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# The S-Statistic: a measure of user satisfaction based on Herzberg's theory of motivation

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## Abstract

*This study describes the development and testing of a new instrument to measure user satisfaction. We have called this the System Satisfaction Schedule (SSS), and the associated statistic, S. In essence, this instrument is based on user-generated complaints. The findings suggest that the SSS is a viable instrument for measuring user satisfaction, despite the lack of positive factors assessed. Other factor-based instruments may be unreliable, since they can omit factors that are important to the user, or include factors which are of no significance to the user. The SSS avoids this difficulty by rating factors which are almost entirely user-generated.*

**Keywords:**

User satisfaction, hygiene factors, motivators, Herzberg, user complaints, user dissatisfaction

## INTRODUCTION

User satisfaction is claimed to be an important component of system success (DeLone and McLean 1992), and so remains a current IS research topic. However, the IS literature surveyed contains no explicit definition of user satisfaction, going little beyond lists of factors thought to comprise the construct. Factor-based instruments such as those of Bailey and Pearson's (1983) Computer User Satisfaction instrument (CUS) or the User Information Satisfaction short-form (UIS) of Ives, Olson and Baroudi (1983) and their later derivatives have two major limitations: they highlight issues not relevant to the user while omitting those that are (Bryman and Bell, 2003). Typically, factors associated with such instruments are collections of users' opinions and seem to include little psychological or sociological theory as their basis. More recently, however, instruments created by Zhang and von Dran (2000), and Cheung and Lee (2005), have their factors aligned to Herzberg's (1959) motivation-hygiene theory of job attitudes. The new instrument developed by this study not only aligns itself to Herzberg's theory, but takes the further novel step of asking respondents to identify their own list of dissatisfaction issues.

Using Herzberg's theory, Mullany (1989) developed an approach to measure user resistance as a surrogate of user dissatisfaction. His 'R-Score' instrument employed the weighted complaints made by a user, in private, against the system under study, or its manner of implementation (see Appendix 1 for a description). He argued for a relationship between user complaints and user resistance. However, his instrument is actually a measure of user complaints, which Herzberg et al. (1959) relate to job dissatisfaction. We argue that the construct of user satisfaction is the absence of user dissatisfaction and complaint. As such the R-Score can also be seen as a basis for measuring user satisfaction, and this study proposes such a satisfaction measure, the System Satisfaction Schedule (SSS). Our paper reports on an empirical study of the R-Score, the consequent development of the SSS and the S Statistic, and the statistical verification of S as a valid measure of user satisfaction. Our new instrument is not intended as an extension of the R-Score as such, but rather makes use of what we deduce that the R-Score really measures: user dissatisfaction as the number and intensity of user complaints.

## SUMMARY OF PRIOR RESEARCH

### Prior user satisfaction instruments

As noted above, DeLone and McLean (1992) suggest that user satisfaction is an important component of system success, making user satisfaction an IS research topic of current interest. They claim further that the Bailey and Pearson (1983) Computer User Satisfaction instrument (CUS) and its derivatives are reliable tools for measuring satisfaction and for making comparisons among studies. In a description of the CUS, Bailey and Pearson (1983) argue that a 'standard measure' of user satisfaction should encompass a *complete* list of relevant factors. This is supported by Wanous and Lawler (1972), who concluded, in an empirical study of worker job satisfaction, that single-item (one-scale) psychometric measures are generally less reliable in the psychometric sense than are composite measures. Bailey and Pearson's (1983) 39-factor CUS instrument was developed after the identification and testing of many more factors affecting user satisfaction (Bailey and Pearson, 1983).

Ives, Olson and Baroudi (1983) empirically tested the CUS together with three older measures of user satisfaction. These were Gallagher's (1974) questionnaire, Jenkins and Rickett's (1979) 20-item measure, and Larcker and Leasing's (1980) perceived usefulness instrument. They found the CUS to be the most predictive of the four and to have the greatest construct validity. However, the CUS requires 5 x 39, or 195 individual seven-point scale responses. Errors of attrition, caused by the increasing carelessness of the respondent as they fill in a long questionnaire, were seen as a possibility. This motivated Ives et al. to construct their shortened version of the instrument: the User Information Satisfaction (UIS) short-form.

