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Computer Simulated Game Tool to Overcome Cognitive Turnover Hawthorne Effect

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Abstract

Many studies show that personnel leave their job mentally before physically leaving. This phenomenon is called as Cognitive Turnover (CT). Companies and Industries are interested in measuring this phenomenon before it happens in order to prevent the personnel from leaving the job or take other necessary actions. Many tools are available to measure the CT. Despite the effectiveness of these tools, there is still one issue that affects the accuracy of this tool, namely Hawthorne Effect (HE). HE indicates the behavior of the personnel being tested will change, provided they have the knowledge that they are being tested. This biased behavior will reduce the accuracy of the CT measurements. In this article a new approach using a Computer Simulated Game (CGS) as a tool to measure the CT indirectly is provided. The questions that are used to measure in CT are converted into equivalent scenario based simulation game. So when the user is answering the questions in the game, they will be indirectly answering to the CT measurements. CGS approach prevents the user from knowing that they are being tested. This will overcome HE during the test, therefore increasing the accuracy of the CT measurements considerably.

Keywords
Cognitive Turnover, Hawthorne Effect, and Computer Simulated Game.

1. Introduction
It can be theorized that organizations worldwide are only as good as the ideas, services, and products that can be commercialized and sold. The key to these commercialized and sold products is that they have to be created and executed by talented human capital, commonly termed as knowledge workers. In our society today there is a dangerous mindset, which organizations may be witnessing, that results in behavior [1] which could hurt productivity in knowledge workers. Loss of personnel or turnover has always been costly to business and industry. Turnover is defined as individual movement across membership boundaries of a social system initiated by the individual [2].

In many cases the actual turnover is preceded by a period of alienation, distancing, psychological preparation, poor or even counter-productive performance on the part of the individual considering changing jobs. Cognitive Turnover (CT) is pre-turnover behavior and attitude due to burnout, dissatisfaction with working condition, or a lack of confidence in ability to succeed [3].

Because the knowledge work is nebulous and difficult to monitor and measure organizations may frequently be unaware of someone who exhibits behaviors and attitudes that are precursors to turnover. The result is a loss in productivity in the short term and a loss of an employee that may be a valuable asset to the organization. Experience, ideas, and innovations may be lost that are critical to the goals of the organization. Cognitive Turnover (CT) is a caused phenomenon. It is a condition in which personnel have thoughts of quitting because of burnout, lack of advancement, low job satisfaction or a myriad of other reasons. When the condition becomes excessive it becomes problematic and is termed “Extreme Cognitive Turnover” (eCT).

When a knowledge worker experiences eCT they appear to do the requirements of the job, but do not put the cognitive effort necessary to assist the organization in meeting its goals. Given the complex nature of their work and the multiple relationships between various factors to be considered by these workers, traditional performance measurement techniques such as work measurement have not been very effective in identifying variant behavior. Traditionally, most organizations understand “what you cannot measure, you cannot control.”

Many of the fundamental Quality Control principles have been well proven in academics studies and in practice from industry. Data collection of meaningful data and proper statistical analysis has lead to the improved quality through process control actions. It is likely those high levels of cognitive turnover can result in loss of productivity, high turnover, and even sabotage. As a consequence, there is a critical need to develop and refine a noninvasive methodology by which CT can be identified, measure using advanced statistics, and extreme cases intervened on prior to the time that high levels might negatively impact the organization and lead to the loss of valuable knowledge work product.

There are variety of noninvasive tools are available today for identifying the CT. But their reliability is not high because most of them do not address the Hawthorne Effect (HE). The HE is a form of reaction of the participants to the test, when they are informed that they are being tested. It is also described as that the people tend to perform better when they are being tested. Hawthorne effect can be both positive and negative depending on the situation. In this case of CT measurement the HE has a negative value.

In order to overcome the aforementioned problem this article provides a new methodology to use a game based simulator to keep the participant from realizing what they are being tested for. This will help to obtain the more accurate value of the measure CT and thereby increasing the reliability of the CT measuring tool.

