

Description

This invention relates to an attention monitor.

More particularly, the invention relates to a method and apparatus for monitoring the level of attention of a subject to a visual stimulus. Results from the method and apparatus of the invention provide valuable information of an objective nature as to a subject's attention or interest in visually displayed information such as a television commercial, picture or poster or the like. The assessment can then be used to make changes in the advertisement, picture or poster or the like in order to make it more attractive or more likely to keep the attention of an observer.

The document US-A-4 216 781 discloses a method of assessing the ability of a subject to concentrate the senses on a particular sensory stimulus. In accordance with this known method, a primary stimulus such as a video display is presented to the subject while he is also exposed to a specified pattern of secondary meaningless and irrelevant sensory stimuli. A comparison of evoked electrical brain responses to these combined stimuli with the response to the secondary stimuli alone indicates the subject's ability to suppress irrelevant information.

According to the present invention there is provided a method of assessing the interest of a subject in a visual stimulus, by means of application of a control signal in combination with said visual stimulus, which control signal produces a distinguishable response in the subject, and measurement of said interest by reference to a change in said response, said method comprising the steps of

displaying a periodic visual control signal having a preselected frequency,
obtaining an electroencephalographic (EEG) signal from the subject whilst said visual control signal is being viewed, and

analysing the EEG signal to determine the magnitude of that component of the EEG signal which corresponds in frequency to said control signal,

wherein said method further comprises the steps of displaying said control signal and the visual stimulus simultaneously to the subject during a data acquisition period,

obtaining and analysing the EEG signal to determine the magnitude of said component during said data acquisition period,

determining the change in the magnitude of said component of the EEG signal during said data acquisition period, and

assessing the interest of the subject in said visual stimulus in accordance with said change.

It has been found that the human brain will discriminate against visual "noise" signals or flicker signals when it is concentrating on other visual information. Accordingly, in the method above, the brain discriminates against the visual control signal which is presented as a visual "noise" signal or a flicker signal and the method of the invention enables accurate assessment of the EEG response to the visual control signal in order to accurately determine the amount by which it has been diminished in amplitude. This provides a measure of the brain's interest in the visual stimulus.

Preferably the control signal comprises a visual signal and the change in magnitude of said component of the EEG signal is determined by using analytical techniques which enable isolation of a sinusoidal component of known frequency from a background signal.

In one form of the invention, the visual stimulus is displayed on a TV screen and the visual control signal is superimposed on the subject's field of view and preferably comprises a visual light signal the intensity of which varies at an accurately known sinusoidal frequency. Alternatively, it may comprise a sinusoidal variation of the brightness of the screen. In a further form, a liquid crystal screen could be interposed between the viewer and the television screen and be arranged to vary sinusoidally the light transmission therethrough at a fixed sinusoidal rate.

The invention also provides apparatus for assessing the interest of a subject in a visual stimulus by means of application of a control signal in combination with said visual stimulus, which control signal produces a distinguishable response in the subject, and measurement of said interest by reference to a change in said response, comprising

means for generating a visually perceptible periodic control signal having a predetermined frequency,

display means for displaying a visual stimulus,

means for deriving an EEG signal from the subject during a data acquisition period in which the visual control signal and the visual stimulus are simultaneously viewed by the subject, and

analysing means for determining during said data acquisition period the change in magnitude of that component of the EEG signal which is attributable to the periodic control signal from one state in which the subject views only the control signal and another state when the subject views both the control signal and the visual stimulus, the analysing means including discriminating means for discriminating against compo-

nents of the EEG signal which are not at said predetermined frequency.

In one arrangement the means for generating a visually perceptible control signal includes a screen interposed between the subject and the display means for adding a component of light or attenuating light transmitted through the screen. For instance, the means for generating may comprise a semi-reflective screen through which the display means is visible and which is arranged to reflect the control signals to the subject. Alternatively, the means for generating a control signal may comprise a liquid crystal screen which is controlled so as to attenuate light passing therethrough.

Alternatively, the display means and means for generating a visually perceptible control signal may be constituted by a single display element, for instance a television screen. In this case, the control signal is superimposed on the visual stimulus which is displayed by the television screen. For instance, the control signal may comprise the periodic intensity of brightness of the screen.