Several other factor-based instruments followed. Of 37 empirical studies of user satisfaction found during the period 1983-2006, 9 (24%) explicitly mention either the CUS, UIS or both. All of the other 28 reference the CUS and UIS. 34 of the 37 studies used factor-based multi-dimensional user satisfaction questionnaires. The other three used single scale measures; that is, the respondent is asked to rate their satisfaction with a system on a single multiple-point scale. Among articles by other authors, which refer to the CUS and UIS, is the study by Ryker, Nath and Henson (1997). This claims that the UIS modification of the Bailey and Pearson (1983) instrument was "the best available general purpose measure of user satisfaction", and that it has become "widely utilized". Our study therefore concluded that the great majority of user satisfaction instruments employed in IS research are factor-based, and that most of these were developed as extensions of the CUS and UIS. However, as previously noted, all such factor-based questionnaires exhibit two major limitations: they highlight issues not relevant to the user while omitting those that are (Bryman and Bell, 2003).

### Herzberg's motivation-hygiene theory of job attitudes

In an effort to probe the notion of satisfaction further, this study turned next to Herzberg's (1959) theory, which applies to job satisfaction, and the related concepts of job dissatisfaction and motivation. According to Herzberg (1968), motivation only occurs when an intrinsic generator exists in the employee; that is, that the employee wants to do something as opposed to being forced to do it. He also distinguishes between motivation and movement. The former is associated with a desire to act, while the latter is a pain-avoidance strategy; if there is no action, a negative consequence can be expected from the environment. Job satisfaction is related to motivation, he suggests, and both job satisfaction and motivation are distinct from the factors that lead to job dissatisfaction. Herzberg calls the latter hygiene factors, and suggests that they are associated with drives needed to avoid pain from the environment; hence unsatisfied hygiene factors demotivate and can cause movement, but not motivation. Additionally, unaddressed hygiene factors are the main source of unhappiness in a job. Motivators on the other hand, are related to the ability to achieve; and through achievement, to experience psychological growth. He claims that motivators which are the stimuli for this type of growth are inherent in job content, while stimuli involved in pain-avoidance behaviour are found in the job environment. Combinations of hygiene factors and motivators suggest four work scenarios, which may be represented in a 2x2 matrix, as given in Table 1:

**Table 1: Herzberg's Scenarios of Employee Motivation**
(Herzberg et al., 1959)

| | **High Motivation** | **Low Motivation** |
|---|---|---|
| **High Hygiene** | **Best-case Scenario**<br>Employees are highly motivated and have few complaints | Employees are not highly motivated, but have few complaints |
| **Low Hygiene** | Employees are motivated but do a lot of complaining. | **Worst-case Scenario**<br>Employees are unmotivated and do a lot of complaining. |

**Recent use of Herzberg's theory in IS research**

Despite its formulation in the mid-Twentieth Century, Herzberg's theory endures to the present as a key element in IS research. Cheung and Lee (2005), for example, devised a factor-based instrument for the measure of user satisfaction with e-portals. They included positive factors which they believed were examples of Herzberg's motivators and negative factors which they thought to be hygiene factors. They postulated that a negative rating suggests a higher impact than a positive rating. To test this, a large number of first-year university students were surveyed on-line after they had had six weeks' e-portal experience. From these, 515 usable questionnaires were produced. They found that while the internal reliability of their instrument was high, their study could not show strongly significant asymmetric differences between the positive and negative ratings of the factors tested. However, their study did demonstrate that some of the user satisfaction factors which applied in the past also apply to users of systems incorporating newer technologies such as e-portals.

Zhang and von Dran (2000) devised a model of website design which also parallels Herzberg's two-factor theory. They devised yet another factor-based instrument for measuring 'satisfiers' and 'hygiene factors' among users of web sites. The first phase of their research identified a list of 44 core design factors after surveying 76 web site users. In the second phase, 79 different subjects were asked to categorize these core factors as either motivators (satisfiers) or hygiene factors. Both phases used samples of students (undergraduate to doctoral) together with academic staff from a private university in the United States. However, none participated in both phases. In the second phase, the respondents were initially given a lecture on Herzberg's two-factor theory, and their comprehension of this was verified by a short test. The 44 design core factors they found, they asked the second sample of respondents to classify into satisfiers and hygiene factors. A significant finding of their study was that motivators tend to become hygiene factors with the passage of time, and with further experience of the web site. In other words, once a user has had sufficient experience of using a web site, the only factors which apply are hygiene factors. This offers some support for a posit that to measure user satisfaction, one need only measure the number and intensity of unaddressed hygiene factors as complaints (see INTRODUCTION).

