

Stress Combination Index Processing Algorithm

Seung Heon Han¹, Young Kil Kim²

¹Department of Biomedical Engineering, Ajou University

²Department of Electronic Engineering, Ajou University

(Received July 2, 2007. Accepted October 24, 2007)

Abstract

All of us has an experience of using the word 'stress'. During the life, we are influenced with various physical and spiritual pressure, complication, discouragement and shortage. That much, stress exists everywhere and everytime around us. It is not easy to examine how much stress you are getting. You can examine only through the health institutions. The examining method is constituted with the psychological method and physiological method, but these methods have the low accuracy about stress index because of disproportion of subjectivity, objectivity and scientific. Consequently, this thesis suggests the algorithms of processing index to help easing stress which is able to examine personally and indexing with the mixing of results of psychological and physiological methods.

Key words : psychological index, physiological index, stress index

1. INTRODUCTION

Our lives are coming along based on the change and experience in the various environment. We are living in the several areas related with family, school, work places, etc. To achieve these all areas, each personal life would be organized basically. In each living area, the social animal, a human has a social relationship with other people and receives the coincidental role with specific title. However, there will need responsibility and demand for the girded role. A person who could not correspond to the responsibility and demand, experiences the physical and psychological maladjustment. In other words, that is the stress formed by physical and psychological effects. The first matter of concern about stress was the reaction about stress induction stimulus. To wit, in the human society, about the reaction and training in the stimulus situations of universal and extreme stress was the interesting matter. As time passes, people start to get interesting in the changing living stress and the living habit and start researching to clarify the stress stimulus

causes and the relationship with the organic disease.[1, 2]

The definition of stress is divided into three methods. The first is the social and environmental concept that stress is formed by the exterior environment primarily but it could be the interior environment, or thought and feeling. The second is the psychological concept that stress is formed by the reaction of intelligence and emotion which are formed through genetic factor and experience. The third is the concept of physical reaction which includes the objective meaning the doctors identify. For example, it is to examine increasing of heart beating and blood pressure, and stress hormone and strengthening of immunity function. Accordingly, the definition of stress is related to social, environmental, psychological, physical concept.[3-5]

Stress exists around us as the cause of all disease. There is the report that the possibility of disease increases as effected by stress. The various disease, such as, heart system, stomach system, respiratory system, urogenital system, endocrine system, nervous system, muscular system, integument system and etc, are originated. The latest report say the possibility of heart disease can be increased to 75% because of stress. Even if, the heart disease patient keep exercise and eating habits continuously, the disease returns. Also, stress is operated with the smooth living and relationship. If a person keeps getting stress and pressure, then his/her working or relationship will get worthy with that. That much, the research about stress is in very important stage, now. Now days, various instruments to examine stress are available, and the popular method to

This research is supported by the ubiquitous Computing and Network (UCN) Project, the Ministry of Information and Communication (MIC) 21st Century Frontier R&D Program in Korea.
Corresponding Author : Young-Kil Kim, Ph.D.,
 Ajou University School of Electrical and Computer Eng. College of Information Technology Professor, Korea.
 Tel : +82-31-219-2364
 E-mail : ykkim@ajou.ac.kr

examine stress is the use of questionnaires. You may have experience with the questionnaire because it is found easily. Some of you may examine stress index as you visit the hospital and have medical examination. However, among those examinations, it is hard to get balanced measurement because if it is subjective but not objective or reverse. That much, the accuracy is also depreciating.[6-9]

This paper suggests the algorithms getting the stress index through the psychological and physical methods. This paper is not a measurement method which uses any hardware, or a sensor for stress measurement. We use a physiological measuring device and psychological measurement system which has been used in medical institutions. We suggest a method to interpret the results and integrate them, after referring the measurement results to an index. There is the examination of what kinds of methods to measure stress index, in the second page, it suggests the method to unify two measuring ways in the third page, and in the fourth page, there is a description about a result and a subject hereafter.

II. THE KINDS OF STRESS MEASURE

In this page, it introduces the methods to measure the stress index. In the existing paper, we mainly presented methods to measure stress.

