

A physiological approach to assess and promote fan service in a professional baseball game of "The Hokkaido Nippon-Ham Fighters"

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ABOUT THE FIGHTERS

FIGHTERS IS ...
 The Hokkaido Nippon-Ham Fighters is a professional baseball team in Japan's Pacific League. It takes its name from the major shareholding company, "Nippon Ham," which is the corporate name of Nippon Meat Packers, Inc.

FIGHTERS HAS BEEN IN SAPPORO FOR 5 YEARS
 In 2004 the Fighters moved from Tokyo to Sapporo, the largest city on the island of Hokkaido. Its population is 1,850,000.

FIGHTERS USES THE SAPPORO DOME
 The team uses the Sapporo Dome, that is primarily used for football and baseball. Sapporo Dome opened in 2001 and has 42,126 seats, hosted three games during the 2002 FIFA World Cup.

DRAMATIC INCREASE IN THE NUMBER OF FANS REGISTERED WITH THE OFFICIAL FAN CLUB
 38,776 (2004), 41,817 (2005), 41,193 (2006), 60,216 (2007), and 74,974 (2008) – almost doubled in 5 years

AWARDED BY EXCELLENT FAN SERVICES IN 2007
 The Fighters received "Japan's High-service 300" award from the Service Productivity & Innovation for Growth (SPRING), which was founded in June 2007

BACKGROUND OF THE STUDY

NOBODY KNOWS WHY
 Nobody knows accurately why the Fighters have achieved such a great success. This is a long-standing problem in the service industry that blocks the increase of its productivity.

PART OF JAPAN'S NATIONAL PROJECT TO SUPPORT SERVICE INDUSTRIES

As such, the Japanese government, the Ministry of Economy, Trade, and Industry (METI), has decided to fund research and development projects that help service providers implement services more efficiently by understanding the successful practices based on scientific and technological underpinnings.

THE FIGHTERS PROJECT IS ...
 For the Fighters, scientific underpinning includes the understanding of why the fans repeatedly come to the Sapporo dome to watch the Fighters' games and how they enjoy them – evolution of fan loyalty, and correlating such understanding with the events that the Fighters provided.

BACKGROUND OF PHYSIOLOGICAL MEASUREMENT (1)

Psychological conditions affect autonomic nervous system. Autonomic nervous activities are reflected in the fluctuating patterns of physiological signals such as heart rate variability (HRV). By analyzing the fluctuating patterns of HRV numerically, we can evaluate psychological states by HRV index values.

BACKGROUND OF PHYSIOLOGICAL MEASUREMENT (2)

Three advantages in using HRV (physiological signals) for psychological state measurement comparing with subjective evaluation method are:

- (1) It is possible to relatively unconsciously and automatically measure it without preventing the subject from watching the game.
- (2) It is possible to consecutively measure it at short sampling time interval.
- (3) Objective numeric values can be attained.

PURPOSE OF THE STUDY

The purpose of this study is to clarify how the psychophysiological response to each event and service in professional baseball game (e.g., scoring scenes, during the dance exhibition) differ by type of fan and interest level in game.

METHODS

We measured the heart rate variability derived from ECG (electrocardiogram), body acceleration, video images by viewpoint camera, and behavior of ten of the audience (five females and five males, age:21-53) watching games of a Japanese professional baseball team, the Hokkaido Nippon-Ham-Fighters, at Sapporo Dome. The audience participated in the experiments in one to three games during the months from July to September 2008. We measured the data of 27 people in total.

EXPERIMENTAL EQUIPMENT



Heart rate variability and body acceleration measurement

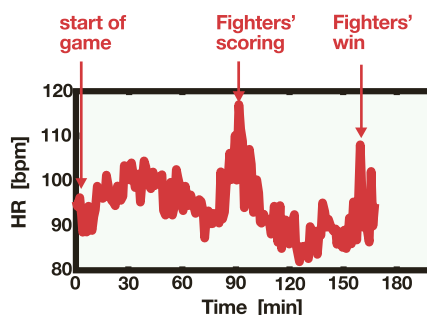


View point camera measurement



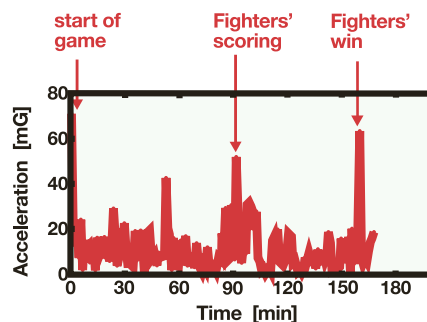
Behavior measurement

EXAMPLE OF HEART RATE AND BODY ACCELERATION SIGNALS



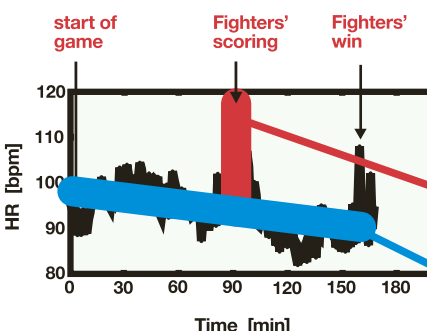
Heart rate (HR) signal derived from RR interval of electrocardiogram measured from a subject watching Fighters' baseball game in July.

$$HR = 60 / (RR \text{ interval}) \text{ [bpm]}$$



Body acceleration signal measured from a subject watching Fighters' baseball game in July.

