Using Cognitive Style Measurements to Forecast User Resistance

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ABSTRACT

To reduce user resistance, several previous studies recommended system designs which suit the user's approach to problem-solving; that is, to match systems to the cognitive styles of users. Since an information system solves problems in a manner dictated by the analyst, the main question underlying this research was, "Is there a relationship between user resistance to a given information system and the difference in cognitive style between the user and the analyst?"

The study developed an interviewing technique for measuring user resistance called the R-score. This was applied to 34 users of different systems. Kirton's Adaption-innovation Inventory (KAI) was used to determine the cognitive problem-solving styles of the user and key analyst for each system. The difference between the KAI scores was taken as a measure of the analyst-user cognitive style differential. A significant association was found to exist between the analyst-user cognitive style differential and the R-score. This indicates that in general, greater differences in cognitive style between the analyst and user will be associated with greater resistance on the part of the user to the new system.

KEYWORDS

Innovators, adaptors, user resistance, cognitive styles, information systems.

1. INTRODUCTION

User resistance has long been identified as an expensive time overhead during system development efforts (see studies by Hirschheim and Newman 1988, Markus 1983, and Jiang, Klein and Crampton 2000). Clarification of issues surrounding user resistance was thus the main aim of this study. Furthermore, it was thought that cognitive style theory had only been sparsely researched in relation to user resistance, and that many of the prior studies were open to question. Consequently, this study investigated user resistance in relation to cognitive style theory.

To reduce user resistance, several previous studies recommend system designs which suit the user's approach to problem-solving; that is, to match systems

to the cognitive styles of users. It can be conjectured, however, that this method will fail where the analyst and user differ significantly in their problem-solving approach. This follows from the supposition that the analyst's cognitive problem-solving style will inevitably form an integral part of the system design rather than the user's, as the analyst produces the system. The user will not believe in the modus operandi of such a system and he will consequently reject or resist it. The main question underlying this research was thus, "Is there a relationship between user resistance to a given information system and the difference in cognitive style between the user and the analyst?"

This issue dictated the need to measure user resistance and cognitive styles in quantifiable ways.

2. THE DESCRIPTION AND MEASURE OF USER RESISTANCE

2.1 A Description of User Resistance

Hirschheim and Newman (1988) enumerate several forms of user resistance. These include behaviours such as low productivity, high labour turnover, disputes, absenteeism, withdrawal, aggression, sabotage of machinery and unfair complaints against the system.

2.2 The Measure of User Resistance

User resistance was measured at personal interviews with the key user of each system selected for investigation. The user was asked to list the problems, which (s)he recalled had occurred during the system's development and implementation. The user was asked, in effect, to make complaints, in confidence, against the system and/or its manner of implementation. They were then requested to rate the severity of each complaint on a seven-point scale (with 7 representing the most severe weighting). The sum of severities of all the complaints measured his Resistance score or R-score.

2.3 Justification of the R-score

Method

The R-score method was justified in terms of previous literary studies, for example, the study by Markus (1983) where unfair complaints are identified as virtually synonymous with user resistance. The severity-weighting concept was derived from the most successful method of Wanous and Lawler (1972), used to measure job satisfaction.

Obvious criticisms of the R-score method are:

1. It may be highly associated with the cognitive style of the interviewer; and
2. At an interview, the user might forget certain crucial problems which had been experienced.

The first criticism above is refuted on the grounds that the same person did all the interviewing in this study. The second criticism, the user forgetting crucial problems, was assumed to be of limited impact, since the object of the R-score method is to observe the user in the process of complaining. Hirschheim and Newman (1988) and Markus (1983) agree that unfair criticism of a system is a resistance behaviour. Consequently, the resistant user is quite capable of exaggerating or even inventing complaints, making the issue of those forgotten irrelevant. However, a limitation is conceded, namely, that there are covert forms of resistance, such as absenteeism and withdrawal, which are not necessarily related to overt complaints.

