CALIFORNIA STATE UNIVERSITY, NORTHRIDGE

DEVELOPMENT OF A NEW EMOTION RECOGNITION TEST WITH EMOTICONS FOR

ADOLESCENTS WITH POOR SOCIAL SKILLS

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By

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ABSTRACT

DEVELOPMENT OF A NEW EMOTION RECOGNITION TEST WITH EMOTICONS FOR

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Traditional emotional interpretation scales rely on images of real faces to express basic and complex emotions, but individuals with High-Functioning Autism or poor social skills may have difficulty in processing these minute variations in features from face to face. Use of standardized, artificial faces has been shown to aid individuals with High-Functioning Autism (HFA) or Asperger's Disorder (AD) in interpreting emotions (Baron-Cohen, 2007). Thus, an emotional interpretation scale with standardized facial features is needed to account for this clinical population. The primary objective of this study was to develop a new emotion recognition test that could effectively measure the emotional interpretation skills of both normally developing individuals and individuals with poor social skills using emoticons instead of real faces. In the first phase of this project, 290 college students were recruited to complete the first version of Emotional Perception and Interpretation Questionnaire (EPIQ). This version of the scale consisted of 35 questions designed to measure an individual's ability to perceive basic and complex emotions in one or multiple emoticons. Based on the results, the EPIQ was revised by adding additional items to improve its internal consistency and reliability. The internal consistency of items on the revised EPIQ was good. In addition, participants' scores on the EPIQ were negatively correlated with social skills scale scores. This version of the EPIQ was administered to adolescents with HFA/AD/poor social skills to investigate whether these

individuals score significantly lower than normally developing adolescents. There was no significant difference between adolescents with HFA/AD/poor social skills and normally developing adolescents for identifying basic emotions, but there was a significant difference in recognizing complex emotions between the groups. The significance and implications of the findings were discussed.

INTRODUCTION

It is well documented that individuals with High Functioning Autism (HFA) and Asperger's Disorder (AD) have difficulty identifying emotions from facial expressions (Baron Cohen, Wheelwright & Jolliffe, 1997). Concurrently, research suggests that individuals with HFA/AD have difficulty recognizing how shaded expressions within particular emotion are associated with each other, and that this might contribute to their failure to understand the emotional states of other people (Castelli, 2005; Golan, Baron-Cohen & Hill, 2006; Hobson, 1986). Thus, the study of facial expressions representing both basic and complex human emotions are particularly important for ongoing research regarding HFA/AD because individuals with this diagnosis typically demonstrate impairment in expressing, interpreting, or reciprocating nonverbal behaviors with other individuals.

The main purpose of this study is to examine the emotional interpretation abilities of adolescents (age thirteen to seventeen years old) who spend more time using online or text based communication mediums than any other group (Derks, Grumbkow & Bos, 2008; Hampton, et al, 2009; Hampton, Sessions & Goulet, 2011). This age group may choose to spend less time in face to face contact with others and may prefer to communicate with others online because of this minimization of face to face contact (Caplan, 2005). Online users implement textual and visual representations of faces (emoticons) to express emotions, but these representations of facial features might lack the capacity to fully express complex emotional states in the same degree as face to face communication (Okdie et al., 2011). Furthermore, adolescents with poorer social skills may prefer online communication over face to face communication because the overt expression of emotions through facial features is limited in this environment (Caplan, 2003). If individuals with poorer social skills have trouble interpreting multiple facial cues and

understanding complex facial features, use of emoticons in online communication may allow these individuals to better understand and express emotional states using standardized faces instead of real faces. The current study aimed to examine whether individuals were able to understand the expression of basic and complex emotions through the use of emoticons and whether these emoticons express the same emotions across individuals.

New Diagnosis Criteria and HFA/AD

Some of the most common difficulties that individuals with HFA/AD experience are maintaining eye contact, interpreting others' emotions from facial expressions, and expressing their own emotions through facial expressions or nonverbal gestures to regulate social interaction. However, the American Psychiatric Association's Diagnostic and Statistical Manual, (4th ed. Text Revision, 2000) notes that individuals with HFA/AD generally do not have clinically significant delays in the development of written or spoken language, as well as no significant delay in the development of other cognitive skills, self-help skills, or adaptive behavior during childhood. So a major criteria for the diagnosis of HFA/AD depends heavily upon whether an individual demonstrates impairment in nonverbal social interaction, primarily involving the interpretation of others' emotions in facial expressions, expressing one's own emotions' through facial expressions, and maintaining eye contact. These impairments can complicate the process of forming relationships with other people because understanding others' emotional states through facial and contextual cues are fundamental to social interaction (Bandura, 1986; Semrud-Clikeman & Hynd, 1991; Yardley et al, 2008). Although individuals with HFA/AD show clinically similar language development and cognitive skills compared to normally developing individuals, dysfunction is characteristically observed in interpreting and expressing external emotions.