Therefore, the paper uses measurement methods that have been used a lot in medical institutions. In this paper, we proposed a method and interpretation for easing the mutuality problem happening in the medical institution.

Now, in the current assessment method, there are various ways to measure the stress psychologically. There are sentences with various question formats in the questionnaire. When the marks for the answer about a particular question are

added up, the mark range of stress appears. We obtained the degree of stress, such as a mental state of uneasiness and the fear of the measurement group, on the basis of the value to be added up. We only need to express the index number to mix it with the physiological measurement results, because a mark range with a varying form results from the measurement in the questionnaire. At the physiological measurement level various measurement methods exist, but if we look into the results they are expressed succinctly in an index that is divided according to the rate.

A. Psychological Methods

In the psychological method, stress index is measured with the background of various events caused of psychological and environmental change. Normally, the measurement is made up with decided questionnaire, but it is important to consider the environmental and intelligent causes. So, the measurement is made up with the background of basic question. However, because of the subjective effects, the results can be different in accordance with personal humanity.

The figure 1 shows the psychological measurement instruments and results about stress measurement. The results are divided in five parts and they show the possibility of getting diseases by stress. There are many questionnaires to measure stress index, such as, examination of worry and depression, MBTI(The Myers-Briggs Type Indicator), SCL-90(Symptom Check List-90), many-sided psychological examination. However, through these questionnaires, we can know the causes of stress, but it is impossible to know what kind of disease is occurring. On the example researched latest, one man got a result that he has normal condition without stress, but after the medical examination, he got a know that he had a medical problem even he could not feel. In other words,

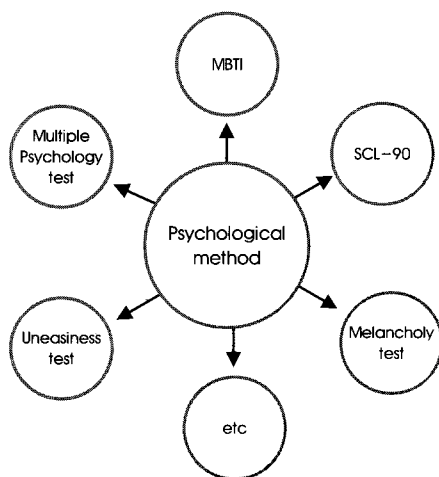


Fig. 1. The kinds of psychological method

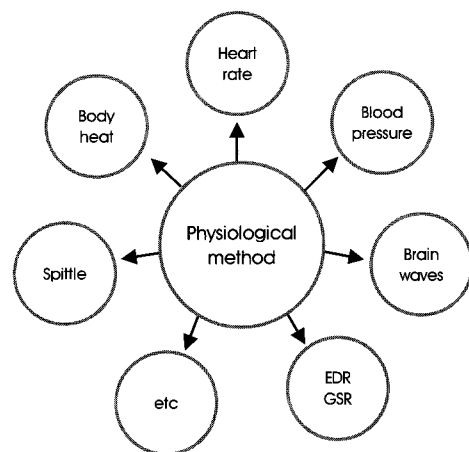


Fig. 2. The kinds of physiological method

the personality applies to stress index. So, there is a problem to measure stress index only using of psychological examination.

B. Physiological Methods

Through the electronics and medical sides, the stress index can be measured more correctly. The exceptional problem about stress measure is occurred in the psychological measurement because it measures stress with the subjective answer of patient, research worker, clinical instruction. So, there are a lot of research to develop more objective and scientific measurement. Generally, the cause of stress is divided in two changes. One is the acute stress happened because of the sudden fitness. The other one is chronicity stress which anyone of us can face to in our lives. Mostly, now days, the acute stress is researched.

