

Use of Criterion Scaling in the Analysis of Experience Sampling Data

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INTRODUCTION

Since the mid-seventies, researchers have been using the experience sampling method (ESM) to examine the objective and subjective aspects of people's experiences. The ESM involves participants carrying an electronic paging device for seven days and completing a self report form when signalled at random times throughout each day. Of importance to leisure research, based on the work of Massimini (Csikszentmihalyi and Csikszentmihalyi, 1988), researchers are now using ESM data to operationalize flow and non-flow experiences in people's daily lives. In the continued quest to accurately examine Csikszentmihalyi's flow model using ESM data, this paper will examine the current approach and propose an alternative approach.

At present, researchers are using standardized scores from two items on the self-report form, "What were the challenges in this activity?" and "What were your skills in this activity?", for categorizing experiences into one of four "channels". High challenge (scores greater than zero) and high skill (scores greater than zero) experiences are categorized as *optimal* experiences. Low challenge and low skill experiences are categorized as *apathy* experiences. Low challenge and high skill experiences are categorized as *boredom* experiences, and high challenge-low skill experiences are categorized as *anxiety* experiences. The identification of these four channels of experience - flow, apathy, boredom, and anxiety — allows researchers to compare the subjective quality of experiences in relation to the challenge/skill ratio (e.g. Donner, Csikszentmihalyi, and Schneider, 1987; LeFevre, 1988).

Csikszentmihalyi and Nakamura (1988) have suggested that researchers use an eight channel model since a model's ability to define flow experiences, in comparison to other types of challenge/skill ratios, increases as the number of channels increases. Accordingly, a number of researchers have used the eight channel model when investigating the quality of daily experiences in relation to challenge/skill ratio (e.g. Carli, DelleFave, and Massimini, 1988; Csikszentmihalyi and Nakamura, 1988; Massimini and Carli, 1988; Massimini, Csikszentmihalyi, and Carli, 1987; Voelkl, 1989).

When considering the present approach to using ESM data for examining the quality of flow experiences, several concerns arise. One of the more important of these issues is related to standardization of the challenge and skill variables prior to the categorization process. Researchers are first standardizing scores and then categorizing experiences based on deviations from individuals' means on challenge and skill. Existing evidence indicates that participants' raw scores may produce means that are not equally matched, whereas standardized scores transform the raw score means so that they are equivalent. For example, in a study by Massimini and Carli (1988) 47 Italian adolescents reported a mean skill of 5.8 and a mean challenge of 3.8 on a 9-point scale. Similarly, three of twelve subjects in a study by Voelkl (1989) had means that appeared to be slightly out of balance.

An alternative method of data analysis that would account for the standardization problem would be to use multiple regression analysis. Raw score measures of experience can be regressed on vectors coded to represent the various combinations of levels of challenges and skills. That approach would enable testing of the significance of the skill and challenge interaction as well as examination of the percentage of variance explained.

The major problem with the regression approach is that the number of coded vectors necessary to represent both the main effects and the interactions becomes unwieldy when large numbers of response categories are used for the challenge and skill variables (Pedhazur, 1982). Typically, nine categories have been used to measure challenge and skill in ESM studies (Csikszentmihalyi and Csikszentmihalyi, 1988). With nine response categories, 44 vectors would be needed to represent the main effects and interactions. This large number of vectors may complicate interpretation due to the inclusion of "parts of variables" in the regression equations (Pedhazur, 1982).

An approach that would enable the direct testing of a challenge/skill interaction and yet avoid the problems associated with the creation of large numbers of coded vectors is the method of criterion scaling (Pedhazur, 1982; Beaton, 1969). Criterion scaling is an approach to regression analysis in which dependent variables are regressed on vectors comprised of cell and category means representing main effects and interactions. With criterion scaling, one vector is needed to represent each main effect and one vector is needed to represent each interaction effect. Coefficients of determination obtained through criterion scaling are identical to those from other methods of coding. Degrees of freedom may be adjusted in formulae for conducting tests of significance.

The purpose of this study was to demonstrate the application of criterion scaling to experience sampling data and to compare results with those obtained from the traditional approach to analysis.

METHOD

Data used for this investigation were collected in a previous study by Voelkl (1989). Included were 307 observations from 12 subjects who resided in long term care facilities. Voelkl's data were used to examine the relationship between challenge/skill ratio and subjective experience.

Since the present study was intended to provide a demonstration of the criterion scaling method, the analysis was limited to two variables: affect and activation. Following Pedhazur (1982), three coded vectors were created for each analysis. In each analysis, one vector was designed to represent the levels of perceived challenge, one vector represented perceived skill, and one vector was created to represent the interaction between challenge and skill. Affect and activation scores were then regressed on their respective vectors. In this manner, R^2 estimates were obtained and, using appropriate adjustments for degrees of freedom, the hypothesis of an interaction between perceived challenge and perceived skill was tested. Finally, means were plotted to facilitate interpretation of the interaction effect.

RESULTS

The analyses associated with the criterion scaled vectors revealed a significant challenge/skill interaction for both affect ($F_{10,288} = 3.48$; $p < 0.01$) and activation ($F_{10,288} = 5.85$; $p < 0.01$). Squared coefficients of multiple determination based on the criterion scaling approach were 0.181 for affect and 0.261 for activation. These results may be contrasted with the original results reported by Voelkl (1989). In Voelkl's previous analysis, differences across the eight channels were significant at the 0.01 level in the analysis involving activation ($F_{7,299} = 3.29$; $p < 0.01$) and at the 0.05 level in the analysis involving affect ($F_{7,299} = 2.57$; $p = 0.013$). Coefficient of determination values were 0.06 for affect and 0.07 for activation. Thus, in addition to providing a direct test of the significance of the challenge/skill interaction, the criterion scaling approach produced an increase in explained variance of 19 percent for activation and 12 percent for affect.

DISCUSSION

When comparing the two approaches for analyzing ESM data, several advantages of the criterion scaling approach become apparent. For instance, the results from the criterion scaling approach provide specific information on the mean subjective experiences in relation to the interaction between each of the response categories of challenge and skill. Advantages of the criterion scaling approach also include that this is a technique which most researchers are familiar with and it eliminates the problem with standardized scores.

The results of the analyses indicate that the variance explained with the criterion scaling approach is greater than the traditional approach (e.g. 8 channels, Csikszentmihalyi and Nakamura, 1988) for examining the relationship between challenge/skill ratio and subjective experience. This findings supports the premise of Csikszentmihalyi and Nakamura (1988) -- as the relationship between challenge and skill is more specifically defined, the model or approach will more accurately define flow and non-flow experiences.

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