This diagnosis has changed recently. The Diagnostic and Statistical Manual 5th edition (DSM-V) does not include AD as a separate diagnosis from Autism; as of 2013, AD has been incorporated into the more broadly defined diagnosis of Autism Spectrum Disorders. The DSM-V diagnosis for Autism Spectrum Disorder accommodates for a wide variety of symptoms that individuals may exhibit across the Autism spectrum, and allows clinicians to incorporate these symptoms into one expansive diagnosis, instead of separate diagnoses in the DSM-IV (Autistic Disorder, Asperger's Disorder's, Childhood Disintegrative Disorder, Pervasive Developmental Disorder Not Otherwise Specified). Although research suggests that individuals with HFA/AD do not exhibit deficits in cognitive ability apart from reciprocating social and emotional reciprocity, individuals with HFA/AD might be diagnosed under the new DSM-V criteria for Autism Spectrum Disorder in the same way an individual with more significant cognitive developmental delays is diagnosed. In this way, the new DSM-V criteria makes limited distinctions between individuals with high-functioning Autism and those with more pronounced deficits in cognitive development; all individuals with dysfunctional social and emotional reciprocation are categorized under Autism Spectrum Disorder according to the DSM-V criteria, but distinction regarding additional developmental delays beyond these are vague.

The DSM-V criterion for co-morbid diagnosis of Autism Spectrum Disorder and intellectual disability is that "social communication should be below that expected for general developmental level" (p. 63). If clinicians do not specifically indicate that individuals with HFA/AD have accompanying intellectual impairment or accompanying language impairment, the DSM-V directs them to give a diagnosis of Autism Spectrum Disorder. This direction pushes clinicians to generalize a diagnosis for Autism rather than establishing a clear distinction between individuals with social/emotional dysfunction and normally developed cognitive

abilities and individuals with social/emotional dysfunction and cognitive deficit. Some individuals with HFA/AD might lose access to health or financial services because of this change in diagnosis. Even worse, clinicians who do not make this additional distinction (between HFA/AD with or without cognitive delay) may prescribe medication or treatment for Autism Spectrum Disorder that is unnecessary or harmful to individuals with HFA/AD.

An objective means to evaluate the emotional interpretation abilities of individuals with this new diagnosis is needed in order to differentiate between those with Low-Functioning Autism and High Functioning Autism. Because a diagnosis of Autism Spectrum Disorder relies heavily upon dysfunctional social and emotional skills, many clinicians may implement tests of emotional interpretation that use real human faces as an appropriate tool for assessing an individual's emotional awareness. This may not be appropriate because individuals with Autism Spectrum have universal difficulties including recognizing facial cues from real faces, maintaining eye contact, and understanding others' inner states. Thus, using real faces on emotional interpretation scales may reinforce these difficulties rather than account for them. Are there alternative methods for measuring emotions without using real human faces for individuals with Autism Spectrum Disorders?

Basic and Complex Emotions

Research on human facial expressions and emotional interpretation suggest that an individual's ability to interpret distinct emotional states from facial expressions is widespread across cultures. Ekman has conducted noteworthy research on the expression of emotions through facial features and found that the emotions of anger, disgust, fear, happiness, sadness, and surprise are recognized universally by literate and preliterate cultures across the world (Ekman 1992; Ekman & Friesen, 1971). Further investigation on the subject of universal human

emotions has corroborated Ekman's findings (Izard, 1971; Plutchik, 1980; Tomkins, 1984). The evidence for this effect suggests that basic human emotions are universally recognized from facial features across cultures because these basic emotions are based on perceivable and typically occurring facial expressions that are associated with actions synonymous with emotional states. Conversely, research has not yet come to a definitive consensus as to which basic emotions represent universal human emotions (Ortony & Turner, 1990). Although debate has arisen over which distinct emotions are universally recognized, there exists a concurrence among the varied findings that basic emotions exist across cultures, due to the fact that individuals possess the ability to communally come to a consensus regarding emotional states when definitive facial expressions are presented.