**The link between user dissatisfaction and user satisfaction**

Overall, dictionary definitions of the term 'satisfaction' appear to be so broad that they include motivation as well. The IS literature surveyed offered little further clarity. Nowhere did it make evident, for example, whether user satisfaction and dissatisfaction are opposite ends of the same construct or different constructs, or whether users can be satisfied and dissatisfied at the same time. After consideration of Herzberg's (1959) theory, our view that user satisfaction means the absence of user dissatisfaction and complaint, as justified below, emerged. In the light of Herzberg's (1968) assertion that job satisfaction is related to motivators rather than hygiene factors, this line may seem inept at first sight. However, Herzberg's definition of 'job satisfaction' differs from 'satisfaction with a tool of the trade', such as a computer system. We argue that for factor-based IS user satisfaction instruments, and Herzberg's theory of motivation simultaneously to be credible, user satisfaction must mean the absence of user dissatisfaction and complaint after the user has at least some experience with the system. Another way of saying this, is that satisfaction with a system is primarily related to the facilitation of the user's job once the user has sufficient experience to know what help (s)he can expect from the system. If at a future time the system no longer meets all such expectations, a deficit in hygiene will occur. According to this model, user satisfaction and dissatisfaction are not opposite ends of the same construct in an algebraic sense. Rather, the condition of complete satisfaction is the zero point on a scale measuring levels of dissatisfaction, and dissatisfaction levels have no theoretical limit.

The justification of our view that user satisfaction means the absence of user dissatisfaction and complaint, can be summarised as follows:

- A tool used in the workplace by a person experienced in its use, is an element of the user's work environment and hence plays a major role in satiating hygiene factors. That this is true, at least of web sites, was demonstrated by Zhang and Von Dran (2000). As a computer system is such a tool, satisfaction with a system implies satiation of associated hygiene factors.
- User satisfaction instruments are designed to apply to a number of systems used and so must measure aspects of the user's job environment. They thus are primarily measures of hygiene. and
- Usually factors found on factor-based user satisfaction instruments are rated on one or more multiple point scales. If the user rates a factor as anything less than the most positive, the user is claiming a negative consequence occurs at least on occasion and to a level in respect of this factor during system usage. This means that each scale really rates dissatisfaction, which implies a deficit in hygiene.

As most user satisfaction instruments are factor-based, we argue that the meaning of user satisfaction implied by these instruments is an acceptable one in IS. Furthermore, since low hygiene results in user complaining behaviour (see Table 1), we suggest complaints identify unsatisfied hygiene factors, and the total severity of complaints is a valid surrogate measure of the degree to which hygiene factors are unsatisfied. Another way of expressing this, is that if instruments such as the CUS, UIS or the many others mentioned above are credible (and they are regarded as such in IS), and if Herzberg's theory applies in IS, then it makes sense to define user satisfaction as the degree to which hygiene factors in respect of the associated system are satiated. In other words, user satisfaction means and can be measured as, the absence of user dissatisfaction and complaint once the user has had at least some experience of using the system.

Mullany's (1989) R-Score (dissatisfaction) method (see description in Appendix 1) is theoretically based on this. The procedure is to identify unaddressed hygiene factors in respect of a system, and to quantify the severity of each. In other words, to measure unaddressed hygiene factors in respect of a given user of a given system at a given point in time:

- Detect a deficit in hygiene factors by inviting the user to complain in respect of the system, and record each user complaint;
- Measure the importance of each complaint by way of the respondent's rating on a multiple point scale; and
- Sum the weighted importance-ratings of user complaints to give R, which is an overall rating of user dissatisfaction.

As mentioned previously, this procedure rates dissatisfaction with a system as the number and intensity of complaints. Mullany (1989) thought that this adequately measured user resistance to a new system. The present study does not debate that issue, but merely suggests that a similar technique can be employed for the measure of user satisfaction as the absence of complaint. This leads on to our user satisfaction measure. We argue that, in the light of the preceding discussion, to determine the satisfaction of a given user with experience of a given system at a given point in time:

- Determine total user dissatisfaction as the R-Score (R); and
- Subtract R from a constant. The constant will then denote the point of complete satisfaction.

