Proceedings of the 15th Annual NACCQ, Hamilton New Zealand July, 2002 www.naccq.ac.nz

The Meaning and Measure of User Satisfaction, and its Relationship to the Analyst-user Cognitive Style Differential

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ABSTRACT

This study examines instruments used to measure user satisfaction and cognitive problem-solving styles. It then discloses the results so far obtained in an on-going endeavour to measure user satisfaction with a number of systems over time. This study highlights the possibility of accurate forecasts of user satisfaction prior to system development, based on the measurement of analyst and user cognitive styles. It also claims that the variation in user satisfaction over time is at least partially predictable.

1. INTRODUCTION

To improve user satisfaction, 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 developer'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 is thus, "Is there a sustained relationship between user satisfaction with a given information system and the difference in cognitive style between the user and the analyst?"

This issue dictated the need to measure user satisfaction and cognitive styles in quantifiable ways. A prior study by the author (Mullany, 2001) upon which this study is based, examined the relationship between *user resistance* and the cognitive style differential. Later studies showed that the resistance score (R-score) could be satisfactorily modified to give a measure of user satisfaction which could be used for *repeated* measurements with the same user given the same system. This opened up the possibility of constructing satisfaction curves from repeated measurements in respect of systems over a period of time.

2. THE DESCRIPTION AND MEASURE OF USER RESISTANCE

2.1 A DESCRIPTION OF USER RESISTANCE

Hirschheim and Newman (1988) suggest that user dissatisfaction is the major cause of user resistance, and they enumerate several forms of this. 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

In the prior study, 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 he/she recalled had occurred during the system's development and implementation. He was asked, in effect, to make complaints, in confidence, against the system and/or its manner of implementation. He was 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 measures his Resistance score or R-score.

2.3 JUSTIFICATION OF THE R-SCORE METHOD

The R-score method is justified in terms of previous literary studies, for example, the study by Markus (1983) where unfair complaints are identified as 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.

An obvious criticism of the R-score method is that at an interview, the user might forget certain crucial problems which had been experienced. This 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 he may forget 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 resistance such as complaints.

3. FROM USER RESISTANCE TO USER SATISFACTION

An empirical study of user satisfaction using a sample of 64 users of systems distributed over 21 organisations, found that a statistically reliable measure of user satisfaction, or S-Score, could be derived from the R-score by adding a further scale for overall satisfaction and then subtracting the sum of the ratings from 40. The reliability and validity of this entirely theoretical measure was then tested using a different sample of 67 systems distributed over 18 organisations. At initial, personal interviews the S-Score instrument was administered to the users to determine their satisfaction with the system being investigated. Within two to four months after the initial interview, the S-Score was re-administered to the users over the telephone. The S-Score's stability and insensitivity to its administrators' cognitive style differences was confirmed in agreement. The S-Score also lost no validity or reliability after being used for a second time. This instrument was thus found to be suitable to measure user satisfaction on an ongoing basis.

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

4.1 THE MEANING OF COGNITIVE STYLE

Cognitive problem-solving style refers to the way in which a person approaches and solves problems. Michael J. Kirton (1976, 1984), has identified two extremes of cognitive style personality; namely *adapters* and the *innovators*. The adapter tends to follow traditional methods of problem-solving, whilst the innovator seeks new, often unexpected, and frequently “less acceptable” methods. The adapter “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. Adapters support changes to the conservative; back to the “good old ways”, and resist changes to novel methodologies. Innovators support changes towards unprecedented systems and technologies, and resist changes to the traditional.

According to Kirton, the presence of both cognitive extremes are necessary for the well-being of the organisation; adapters to improvise to make up for a lack of technology, and innovators to prevent organisational stagnation.

4.2 THE MEASUREMENT OF COGNITIVE STYLE

Kirton has invented an instrument called the Kirton Adaption-innovation Inventory (KAI), widely demonstrated to be a successful measure of cognitive style (Kirton, 1999). This takes the form of a questionnaire, on which the respondent has to rate himself 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 adapter. 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 technical problem-solving heights.