The figure 2 shows the method to measure and the results. There are the various measurement methods of blood pressure, EDR(Electrodermal response), brain waves, hormone, heart beating, spittle, temperature and etc. Now days, there are some research to approach with the biochemical side.[10-12]

III. SUGGESTED THE METHOD OF PROCESSING STRESS INDEX

A. Basic Concept

It suggests the mixed two methods for the complement of problems happened in the approach of psychological and physical methods. Firstly, it divided the results which are from the physical and psychological measurement into five indexes. In other words, it is mixture of 5 physical indexes and 5 psychological indexes. The physical index is dividing the extent of measurement's results about physical change. The psychological index is dividing the extent of score about the questionnaire. So, it appoints each indexes from 1 to 5 part. It adds the indexes up and divide the result about stress measurement more specifically.

B. Combination Index Algorithm

The figure 3 shows the index about the stress intensity with division of measure result. Each of them means five indexes, the added indexes are in "2~10". As it has less stress effect, the index is decreasing and as it has more stress effects, the index is increasing. The index is expressed differently according to the various kinds of questionnaire and measurement method. For example, in the case of having a result range that follows any questionnaire, as follows :

- 0~11 : No stress.
- 12~22 : Light stress. The situation in ordinary life in which stress is not felt particularly.

- 23~33 : Normal stress. The level at which modern people most commonly feel stress.
- 34~44 : High stress. The case of a dangerous situation in which the stress may be disruptive.
- 45~56 : Extreme stress. A morbid situation resulting from the stress.

In the above ranges, when the results of stress measurement are "14" and "20", they reflect the same situation for stress symptoms. In this case, we consider the range "12~22" as index "2". Therefore, the range "0~11" is set as index "1", the range "12~22" is set as index "2", the range "23~33" is set as index "3", the range "34~44" is set as index "4", and the range "45~56" is set as index "5". This index sets a numerical value for each type of stress in a range according to the questionnaire kind. By these results, a stress situation is measured finally according to the above form. Physiological measurement is also the same method such as physiological measurement. It is expressed in each index according to the range from the machine because the numerical value from every measurement machine is different.

We express the result of the above-mentioned measurement to the index briefly and add up a living body and a mental state. It is easy to express the stress for each situation simply by adding up. But, in the same index, there can occur different variable. Therefore, it suggests the way to grasp the information of more specific stress about each index. They can be classified according to the measurement object regarding "Psychological Index+ Physiological Index". For example, we have the case in which A group is Psychological Index 30% +