Other research has categorized emotions into a hierarchy, identifying Ekman's basic human emotions as primary emotions, with more specific secondary emotions stemming from these basic emotions, and even more specific tertiary emotions stemming from the secondary emotions (Parrott, 2001; Plutchik, 1980). In general, these more complex emotions are associated with more complex micro features or more complex combinations of basic facial features (Ekman, 1972, 2003; Matsumoto, et al, 2008). In turn, these more complex facial expressions do not correspond uniquely to a single emotional state in the same way basic facial expressions correspond uniquely to basic emotions. In addition, the inconsistency with which individuals interpret complex emotions from complex facial features is testament to the difficulty of clearly identifying these emotional states in human faces. Thus, differentiating between primary and complex human emotions may be too overwhelming for individuals with HFA/AD if these individuals also experience deficits in understanding emotional reciprocity, perceiving facial

expression, observing facial interpretation, maintaining eye gaze, or understanding nonverbal social cues.

The mechanisms behind these areas of dysfunction suggest that individuals with Autism may not be able to incorporate the additional features inherent in complex facial expressions into complex emotional states. In this way, individuals with HFA/AD may not be able to synthesize changes to multiple or simultaneous facial expressions together; difficulty with combining multiple facial features into a cohesive and entirely new emotion may explain why it is difficult for individuals with HFA/AD to identify complex emotions in human faces. It is then pertinent to evaluate how HFA/AD affects the accuracy of interpreting complex human emotions compared to a normative sample set. Furthermore, identifying a means to measure how individuals with HFA/AD combine multiple facial expressions into one emotional state may also shed light on how these individuals perceive and evaluate basic and complex emotional expressions.

Emotion Recognition Tests for High-Functioning Autism

Scales designed to measure emotional interpretation abilities often include facial recognition tasks. The Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT) serves as a reliable and structured model for measuring an individual's ability to perceive and synthesize emotion in faces and contextual situations using a standardized normative sample set to establish consistent answers (Mayer & et al., 2003). Mayer (2012) suggests in the Laboratory Technical Supplement for the MSCEIT that "some researchers may want to develop further sets of norms, for example,… for special groups such as individuals with depression or autism" (p. 5). However, developing a separate set of norms for this population only establishes a new set of scores different from that of normative samples; in essence, it acknowledges that individual's with

HFA/AD have difficulty in interpreting emotional states, rather than reducing these hurdles from the test.

In addition, other available emotional interpretation tests measure an individual's ability to interpret facial expressions using real faces in the same way. Tests, such as the Karolinska Directed Emotional Faces (KDEF) include images of human faces with accompanying body, hair, clothing, or other context clues (Lundqvist, Flykt & Öhman, 1998), while the Revised Eyes test attempts to uniquely measure an individual's ability to interpret emotions from eyes alone, while excluding other non-facial features (Baron Cohen, 2001). Despite efforts to isolate facial features and exclude extraneous stimuli from emotional recognition tests, emotional recognition scales are designed primarily using real photos of human faces, which may vary in thousands of minute details from face to face (including changes of eye shape, facial position, facial structure, lip shape, etc.). Furthermore, attempts to limit participants' perception of emotion to the eyes alone is neurologically atypical for individuals with Autism Spectrum Disorder, as visual scanpaths of individuals with Autism Spectrum Disorders often reveal that these individuals spend significantly less time examining core feature areas of faces (eyes, nose, eyebrows, mouth) compared with normally developing individuals (Dalton, 2005).

Research suggests that individuals with HFA/AD may be slower at automatically integrating multiple facial cues in faces to form a cognitive representation of emotions than normally developing individuals (Wang et al, 2004). Individuals with Autism Spectrum Disorder tend to exhibit disorganized visual processing of non-core facial features and tend to spend much less time observing eye areas in faces (Pelphrey, et al, 2002; Yi, et al, 2013). These individuals may have difficulty in processing countless facial cues and may demonstrate a bias for parts of faces versus a global representation (Lahaie et al, 2006). When photographs of real faces are

used in emotion perception scales, individuals with HFA/AD are likely to have more difficulty than individuals without HFA/AD at interpreting basic and complex emotional states because these minute changes in expression from face to face may be too numerous or cognitively taxing for these individuals to synthesize into a cohesive emotion. Could using real faces in emotional interpretations scales be too difficult for this population because there are too many elemental changes from face to face? Would the use of standardized facial images such as emoticons in emotional interpretation scales effectively express complex emotions while limiting extraneous details?

Using emoticons limits the amount of variability from one face to another and may aid individuals with HFA/AD in understanding key components of facial features. Individuals with HFA/AD may increase their ability to interpret complex emotional states on tests of emotional interpretation when images of real faces are replaced with standardized faces because the option to examine non-core facial features is removed and infinitesimal difference from face to face are minimized. Moreover, better understanding of emotions from emoticon faces may allow these individuals to better interpret others' basic emotions and enhance empathetic social skills.