The constant is theoretically arbitrary and can be taken as zero. Our research, however, suggests that a convenient value is 40, when the importance of each complaint is rated on a seven-point scale (see RESULTS). This yields a range whose maximum is always 40 and whose minimum is usually zero, although occasionally negative values do occur.

## DEVELOPMENT OF HYPOTHESES

The preceding section provides an argument for taking user satisfaction to mean the absence of user dissatisfaction and complaint, and for employing user-generated complaints as a basis for measuring user satisfaction. This study thus set out to verify the reliability and construct validity of the R-Score, and then to develop the new measure of user satisfaction using the R-Score as a basis. Starting with the latter, the following research question was considered:

**Is the R-Score a valid measure of user dissatisfaction, and if so, would it be a valid inverse measure of user satisfaction?**

To test this, we studied the construct validity of R as well as the association of R with positive ratings volunteered by respondents. Hence the question was decomposed into two sub-questions for testing, as follows:

1. **The R-Score rates expressions of dissatisfaction. How would such an instrument compare with other well-known measures of user satisfaction, such as the UIS? and**
2. **Our argument is that the number and intensity of user complaints are a valid <u>negative</u> measure of user satisfaction. Can this be verified empirically? More specifically, if users are asked to rate a system positively as well as negatively, will the positive and negative ratings be strongly negatively associated?**

The first research question is easily tested by obtaining a bivariate sample of R-Scores on UIS scores for users rating one of their systems on both measures. Hence the first hypothesis:

$H_1$: The R- and UIS-scores in respect of the same system produced by the same user are strongly negatively associated.

The second research question calls for a comparison between the way users give positive and negative responses. If it is true that satisfaction is associated with positive ratings and dissatisfaction with negative ratings (a consequence of Herzberg's theory), then the sets of readings should be strongly negatively associated. If, on the other hand, satisfaction is associated principally with a lack of dissatisfaction and complaint as suggested above, then the positive comments measure some other construct; possibly a mix of satisfaction and motivation. In this event, the association should either be found to be insignificant, or weakly significant. Either way, the research question was testable as hypothesis 2, thus:

$H_2$: If users are asked to make both positive and negative comments about a system, and all their responses rated in terms of importance, then the sum of the ratings of the positive and negative factors will be strongly negatively associated.

## RESEARCH METHODOLOGY

The tests of the hypotheses were based on one sample of 64 users over 12 organisations. Details of the sample stratification are given in Table 2.

**Table 2: Sample of 64 systems stratified by organisation-type, system-type and sector**

| Type of organisation | | Type of system | | Sector | |
|---|---|---|---|---|---|
| Insurance | 25 | Financial Planning | 12 | Private Sector | 61 |
| Clothing Manufacturing | 13 | Accounting | 11 | Public Sector | 3 |
| Multinational Fuel Company | 8 | Hired Item Tracking | 11 | **Total:** | **64** |
| Video Rental | 7 | Help Desk | 8 | | |
| University Library | 5 | Travellers' Itinerary | 4 | | |
| Travel Agent | 4 | Stock Control | 4 | | |
| Jewellery Distributor | 1 | Executive Information Systems | 3 | | |
| Sports Club | 1 | Human Resources | 3 | | |
| **Total:** | **64** | Branch Administration Control | 2 | | |
| | | Project Management | 2 | | |
| | | Transport Control | 2 | | |
| | | Geological Survey | 1 | | |
| | | Estate Agents Property Register | 1 | | |
| | | **Total:** | **64** | | |

Each organisation identified key users for a given system. Every one of these was interviewed on a face-to-face basis as the first step. At this interview, the R-Score and UIS for a key system used by the respondent, was duly completed. To provide a simple measure of construct validity, users were also asked to rate their satisfaction with the system on a 7-point Construct Validity Scale (CVS) (see Appendix 2).

An examination of the data gathered revealed that 10 out of the sample of 64 R-Score instruments had three or fewer complaints entered, and 3 had no associated complaints. In such cases, the R-Score could hardly be called a composite measure: a requirement suggested by Wanous and Lawler (1972) and called for by Bailey and Pearson (1983). To increase the number of items on the R-Score instrument, it was proposed to reverse the CVS and to add it on, thus giving a Modified R-Score. As the CVS is rated using a 7-point scale (1 to 7), the reading needs to be subtracted from 8 to achieve reversal. The formula for the Modified R-Score thus became:

**Modified R-Score = R-Score + 8 – CVS**

To test the relationship between positive and negative system ratings, a second sample of 20 users was targeted. They were asked to identify a system which they used extensively, and then to rate it as per the R-Score instrument. They were further asked to rate their satisfaction with the system overall to give values for the CVS. Additionally they were all asked to give opinions as to what they considered good or positive about the system. The importance of each of these opinions was rated similarly to their R-Score complaints on a 7-point scale (see description in Appendix 3).