2. Background

The term knowledge work was first coined by Dr. Peter Drucker in the 1960s as any work that requires mental power rather than physical power [4]. It has been further defined as work that involves analyzing information and applying specialized expertise to solve problems, generate ideas, teach others, or create new products and services [4]. Knowledge work requires a special set of skills related to an area of expertise, such as those of a project manager, an engineer, a salesperson, a consultant, a manager, or a health-care professional. But it requires much more than a technical competence to be successful as a knowledge worker. Savvy knowledge workers understand that these additional skills include the ability to acquire and transfer knowledge effectively. Knowledge is the stock in trade of knowledge workers-it is both process and the product of their work [5].

Knowledge workers resist any attempt to have their productivity “measured” in any traditional sense. Given the complex nature of their work and the multiple relationships between various factors to be considered by these workers, traditional performance measurement techniques such as work measurement have not been very effective in identifying best practices. Most see themselves more as “artists” or “brain workers” than production workers, and most believe that there are no fair and equitable measures that could be used to establish how well they perform. However, management that “what you cannot measure, you cannot control.”

Previous research in Industrial Psychology and Organization Behavior provide some background models for the development of the behavior that may be causing knowledge workers to experience eCT. Research by Mobley, Price and Mowday was the foundation of the development of this concept of “Cognitive Turnover”. Further comparison of CT with related models that include the “unfolding model” by Mitchell and Lee [6], and the “Theory of Planned Behavior” by Azjen [7] may provide more insight on CT and its importance.

Previous researches theorized that turnover may erode the morale and stability of those who remain employed [8]. Their morale suffers because they lose friends and may interpret motives for quitting as social criticisms about the job [9]. Expanding this idea leads to the concept that the underlying mindset that knowledge workers work conditions are too difficult and they should compensate for the challenging organizational environment. Workers renounce their job due to work group conflicts and personal dissatisfaction [10]. Collectively, these findings imply that colleagues’ resignations may undermine the employee’s social integration and, in turn, stimulate more turnovers [11]. If these thoughts are expanded to the knowledge worker who cannot quit because of loyalty or financial condition we have insight to the eCT condition.

Researchers theorized about reasoned action and planned behavior as a function of attitudes toward behaviors, perceived behavior control, and subjective norms which lead to intention and then behaviors. The final behavior would then be the action of quitting or changing major. [11] “Theory of Reasoned Action” utilized the Fishbein model [11] for predicting turnover for nurses and had highly respected validity. It also suggested that

employee's beliefs about turnover consequences could be used to suggest interventions.

Another model relevant to this research is the "Unfolding Model" by Lee and Mitchell [9] which is founded on the image theory originated by Beach [12]. Image theory suggests that people make decisions by comparing the fit of other options with respect to self-definition, goals, and tactics for attaining goals. The unfolding model expands this theory by adding a defining event leading to the beginning of this thought process. This model is also related to cognitive turnover, but the focus of this research is to identify this defining event or shock quickly to develop an intervention that can be used to reverse the intention to attention. The test selected for this study was developed by Jones [4]

3. Statistical Evaluation of Cognitive Turnover Control System (SECtCS)

The test instrument developed by Jones [4] is adopted to develop the computer based simulator to measure the Cognitive Turnover. The test instrument identifies the probable knowledge worker turnover, predicts length of time before departure, and measures the loss of productivity before actual turnover. It measures the worker satisfaction components of part-time industrial workers, then tested populations that stayed and population that quit. A regression was used to predict how long a part-time worker would stay at the company, and identify part-time workers who were at-risk of quitting in a short time frame.