DEFINITION OF HR RESPONSE



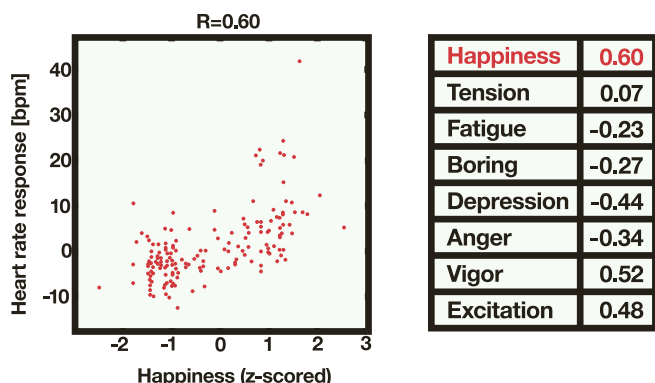
HR response = Deviation of HR from the linear regression line (trend)

Heart rate response to Fighters' scoring

linear regression line (trend)

RESULTS

RESULTS 1 CORRELATION BETWEEN HR RESPONSE AND SUBJECTIVE MOOD



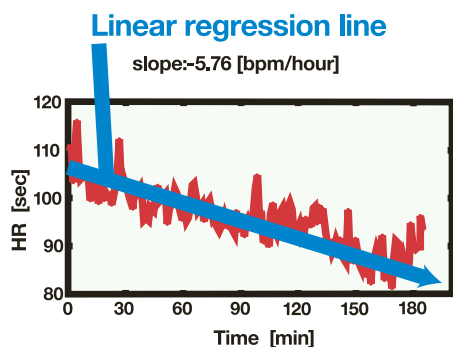
Correlation coefficient between subjective evaluation of happiness and heart rate response was 0.60. This implies that we can use heart rate response to assess fan's happiness during baseball game.

RESULTS 2 DEPENDENCE OF INTEREST LEVEL IN GAME ON HR RESPONSE

	HR response to Fighters' scoring (averaged among all subjects)
July	13.10 [bpm]
August	4.91 [bpm]
September	5.87 [bpm]

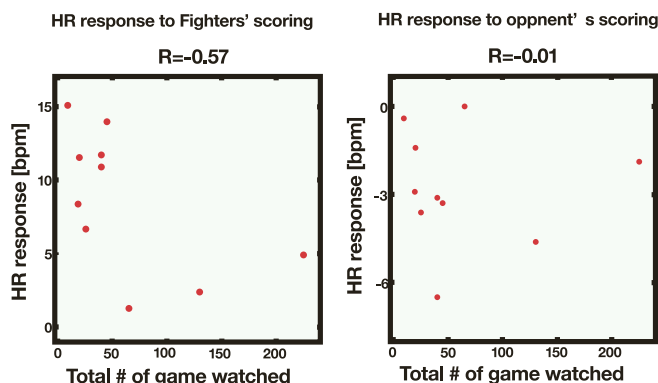
The heart rate responses to Fighters' scoring decreased in August and September compared to that in July. Fighters were in contention for the league championship in July but fell behind the competition in August and September. Moreover, the game schedule overlapped games at the Olympic Games in Beijing in August. These factors might have affected the decrease in the excitement response.

RESULTS 3 SLOPE OF LINEAR TREND OF HR



The slope of linear regression line (trend) from the beginning of the game till the end was negative for 22 out of the 27 subjects. This suggests increasing weariness and sleepiness as the game progressed.

RESULTS 4 DEPENDENCE OF FAN CAREER ON HR RESPONSE



The heart rate increase response to Fighters' scoring was likely to become lower as the total number of Fighters' games watched increased. This indicates that responses to scoring became duller as the fan career matured.

RESULTS 5 PERCENTAGE OF TIME NOT WATCHING GAME

Analysis from view point camera and behavior measurement % of time not watching game

	Type of subjects	
	cheering dominant	game watching dominant
During Fighters' offense	< 1%	< 1%
During Fighters' defense	29%	7%

The percentage of time not watching game during Fighters' defense was larger in cheering dominant subjects than in game watching dominant subjects, whereas no difference was observed during Fighters' offense.

CONCLUSION

This study introduced a new approach that uses physiological signal (HR:heart rate) and video analysis to assess fan service in a professional baseball game.

Analysis of the measured data clarified the followings:

- (1) HR response had high correlation with subjective level of happiness.
- (2) HR response to scoring by supported team depended on interest level in game and fan career.
- (3) The slope of linear trend of HR was negative in 22 out of 27 subjects showing increasing weariness and sleepiness as the game progressed.
- (4) Cheering dominant subjects and game watching dominant subjects showed clearly different behavior during supported team's defense.