**RESULTS**

With reference to the data sample of 64 users, the relationships between the UIS, CVS, R-Score and modified R-Score were tested both as Pearson correlations (r) and Kendall associations ($t_a$). All correlations using both statistics exhibit a significance of 0.05 or less. In fact, all but one exhibits the stronger significance of 0.01 (see Table 3). They thus suggest a strong departure from independence for the UIS, R-Score and modified R-Score when compared to the single-scale CVS (see Table 3). The construct validity the three former measures were consequently supported. The modified R-Score exhibited a slightly higher construct validity than the R-Score alone. The UIS exhibited a lower construct validity than either R-Scores when compared with the CVS (see Table 3).

**Table 3: Tests establishing the comparative construct validities of the R-Score, Modified R-Score and UIS**

| **Pearson Correlations:** | ***r*** | **Significant:** | **Supports construct validity of:** |
|---|---|---|---|
| CVS on R-Score: | -0.54425 | at p = 0.01 | R-Score |
| CVS on UIS: | 0.25574 | at p = 0.05 | UIS |
| CVS on Modified R-Score: | -0.67994 | at p = 0.01 | Modified R-Score |
| **Kendall Associations:** | $t_a$ | | |
| CVS on R-Score: | -0.3547 | at p = 0.01 | R-Score |
| CVS on UIS: | 0.3125 | at p = 0.01 | UIS |
| CVS on Modified R-Score: | -0.4449 | at p = 0.01 | Modified R-Score |

The correlation coefficients determined for the UIS on the Modified R-Score were significant at 0.01 and 0.02 respectively (see Table 4). This supports $H_1$; that the R- and UIS-scores are negatively associated.

**Table 4: Tests on Hypothesis $H_1$**
***(The R- and UIS-scores in respect of the same system produced by the same user are negatively associated.)***

| **Pearson Correlations:** | ***r*** | **Significant:** | **Finding for Hypothesis $H_1$:** |
|---|---|---|---|
| UIS on Modified R-Score: | -0.29815 | at p = 0.02 | Supported |
| **Kendall Associations:** | $t_a$ | | |
| UIS on Modified R-Score: | -0.2555 | at p = 0.01 | Supported |

As previously mentioned, to test for the effect of omitting positive responses, another sample of 20 users was targeted. The instrument for measuring the combined positive and negative factors is described in Appendix 3. The results are given in Table 5.

It will be noted from Table 5 that the correlation between the positive ratings and the R-Score is significant but small. The association between the two, is not significant at p = 0.10. Following the discussion of the second research sub-question above, these results confirm that the positive ratings are not strongly correlated or associated with the user-specified dissatisfaction factors. They further vindicate the claim that a more reliable measure of satisfaction is obtained if positive ratings (other than the CVS) are omitted from the proposed instrument. A further observation was that the Modified R-Score occupied a range of 0 to 35 for this sample. A constant of 35 or more was thus suggested as a possible position of maximum satisfaction (see **The link between user dissatisfaction and user satisfaction**). We selected a value of 40 to accommodate samples where R exceeds 35.

**Table 5: Tests on Hypothesis $H_2$**
***(The R- and UIS-scores in respect of the same system produced by the same user are negatively associated.)***

| **Pearson Correlations:** | ***r*** | **Significant:** | **Finding for Hypothesis $H_2$:** |
|---|---|---|---|
| Positive ratings on R-Score: | -0.2623 | at p = 0.05 | Supported, but r is low |
| **Kendall Associations:** | **$t_a$** | | |
| Positive ratings on Modified R-Score: | -0.1895 | **not** at p = 0.10 | Weakly supported, but $t_a$ is very low |

The discussion and results up to this point suggest that the Modified R-Score, being primarily a set of weighted complaints, could be converted into a satisfaction-measuring instrument as follows:

- Include the CVS scale to increase the number of responses, to cater for cases where there are few or no complaints made;
- Give scales for the ratings of the CVS and user complaints;
- Give detailed instructions so that the data collection performed by way of this instrument could be standardised; and
- Select a constant of 40 to denote a position of complete satisfaction.

