Field of the Invention

The device and method relate to an automated cognitive therapy system which provides a reliable, objective means for providing therapeutic training in emotional interpretation expression for subjects with Autism Spectrum Disorder (ASD). It consists primarily of an expressive facial avatar, a video camera system, control electronics, and computer control software. The full system, referred to as EDDIE (Emotion Demonstration, Decoding, Interpretation, and Encoding), provides a significant advance in the delivery methods for cognitive therapies of documented value. It also can be employed as a research tool in the study of emotional expression recognition and production by subjects with ASD.

Background of the Invention

The CDC reports that 1 in 68 children in the US are identified with some form of ASD. Among the common symptoms of ASD is the significantly, sometimes severely, reduced ability to both interpret and produce standardized facial expressions of emotion. It has been shown that cognitive therapies can be instrumental in enabling high functioning ASD (HFASD) subjects substantially improve these abilities. Concurrent with improved emotion recognition ability is a measurable improvement in measured IQ and an improved ability to interact in social situations, resulting in improved quality of life for the HFASD subject.

Typically, these cognitive therapies are conducted in one-on-one sessions with highly trained experts. In a therapy session the therapist will act as both a model of expression, and as an evaluator of expression. As a model, the therapist will artificially reproduce expressions of emotion, usually in compliance with the standards defined by Dr. Paul Ekman’s FACS system. Initially, the subject is given verbal descriptions of the emotion expressed and of the facial action units (FAUs) associated with the expression. As the therapy progresses, the subject is asked to identify the expressed emotions without verbal clues, and given guided feedback regarding accuracy. As an evaluator, the therapist instructs the subject to produce a facial expression of emotion, and provides feedback to the subject on which FAUs are correctly expressed with the goal of guiding the subject toward more reliable expression.

While the typical method of training does work, it suffers from three important limitations. Firstly, any training activities must take place in the presence of the trained therapist. This limits, both through cost and availability, the amount of therapy a subject can receive in a given time period. Since studies indicate that intervention is more effective the earlier it is provided in a subject’s life, this limits both the rate and total effect of the therapy. Secondly, human models of posed emotional expression are limited, both by muscle control and a susceptibility to the mixed production of genuine and artificial expressions of emotion. Thirdly, it is known that real-time human reading of emotional expression is limited by subjective judgement and the inherent limitations of perception.

The proposed system overcomes the above limitations. Regarding the first limit, that of training time, automated production and reading of emotional expression relieves the need for a trained therapist to be present for all training sessions. Subjects can engage with EDDIE under home supervision, or at a clinical facility with a less skilled care provider. This allows for an overall increase in training rate, and can free the time spent with the most skilled therapy providers for more advanced therapeutic interventions. Regarding the second and third limits of the current therapy, EDDIE overcomes them by automating the production and reading of expressions. The animatronic face is specifically designed to produce only the combination of FAUs required at the moment needed, to the precise extent needed. There is no risk of either mixed expressions or unintended expressions. Furthermore, the fine control of the face allows for increased ability to adjust the intensity of modelled expressions, allowing the therapist to prescribe some subjects a training routine designed to develop more precise detection of subtle variations in the level of emotional expression. Finally, by providing an objective reading of emotional expression, EDDIE can provide more precise and reliable real-time feedback than a human reader regarding the FAUs produced by the subject in relation to the requested FAUs. For these reasons EDDIE provides a substantial improvement over the typical current therapy methods.

With respect to the above description, before explaining at least one preferred embodiment of the method and apparatus herein in detail, it is to be understood that the invention is not limited in its application to the details of construction and to the arrangement of the components or steps set forth in the following description or illustrated in the drawings; nor is it limited solely to delivery of therapy to ASD subjects. While ASD subjects are known to respond to therapies of the sort described herein, other classes of subjects may likewise benefit and their inclusion as therapy subjects is implied herein. Likewise, the various apparatus and methods of employment of the invention are capable of other embodiments, including but not limited to adjustments to the motional capabilities of the facial avatar, selection of alternate camera technologies, and the range of FAUs and facial expressions available for presentation and interpretation during therapies. This includes such variations capable of being practiced and carried out in various ways which will be obvious to those skilled in the art once they review this disclosure. Also, it is to be understood that the phraseology and terminology employed herein are for the purpose of description and should not be regarded as limiting.

Drawings of the Invention:

1. Diagram of apparatus (Head, electronics, camera, computer)
   1. Could be a photograph or a block diagram. Should indicate connections among parts.
2. Schematic of usage layout (Head, camera, subject)
   1. Should be a drafted diagram.
   2. Show placement of three key parts: face, subject, camera
3. Detail of head mechanics, no fleece
   1. Chrissy’s CAD rendering.
4. Detail of head mechanics and expression, with fleece
   1. Photographs of Kim’s fleece covered face in two or more poses
   2. Can be connected to figure 3 above.
5. Electronics circuit diagram
   1. Should be able to use the Eagle drawing Jon made already
6. Figures of human expressions, with FAU IDs (Happy, Sad, Angry, Neutral)
   1. Use Ekman-esque validation images
   2. List or table of FAUs needed for H, S, A.

Detailed Description of the preferred embodiements:

1. This will run through all 6(?) figures item by item.