Investigations of emotional interpretation in children with HFA/AD revealed that subjects increased their ability to perceive and identify basic emotions in real faces, after they had learned about these basic emotions from standardized images (Baron-Cohen, 2007; Castelli, 2005). If subjects with HFA/AD can enhance their ability to interpret basic emotional states using standardized facial images, then it is prudent to investigate how this population interprets basic and complex emotional states from standardized images of facial expressions. Furthermore, diagnosing clinicians and education leaders may be better able to assess emotional interpretation abilities for individuals with HFA/AD by using emoticons to express complex emotions.

The current scale was designed with a clinical population in mind. If individuals with HFA/AD or poor social skills have difficulties with emotional interpretation scales, it could be largely due to the use of real faces. These individuals have recognized delays in observing and synthesizing multiple facial cues to understand comprehensive emotional states (Castelli, 2005; Golan, Baron-Cohen & Hill, 2006; Pelphrey, et al, 2002). Methods for testing emotional perception in clinical populations require more appropriate stimuli. The main purpose of this study was to develop a new emotional interpretation scale that presents standardized faces in the form of emoticons instead of real faces. Using emoticons should limit the variability of facial features, and it was estimated that adolescent individuals with poor social skills should be able to perceive and comprehend basic and complex emotions as a result of this uniformity. A control group of normally developing adolescents was compared to an experimental group of adolescents with HFA/AD/ poor social skills. It was hypothesized that although participants in the experimental group should not score significantly different than adolescents in the control group on basic emotion interpretation, complex emotion interpretation scores should be significantly different between the two groups.

METHOD

Participants

Sample 1 consisted of 290 undergraduate students from California State University, Northridge. These participants completed the initial version of the Emotional Perception and Interpretation Questionnaire (EPIQ) and the Autism Spectrum Quotient (ASQ) in small group settings in exchange for course credit. This sample was recruited to evaluate the initial construct validity of the EPIQ and compare it to self-reported ratings on the ASQ. Participant ages were between 18 to 36 years old ($M = 19.67$, $SD = 2.7$). Approximately 67% of the participants were female ($N = 195$). Of the total participants, 8% were African American, 19% were Asian, 15% were Caucasian, 47% were Latino, 6% were Middle Eastern, and 5% were "Other."

Similarly, Sample 2 ($N = 121$) consisted of adult participants from the community who completed a modified version of the EPIQ and the ASQ. The age range for this sample was between 18 and 67 years old ($M = 30.3$, $SD = 13.45$), and approximately 68% of the participants were female ($n = 82$). The majority of the sample was either Caucasian (47%) or Latino (31%). There was no compensation offered in this sample.

Lastly, Sample 3 consisted of 46 adolescents (age 13 to 17 years old) who were separated into experimental and control conditions. Eighteen male and four female adolescents with poor social skills were recruited for the experimental group from the CSUN Program for the Education and Enrichment of Relational Skills (PEERS), the community, or by referral. Ages ranged from 13 to 17 years old ($M = 15.91$, $SD = 2.486$). Similarly, fifteen normally developing male and nine female adolescents were recruited for the control group from the community or by referral. The age range for the control group was also 13 to 17 years old ($M = 15.45$, $SD = 0.963$). A gender ratio in this sample was biased towards males in the experimental group, as individuals with

HFA/AD are statistically more likely to be male than female (Baron Cohen, 2002; Lord, Schopler, & Revicki, 1982; Wing, 1981). A sample with comparable gender proportion was obtained for the control group (62.5% Male, 37.5% Female). Criteria for poor social skills were based on parent report or diagnosis of HFA/AD.

Materials

       Development of the EPIQ. Adapting sample questions from the Mayer-Salovey-Caruso Emotional Intelligence Test, the EPIQ was designed to assess individual's basic and complex emotion interpretation. Six basic emoticons representing anger, disgust, fear, happiness, sadness, and surprise were used in the development of the EPIQ to measure participants' interpretation of basic emotional states. Each question in the EPIQ featured either one or two of these emoticons. Specific combinations of these six emoticons were presented across scale items to assess participants' ability to synthesize multiple emoticons into one complex emotion.

