environment;
- it can work on any type of group, not requiring similar or "randomized" groups.

But why is this method still unknown among psychologists? Because it requires powerful data processing. The methodology of concomitances has become accessible only recently;

whereas experimental methodology, which uses techniques such as ANOVA and t of Student, and only requires pencil and paper calculations, has always been available. This difference has lead to a late start, and the methodology of concomitances is still almost unknown among psychologists.

The need of psychology to be recognized as scientific, plus the widespread belief that the experimental method is the only scientific method, have lead to overvalue the requirements of this method, and to recognize only the results produced in those fields in which these requirements could be met, such as cognitive and behavioral psychology.

Prigatano asserts that this emphasis on randomization has caused the growth of an orthodox science in which the only parameter of truth is to obey the rule of randomization, even if the results are frequently contradictory. It is interesting to signal a study published on 13 July 2005 by Jama (*Journal of the American Medical Association)*, which examined clinical research studies published in three major general clinical journals of high-impact between 1990 and 2003 and cited more than 1000 times in the literature. The outcome is that 1 study out of 3 is contradicted by other research.

Raymond B. Cattell, well known for the development of factor analysis techniques widely used in psychology, shows in the introduction to "The Scientific Use of Factor Analysis in Behavioral and Life Sciences" that the use of the experimental method and of ANOVA analysis in life sciences leads to unstable and often non-scientific results.

The dichotomy which Prigatano described among quantitative "experimental scientism" and qualitative "clinical observation", could fall short with the introduction of the methodology of concomitances which could lead to a "change of paradigm", using the words of Thomas Kuhn.

7.4 Concomitant variations: the relational methodology

Two methodologies permit the study of relations:

1. the methodology of differences, from which the experimental method takes form, but which allows to study only cause➔effect relations (entropic).
2. the methodology of concomitances, introduced by Stuart Mill in 1843, from which the

relational methods takes form, which permits the study of any type of relation allowing science to broaden beyond entropic phenomena.

Until now, relational methodology has been used only in a very limited way, because:

- it was generally accepted that only cause➔effect relations existed;
- data-processing power was not available.

Until now it was postulated that only those phenomena which could be studied using the experimental method could be considered scientific. This assumption has lead to the exclusion of the properties of life from the realm of science.

The experimental method studies cause➔effect relations in the form of differences between groups:

1. similar groups are formed (same mean values and variances);
2. only one element varies (treatment);
3. differences which arise between the two groups can be attributed only to the treatment (cause).

For example, in order to test a drug, two similar groups (same average values, variances, etc.) are formed, all the other variables are kept under control and the drug is given only to one group. The differences observed between the two groups can be attributed only to the drug. The drug is the cause, the differences are the effects: cause➔effect knowledge is produced. While the experimental method has been used with great success in physics and chemistry, in medicine, biology, psychology and sociology it has lead to the treatment of life, humans and society, as if they were mechanisms, and has produced an enormous amount of single cause➔effect relations, losing the unified vision of life. Pharmacology is the most evident example: a huge amount of cause➔effect relations, with no understanding of life.
Relational methodology, instead, studies concomitances. How does it work? Data is gathered through a questionnaire or an observation grid, and information crossed. In the following

example sex and car accidents are crossed. It is possible to read that 20% of men have had few accidents compared to 70% of women, whereas 80% of men have had many car accidents compared to 30% of women:

Accidents	Males	Females	Total
Few	50	105	155
	20%	**70%**	**39%**
Many	200	45	245
	80%	**30%**	**61%**
Total	250	150	400
	100%	**100%**	**100%**

Tab. 1 – Relation: male ➔ accidents

It is possible to cross three variables. For example, if the sample is divided among those who drive a lot and those who drive little, the relation male ➔ accidents disappears:

Accidents	drive little		drive a lot	
	Male	Female	Male	Female
Few	70%	70%	20%	20%
Many	30%	30%	80%	80%
Total	100%	100%	100%	100%