The invention will now be further described with reference to the accompanying drawings, in which:

Figure 1 is a schematic view of an attention monitor for carrying out the invention;

Figure 2 is a schematic plan view showing the location of EEG electrodes and goggles of the invention;

Figure 3 is a more detailed block diagram of the control signal generator;

Figure 4 shows a circuit for controlling the intensity of an LED array;

Figure 5 is a schematic view of an LED array;

Figure 6 is a schematic side view of the LED array with shielding;

Figure 7 is a more detailed schematic view of the EEG receiving circuitry;

Figure 8 is a circuit diagram for part of the circuitry of Figure 7;

Figures 9A, B and C, are waveform diagrams useful in understanding the operation of the circuits of Figures 7 and 8;

Figure 10 is a flowchart showing the method of calculating steady state visually evoked potential (SSVEP); and

Figures 11A, B and C show more detailed parts of the chart of Figure 10.

The attention monitor apparatus shown schematically in Figure 1 is used to determine the interest of a subject 2 in a visual information displayed on a television screen 4. EEG electrodes are applied to the head of a subject and are coupled by input lines 6 to a receiver 8 for amplification and other processing prior to transmission to a computer 12. The computer 12 is coupled to a disc storage unit 13 and a visual display unit 15 and to a printer if required. The apparatus also includes a stimulus generator 14 which applies control signals to left and right LED arrays 16. The LED arrays are preferably carried by goggles 17 which are worn in use by the user 2. In practice a number of subjects may be provided with goggles 17 for simultaneous testing of the subjects.

As shown in Figure 2, the goggles 17 include arms 18 and cross-piece 20 which enable the goggles to be supported on the ears and nose of the user. Alternatively, a resilient head band could be employed for that purpose. The goggles have a pair of semi-reflective screens 19 which in use are located at about 45° to the line of sight of the user. The screens permit the user to view the television screen 4 directly therethrough and permit light to be reflected towards the eyes of the subject from the left and right LED arrays 16 which are mounted on the arms 18.

Figure 5 shows schematically the arrangement of one of the LED arrays 16. It comprises seven LED's 128 arranged in a circular pattern. Each array is located within inner and outer shields 138 and 140 to substantially eliminate electric and magnetic fields which might be generated by the currents to the arrays. These stray fields could adversely affect the EEG electrodes on the subject. The conductor 142 to the LED arrays is also shielded for the same reason.

Generally speaking, the operation of the system is as follows: the stimulus generator 14 generates a control signal at a precisely known frequency in the range say 8 to 15 Hz. Preferably the frequency is 10 Hz. The reference frequency is used to modulate the intensity of light output of the LED arrays 16 so that the subject 2 will receive reflected red light from the screens 19 which is modulated in intensity at the reference frequency. Initially, no information displayed on the television screen 4 and EEG signals are obtained for this condition. The receiver 8 and computer 12 are arranged to isolate from the received EEG signals the components which occur at the reference frequency and the magnitude of these components is stored in the disc storage unit 13. This information provides a reference for the subject as to the normal magnitude of EEG signals produced. The system is then operated as before but this time with a visual stimulus applied to the television screen 4. For instance, a television commercial might be screened and the composite EEG signal is received and processed by the receiver 8 and computer 12. The system is arranged to isolate the components of the EEG signal at the reference frequency and to store their magnitudes in the disc storage units 13. The information thus available in the disc storage unit 13 can be used to determine the decrease in magnitude of the component at the reference frequency when the

commercial is being screened compared to the case where the commercial is not being screened. The size of the decrease in magnitude is an objective measure of the interest which the subject has in the commercial because the brain of the subject will discriminate against unwanted information when the subject focuses interest on other visual information.

As will be discussed below, the EEG information is sampled comparatively rapidly and all of the sampled information stored in the unit 13. This would enable assessment of different sequences of the commercial displayed on the screen 4. Further, it is envisaged that the commercial displayed on the television screen 4 would be simultaneously viewed by a number, say 25, of subjects so that a reasonable cross-section of likely responses to a commercial can be obtained. It will be appreciated that many variations are possible regarding the number of subjects, the number of commercials or stimuli screened, and the quantity of information stored and also the type of analysis performed on the information so as to make objective determinations of interest in the subject matter being screened.

Figures 3 to 11 illustrate in more detail one such arrangement for determination of the interest of a number of subjects to a commercial screened on the television screen 4.

Figure 3 illustrates in more detail the circuitry for the stimulus generator 14. It comprises a crystal controlled oscillator 36 which for instance has a stable frequency at say 4 MHz. Output from the oscillator passes to a divider the output of which is at the reference frequency say in the range 1 to 100 Hz but preferably 10 Hz. The output from the divider 38 is connected to LED control circuits 90, there being one for each set of goggles 17. Output from each circuit 90 then passes to the left and right LED arrays 16 the diodes 128 of which are connected in series.