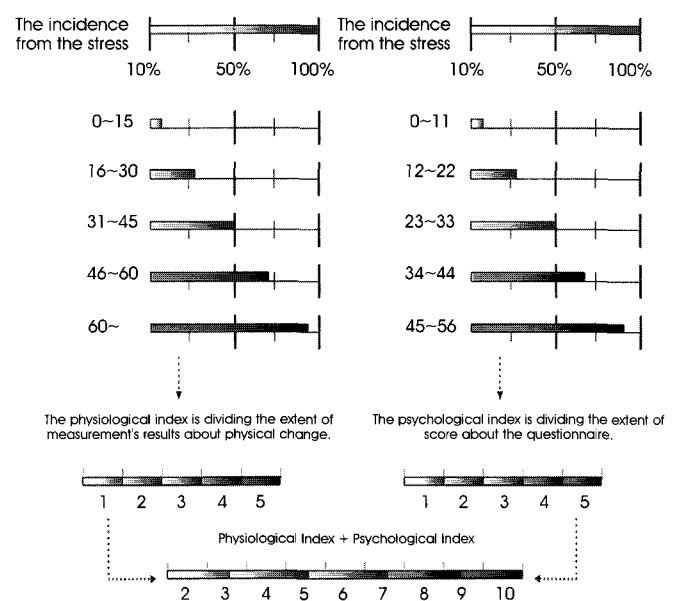


Fig. 3. Physiological index and psychological index

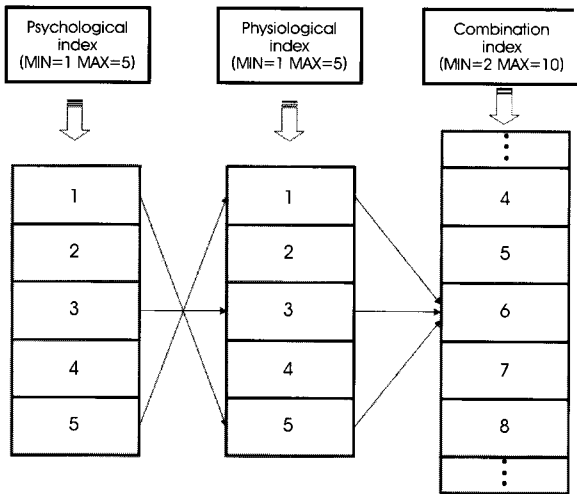


Fig. 4. The method of combination index

Physiological Index 70%, the case in which B group is Psychological Index 70% + Physiological Index 30%, and the case in which C group is Psychological Index 40% + Physiological Index 40%. Methods for a stress measurement have been utilized. But, if we look into the result of the tools to be used for the measurement, they treat the influence the same as the level of stress, according to the range of the measurement result.

The figure 4 suggests the method to show the combined index gained by the mixture of physical index and psychological index.

In the figure 4, the physical and psychological indexes are set up "1~5", "1" is when it is stressless or a few and "5" is when it has maximum stress and need medical treatment. However, when these two index are sum up, three cases occur. The first is the index "6" adding of psychological index "1" and physical index "5", the second is the index "6" adding of psychological index "3" and physical index "3", the third is the index "6" adding of psychological index "5" and physical index "1". These three cases have the same result "6" but they are not in the same situation. In according of this, the figure 5 shows the algorithms.

In the figure 5, it shows the addition of two index as the lowest "A" to the highest "I" and B1~B4 is when physical index is higher than psychological index and the number next to "B" means the difference with psychological index. In other words, if it is B4, it means the physical index is four higher than psychological index. "BP" is when physical and psychological indexes are same. That is the average result. P1~P4 samely means psychological index is higher than physical index. In according of this, even the addition of two indexes are same, it has different meaning. It means through the

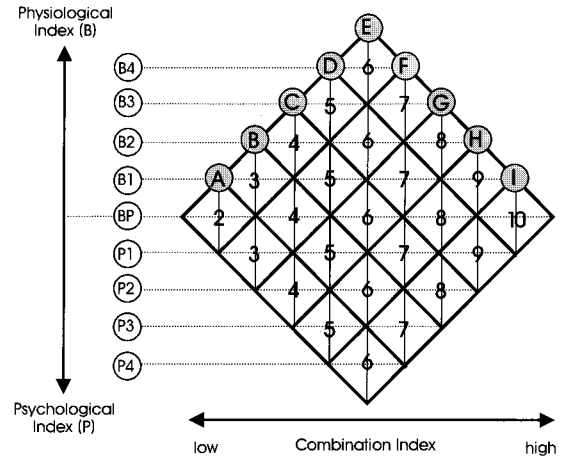


Fig. 5. Combination index algorithm

addition of two indexes, people can predict their stress measure more correctly. Also, it is a method to get efficiency data as it has objective, subjective and scientific balances. As applying the results of adding two indexes, to the stress measurement plan programme, it can help the stress treatment. There are various measurement plans for classified of ages, occupations, but with the statistical data, the efficiency programmes with considering the environmental causes about the physical solution and physical solution, are suggested through the research.

C. Application of Algorithm Result

In the figure 6, there is a one example of the result from the algorithms.