3. THE MEANING AND MEASURE OF COGNITIVE PROBLEM-SOLVING STYLE

3.1 The Meaning of Cognitive Style

Cognitive problem-solving style refers to the way in which a person approaches and solves problems. The well-known occupational psychologist, Michael J. Kirton (1976, 1984), has identified two extremes of cognitive style personality; namely the adaptor and the innovator. The adaptor tends to follow traditional methods of problem-solving, whilst the innovator seeks new, often unexpected, and frequently less acceptable methods. The adaptor 'does well' within a given paradigm, where the innovator 'does differently', thus tending to extend it. The adapter is prepared to wed himself to systems, solving problems

'in the right way', but is often seen as 'stuck in a groove'. The innovator has little regard for traditions, is often seen as creating dissonance, and elicits comments such as, 'He wants to do it his own way, not the 'right' way'. All humans, Kirton claims, can be located on a continuum between the extremes of these two cognitive styles.

Both cognitive extremes can be highly creative, can resist change and act as agents for change. Adaptors support changes to the conservative; back to the 'good old ways', and resist changes to new methodologies. Innovators support changes towards unprecedented systems and technologies, and resist changes to the traditional.

3.2 The Measurement of Cognitive Style

Kirton has invented an instrument called the Kirton Adaption-innovation Inventory (KAI), widely accepted to be a successful measure of cognitive style. For example, Bobic *et al.* (1999) performed an empirical study of the KAI with samples drawn from three respondent-groups: 203 middle-level state managers, 122 international managers studying in the United States, and 262 university students. Based on these samples, they demonstrated credible construct validity, content validity and criterion validity, for the KAI.

The KAI takes the form of a questionnaire, on which respondents have to rate themselves against 33 character traits. KAI scores can range from 32 to 160 with a mean of 96 and a standard deviation of about 16. A person scoring above 96 is considered to be an innovator, and conversely, a person scoring below the mean is an adaptor. However, in the range of 80 to 112 (that is, within one standard deviation of the mean), a third cognitive style can be identified; that of the mid-scorer. Such persons tend to have group-cohesion skills, since they can better relate to the extreme scorers. However, they will lack certain of the skills possessed by the extreme scorers, and therefore will tend not to reach their problem-solving heights (see Kirton, 1984).

4. EFFECT OF COGNITIVE STYLES OF THE USER AND THE ANALYST.

This study aimed to discover a relationship between cognitive style differences and user resistance. 34 systems were identified in ten South African organizations, and the key analyst and key user of each were interviewed. Measures were thus obtained for the analyst KAI scores, user KAI scores, and user R-scores. At the same time demographic data were collected; most particularly, the ages and lengths of service of the respondents. In addition, further data were gathered for the testing of other less significant hypotheses. These data were measured as responses to suitably phrased questions on seven-point scales.

A relationship as an association could thus be tested for the user R-scores versus the absolute differences between analyst and user KAI scores. An association, as opposed to a linear correlation, implies a tendency for paired data to describe some strictly increasing or decreasing function. Two popular statistics are used to measure association; the Spearman rank order and Kendall rank order correlation co-efficients. The null hypothesis of independence can be tested with the aid of these, where rejection of the null hypothesis implies an association between the paired variables.

The association (with $p < 0{,}005$) proved to be far stronger than the minimum normally accepted as significant in human studies, showing that user resistance can be minimized by matching a user with an analyst of similar cognitive style. In the light of Kirton's (1984) research, however, a tendency to do this indiscriminately is dangerous, because many occupational situations require the balance between innovative and adaptive problem-solvers for optimum long-term success. It is recommended that such cognitive style matching only be done in situations where user resistance is a high-risk, high penalty overhead; for example, where systems have to undergo radical modification at short notice.

An interpretation of the R-score was possible based on a near perfect direct proportion which proved

to exist between the weighted and unweighted numbers of the users' complaints. In this relationship, the constant of proportionality was found to be 3.913 (that is, nearly 4). The R-score can thus be taken as approximately four times the number of complaints which the user will make retrospectively, in private, concerning a system and/or its manner of implementation.