Figure 4 shows one circuit realization for the LED control circuit 90. Output from the divider 38 is connected to input line 120 which is coupled to the input of an amplifier 122 via a zero adjusting network 124 which is adjusted so that the output of the circuit 90 has a desired DC level. Output from the amplifier 122 is coupled to the input of a current buffer 126 for driving the LED arrays 16. Each array 16 comprises seven LED devices 128 arranged in a circular pattern, as diagrammatically illustrated in Figure 45. The fourteen LED's are connected in series and are driven by the currents supplied from the buffer 126. The other end of the series connection of LED's is connected to a negative supply line 130 the value of which is fixed and selected in accordance with the number of LED's connected in series. In order to regulate the intensity of the output of the array 16, a control LED 132 is connected in series and arranged to irradiate a phototransistor 134 the output of which is connected via amplifier 136 to the input of the amplifier 122. The output of the control LED 132 which is selected so as to be of the same type as those used in the array 16 is thus representative of the light intensity output of the array and this is used for negative feedback so as to control the peak intensity reached by the LED arrays 16. The circuit 90 thus ensures the same average level of intensity of light output from the LED arrays 16, regardless of frequency. In one arrangement, it was found convenient to use LED devices manufactured by Stanley known as ESBR diodes. The current flowing through the diodes is typically 20 to 30 milliamps and less than 50 milliamps. The zero adjust circuit ensures that the LED devices are not reversed biased at any stage in the process because this would have the effect of upsetting the otherwise purely sinusoidal inputs to the LED devices. The feedback LED 132 also ensures that the intensity of the light output from the array 16 is a linear function of the current input thereto thereby ensuring that the light emitted by the LED arrays 16 vary in intensity at the reference frequency 10 Hz.

Figure 2 shows the preferred location of the EEG electrodes for obtaining EEG signals from the subject 2. The arrangement has a pair of electrodes 21 and 23 connected to the ears of the subject. A ground electrode 25 is connected to the forehead of the subject and six other electrodes 27, 29, 31, 33, 35 and 37 are located in accordance with the table below. The code names for the site are in accordance with the International 10-20 Convention. Other sites which may also be used include midway between sites T₃ and T₅ and midway between sites T₄ and T₆.

- SL(n) - nth slice
 SL(i,n) - ith point of slice n
 SL^g(B_W) - slice of EEG data recorded during viewing of the Jth blank period in ith sequence for subject g.
 SL(SIN) - slice with sine reference waveform
 SL(COS) - slice with cosine reference waveform
 NC = number of complete cycles of reference waveform (10Hz) in slice duration, typically NC = 25 cycles.
 SL(z) = slice with locations of positive gradient zero crossings of sine reference waveforms.
 SL(m) = slice with magnitude of SSVEP as a function of time.
 SL(F) = slice with phase of SSVEP as a function of time.

The information yielded by the analysis used above can be used as an objective assessment of the interest of the various subjects in the commercials being screened. Further, it is possible to look at say 10 second segments of each commercial in order to ascertain the viewer's interest in that segment so that useful information can be obtained regarding the reaction to different parts of the commercial. It follows of course that the information obtained can be used to change the commercial and thereby produce a more commercially useful end product. It is also possible to discriminate different types of evoked reaction by considering outputs generated from different EEG electrode sites on the subjects. Information of this sort is of course useful when a particular effect is intended in a commercial.

Claims

1. A method of assessing the interest of a subject (2) in a visual stimulus, by means of application of a control signal in combination with said visual stimulus, which control signal produces a distinguishable response in the subject, and measurement of said interest by reference to a change in said response, said method comprising the steps of
 - displaying a periodic visual control signal having a preselected frequency,
 - obtaining an electroencephalographic (EEG) signal from the subject whilst said visual control signal is being viewed, and
 - analyzing the EEG signal to determine the magnitude of that component of the EEG signal which corresponds in frequency to said control signal,
 - wherein said method further comprises the steps of displaying said control signal and the visual stimulus simultaneously to the subject during a data acquisition period
 - obtaining and analysing the EEG signal to determine the magnitude of said component during said data acquisition period,
 - determining the change in the magnitude of said component of the EEG signal during said data acquisition period, and
 - assessing time variations in the interest of the subject in said visual stimulus in accordance with said change.
2. A method as claimed in claim 1, wherein the visual control signal comprises a sinusoidal signal (216).
3. A method as claimed in claim 2, wherein the visual control signal is a red signal which is varied in intensity.
4. A method as claimed in claim 1, 2 or 3, wherein a semi-reflective screen (19) is placed between the subject and a source of said visual stimulus and the visual control signal is reflected towards the eye or eyes of the subject.
5. A method as claimed in claim 4, wherein, said visual stimulus is displayed on a television screen (4).
6. A method as claimed in claim 5, wherein the visual stimulus is an advertising material.
7. A method as claimed in claim 6, wherein the advertising material is altered and displayed in order to attain a higher level of interest in the subject.
8. A method as claimed in claim 6 or 7, wherein the advertising material is simultaneously displayed to a plurality of subjects and the individual responses are averaged.



