The Feasibility of Music and Talk Radio Program as a Focus Stimulant for Driver

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Abstract—**Long distance driver tends to listen to the music in order to help them awake on the road. However, several studies have reported that music has repetition element which is a catalyst to attention deficit phenomenon. This study evaluated the feasibility of music and talk radio program as a stimulant to keep our focus behind the wheel. N1 waves of 11 participants were studied and the results have suggested that music is not a good stimulant for driving partner compared to talk radio program. All the participants showed a great attention when listened to talk program compared to music of their choice.**

Keywords—attention loss; music repetition; N1 wave; driving alertness

I. INTRODUCTION

ON average 7000 deaths due to the accident were reported every year and each death caused our country loss roughly RM 1.43 million per months and RM10 billion per year [1]. Loss of attention is one the causes of the road accident. A study from the University of Bordeaux in France has reported that of nearly 1000 drivers injured in the accident, 52% reported occurrence the attention-deficit before crashing their cars [2]. New research reveals more than a fifth of drivers (21%) switch to autopilot when on familiar routes, putting themselves and other road users at risk [3]. Scientists say the problem which is also known as white line syndrome arises when those behind the wheel start day dreaming or become engrossed in the radio. With the increasing of road accident due to the lack of alertness while driving, this research is crucial, especially in Malaysia. The road accidents are most happening when the drivers' anilities of perception, recognition and vehicle control abilities have declined during driving [4].

To overcome boredom and to keep awake, drivers usually listen to music, especially if they are travelling alone. However, music has element of repetition in their melody and lyric. Repetition is the best elements that elicit attention-deficit. Based on previous studies, [5]-[7], it shown significant decrements of electric evoked potential (erp) (Erp is an electrical potential recorded from the nervous system of a human or other animal following presentation of a stimulus, response) in particularly N1 wave correlates with higher loss of attention.

Therefore, in this study, electroencephalographic (EEG) of driver is recorded and the N1 wave component is studied to measure the attention on driving while listening to the music and talk program, respectively. The findings could be beneficial to the long-distance traveler in keeping their safety on the road.

II. METHODOLOGY

A. Subject

Eleven adults with driving license with healthy hearing and visual (age within 18-20 with standard deviation of 2) participated in this experiment. Healthy participant is crucial as to establish a benchmark reading. An audiogram

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test is conducted before and immediately after the experiment to ensure no after effects due to the experiment. The experiment is conducted after the participants were thoroughly explained with regards to experiment procedure and they have signed the consent form.

B. Experiment Setup

A driving simulator is used in this experiment. Three monitors were arranged in semi-circle in order to give a 3-D visual. The driving simulator is equipped with regular size of steering wheel, clutch-petrol-brake pedal, gear stick and signal pedal. The EEG recording setting is consists of a biosignal amplifier BIOPAC Inc system, MP150 EEG 100C and computer software (Acknowledge 4.2) and a computer for monitoring. The EEG was sampled at 500Hz, The electrodes (Ag/AgCl) are placed at the left and right mastoid, the upper forehead (negative electrode) and the vertex (Cz) for grounding. The recording is done in a sound proof room with light off. This is to avoid lighting noise and visual interruption while driving.

C. Experimental Paradigm

There were 3 parts of simulations. Every part took about 25 minutes and 5 minutes break in between. In all parts, less traffic highway scenario was played at the monitor. In part 1, participants were stimulated with no sound (control data). They drove in 'quiet' condition except traffic and car sound. In part 2, participants drove with music playing through a head phone. The music is their own favourite music. Any kind of music of their choice. In the last part, the music is replaced with a talk radio program (deejay chit chatting with the radio caller or with the guest).

D. Analysis

The EEGs are filtered with digital band pass filter (1-30Hz) in order to obtain alpha and beta waves which are related to active and in focus condition. Sweeps that contained artefacts were rejected using threshold detection (amplitude larger than 50μV). They were then segmentized at every 1s post stimulus. At least 500 responses were obtained from the recording from each participant.