The measure of user satisfaction, S, was then derived as follows:

$$S = 40 - \text{Modified R-Score}$$

$$\Rightarrow S = 40 - (\text{R-Score} + 8 - \text{CVS})$$

$$\Rightarrow \mathbf{S = 32 + CVS - R\text{-}Score}$$

The SSS was thus designed (see Appendix 4, for a description). It was further tested on another sample of 20 system users distributed over an oil refinery, a primary school and a transport organisation. The SSS instrument was completed by 20 users, and the correlation and association of the CVS on S was measured. The results are given in Table 6. The significance levels, which are less than 5%, and the power of the test on the Pearson correlation coefficient suggest that S exhibits acceptable construct validity when compared to the CVS.

**Table 6: Results of a study on the Modified R-Score and S Statistic; 20 system users**

| **Pearson Correlation:** † | ***r*** | **Significant:** |
|---|---|---|
| CVS on S Statistic: | 0.4690 | p = 0.01 |

| **Kendall Associations:** † | **$t_a$** | **Significant:** |
|---|---|---|
| CVS on S Statistic: | 0.3368 | p = 0.03 |

† **Power of the Tests:**
**Correlations:** 0.5 significance level, effect size $\rho = 0.55$, power exceeds 80%.
**Associations:** 0.5 significance level, effect size $\tau_a = 0.5$, power exceeds 60%.

## DISCUSSION

We have developed a new, theoretical model, based on Herzberg's theory and endeavoured to justify our model by way of empirical research. Our approach to measuring user satisfaction has been supported on the basis that factor-based instruments and Herzberg's theory of motivation, taken together, imply a definition of user satisfaction as the degree to which hygiene factors in respect of a system are satiated. This provides the basis of the SSS; that complaints measure dissatisfaction, and thus also determine the degree to which hygiene factors are

unaddressed. By making an overall measure of a user's complaints for a given system at a given point in time and subtracting from a constant, one achieves a measure of the degree to which all hygiene factors are satiated, and hence a valid measure of satisfaction. Additionally, this study found empirically that the resultant statistic S exhibits acceptable construct validity. A further implicit result is that satisfaction, when it comes to any tool of the trade, is primarily related to the facilitation of the user's job. A satisfactory tool operates according to an expected fashion, and when the tool operates differently, a deficit of hygiene normally occurs.

From the point of view of the IS researcher, there is a practical objection to the direct use of hygiene factors as the basis for satisfaction instrument construction, since the presence of such a factor only usually becomes evident when its incomplete address invokes a complaint. This makes a complete set of hygiene factors in respect of a user's job context difficult to predict. Despite this, researchers such Bailey and Pearson (1983) call for the need for a complete set of such factors reliably to measure user satisfaction (see **Prior user satisfaction instruments**). We thus argue that it is more tractable and less artificial to identify and rate dissatisfiers, which are simply defined as the sources of complaints, as and when they occur.

In short, the SSS, with the associated S Statistic, is based on user-generated complaints. The findings suggest that the SSS is a viable instrument for measuring user satisfaction. Also it has advantages over other factor-based instruments in that it requires no ongoing update and avoids errors brought about by the omission of factors that are important to the user or by the presentation of factors which are of no significance to the user. Other diary techniques are available, but these fail to provide entirely quantitative data for statistical analysis (Bryman and Bell, 2003).

The SSS is of potential use to both IS practitioners and managers of organizations. For instance, the SSS can be used as a measure of users' satisfaction at any point in time during a system's life. In the light of the link between user satisfaction and system success, and between system success and the perceived benefits to organizations (DeLone and McLean, 1992), the implications are obvious. The SSS can even be used repeatedly to obtain reliable results from the same user in an organizational setting. As each user complaint is respondent-generated, a user could be asked to re-evaluate each complaint at a future time, to discard complaints that are no longer current and to add new complaints and weightings. This means that changes in user satisfaction with time can be monitored by the organization, and may facilitate the decision to maintain, update or replace a given system.