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 SL(i,n) - ith point of slice n
 SL^g(B_{ij}) - slice of EEG data recorded during viewing of the Jth blank period in ith sequence for subject g.
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 NC = number of complete cycles of reference waveform (10Hz) in slice duration, typically NC = 25 cycles.
 SL(z) = slice with locations of positive gradient zero crossings of sine reference waveforms.
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 SL(F) = slice with phase of SSVEP as a function of time.

The information yielded by the analysis used above can be used as an objective assessment of the interest of the various subjects in the commercials being screened. Further, it is possible to look at say 10 second segments of each commercial in order to ascertain the viewer's interest in that segment so that
 15 useful information can be obtained regarding the reaction to different parts of the commercial. It follows of course that the information obtained can be used to change the commercial and thereby produce a more commercially useful end product. It is also possible to discriminate different types of evoked reaction by considering outputs generated from different EEG electrode sites on the subjects. Information of this sort is of course useful when a particular effect is intended in a commercial.

Claims

1. A method of assessing the interest of a subject (2) in a visual stimulus, by means of application of a control signal in combination with said visual stimulus, which control signal produces a distinguishable
 25 response in the subject, and measurement of said interest by reference to a change in said response, said method comprising the steps of
 displaying a periodic visual control signal having a preselected frequency,
 obtaining an electroencephalographic (EEG) signal from the subject whilst said visual control signal is being viewed, and
 30 analyzing the EEG signal to determine the magnitude of that component of the EEG signal which corresponds in frequency to said control signal,
 wherein said method further comprises the steps of displaying said control signal and the visual stimulus simultaneously to the subject during a data acquisition period
 obtaining and analysing the EEG signal to determine the magnitude of said component during said
 35 data acquisition period,
 determining the change in the magnitude of said component of the EEG signal during said data acquisition period, and
 assessing time variations in the interest of the subject in said visual stimulus in accordance with said change.
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2. A method as claimed in claim 1, wherein the visual control signal comprises a sinusoidal signal (216).
3. A method as claimed in claim 2, wherein the visual control signal is a red signal which is varied in intensity.
- 45 4. A method as claimed in claim 1, 2 or 3, wherein a semi-reflective screen (19) is placed between the subject and a source of said visual stimulus and the visual control signal is reflected towards the eye or eyes of the subject.
- 50 5. A method as claimed in claim 4, wherein, said visual stimulus is displayed on a television screen (4).
6. A method as claimed in claim 5, wherein the visual stimulus is an advertising material.
7. A method as claimed in claim 6, wherein the advertising material is altered and displayed in order to
 55 attain a higher level of interest in the subject.
8. A method as claimed in claim 6 or 7, wherein the advertising material is simultaneously displayed to a plurality of subjects and the individual responses are averaged.



9. A method as claimed in any one of claims 1 to 8, wherein the method is repeated with respect to each of a plurality of subjects and said change in magnitude for each subject is determined indirectly by the steps of:

calculating a normalized mean response from the magnitudes of said component of the EEG signal determined for display of the control signal alone to each of the individual subjects; and

subtracting during each data acquisition period the normalized mean response from the magnitude of said component of the EEG signal determined for display of the control signal and the visual stimulus simultaneously to each of the subjects respectively.

10. Apparatus for assessing the interest of a subject in a visual stimulus by means of application of a control signal in combination with said visual stimulus, which control signal produces a distinguishable response in the subject, and measurement of said interest by reference to a change in said response, comprising

means (14, 16) for generating a visually perceptible periodic control signal having a predetermined frequency,

display means (4) for displaying a visual stimulus,

means (8) for deriving an EEG signal from the subject during a data acquisition period in which the visual control signal and the visual stimulus are simultaneously viewed by the subject, and

analysing means (12) for determining the change in magnitude of that component of the EEG signal which is attributable to the periodic control signal from one state in which the subject views only the control signal and another state when the subject views both the control signal and the visual stimulus, the analysing means including discriminating means for discriminating against components of the EEG signal which are not at said predetermined frequency, whereby the apparatus can assess time variations in the interest of the subject in the visual stimulus

11. Apparatus as claimed in claim 10, wherein the means for generating a visually perceptible signal comprises a source of red radiation and means for sinusoidally varying the intensity of the radiation at the predetermined frequency.