Tab. 2 – Relation: male ➔ km driven ➔ accidents

Table 2 shows that there is no difference in the number of accidents between males and female when the relation is studied dividing the sample between those who drive little, and those who drive a lot. The relation between sex and accidents is mediated by this third variable: males drive more than females and therefore are subject to a greater number of accidents:

Males ➔ drive a lot ➔ do more accidents

Three variable tables allow to control the boundaries of relations. For example, when a relation between treatment and healing is found, it could be found that the relation is present only in certain age groups, sex, or other particular cases. Some important properties of the relational methodology are:

- it permits the study of many relations at the same time, producing in this way global and also analytical information;
- it uses dichotomic variables, any information quantitative or qualitative can be transformed in one or more dichotomic variable;
- it uses "a-posteriori" controls, and permits to develop information which can reproduce the complexity of natural phenomena;
- it does not require controlled laboratory environment, homogeneous or randomized groups;
- it permits the use of very different groups, and information which has been gathered previously.

These properties of the relational methodology permit to work directly on the field, without using artificial settings and environments. Research activity becomes easy, accessible, cheap, and it allows to study any kind of phenomena.

7.5 Statistical techniques

Dichotomic variables are those which can only have two values, for example: yes/no, true/false, 0/1; they are similar to the bit used in computers which can be set only to 0 or 1 and for this reason they are often called “bit of information”. Any information, quantitative or qualitative, can be translated in one or more dichotomic variables. At this level it is therefore possible to cross any kind of information and to study any kind of relation. The basic operation which is performed with dichotomic variables is counting. Counting produces frequencies on which it is possible to calculate percentages. When dichotomic variables are cross-tabled it is possible to apply sums, subtractions, divisions and multiplications. In this way, with dichotomic variables, it is possible to produce:

- *frequency distributions:* which permit the study of the distribution of the values of the

variables;

- *cross tables:* which are produced crossing the distribution of two variables allowing the study of the relation between the two variables, thanks to the comparison of row and column percentages;
- *relations tables:* for each pair of dichotomic variables it is possible to calculate the strength of the relation using Chi Square and other statistical indexes. By sorting the relation values it is possible for each variable to produce a profile in which variables are put in order on the basis of the strength of the relation. As every researcher knows cross tables can produces thousands of pages which are often difficult to read and interpret. Relation tables synthesize this huge amount of information in a few pages which are easy and fast to read and interpret.
- *factor analysis:* relation indexes are values which express the relation between couples of variables. When the interest is to reach a global perspective of the phenomena it is necessary to analyze the relations together. Factor analysis generates new variables which use the correlations of the original variables as coordinates in such a way that it is possible to represent the variables in a multidimensional space and study how they cluster together.
- *factorial points:* the clusters of variables can be translated into new variables (factorial points) which are used to select subjects in homogeneous groups.

- frequency distributions

Age years	n.
13	2
14	56
15	161
16	183
17	194
18	134
19	72

Frequency distributions provide a picture of the distribution of the variable. Each line of the table corresponds to a dichotomic variable. For example the variable 13 years can have the values yes/no, the same can be said for the dichotomic variable 14 years,... Frequency distributions permit to describe the sample population used in the study (age, sex, level of education). When the sample is representative of the population it is possible to weigh each unit in order to obtain an estimate of the

distribution of the variable in the population.

- cross tables

Accidents	Males	Females	Total
Few	50	105	155
	20%	***70%***	***39%***
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	80%	***30%***	***61%***
Total	250	150	400
	100%	***100%***	***100%***

Cross tables are produced crossing the distribution of two variables. Thanks to the comparison of the percentage values it is possible to assess if a relation exists. In this example 39% of the 400 interviewed have had few accidents, while 61% have had many. If no relation exists, between sex and accidents, the same percentages would be expected in the columns “males” and in the column “females”. Instead, only 20% of males have had few accidents, compared to 39% of the total (expected value) and 70% of the females; 80% of males have had many accidents compared to 61% of the total (expected value) and 30% of the females. It is therefore possible to state that a relation between sex and car accidents exists. The greater is the difference between observed and expected percentages, the strongest is the relation. It is possible to study the strength and significance of relations using statistical tests such as Chi Square, r phi, f of Fischer, etc...