5. THE RELATIONSHIP BETWEEN USER RESISTANCE AND THE DIFFERENCES IN COGNITIVE STYLES BETWEEN THE USER AND THE ANALYST

The former study (Mullany, 2001) aimed to discover a relationship between cognitive style differences and user resistance. 34 systems were identified in ten South African organisations, 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 minimised 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 was identified as dangerous, because many occupational situations require the balance between innovative and adaptive problem-solvers for optimum long-term success. It was 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. However, such suggestions are based on conjecture alone, motivating the present long-term study of systems in a state of development and evolution.

6. RESEARCH METHODOLOGY

An attempt was made to measure user satisfaction over time with 64 newly implemented systems distributed over 12 organisations. At the first interview, the cognitive style of the user and the person whom he/she identified as the key analyst/system developer were made using the KAI. The user was then asked to rate his/her satisfaction with the system on the S-score form.

In the S-Score's administration, the user is asked to rate his/her satisfaction with the system on this scale. The interviewer then asks the user to list his/her complaints against the system, which are recorded in the blank lines provided. The complaints are read back to the user for verification and he/she is asked to weight the severity of the problems on the seven-point scale provided. The sum of these ratings is the R-Score which is mathematically transformed to get the S-Score (see Section 2.2) as follows:

$$S = 33 + CVS - R\text{-Score}.$$

As in previous studies, the S-Score instrument was included in the System Satisfaction Schedule. This consists of an A3 sheet of paper folded in two. The user is asked to name the system, his/her organisation and give a description of the system as well as provide the date on which it was installed. He/she is also requested to identify the key analyst involved in the system. In order to facilitate the testing of hypotheses pertaining to the ages and lengths of service of users and analysts, their dates of birth and dates of initial employment with the organisation are also entered. Other demographic details are recorded such as the users' contact numbers which are needed to conduct follow-up interviews over the telephone in order to monitor satisfaction on an ongoing basis. The above details are all recorded on the front cover of the System Satisfaction Schedule.

The S-Score was converted into an instrument to monitor satisfaction over successive intervals of time. Corresponding to each blank line where the user's complaints are noted, a number of columns were added. At successive interviews the problems are read back to the user who is asked to re-rate them on the problem severity scale. The rating is entered into the appropriate column. For example, the ratings provided at the second interview are entered into the second column, with the date of the interview being placed at the top of the column. Provision is also made for the user to re-rate his/her satisfaction with the system in the same manner. At subsequent interviews, the users are asked if there are any further problems which have become apparent since the last interview. These are recorded in the blank lines and rated as in the initial interview.

At interviews following the initial one, the user is asked if he/she is still using the system or if the system is still in use, and if the same analyst is dealing with the system. His/her responses are recorded in the appropriate column. If the user indicates that he is no longer using the system or the system is no longer in use, the reasons why and the date on which usage was stopped are noted. Likewise if the analyst has changed or ceased to be the details were recorded. The process was continued for a period of approximately eighteen months for each system.

6. RESULTS

6.1 DECREASE OF PROBLEM SEVERITY WITH TIME

After the first 192 days of observation for each system, it was possible to consider the average of all 204 problems which were or had been reported over all the systems in the study. The severity of each problem at various points in time was plotted, and the points joined by straight lines. An average problem severity then could be found for all problems at any given time. The average curve resulting is shown by the solid line in *Fig 1*. Linear, quadratic, hyperbolic and exponential curves were fitted to the average curve. Of them all, the best-fitting exponential curve gave the lowest sum-of-least-squares value. This result implies that in general, user problem intensities decay exponentially with time.

6.2 SATISFACTION CURVES FOR EACH SYSTEM

The prior study could only give a descriptive result in the short term. This study seeks a prescriptive