12. Apparatus as claimed in claim 11, wherein said frequency is in the range 1 to 100 Hz.

13. Apparatus as claimed in claim 12, wherein said frequency is approximately 10 Hz.

14. Apparatus as claimed in any one of claims 11 to 12, wherein said means for generating a visually perceptible signal comprises an array (16) of LEDs.

15. Apparatus as claimed in claim 14, wherein there are two of said LED arrays mounted upon spectacle frames (18).

16. Apparatus as claimed in claim 15, wherein the display means comprises a television screen (4) and wherein the spectacle frames include semi-reflective screens (19) which permit the subject to view the television screen directly, the screens reflecting radiation from the LED arrays towards the eye or eyes of the subject.

17. Apparatus as claimed in any one of claims 11 to 16, wherein the discriminating means includes a sample and hold circuit (172) which holds the output value of said EEG signal at the end of each period of the frequency component of the stimulus.

18. Apparatus as claimed in claim 17 wherein the discriminating means includes an arithmetic unit (12) for calculating the magnitude M_n of the EEG signal at said frequency by taking the square root of the sum of the squares of said output values.

19. Apparatus as claimed in claim 10, which further comprises a device for use in assessing the interest of a subject in visual stimulus, said device comprising support means (18, 20) for supporting at least one semi-reflective screen (19) adjacent to at least one of the eyes of a subject whereby the subject can view directly the visual stimulus, and a source (16) of visible radiation carried by the support means for reflecting radiation from said source towards the eye or eyes of the subject so as to provide the visual control signal.



20. Apparatus as claimed in claim 10, wherein the analyzing means comprises means for calculating a normalized mean response from the responses of each of a plurality of subjects to the control signal alone, and for determining during the data acquisition period said change in magnitude for each subject by subtracting the normalized mean response from the magnitude of said component of the EEG signal determined for each subject for simultaneous display of the control signal and the visual stimulus.

Patentansprüche

1. Verfahren zum Bewerten des Interesses einer Person (2) für eine visuelle Stimulierung, durch Anwenden eines Kontrollsignals in Kombination mit der visuellen Stimulierung, wobei das Kontrollsignal ein unterscheidbares Ansprechverhalten bei der Person hervorruft, und durch Messung des Interesses unter Bezugnahme auf eine Änderung im Ansprechverhalten, welches Verfahren folgende Schritte aufweist:
 - Darstellen eines periodischen, visuellen Kontrollsignals vorgegebener Frequenz;
 - Erfassen eines Elektroenzephalographie(EEG)signals von der Person, während diese das visuelle Kontrollsignal sieht; und
 - Analysieren des EEG-Signals, um die Größe derjenigen Komponente des EEG-Signals zu bestimmen, die frequenzmäßig dem Kontrollsignal entspricht;
 - wobei das Verfahren weiter die folgenden Schritte aufweist:
 - gleichzeitiges Anzeigen des Kontrollsignals und der visuellen Stimulierung für die Person während einer Datenerfassungsperiode;
 - Erfassen und Analysieren des EEG-Signals, um die Größe der genannten Komponente während der Datenerfassungsperiode zu bestimmen;
 - Bestimmen der Änderung der Größe der genannten Komponente des EEG-Signals während der Datenerfassungsperiode; und
 - Bewerten der zeitlichen Änderung des Interesses der Person für die visuelle Stimulierung abhängig von der Änderung.
2. Verfahren, wie in Anspruch 1 beansprucht, bei dem das visuelle Kontrollsignal ein Sinussignal (216) aufweist.
3. Verfahren, wie in Anspruch 2 beansprucht, bei dem das visuelle Kontrollsignal ein rotes Signal ist, dessen Intensität variiert wird.
4. Verfahren, wie in Anspruch 1, 2 oder 3 beansprucht, bei dem ein halbreflektierender Schirm (19) zwischen der Person und einer Quelle für die visuelle Stimulierung angeordnet wird und das visuelle Kontrollsignal auf das Auge oder die Augen der Person reflektiert wird.
5. Verfahren, wie in Anspruch 4 beansprucht, bei dem die visuelle Stimulierung auf einem Fernsehschirm (4) dargestellt wird.
6. Verfahren, wie in Anspruch 5 beansprucht, bei dem die visuelle Stimulierung Werbematerial ist.
7. Verfahren, wie in Anspruch 6 beansprucht, bei dem das Werbematerial verändert wird und angezeigt wird, um einen höheren Interessegrad der Person zu erzielen.
8. Verfahren, wie in Anspruch 6 oder 7 beansprucht, bei dem das Werbematerial gleichzeitig mehreren Personen gezeigt wird und die individuellen Ansprechverhalten gemittelt werden.
9. Verfahren, wie in einem der Ansprüche 1 bis 8 beansprucht, bei dem das Verfahren für jede von mehreren Personen wiederholt wird und die Änderungen in der Größe für jede Person indirekt durch folgende Schritte bestimmt wird:
 - Berechnen eines normierten mittleren Ansprechverhaltens aus den Größen der Komponente des EEG-Signals, wie sie für die Anzeige des Kontrollsignals für jede der individuellen Personen bestimmt wurde; und
 - Abziehen, während jeder Datenerfassungsperiode, des normierten mittleren Ansprechverhaltens von der Größe der Komponente des EEG-Signals, wie es für die Anzeige des Kontrollsignals gleichzeitig mit der visuellen Stimulierung für jede der Personen bestimmt wurde.



