A Simple Model to Demonstrate the Critical Flicker Fusion Frequency Using Microsoft Office Powerpoint

Kamalakannan Vadivel[1], Nilesh N Kate[2]

[1]Associate Professor, [2]Professor, Dept. of Physiology, ESIC Medical College, Gulbarga, Karnataka

Abstract

Background: The critical flicker fusion frequency (CFF) is the frequency at which a flickering light is perceived as a continuous light. It is an index of visual temporal processing. It is affected in several disease conditions like hepatic encephalopathy, multiple sclerosis, age related macular degeneration and cataract. We wanted to demonstrate the phenomenon to undergraduate medical and health science students to help them understand the concept using a personal computer with Microsoft office power point suite.

Aim: The aim of the study was to demonstrate this concept of CFF using a personal computer with Microsoft office power point suite in small groups to undergraduate medical and health science students and to take a survey from the students regarding the demonstration and its outcome in understanding the concept of CFF.

Material and Methods: It is a cross sectional survey obtained from the medical, dental and allied health science students following the demonstration of CFF using the personal computer with Microsoft office power point suite in small groups.

Results: Our results have shown that the demonstration have helped 94% of the students in understanding the concept of the CFF. 91% of the students felt that the demonstration has helped them in reviewing the topic.98% of the students felt that they would recommend the demonstration to future batches of the students. 86% of the students said that the demonstrations made the learning fun and exciting.

Conclusions: The demonstration of CFF using the Microsoft office power point suite have helped the students to understand the concept evoking interest and enthusiasm as they were able to relate the concept by demonstration and seeing it for themselves.

Keywords: *Critical flicker fusion frequency (CFF), demonstration, power point*

Introduction

Critical fusion frequency or critical flicker fusion frequency (CFF) is the frequency at which a flickering light is perceived as a continuous light. The CFF is used as an index for visual temporal processing. It depends on the light source intensity, color of the light, mono or binocular vision, light-dark ratio of the stimulus, locus of stimuli on retina, degree of central fatigue of the subject and with age[1].The concept of CFF is taught to UG medical students while teaching visual processing. There are several models that are available to demonstrate the CFF[2]. Most models available are expensive and may not be suitable for resource limited setting. Hence, we used a computer with Microsoft office power point suite to demonstrate CFF. It is well established that the concepts are learnt better when demonstrated, than with a lecture[3].

Corresponding author:
Dr Kamalakannan V
Associate Professor, Dept. of Physiology, ESIC Medical College, Gulbarga, Karnataka; email: vk.kannan83@gmail.com

Materials and Methods

The demonstration was performed after clearance from the institutional ethical committee. To demonstrate the CFF we used a personal computer with 2016 Microsoft office power point suite. The animation window in the power point suite was used to demonstrate the CFF. The background of the slide was set to black color. A small circle was inserted in the middle of the slide. The size of the circle is formatted with height and width to be equal. For demonstration it was set at 0.51". It was formatted with white color fill and outline and is aligned at the middle and center. The animation with blink or pulse emphasis effect was enabled. In the animation pane the timing option was chosen with the following setting, the animation was set to start on click, with zero second delay, and the duration from 1s (1Hz) to 0.01s (100Hz). The animation was set to play until next click. The slideshow was then played to the students.

The animation was played at different frequencies ranging from 1Hz, 11Hz, 20Hz, 33Hz, 50Hz, and 100Hz. The blinking was appreciated by the students until the frequency of 33Hz, above which the image appeared as a constant at higher blink frequency. The above demonstration can be done with different background color and for various color blink.

Results

To assess the usefulness of the demonstration students were asked to give an anonymous written feedback.

The feedback was completed by one hundred and forty students. The data collected is expressed as percentage of the total students who responded (see Table 1). 94 % of student opined that this demo helped them in understanding critical flicker-fusion frequency. 91 % percent of students felt that the demo helped them review the topic. 98% of the students responded that they would recommend this demonstration to future batches of students and 86 % of the students felt that this demonstration made their learning fun and exciting. They used words like "innovative" and "helpful" to describe the demonstration and no comments were negative.

Table 1 Consolidated survey of Feedback from the students

Question	Yes (%)	No (%)	Not sure (%)
My understanding of the CFF improved with this demo	94.3	0.7	5.0
The demonstration helped me review the topic	91.4	2.9	5.7
I would recommend such demonstration for future batches of students	98.6	0.0	1.4
Was learning exciting and fun with demonstration	86.4	4.3	9.3

Discussion

The brain processes the visual inputs in two domains, spatial and temporal. Spatial resolution is defined as the ability to discriminate two adjacent objects in space. Temporal resolution is defined as the ability to discriminate luminance change over time[4]. The temporal resolution is limited by the time required to collect and process the visual input and it is finite. Intermittent stimuli presented to the eye will be perceived as distinct only when they are presented below a rate called as critical flicker-fusion frequency above which the stimuli will be perceived as a continuous stimulus. The CFF is affected by several physical factors such as intensity, color and size of the stimulus[1,4]. It is also influenced by

the contrast, light condition and the age of the subject. The CFF is reduced in several medical conditions such as hepatic encephalopathy, multiple sclerosis, age related macular degeneration and cataract.

The CFF is very important concept which a medical graduate should understand. The demonstration has shown that the concept can easily be conveyed during the lecture using the simple animation available with the Microsoft office suite. The demonstration doesn't require a mat lab software which is commonly used for demonstration and research. The demonstration is suitable for a small group. It allows the students to interact with their peers and the demonstrator and have their concepts clear[5,6].

The demonstration can be completed in less than 15 minutes and is suitable for undergraduate medical, dental and health science students.

Conclusions

The model using the Microsoft office power point suite is suitable for demonstration of CFF. The demonstration is suitable for small group discussion and is most apt for resource limited setting. Our demonstration favors the students by enhancing their understanding of CFF by increasing the enthusiasm and interest in learning.

Limitations

Although the demonstration doesn't require any proprietary software like MATLAB, but it requires a Personal computer with dedicated graphic card and Microsoft office. The animation could be played clearly to demonstrate the CFF only if the screen refresh rate is 120Hz and a dedicated graphic card of at least one GB.

Conflicts of Interest: None

Ethical Clearance: Obtained from institutional ethical clearance committee of ESIC Medical College, Gulbarga

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