       Thirty-five items were created for the EPIQ to measure emotional interpretation in this developmental phase. This version of the EPIQ was separated into five sub sections. Sections A and B (twelve questions total) measured basic emotion interpretation, while Sections C, D, and E (twenty three questions total) measured complex emotional interpretation. This version of the EPIQ required participants to choose one of six basic emotions that best represented a presented emoticon (Section A) and, conversely, choose one of six emoticons that best represented a basic emotion (Section B). In Section C and D, participants were presented with two emoticons and directed to choose one of four complex emotions that best combines these faces. Finally, items in Section E featured a brief scenario involving two complex emotions, and participants indicated which two emoticons best represented these emotions.

Participants also complete the ASQ, a self-reported scale designed by Baron Cohen, et al (2001), which requires participants to rate how much they agree or disagree with statements about themselves on a 4 point Likert scale. Participants scored one point on this assessment if they agreed with any statements typically associated with Autistic individuals, and one point if they disagreed with any statement typical of normally developing individuals. Higher ASQ scores were suggestive of more Autistic like personalities, and vice versa.

Total EPIQ scores were negatively correlated with total ASQ scores, r (288) = -0.223, p < 0.001). Furthermore, EPIQ total scores were negatively correlated with ASQ sub scores for social skills (items 1, 11, 13, 15, 22, 36, 44, 45, 47, and 48), r (288) = -0.209, p < 0.001. These results suggested that individuals who rated themselves as having social skills typical of Autism Spectrum Disorders are scoring lower on the EPIQ, and vice versa.

Refinement of the EPIQ. Internal reliability measures for the initial version of EPIQ were low. The overall Cronbach's alpha for the EPIQ was .48 with .611 for basic emotions and .395 for complex emotions. Because the correct responses for items in Section D were found to be at chance levels, these items were substantially revised to promote internal consistency. Twenty three additional items were also added to the EPIQ to better estimate construct validity and improve internal consistency - 8 items, designed to assess participants' ability to correctly match one complex emotion to a single emoticon, were added to the revised EPIQ, and 5 additional scenario items were included in the revised EPIQ.

Participants from Sample 2 were asked to complete the revised version of the EPIQ as well as the ASQ scale through online. Total EPIQ scores and total ASQ scores were negatively correlated, r (119) = -0.236, p = 0.009. In addition, EPIQ total scores were negatively correlated with ASQ sub scores for social skills items, r (119) = -0.345, p < 0.001. Whereas participants'

basic emotion sub scores on the EPIQ (items 1-12) were not significantly correlated with ASQ

total scores, r (119) = -0.171, p = 0.063, participants' complex emotion sub scores on the EPIQ

(items 13-58) were significantly correlated with ASQ total scores, r (119) = -0.222, p =0.016.

This suggests that participants with more autistic like characteristics missed more complex

emotion questions (items 13-58). Finally, EPIQ basic emotion sub scores and complex emotion

sub scores were moderately but significantly correlated, r (119) = 0.327, $p < 0.001$.

The alpha coefficient for the revised EPIQ was 0.734, (α = 0.643 for the first 12 basic

emotion items and α = 0.688 for the 46 complex emotion items). Thus, in the revised version of

the EPIQ, internal reliabilities for basic and complex emotions were considered acceptable. See

Appendix A for the final version of the EPIQ used in the experimental phase of this study.

Procedure

Adolescent participants completed demographic questions and the revised EPIQ scale.

Adolescents with a prior diagnosis of HFA/AD or parent report of social difficulties were

assigned to the experimental group. Adolescents with no history of HFA/AD or social interaction

difficulties were assigned to the control group. Both the experimental and control group

participants completed identical measurements. Data were collected in small group settings or

individually, and all assessments were completed via a computer with internet access. The time

taken for each participant to complete all test procedures was between 10 to 20 minutes.

Correct answers on the EPIQ were based on the answers collected from Sample 2. Sample

2 participants indicated a clear answer for each item on the EPIQ above chance levels. Thus,

these answer choices are considered correct for scoring in future use of the EPIQ.

For each EPIQ question, participants received one point for choosing the correct answer

and zero points for any other answer. In this way, higher or lower EPIQ scores are assigned to

individuals with more normal or abnormal emoticon interpretation abilities, respectively. The revised EPIQ was designed with an adolescent population (age 13-17 years old) in mind, since this population spends more time using online or text based communication than any other age group.

  The ASQ was not administered to adolescent participants because the version of this scale that was administered in the previous samples was designed for adult participants. An ASQ scale designed for adolescents does exist (Baron-Cohen, 2007); however, it contains different questions than the adult version and is designed to be completed by parents. In an effort to collect information directly from adolescents about themselves and not from their parents, the adolescent ASQ scale was not administered to participants.