To extract N1 wave, the similar method as in [5]-[7] is used. N1 waves were extracted between 80 to 120 ms after stimulus. This is due to jittering.

III. RESULTS

N1 wave reduction was analyzed by using commonly used averaging technique. Despite the possibility of losing some information due to signal to noise ratio cancelling action, this technique shows the real outcomes without any modification on the response such as by using wavelets and feature extraction analysis.

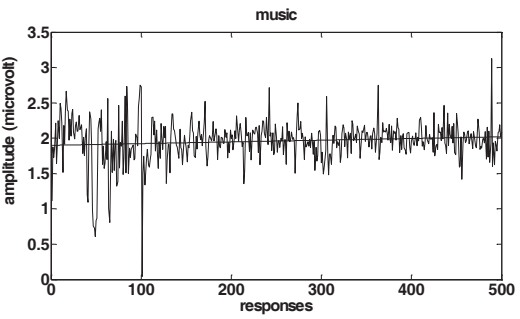

Fig. 1. Grand averaged results of N1 wave peak elicited by music stimulation.

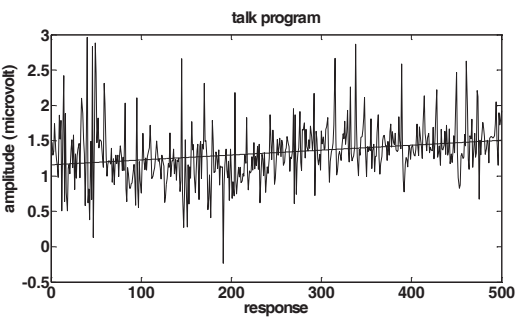

Fig. 2. Grand averaged results of N1 wave peak elicited by talk radio program stimulation.

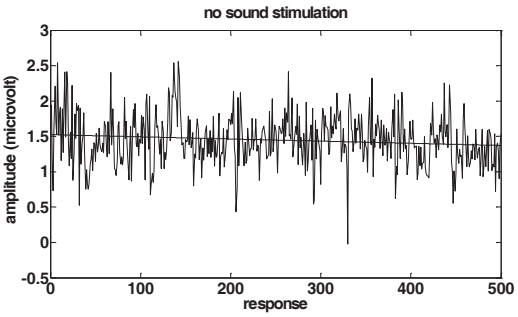

Fig.3. Grand averaged results of N1 wave peak elicited by no sound stimulation.

Fig. 1. to Fig. 3. show the grand averaged of 11 participants N1 wave peak for all obtained 500 responses. N1 wave degrading clearly when no sound is stimulated. Whereas, for talk radio program and music, the N1 wave keep increasing over time.

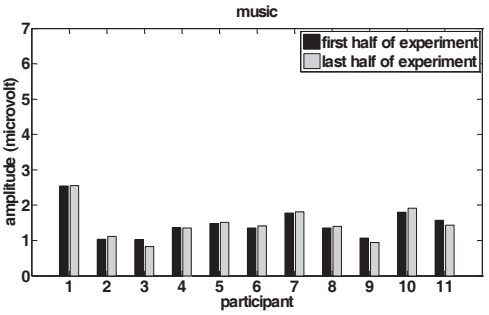

Fig. 4. Individual results of N1 wave peak elicited by music stimulation.

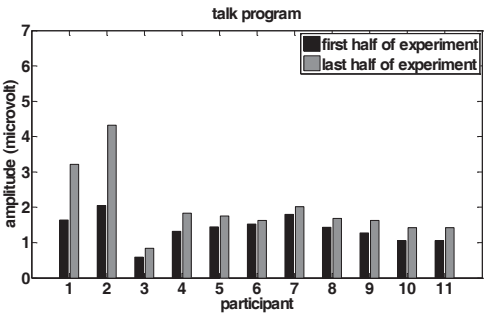

Fig. 5. Individual results of N1 wave peak elicited by talk radio program stimulation.