10. Gerät zum Bewerten des Interesses einer Person für eine visuelle Stimulierung durch Anwenden eines Kontrollsignals in Kombination mit der visuellen Stimulierung, wobei das Kontrollsignal ein unterscheidbares Ansprechverhalten bei der Person hervorruft, und durch Messung des Interesses unter Bezugnahme auf eine Änderung im Ansprechverhalten, mit:

- einer Einrichtung (14, 16) zum Erzeugen eines visuell wahrnehmbaren, periodischen Kontrollsignals vorgegebener Frequenz;
- einer Anzeigeeinrichtung (4) zum Anzeigen einer visuellen Stimulierung;
- einer Einrichtung (8) zum Erfassen eines EEG-Signals der Person während einer Datenerfassungsperiode, in der das visuelle Kontrollsignal und die visuelle Stimulierung von der Person gleichzeitig gesehen werden; und
- einer Analyseinrichtung (12) zum Bestimmen der Änderung der Größe derjenigen Komponente des EEG-Signals, die dem periodischen Kontrollsignal zuordenbar ist, zwischen einem Zustand, bei dem die Person nur das Kontrollsignal sieht, und einem anderen Zustand, bei dem die Person sowohl das Kontrollsignal als auch die visuelle Stimulierung sieht, welche Analyseinrichtung eine Unterscheidungseinrichtung aufweist, um eine Unterscheidung gegenüber Komponenten des EEG-Signals zu treffen, die nicht die vorbestimmte Frequenz aufweisen, wodurch das Gerät zeitliche Änderungen im Interesse der Person für die visuelle Stimulierung bewerten kann.

11. Gerät, wie in Anspruch 10 beansprucht, bei dem die Einrichtung zum Erzeugen eines visuell wahrnehmbaren Signals eine Quelle roter Strahlung und eine Einrichtung zum sinusförmigen Variieren der Intensität der Strahlung mit der vorgegebenen Frequenz aufweist.

12. Gerät, wie in Anspruch 11 beansprucht, bei dem die Frequenz im Bereich von 1 bis 100 Hz liegt.

13. Gerät, wie in Anspruch 12 beansprucht, bei dem die Frequenz näherungsweise 10 Hz beträgt.

14. Gerät, wie in einem der Ansprüche 11 bis 12 beansprucht, bei dem die Einrichtung zum Erzeugen eines visuell wahrnehmbaren Signals ein Array (16) aus LEDs aufweist.

15. Gerät, wie in Anspruch 14 beansprucht, bei dem zwei der LED-Arrays an Brillenbügeln (18) angebracht sind.

16. Gerät, wie in Anspruch 15 beansprucht, bei dem die Anzeigeeinrichtung einen Fernsehschirm (4) aufweist und bei dem die Brillenbügel halbreflektierende Schirme (19) aufweisen, die es der Person erlauben, den Fernsehschirm direkt zu betrachten, welche Schirme Strahlung von den LED-Arrays auf das Auge oder die Augen der Person reflektieren.

17. Gerät, wie in einem der Ansprüche 11 bis 16 beansprucht, bei dem die Unterscheidungseinrichtung eine Abtast/Halte-Schaltung (172) aufweist, die den Ausgangswert des EEG-Signals am Ende jeder Periode der Frequenzkomponente der Stimulierung hält.