RESULTS

Internal Consistency

Overall reliability of the EPIQ (for adolescent participants) was good across groups (Cronbach's $\alpha = 0.852$). In addition, overall internal reliability of the EPIQ was acceptable for both the experimental and the control groups (Cronbach's $\alpha = 0.874$, $\alpha = 0.733$, respectively). Internal consistency of basic emotion items 1-12 was low (Cronbach's $\alpha = 0.478$). This could be due to a low number of scale items used in computing internal reliability for basic emotions paired with a low sample size ($n = 46$). For the observed alpha, the Spearman Brown prophecy estimates having a sample size of at least 72 participants in order to obtain a Cronbach's $\alpha = 0.60$. (e.g., Alpha levels ≥ 0.60 were observed for basic emotion items in Sample 2 with $N = 121$.) Conversely, internal consistency of complex emotion items (items 13-58) was good (Cronbach's $\alpha = 0.853$).

Testing the Main Hypotheses

The main hypothesis for this experiment was that adolescents in the experimental group would score significantly higher than the control group on overall EPIQ scores. To investigate if any differences exist between the EPIQ scores, an independent means t-test was conducted using EPIQ total scores as the dependent variable and group assignment as the grouping variable. Mean EPIQ scores are presented by group and section in Table 1 (see Appendix A). EPIQ total scores for the control group ($M = 53.79$, $SD = 3.39$) and the experimental group ($M = 49.36$, $SD = 7.2$) were significantly different, $t(44) = 2.705$, $p = 0.01$.

A 2x2 factorial ANOVA analysis was conducted with independent variables Gender (Male or Female) and Group (experimental vs. control) and dependent variable EPIQ total score. There was no difference between males and females on EPIQ total score, $F(1,42) = 0.032$, $p =$

0.859. There was however an observed difference in EPIQ total scores based on group assignment, $F(1,42) = 4.602$, $p = 0.038$. There was no interaction of gender and group assignment on EPIQ total scores, $F(1,42) = 0.049$, $p = 0.826$.

In addition, it was hypothesized that EPIQ scores on basic emotion interpretation items would not be different between the experimental and control groups. To investigate if basic emotion interpretation differed between groups, an independent means t-test was conducted using basic EPIQ sub scores (items 1-12) as the dependent variable and group assignment as the grouping variable. Basic emotion scores for the control group ($M = 10.96$, $SD = 1.20$) and the experimental group ($M= 10.77$, $SD = 1.31$) were not significantly different, $t (44) = 0.503$, $p = 0.618$.

A 2x2 factorial ANOVA analysis was conducted with independent variables Gender and Group as the independent variables and dependent variable EPIQ basic score. There was no difference between males and females on EPIQ basic scores, $F(1,42) = 0.169$, $p = 0.683$. As expected, there was no observed difference in basic scores based on group assignment, $F(1,42) = 0.049$, $p = 0.826$. Similarly, there was no interaction of gender and group assignment on EPIQ basic scores, $F(1,42) = 0.049$, $p = 0.826$.

Finally, it was predicted that complex emotional interpretation would be different between groups, even though participants with poor social skills have similar basic emotion interpretation abilities as normally developing participants. It was hypothesized that EPIQ scores on complex emotion items (13-58) would be significantly higher for the control group when compared to the experimental group. Participants in the control group ($M = 42.83$, $SD = 2.81$) scored significantly higher than the experimental group ($M = 38.59$, $SD = 6.45$) on complex emotion interpretation, $t (44) = 2.936$, $p = 0.005$.

A 2x2 factorial ANOVA was conducted using Gender and Group as the independent variables and EPIQ complex emotion score as the dependent variable. There was no difference between males and females on complex emotion items, $F(1,42) = 0.009$, $p = 0.923$. There was, however, an observed difference in complex emotion scores based on group assignment, $F(1,42) = 5.630$, $p = 0.022$. There was no interaction of gender and group assignment on EPIQ total scores, $F(1,42) = 0.038$, $p = 0.847$.

DISCUSSION

The purpose of this study was to develop a new emotion recognition test that could be applied to adolescents with High-Functioning Autism (age thirteen to seventeen years old). Since adolescents spend more time than any other age group communicating via text message (the Nielson Company, 2010), using social media websites (Hampton, Sessions & Goulet, 2011), and online mediums (Derks, Grumbkow & Bos, 2008), the results of this study are particularly generalizable to an adolescent population who are likely exposed to emoticons more than any other age group.