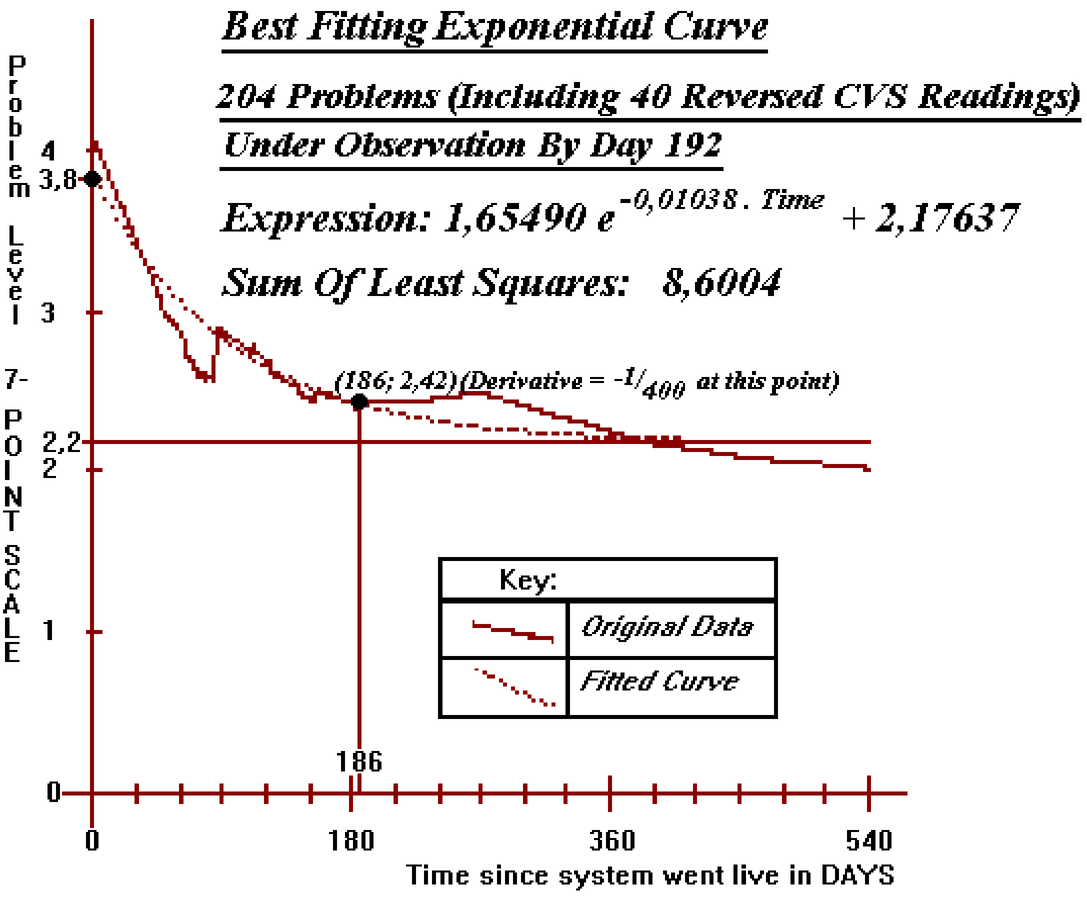


Figure 1: Average problem severity curve and best-fitting exponential curve

result in the longer term. In short it aims to answer the following questions:

1) How will matching or mismatching analysts and users cognitively affect the developing system over time?