It was possible to develop the following table of confidence intervals, which permits approximate forecasts of user resistance (in the form of R-scores) from KAI scores:

Table of Confidence Intervals For Ratio R-score / KAI score difference

Confidence Level (%)	Lower Limit	Upper Limit
55	.66	2.30
60	.61	2.45
65	.56	2.66
67	.55	2.75
70	.52	2.89
75	.48	3.17
80	.43	3.53
85	.38	4.02
90	.32	4.74
95	.24	6.17

Suppose that prior to its embarking upon a joint project, an analyst-user dyad exhibits an absolute KAI score difference of 10. Then any of the following statements, based on the values given above, are acceptable:

After implementation of the system,

1. There is a better than 50 % (namely 55 %) chance that the user R-score will be at least 7;
2. There is an approximately 80 % chance that the user R-score will be at least 5;
   and
3. There is an approximately 80 % chance that the user R-score will be no more than 35.

The R-score is approximately four times the number of complaints, which the user will make retrospectively, in private, to a consultant concerning a system and/or its manner of implementation.

5. OTHER NOTEWORTHY RESULTS

5.1 System Accuracy and Reliability

Bailey and Pearson (1983) showed system accuracy and reliability to be highly associated with user satisfaction. In confirmation, significant negative associations were found in this study between the user R-scores and the users' expressions of satisfaction with the accuracy and reliability of their systems.

5.2 Ages and Lengths of Service of Users

No significant associations were found between these variables and the R-scores. A study by Bruwer (1984) suggests that the greater a user's age or length of service, the more resistant that user will be to new computer systems. This study rejects such a conjecture as a myth.

6. SUMMARY

The major achievements of this study were as follows:

1. A method of measuring user resistance by direct observation has been devised;
2. The replication of the KAI instrument in the IS field;
3. The demonstration of a strong relationship be-

tween user resistance and analyst-user cognitive style difference;

4. The use of the KAI instrument to provide quantitative forecasts of user resistance; and
5. The rejection of user age and user length of service as forecasters of user resistance.

7. CONCLUSION

Based on a sample of 34 systems, the R-score measure and the KAI, this study finds that there is a significant association between user resistance to a given information system and the difference in cognitive style between the user and the analyst. A consequence of this is that system development dissonance will be reduced if team members are cognitively matched. Unfortunately, there may well be hidden dangers in matching developers to users of similar cognitive style in the long term. One might conjecture, for example, that adaptive analysts with adaptive users would develop a system, which, while well-designed, is of too limited a scope to be more than a mechanized form of the old system. In other words, little or no advantage may be taken of the improved technology at the *design* level. The possibility that a *completely new design* would increase system effectiveness could be over-looked. This follows from the characteristics of adaptors to work hard within the limits of existing methodologies. It was thus suggested that adaptive users with adaptive analysts would produce systems which are implemented with reduced development time (see below), but which require drastic post-implementation up-grading (enhancement). One might also conjecture that such systems have a relatively short life, since they are but implementations of obsolescent systems on the available technology.

The placing of innovative analysts with innovative users may well lead to a remarkable reduction in development time, since innovators not only find it easy to agree upon a solution, but do not wed themselves to systems for long (Kirton: 1976). However, the resulting system, while taking fuller advantage of any new technology, could be the result of a mediocre design effort and result in extensive debugging.

Where the match between analysts and users is mixed, that is, adaptive analysts with innovative users, or vice versa, heightened user resistance, and increased development time would be expected. This is in agreement with Kirton's (1984) discussion of cognitive styles, which claims heightened dissonance between team members of opposite cognitive styles. However, the final system might well be more successful in the long term as it would achieve an improved balance between, on the one hand, being sufficiently innovative to take full advantage of new technology, and on the other hand, to be relatively well-designed and error-free. In short, persons of differing cognitive styles should tend to form a control, though a dissonant one, providing a healthier product in the long run.

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