It was hypothesized that normally developing adolescents would score significantly higher on the EPIQ compared to adolescents with poor social skills. These differences did manifest between groups for complex emotion scores, while basic emotion scores were not significantly different between groups. Baron-Cohen (2007) found that individuals with Autism were able to discern basic emotions similar to normally developing individuals. Moreover, Baron-Cohen relayed that using standardized faces to teach emotions to participants with Autism improved these participants' ability to identify emotions in other faces. Yet, the experimenters acknowledged that Autistic participants still experienced difficulty in identifying more complex emotions compared with normally developing participants, despite instruction with standardized faces. These differences between basic and complex emotion interpretation are apparent from the results of this experiment, even with use of emoticons instead of real human faces.

Significance and Implications

The main goal of this study was to establish the construct validity of the EPIQ as a tool for assessing emotional interpretation among normal and clinical populations. The results from the current study seem to provide preliminary support for the construct validity of the EPIQ as a

viable measure of emotion recognition skills. Emoticon faces seem to be an efficient tool for displaying basic and complex emotions, and score differences among participants suggest that the EPIQ is able to discern between varying levels of emotion interpretation using emoticons instead of real faces. There also appears to be no difference in EPIQ scores between males and females, regardless of assignment to the experimental or control conditions.

Specifically, the EPIQ utilizes six different emoticon faces across the entire test. Each face remains the same throughout the scale, and this allows individual participants to experience the same six faces throughout the test (as opposed to traditional emotion recognition tests). In this way, minimal attention is required to examine the details of each face beyond the first presentation. A participant could establish which emotion corresponds with a single face, and use this emoticon-emotion pairing towards recognizing subsequent emotions. Most importantly, this study demonstrates that both normally developing participants and those with poor social skills are able to identify complex emotions using multiple emoticons and that this process is consistent across groups; pairing two single emoticon faces together is sufficient for a normally developing person or a person with HFA/AD to identify a complex emotion. However, the percentage of correct responses on complex emotion items seems less for the experimental group overall compared to the control group .

Still, the most evident differences between groups come from complex emotion interpretation items on the EPIQ (items 13-58). Participants with marked emotion recognition deficits still show difficulty combining multiple emoticon faces to form one complex emotion compared to normally developing participants (as in traditional emotion recognition scales). It seems that interpretation of basic emoticons alone is insufficient for evaluation of an individual's emotional interpretation abilities using standardized faces. Interpreting complex emotions

through synthesis of multiple emoticons seems to be what separates higher and lower scores on the EPIQ.

Emotional Knowledge vs. Facial Interpretation

The EPIQ may assess "emotional knowledge" rather than an individual's ability to perceive emotions from the face. In Section A and B, participants are required to identify one basic emotion from one of six emoticon faces. In this task, both groups scored equally well, suggesting that knowledge of basic emotions (Sadness, Happiness, Disgust, Anger, Surprise, Sadness) is both readily available to either group and that these basic emotions are identifiable in the stimulus presented (See Table 1). However, it is unclear from Sections C, D, E, and F scores whether participants with poor social skills have applicable experience or knowledge of these complex emotions from their daily lives. Lower scores on the complex emotion items could imply that the participants in the experimental group are not as familiar with the hierarchy of emotions described by Ekman (1972), Plutchik (1980), and Parrott (2001) as participants in the control group.

DSM-IV diagnostic criteria for ASD does not identify delays in intellectual development different from normally developing individuals. Accordingly, individuals in the experimental groups should have comparable knowledge of vocabulary levels for complex emotion words as the control group, However, experimental participants may have limited experience with certain complex emotions (from social interactions with other people in their environment), and the vocabulary used on the EPIQ to describe complex emotion may not relate to applicable experience for these individuals. In essence, poor social skills could affect the amount of experience one has with specific emotions, and if experience with understanding the different

levels of emotions is limited, vocabulary associated with these complex levels of emotion will also be limited.

Thus, emotional knowledge is a factor that may be measured on the EPIQ rather than direct perception and interpretation of facial features. For questions in Section E, participants were presented with two emoticon faces and asked to identify one emotion that corresponds with both faces; these faces do not change throughout the EPIQ, but combining multiple faces together to form one complex emotion is a process that is unique to each participant. This process is likely based on each individual's existing knowledge of emotions. In other words, participants could be using personal experience, memories, and/or existing schemas of emotion to identify complex emotions. If this is the case, normally developing individuals have a practical advantage over individuals with poor social skills at combining emoticon faces because, at the time the EPIQ test is taken, normally developing individuals may have acquired a wealth of knowledge regarding the subtle levels within complex emotions. Individuals with poor social skills may only have developed limited emotional knowledge of these subtle qualities of complex emotion because they have not engaged in as many social interactions or observed as many faces as normally developing individuals. Less experience with complex emotions would likely lower EPIQ scores in the complex emotion sections for individuals in the experimental group.