18. Gerät, wie in Anspruch 17 beansprucht, bei dem die Unterscheidungseinrichtung eine Arithmetikeinheit (12) aufweist, zum Berechnen der Größe M_n des EEG-Signals mit der genannten Frequenz, durch Ermitteln der Quadratwurzel der Summe der Quadrate der Ausgangswerte.

19. Gerät, wie in Anspruch 10 beansprucht, das ferner eine Vorrichtung zur Verwendung beim Bewerten des Interesses einer Person für eine visuelle Stimulierung aufweist, welche Vorrichtung eine Halteeinrichtung (18, 20) zum Halten mindestens eines halbreflektierenden Schirms (19) neben mindestens einem der Augen einer Person, wobei die Person die visuelle Stimulierung direkt erkennen kann, und eine Quelle (16) sichtbarer Strahlung aufweist, die von der Halteeinrichtung getragen wird, um Strahlung von der Quelle zum Auge oder zu den Augen der Person zu reflektieren, um so das visuelle Kontrollsignal zu liefern.

20. Gerät, wie in Anspruch 10 beansprucht, bei dem die Analyseinrichtung eine Einrichtung zum Berechnen eines normierten, mittleren Ansprechverhaltens aus den Ansprechverhalten jeder von mehreren Personen alleine auf das Kontrollsignal hin aufweist, und zum Bestimmen während der Datenerfassungsperiode, der Änderung der Größe für jede Person durch Abziehen des normierten, mittleren Ansprechverhaltens von der Größe der genannten Komponente des EEG-Signals, wie sie für



jede Person für gleichzeitige Anzeige des Kontrollsignals und der visuellen Stimulierung bestimmt wurde.

Revendications

1. Procédé d'évaluation de l'intérêt d'un sujet (2) pour un stimulus visuel, en utilisant l'application d'un signal de commande en combinaison avec ledit stimulus visuel, ledit signal de commande produisant une réponse discernable dans le sujet, et la mesure dudit intérêt par référence à une variation de ladite réponse, ledit procédé comprenant les étapes suivantes :
 - présenter un signal de commande visuel périodique ayant une fréquence présélectionnée ;
 - obtenir un signal électroencéphalographique (EEG) du sujet pendant qu'il voit ledit signal de commande visuel ;
 - analyser le signal (EEG) pour déterminer l'amplitude de la composante du signal (EEG) qui correspond en fréquence avec ledit signal de commande,
 dans lequel ledit procédé comprend en outre les étapes consistant à présenter ledit signal de commande et du stimulus visuel simultanément au sujet pendant une période d'acquisition de données;
 - obtenir et analyser le signal (EEG) pour déterminer l'amplitude de ladite composante pendant ladite période d'acquisition de données ;
 - déterminer la variation d'amplitude de ladite composante du signal (EEG) pendant ladite période d'acquisition de données ; et
 - évaluer la variation temporelle de l'intérêt du sujet pour ledit stimulus visuel en fonction de ladite variation.
2. Procédé selon la revendication 1, caractérisé en ce que le signal de commande visuel comprend un signal sinusoïdal (216).
3. Procédé selon la revendication 2, dans lequel le signal de commande visuel est un signal rouge qui varie en intensité.
4. Procédé selon la revendication 1,2 ou 3, dans lequel un écran semi-réfléchissant (19) est placé entre le sujet et une source dudit stimulus visuel et le signal de commande visuel est réfléchi vers l'oeil ou les yeux du sujet.
5. Procédé selon la revendication 4, dans lequel ledit stimulus visuel est présenté sur un écran de télévision (4).
6. Procédé selon la revendication 5, dans lequel le stimulus visuel est un motif publicitaire.
7. Procédé selon la revendication 6, dans lequel le motif publicitaire est modifié et présenté de manière à obtenir un niveau plus élevé d'intérêt du sujet.
8. Procédé selon la revendication 6 ou 7, dans lequel le motif publicitaire est présenté simultanément à une pluralité de sujets et en ce que l'on fait la moyenne des réponses individuelles.
9. Procédé selon l'une quelconque des revendications 1 à 8, dans lequel le procédé est répété en ce qui concerne chacun d'une pluralité de sujets et ladite variation d'amplitude pour chaque sujet est déterminée de manière indirecte par les étapes suivantes :
 - calculer une réponse moyenne normalisée à partir des amplitudes de ladite composante du signal (EEG) déterminée pour présenter le signal de commande seul à chacun des sujets individuels ; et
 - soustraire, pendant chaque période d'acquisition de données, la réponse moyenne normalisée d'amplitude de ladite composante du signal (EEG) déterminée pour présenter le signal de commande et le stimulus visuel simultanément à chacun des sujets respectivement.
10. Appareil pour évaluer l'intérêt d'un sujet pour un stimulus visuel au moyen de l'application d'un signal de commande en combinaison avec ledit stimulus visuel, ledit signal de commande produisant une réponse discernable sur le sujet et la mesure dudit intérêt en référence à une variation de ladite



réponse, comprenant:

- des moyens (14,16) pour engendrer un signal de commande périodique visuellement perceptible ayant une fréquence prédéterminée ;
- des moyens d'affichage (4) pour présenter un stimulus visuel ;
- des moyens (8) pour dériver un signal (EEG) du sujet pendant une période d'acquisition de données au cours de laquelle le signal de commande visuel et le stimulus visuel sont vus simultanément par le sujet ; et
- des moyens d'analyse (12) pour déterminer la variation de l'amplitude de la composante du signal (EEG) qui est attribuable au signal de commande périodique à partir d'un état dans lequel le sujet voit seulement le signal de commande et d'un autre état pendant lequel le sujet voit à la fois le signal de commande et le stimulus visuel, les moyens d'analyse comprenant des moyens de discrimination pour discriminer des composantes du signal (EEG) qui ne sont pas à ladite fréquence prédéterminée, grâce à quoi l'appareil peut évaluer des variations de temps dans l'intérêt du sujet pour le stimulus visuel.

11. Appareil selon la revendication 10, dans lequel les moyens pour engendrer un signal perceptible visuellement comprennent une source de rayonnement rouge et des moyens pour faire varier de manière sinusoïdale l'intensité de ce rayonnement à la fréquence prédéterminée.

12. Appareil selon la revendication 11, dans lequel ladite fréquence est comprise dans la gamme de 1 à 100 Hz.

13. Appareil selon la revendication 12, dans lequel ladite fréquence est approximativement égale à 10 Hz.

14. Appareil selon l'une quelconque des revendications 1 à 12, dans lequel lesdits moyens pour engendrer un signal perceptible visuellement comprennent un réseau (16) de diodes électroluminescentes.

15. Appareil selon la revendication 14, dans lequel il y a deux réseaux de diodes électroluminescentes montés sur des montures de lunettes (18)

16. Appareil selon la revendication 15, dans lequel les moyens d'affichage comprennent un écran de télévision (4) et dans lequel les montures de lunettes comprennent, des écrans semi-rélecteurs (19) qui permettent au sujet de voir l'écran de télévision directement, les écrans réfléchissant le rayonnement provenant des réseaux de diodes électroluminescentes vers l'oeil ou vers les yeux du sujet.

17. Appareil selon l'une quelconque des revendications 11 à 16, dans lequel les moyens de discrimination comprennent un circuit d'échantillonnage et de blocage (172) qui bloque la valeur de sortie dudit signal (EEG) à la fin de chaque période de la composante de fréquence du stimulus.

18. Appareil selon la revendication 17, dans lequel les moyens de discrimination comprennent une unité arithmétique (12) pour calculer l'amplitude (M_n) du signal (EEG) à ladite fréquence en calculant la racine carrée de la somme des carrés desdites valeurs de sortie.

19. Appareil selon la revendication 10, qui comprend en outre un dispositif pour l'utilisation dans l'évaluation de l'intérêt d'un sujet pour un stimulus visuel, ledit dispositif comprenant des moyens supports (18,20) pour supporter au moins un écran (19) semirélecteur adjacent à au moins un des yeux d'un sujet, le sujet pouvant voir directement le stimulus visuel et une source (16) de radiation visible supportée par les moyens supports pour réfléchir un rayonnement provenant de ladite source vers l'oeil ou les yeux du sujet de manière à fournir le signal de commande visuel.

20. Appareil selon la revendication 10, dans lequel les moyens d'analyse comprennent des moyens pour calculer une réponse moyenne normalisée à partir des réponses de chacun d'une pluralité de sujets au signal de commande seul et pour déterminer, dans la période d'acquisition de données, ladite variation d'amplitude pour chaque sujet en soustrayant la réponse moyenne normalisée de l'amplitude de ladite composante du signal (EEG) déterminée pour chaque sujet pour la présentation simultanée du signal de commande et du stimulus visuel.