- Relations

Many statistical tests permit to study the significance and strength of the relations. One of the most widely used is the Chi Square. Chi Square studies the difference between observed and expected frequencies. The stronger the relation (concomitance) between the two variables the wider is the differences between observed and expected frequencies. The value of Chi Square, when applied on dichotomic variables, can vary between 0 (no relation) and n (the cases in the sample) for maximum relation. Chi Square values equal to 3.48 have a probability of 5% of happening by chance, whereas Chi Square values equal to 6.635 have a probability of 1% of happening by chance. It is common to consider relations to be statistically significant when the probability of happening by chance is inferior to 1%.

Relations can have directions: a positive relation means that one variable is present when the other one is also present (yes/yes or no/no), a negative relation means that one variable is present when the other is absent (yes/no or no/yes). In the example which follows, Chi Square values are paired with r-phi which varies between -1 to +1, where 0 means no correlation, +1 maximum positive correlation, while -1 maximum negative correlation.

I feel depressed:

ChiQ	rPhi	%Yes	%No	
974.00	1.000	(100.00%/	0.00%)	I feel depressed
507.08	0.722	(85.42%/	12.96%)	I feel anxious
229.19	0.485	(69.37%/	20.60%)	I feel useless
209.18	0.463	(78.04%/	31.94%)	I feel lonely
189.70	0.441	(72.14%/	27.78%)	I am pessimist
189.15	0.441	(65.50%/	21.30%)	Displeased
179.18	0.429	(71.59%/	28.47%)	Unsatisfied
173.57	0.422	(71.59%/	29.17%)	Un-happy
169.88	0.418	(71.59%/	29.63%)	I don't trust myself

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Tab. 3 – Relations obtained by the dichotomic variable “I feel depressed” in a questionnaire study which involved 974 high school students.

The highest Chi Square value is 974 which coincides with the number of subjects used in this research; in the first line r-phi is equal to +1.000 which tells that the correlation is the highest possible. This correlation obtained the maximum possible value because “I feel depressed” was crossed with itself. In the second line “I feel depressed” is related to “I feel anxious”; 85% of the students who have answered “I feel depressed” have also answered “I feel anxious”, while only 12% of those who have not answered “I feel depressed” have said “I feel anxious”. When the dimension of the sample (number of subjects) is high, relations become extremely precise. The highest is the number of subjects the lowest is the background noise, and very delicate relations can emerge.

7.6 Qualitative data, subjective answers and the social mask

Relational methodology works well not only with qualitative and subjective information but also with masked answers; for example, it is correct to ask direct questions regarding personality, social environment, quality of life, etc., such as: *"do you feel alone?"* It is well known that to this kind of question nearly everyone answers using a social mask. Even if the person feels alone, unsatisfied, depressed, he will probably try to present a more positive image, not only to others but also to himself.

Psychologists have tried to solve this problem by developing tests which are designed to get information in an indirect way. Secondary questions which are correlated to the trait which is being measured, and which the person does not mask, are used. In this way it is possible to obtain an indirect estimation of anxiety, depression and other psychological characteristics.

Even if data is distorted by the effects of social masks and cannot be used in a quantitative way (average values or frequency distributions), it can be used successfully with correlation analysis. This happens because the mask is coherent: it is not used only on one variable, but on all the variables. For example if a subject says that he does not feel depressed, when in fact he is depressed, he will also say that he does not feel anxiety, when instead he feels it. The relation between depression and anxiety still shows up, even if the subjects are using masks. In table 5, the answers to direct answers about depression and anxiety are crossed:

	Depressed	Not depressed	Total
Anxiety	15	3	18
No anxiety	2	***180***	182
Total	17	183	200

Tab. 4 – Relation obtained with “masked” answers

As a consequence of the social mask the answers are mainly grouped in the cell "no anxiety" and "no depression". Depression and anxiety come out as correlated (concomitance of the answer No).