Later, the instrument is further developed into an overall methodology, by adding the components of burnout and stress to the questionnaire, and statistical measurement of Cognitive Turnover values, which indicate pre-turnover behavior [14]. Multiple questions designed to measure responses are grouped into constructs, or measurable variables. The final test instrument was a questionnaire with 11 constructs – three of the 11 constructs are related to burnout, and other eight constructs are related to turnover. The questionnaire, also called Statistical Evaluation of Cognitive Turnover questionnaire has 109 questions that measure the 11 constructs. It was developed using questions from other well-known and related questionnaires, including the [15] Burnout Inventory, Minnesota Satisfaction Questionnaire, and the facet-Specific Job Satisfaction Questionnaire.

This research was applied to engineers working in industry. The methodology is called statistical Evaluation of Cognitive Turnover Control System (SECtCS – Figure 1). By measuring CT and identifying extreme cases of CT, organizations that have knowledge worker population, such as school districts, IT companies, and engineering firms – even academic programs – could be proactive about turnover [14]. SECtCS is expected to function as an opportunity for organizations to save money and improve morale by increasing productivity and reducing knowledge worker turnover.

The SECtCS methodology identifies dissatisfied populations and can measure intervention impact. Previous research on SECtCS resulted in quantifying (scoring the Cognitive Turnover index) the level at which workers and engineers exhibited pre-turnover behavior that indicated lower productivity, reduced work output, and probable departure. The regression predicted dependent variables in the earlier research, which were early warning measures for the organizations. This warning measure was designed to allow industry to identify workers who were about to quit and later non-productive engineers so organizational action could take place to minimize the effects on reduced engineering production and increased turnover. This proactive measure can be adopted to address similar knowledge populations like computer scientists, consultants, and other engineers.

Many of the fundamental Quality Control principles have been well proven in academic studies and in practice from industry. Data collection of meaningful data and proper statistical analysis has lead to improved quality through process control actions. The main disadvantage of this approach is that when the workers are being tested for the CT there is a possibility that the worker may give a misleading answer. This can be easily avoided by led computer game, in which their response to the indirect questions can be interpreted for the right questions.