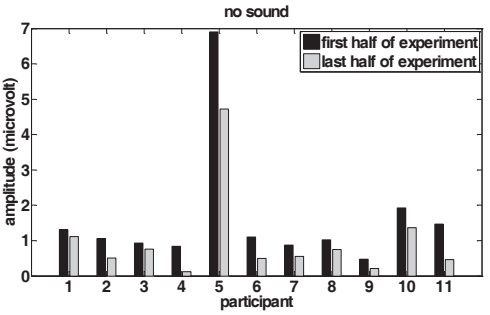

Fig. 6. Individual results of N1 wave peak elicited by no sound stimulation.

Theoretically, if the peak of N1 wave reduce overtime, the amplitude of N1 wave at the beginning of the recording/experiment will be higher than the amplitude of N1 wave at the end of the experiment. Hence, Fig. 4. to Fig.6. show the individual results of music, talk program and no sound stimulation, respectively by visualizing the reduction of N1 wave by separating the responses into two segments; first half of the experiment and the last half of the experiment. The average peak of N1 wave of each segment is visualized in Fig. 4. to Fig. 6.

TABLE I. The difference of N1 wave peak of first half of the experiment and last half of experiment.

Participant	Music	Talk program	No sound
1	-0.0118	-1.5861	0.1949
2	-0.0822	-2.2672	0.546
3	0.1932	-0.2509	0.1695
4	0.0213	-0.5096	0.7181
5	-0.0264	-0.3029	2.1835
6	-0.0589	-0.1013	0.6096
7	-0.0416	-0.2258	0.3243
8	-0.0495	-0.2527	0.2678
9	0.1234	-0.351	0.2549
10	-0.1071	-0.3576	0.5666
11	0.1362	-0.3576	0.9961

From Fig. 6., the reduction of N1 wave is seen clearly across participants. For talk program simulated responses, the negative notation of the difference between first half of the experiment and last half of experiment as shown in Table 1 shows that the amplitude of the N1 wave increasing overtime. Fig. 5. visualizes

that the N1 peak amplitude towards the end of the experiment is higher than at the beginning in all subjects. Compared to talk simulated responses, music elicited less attention. This can be seen by the difference value as shown in Table 1. The value is smaller than talk radio program and not all participants show increasing of N1 wave peak over time. However, they are not as clear as no sound reduction.

IV. DISCUSSION

This study is to evaluate the feasibility of talk radio program and music as a stimulant to keep focus on driving. As mentioned earlier, daydreaming while behind the wheel is uncontrollable event. It can simply happen without any warning or sign. Most of the drivers choose to listen to music or radio to keep awake. How far these stimulants could help the driver on focus?

N1 wave shown to be feasible to measure attention, see [5]-[7]. Those previous studies have found that N1 wave reduced overtime when the scenario is suitable such as repeating stimulation, quiet surrounding, and boring atmosphere. These conditions are usually found on the highway especially when travelling alone. Without us noticing, the repeating factor is provided by the light polls along the highway road. As shown by the control results, without stimulant given, the attention of all participants was decreasing across the experiment.

This study has found that talk radio program is better stimulant from music. The increment of N1 wave peak of talk program elicited responses are bigger than music about averagely 10%. The attention of 4 out of 11 participants decreasing overtime when they listen to the music. However, the same participants showed an increasing of attention throughout the experiment when listened to the talk program. Previous studies such as [8]- [11] have found that song and music in fact have element of repetition. Margulis [11] reported that repetition might help clarify the ways music elicits emotion differently than speech. Therefore, this could have explained why some of the participants losing their attention and most of them showed less attention than listen to the talk program. This also suggests the reason driver could fall into deep thought even though they have music which they thought as stimulant to keep awake. To make the matter worse, the loss of attention can happen within 20 minutes as shown in this study. With respect to talk program, its normally has up and down intonation that cancel out repetition element in terms of sound, mood and text. Hence, it is a good stimulant for the drivers to keep focusing on the road.

In the future, the experimental paradigm will be modified for visual and hearing attention with exogenous and endogenous influences and compare with driving performance.

V. CONCLUSION

A talk program such as deejay chit chatting is better stimulant than a song or instrumental music. This finding is beneficial for regular driver especially long-distance traveler.

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