and

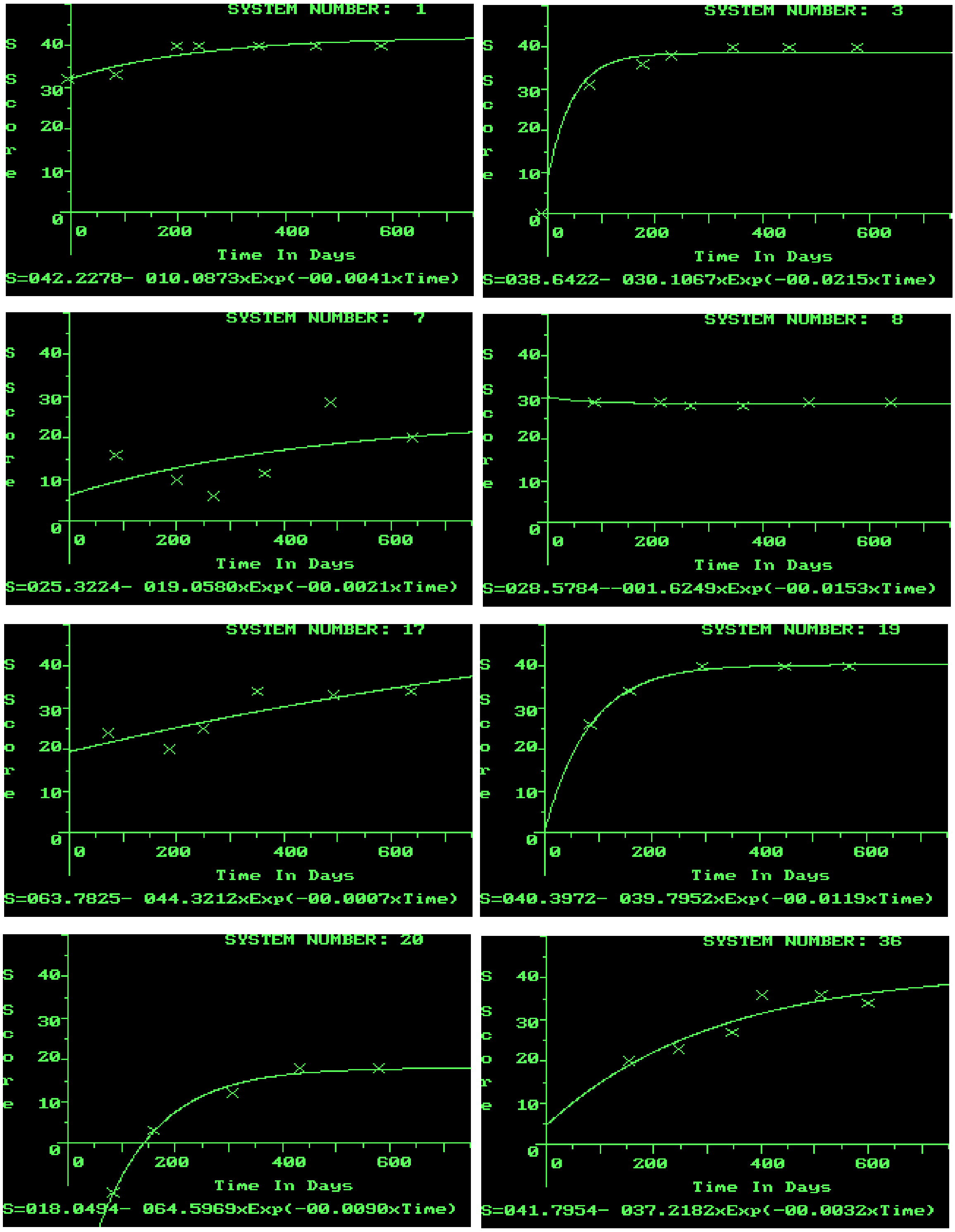
2) How safe is it to prescribe cognitive matching as a means of reducing user resistance?

To these ends, a satisfaction scatter-gram was constructed for each of the 64 systems under investigation, and the best-fitting exponential curve plotted. Eight typical results are shown in Fig. 2. It will be noted that in general the systems exhibit a rising satisfaction level up to some plateau, which strongly suggests the first part of the SDLC curve.

The stable heights of the plateaux were compared with the corresponding absolute analyst-user cognitive style differentials, and gave a Kendall t_a value of -0.2785. This is slightly smaller than the value achieved in the pilot study, but over 64 systems (compared to 34) is substantially more significant, at p = 0,0001. This means that the result of the pilot study could be extended to imply that the analyst-user cognitive style differential predicts a *sustained* level of user satisfaction with a given system, to which it is inversely proportional.

Fig. 2

System Satisfaction Curves
Eight Typical Curves Selected From Forty



CONCLUSION

This study set out to examine instruments used to measure user satisfaction as well as cognitive problem-solving style measurements. The satisfaction curves produced suggest at least one potential relationship between the parameters of these curves, namely that the altitudes of their plateaux, and the analyst-user cognitive style differential are negatively associated.

Further studies may expand on this by obtaining more complete system data, to which potentially better analytic curves can be fitted. Such analytic curves normally yield mathematical parameters, such as for example, the values of a and k in the well-known exponential function $y = a e^{kt}$. Furthermore these analytic functions describe simple models of behaviour, which the analyst-user cognitive style differential may or may not impact. By studying relationships between the analyst-user cognitive style differential and these parameters, simple models of these influences would be expected.

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