It is difficult to see how repeated measurement of user satisfaction could be successfully achieved with prior factor-based instruments. Such an attempt would require the same user to re-evaluate the same static set of complaints at different times. As noted previously, some of these are likely to be irrelevant to the user while others relevant to the user could be omitted (Bryman and Bell, 2003). It is doubtful that the user would find the repeated administration of such an instrument convincing, and we therefore suggest that attrition rates could be unacceptably high. By comparison, the SSS provides both a diary of system usage issues together with quantitative data for formal statistical analysis; a combination which we suggest is both novel and of great potential value to IS researchers, IS practitioners, managers and organizations alike.

## AREAS FOR FURTHER RESEARCH

This study proposes the use of the SSS as a measure of user satisfaction. Further verification and validation of the instrument and the S Statistic is required. Such studies could either replicate the verification tests described above, or could test the SSS against other criteria and instruments as they emerge from the literature.

This study proposes an extension of Herzberg's theory to information systems as tools of the trade. Similar studies with other tools, equipment and apparatus would reveal whether the SSS is capable of a more general application than to information systems. If so, it could form the basis of a more global understanding of what satisfaction with any given equipment may mean. This could have implications, for example, in the electronic industry as it is potentially applicable to any of the plethora of electronic devices sold in today's market. Such research would be of profound interest to manufacturers of such equipment, since it would provide a new and possibly improved way of judging consumer satisfaction.

## CONCLUSION

This study offers the SSS instrument as a valid method to measure user satisfaction which will not date with changes in technology. Hopefully its further investigation and usage will help to establish it as a sound instrument, either in its present or some modified form. The correlative statistic, S, relies on the association of user dissatisfaction with user complaint, and hence with Herzberg's hygiene factors. Further, as noted in the discussion, the rating of dissatisfaction by way of dissatisfiers proves to have advantages over the hygiene factor

approach, since this does not require a complete set of hygiene factors reliably to measure user satisfaction. We have argued that it is more tractable and less artificial to identify and rate dissatisfiers, which are simply defined as the sources of complaints, as and when they occur. Finally, the SSS provides both a diary of system usage issues together with quantitative data for formal statistical analysis; aspects which make it of great potential value to IS researchers, IS practitioners, managers and organizations.

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## APPENDIX 1

**Resistance Score (R-Score)**

*This instrument asks the respondent to dictate all problems which they felt had occurred during the implementation and/or the early life of the system.*

*Original instrument has 18 lines for complaints*

*Next, the respondent is asked to rate each complaint according to its severity on the following scale:*

| (7) | (6) | (5) | (4) | (3) | (2) | (1) |
|---|---|---|---|---|---|---|
| *an extremely serious/totally insoluble problem* | *a very serious problem* | *a serious problem* | *a rather serious problem* | *a significant problem* | *a slight problem* | *no real problem* |

## APPENDIX 2

### Construct Validity Scale (CVS)

*Please rate your satisfaction with the system on the following scale:*

| (7) | (6) | (5) | (4) | (3) | (2) | (1) |
|---|---|---|---|---|---|---|
| *Extremely* | *Quite Satisfied* | *Slightly* | | *Slightly* | *Quite Dissatisfied* | *Extremely* |

## APPENDIX 3

### Combined Satisfaction / Dissatisfaction Instrument

*This operates similarly to the R-Score instrument, (see Appendix 1) except that lines for positive comments are also given, together with the following 7-point scale to rate them:*

| (7) | (6) | (5) | (4) | (3) | (2) | (1) |
|---|---|---|---|---|---|---|
| *extremely important* | *very important* | *important* | *rather important* | *of some significance* | *slight* | *barely worth mentioning* |

## APPENDIX 4

### System Satisfaction Schedule (SSS)

*Please rate your satisfaction with the system on the following scale:*

| (7) | (6) | (5) | (4) | (3) | (2) | (1) |
|---|---|---|---|---|---|---|
| *Extremely* | *Quite Satisfied* | *Slightly* | | *Slightly* | *Quite Dissatisfied* | *Extremely* |

*Please enumerate all the problems you or others find with the system:*

*Original instrument has 18 lines for complaints*

*Please rate each complaint according to its severity on the following scale:*

| (7) | (6) | (5) | (4) | (3) | (2) | (1) |
|---|---|---|---|---|---|---|
| *an extremely serious/totally insoluble problem* | *a very serious problem* | *a serious problem* | *a rather serious problem* | *a significant problem* | *a slight problem* | *no real problem* |

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