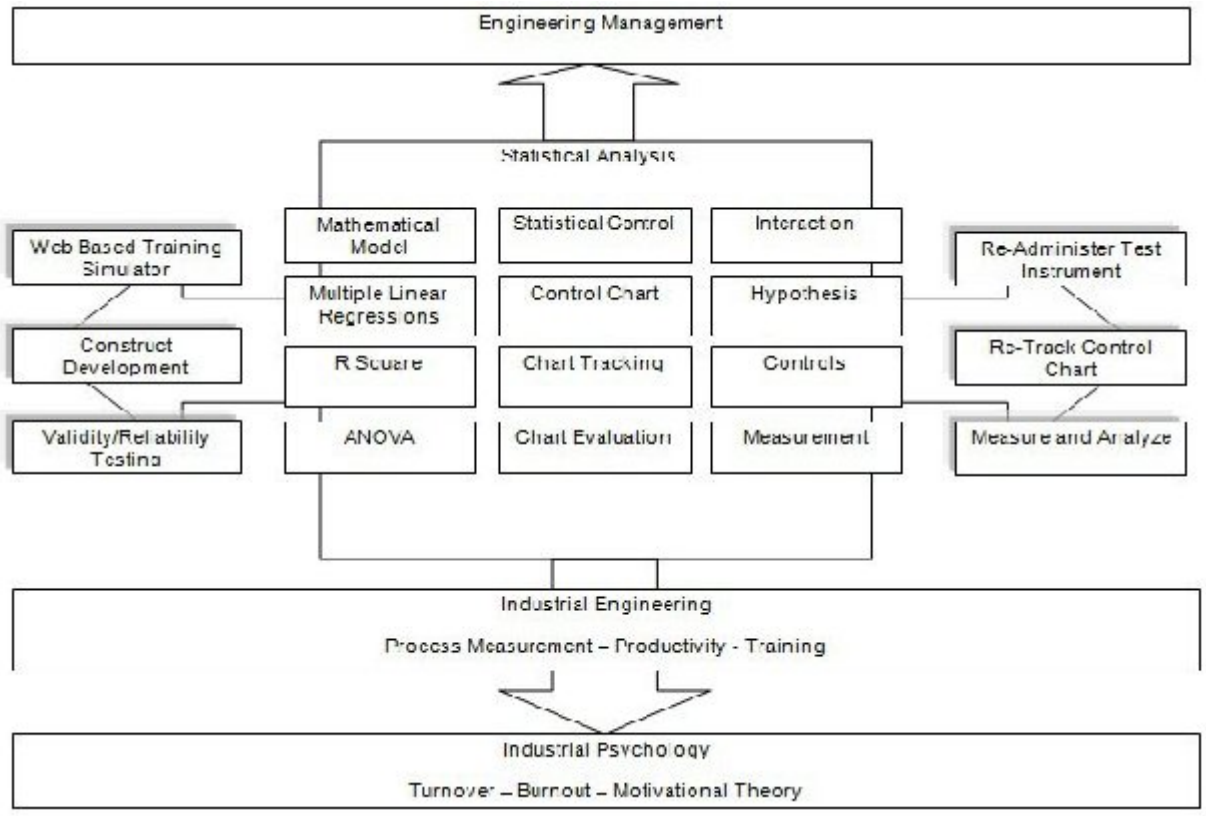

Figure 1: SECtCS Methodology

4. Computer Based Simulator to Measure the Cognitive Turnover

The simulator involves three different modules, namely the game representing the cognitive constructs being measured, the mathematical model built into the software to calculate the statistical value and finally the repository to keep track the longitudinal measurement of the users (Figure 2).

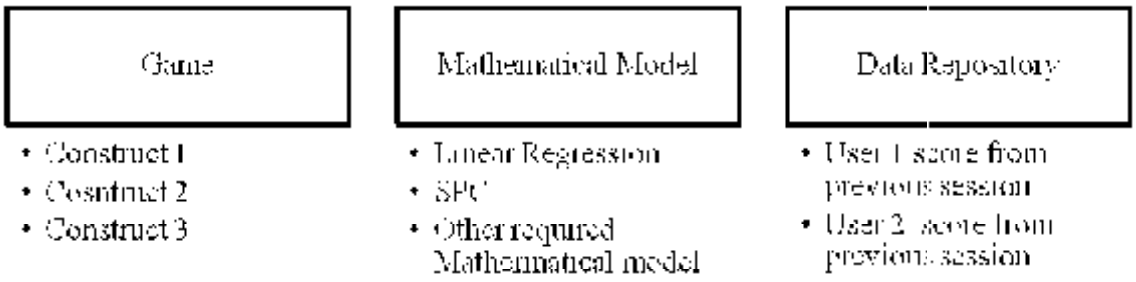

Figure 2: Three modules of the Simulator

The Game part of the simulator will have different constructs to measure the cognitive aspects of the user. The questionnaire to measure the construct is represented in form a game. For example if the user initiation has to be measured, a similar scenario will be created in the game in a comic sense. According the user, he or she is just playing the game, but the options available to the users for answering will be equivalent to the options of the real questions. This will enable to obtain an unbiased answer from the user. In traditional method it was difficult to do this since the user knows that his answer will be evaluated and decisions will be made based on that.

A scenario bank will be created consisting more than one scenario for a single questions. When the user is ready to play the game, simulator checks whether the user has answered the scenario before and provide a new scenario for the same questions if available. The scenario bank will also help to create questionnaire in random and also different order for different users. There will be also provisions to edit, add, and delete a question. In addition to that the additional construct can be added, delete or edit the existing one.

All the response of the user is stored in a data repository, namely a database. This information helps to provide longitudinal information about the previous tests taken by the same user. It also helps to provide a different scenario for the same user in different test. The various mathematical model that will be used for the constructs are developed and included in the simulator. The relationship between the construct and the mathematical model are stored in a relationship tables. The simulator will choose the correct mathematical model required based on the construct used from the relationship table. The entire process is provided in the figure 3.