When psychological tests are used, which provide an objective measure of depression and anxiety, the result shifts to:

	Depressed	Not depressed	Total
Anxiety	***158***	10	168
No anxiety	2	30	32
Total	160	40	200

Tab. 5 – Relation obtained with objective measures

the answers are mainly grouped in the cell “yes anxiety” and “yes depression”. Because the relation is studied as presence of concomitances, depression and anxiety remain correlated (concomitances of the answer Yes). This example shows that if a relation exists between variables, this relation shows up even if answered are masked. This happens because the mask is used in a coherent way on all the answers. The possibility of analyzing answers which have been distorted by social masks is a profound innovation in the field of psychological and social research.

7.7 The sample

It is important to note that:

- when the aim is that of quantifying, a representative sample is necessary;
- when the aim is that of studying correlations, a heterogeneous sample is needed.

If the aim is that of studying what explains drug addiction, a sample in which half of the population is drug addicted and half is not drug addicted will be necessary. The comparison of these two samples will tell what is linked or correlated, to drug addiction. If the study would be carried out only on drug addicts it could study quantitative distributions, but not what characterizes drug addicts as compared to non drug addicts (correlations).
In order to study correlations it is necessary to maximize the variance of the sample. The greater the variance, the greater is the possibility for correlations to emerge. When the sample is homogeneous correlations tend to disappear.

7.8 The first steps of a study based on the relational methodology

A research which uses the relational methodology starts with the development of a questionnaire or a form which is used to gather information. The development of this tool can be considered the most important moment of all the research work. If information which is not useful is gathered, or no space to alternative hypothesis is given, the work can turn out to be of limited scientific value. Before developing the questionnaire or form it is therefore important to distinguish among key, explicative and structure variables:

- *key variables* are those which describe the topic under investigation, for example if the research is relative to cancer, the key variables will be relative to this illness;
- *explicative variables* are all those which could explain the key variables, and could therefore show correlations; for example with the topic “cancer” explicative variables could be the habits, stress, environment;
- *structure variables* are all those variables which are generally used to describe the sample, such as: age, sex, education, profession.

Usually the steps which are followed in the development of the questionnaire/form are the following ones:

1. start stating the aims of the study (key variables);
2. continue stating all the hypotheses about what could explain the key variables (explicative variables). It is very useful to keep track of the hypotheses, this habit will simplify the interpretation of the results. If everything is vague and hypotheses are not well formulated poor results are usually produced;
3. before using the questionnaire/form it is necessary to test it in order to check if it is possible to gather all the information. This phase has to be repeated until the tool meets those standards which are considered necessary for the quality of the results.

7.9 Conclusions

One of the major objections against relational methodology is that it does not show the causal direction of relations, while experimental methodology always shows the direction: cause➔effect.

It is important to say that the assumption that only cause➔effect relations are scientific can now be considered a dogma as it has been widely shown that retrocausal relations also exist. This dogma is probably the main reasons for the delay that is observed in clinical psychology with the application of the scientific method.

A shift of paradigm is approaching, the old cause➔effect paradigm has entered into a crisis, but the new paradigm is counter-intuitive and meets many difficulties. However, all major changes of paradigm have always been counter-intuitive:

- it was intuitive to imagine the Earth flat but counter-intuitive to imagine it round;
- it was intuitive to imagine the Sun orbiting the Earth, but counter-intuitive to imagine the Earth orbiting the Sun.

A new counter-intuitive discovery is now emerging:

- it is intuitive to imagine time flowing from the past to the future, but counter-intuitive to imagine past, present and future which co-exist!