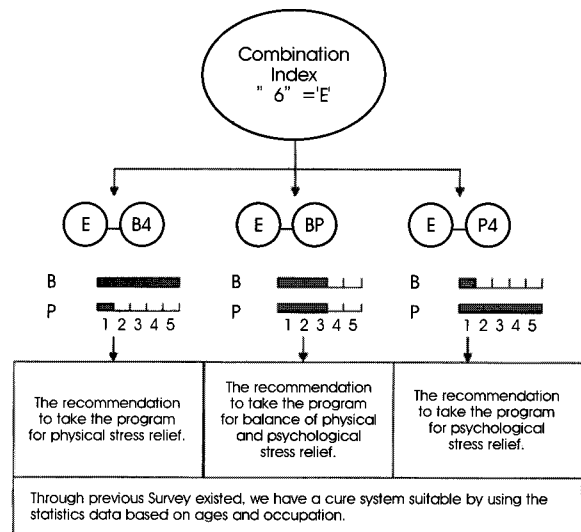


Fig. 6. Application example of algorithm result

As you see in the figure 5, if the addition of two indexes is “6”, the corresponded level is “E” on the horizontal axis. If it looks at the ordinate axis of “E”, there are E-B4, E-BP and E-P4. For each of them, there is the difference between physical index and psychological index. So, even there are the same addition number, they have different measure plan each other. It suggests the above algorithms to divide the statistical data about the stress treatments more correctly and to improve the accuracy about stress measurement.

IV. CONCLUSION

In this paper, stress index is not measured directly with a measuring device, but is expressed briefly using a mixed stress index with the data of the measurement result which has been used in medical institutions. Now, we express the index number after choosing one of them voluntarily because there are the tools to be used variously for the measurement. In result, the method to interpret a mixed index could appear. But, stress index can be expressed differently according to the specific group because this paper appears a general case except for environmental elements such as the age or the occupation. Consequently, we need to interpret the method and apply index according to the result of measurement which fits the case after selecting a specific group voluntarily.

Now days, many research for measurement and diagnosis for stress are on process. But, they are still using the subjective questions to measure stress in the psychological measurement. By the way, in the physical measurement, as electronic, medical and physiological approaches are researched, it makes the scientific stress measurement more possibly. But, there is no well positioned measurement method because it has a weak general idea about stress and there are several methods to approach with several analysis and also it has the difference of reaction for each person and many elements effect it. In according of this, this thesis suggests the algorithms to check

one’s stress measurement more easily as making the stress measurement more correctly with addition of physiological and psychological indexes. In the future, based on this algorithms, the analysis and examination would be achieved with examination targets. For the more, we are planning to organize the treatment programme as applying it to Life-Care system.

REFERENCES

- [1] K.Y.Kim, D.Y.Kim, and other 14, *Understanding of Stress Science*, 1997, pp.11-65.
- [2] Chrousos GP, Gold PW, “The concepts of stress and stress system disorders,” *JAMA*, vol. 267, no.9, pp.1244-1252, 1992.
- [3] K.H.Byun, H.G.Jang, *Stress and mental medical science, the educational governor.*, 2005, pp.115-142.
- [4] Adler, J., “Stress,” *Newsweek*, June, vol.14, pp. 56-63.
- [5] Cousins, N. Head First., *The Biology of Hope and the Healing Power of the Human Spirit*, New York : Penguin Books. 1989.
- [6] Cooper, C.L., *Handbook of stress, Medicine, and Health*, CRC Press., 1996.
- [7] Appley MH, Trumbull R(eds), *Psychological Stress : Issues in Research*, New York Appleton Century Crofts, 1967.
- [8] K.G.Cheon, K.H.Kim, “Development of stress measure in University life : the control objective approach,” *Korean Psychology bulletin (clinic)*, vol.10, pp137-158, 1991.
- [9] K.E.Hong, G.C.Pack, “Research the relationship between life event, control’s dwelling place and uneasiness as the causes of stress,” *neuropsychiatry*, vol.26, no.1 pp75-111.
- [10] J.M.Kim, J.H.Hong, N.J.Kim, E.J.Cha, T.S.Lee, “The detection of EDR using portable ECG device in mobile environment,” *J.Biomed. Eng.Res.*, vol. 33, 2005.
- [11] A.R.Sul, J.W.Shin, C.G.Lee, Y.R.Yoon, “Change of biosignals caused by Stress,” *J.Biomed. Eng.Res.*, vol.24, no.1, pp.127-128, 2001.
- [12] M.K.Seo, W.S.Han, K.K.Lee, and other 4, “Characteristics of physiological variables (EDR, EMG) in biofeedback treatment,” *J. Sleep Medicine and Psychophysiology*, vol.6, no.1, pp.38-45, 1999.