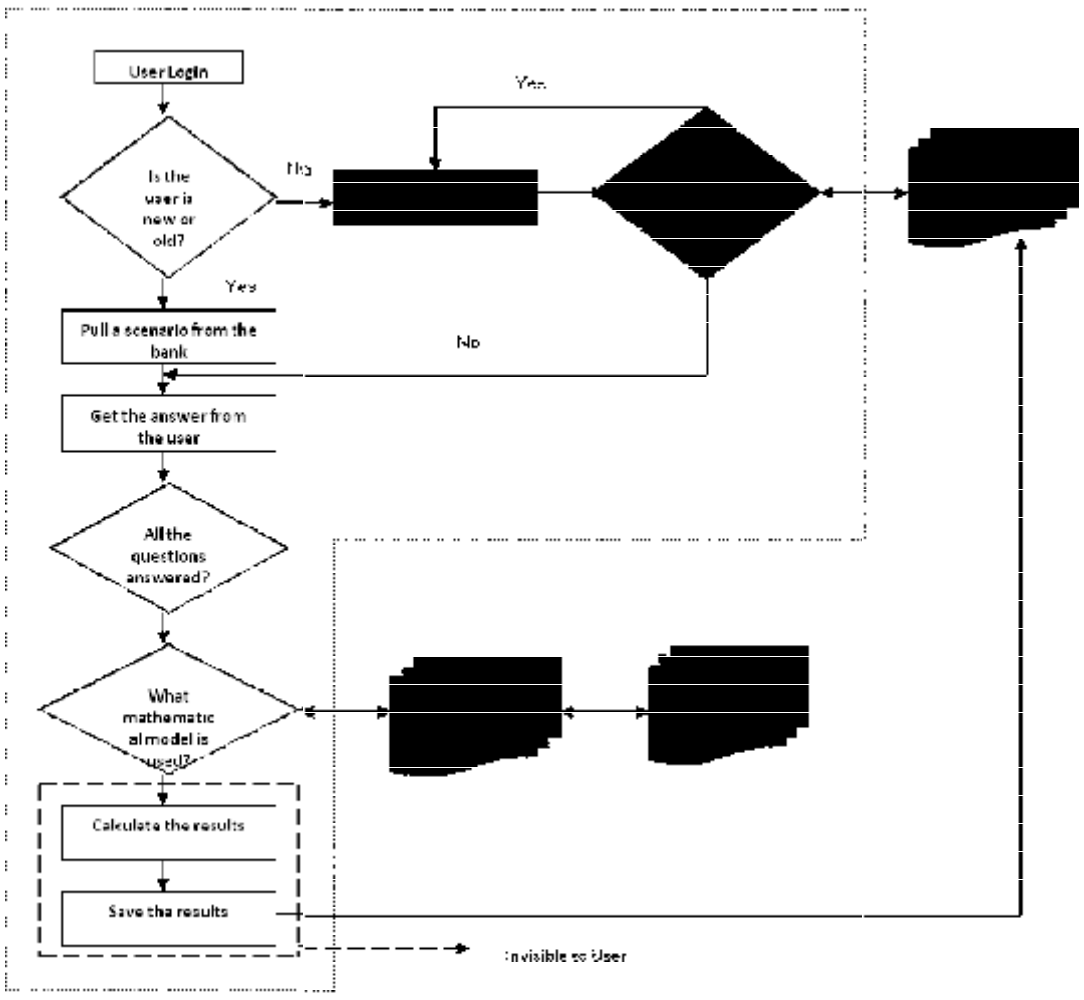

Figure 3: Game Module

5. Expected Outcome

The computer simulated game based tool developed in this paper will prove to be an effective tool to measure Cognitive Turnover. This tool will also be able to avoid the bias behavior of the test subjects. The result obtained from this tool will have more accuracy of predicting the cognitive turnover than the conventional tools.

6. Limitations

The model provided is a conceptual model. The computer simulated game developed has to be validated. In addition to that the simulation for each question has to be validated. Further the tool has to be tested with the test subject before informing about why they are being tested and after informing about the test.

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