Conclusion

Recent research suggests that complex emotions are displayed in the face using combinations of facial features from different basic emotion categories to create unique expressions of mood (Du, Tao & Martinez, 2013). The structure of the EPIQ generalizes this concept to emoticons; specifically, the EPIQ was designed to evaluate whether basic and complex emotions can be constructed from emotions. Each emoticon included in the EPIQ is

intended to represent one of six basic emotions that are universal to human facial expression (sadness, anger, fear, happiness, disgust, surprise). Multiple pairings of these emoticons can be understood as multiple pairings of basic emotions, which in turn can be interpreted as complex emotions. Consistency measurements for the EPIQ are good, suggesting that individuals identify specific complex emotions for specific pairings of emoticons across the scale. However, interpretation of these emoticon pairs draws largely from an individual's existing knowledge of emotions, not necessarily from the facial features of the emoticons themselves. Understanding of the abstract concept of each emotion seems to be what allows normally developing individuals to combine multiple emoticons together to form complex emotions. Individuals with HFA or poor social skills may have difficulty representing emotion as an abstract idea based on acquired knowledge, and these individuals may not be able to combine two basic emotions together to form a cohesive understanding of one complex emotion.

Adolescents with HFA/AD or poor social skills may not have the sufficient cognitive skills necessary to functionally combine multiple emoticons on the EPIQ into a representative complex emotion (items 31-58). This could explain the observed differences between the experimental and control groups (see Table 1). These individuals may also have difficulty identifying complex emotions from one emoticon (items 13-30). Whichever items are driving these differences between groups, it seems that complex emotion interpretation tasks still remain difficult for adolescents with poor social skills, despite use of emoticons in place of real faces. Nevertheless, the EPIQ test should demonstrate that the process of matching a complex emotion to an emoticon or combining emoticons together to form a complex emotion is difficult for adolescents with poor social skills; in either case, the EPIQ is detecting these differences.

The EPIQ could be used to help individuals with categorization of complex emotions into basic groups easier (i.e. participants may be better aided in establishing that a complex emotion belongs to the "angry" emoticon). The variations in features of real faces may be overwhelming for individuals with HFA/AD, and these individuals may struggle with interpreting human emotions on traditional emotion interpretation scales; the EPIQ allows these individuals to take existing knowledge of basic emotions and attempts to demonstrate a method for combining these emotions into more complex emotions. Future research is necessary to understand if this direction is possible.

In the future, emoticon faces may be paired together to represent complex emotions, and individuals with HFA/AD may increase their understanding of complex emotions through this process. In this way, resource specialists and mental health professionals might be able to teach adolescents with poor social skills which real facial features correspond to basic emoticons. Adolescents with HFA/AD may find it difficult to learn which combination of facial features corresponds to which basic or complex emotion because as children, they may not have constructed schemas for emotional processing from observing or experiencing emotions from other individuals in their environment (Piaget, 1975; Papert, 1993). Children with HFA/AD typically struggle with this type of "dirty" schema learning because of decreased eye contact and problems with early social interaction. As such, this type of holistic learning may not be appropriate for children with HFA/AD. A "clean" process of teaching emotional schemas, whereby individual facial features are isolated and then combined to construct meaningful and regimented emotions, may be a more appropriate learning tool for adolescents with HFA/AD.

If this method successfully allows these adolescents to improve their complex emotional interpretation skills, emoticons could be paired with real human faces in further instruction. Once

facial features in emoticons are paired with abstract emotions, it may be easier for adolescents with HFA/AD to pair similar facial features in real faces with the same abstract emotions learned previously. Schema learning in this manner has already been investigated, though not in adolescents (Du, Tao & Martinez, 2013; Golan, Baron-Cohen & Hill, 2006). This gradual learning process might be necessary for individuals with HFA/AD to group complex emotions into schemas (based on basic emotions) to learn which basic emotions combine to form which complex emotions.

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Emotional Perception and Interpretation Questionnaire

PLEASE CHOOSE ONLY ONE ANSWER FOR EACH QUESTION.

Question 1 of 58

Which emotion best represents the image seen here?

- Sadness
- Happiness
- Anger
- Fear
- Disgust
- Surprise

Question 2 of 58

Which emotion best represents the image seen here?

- Sadness
- Happiness
- Anger
- Fear
- Disgust
- Surprise

Question 3 of 58

Which emotion best represents the image seen here?

- Sadness
- Happiness
- Anger
- Fear
- Disgust
- Surprise

Which emotion best represents the image seen here?

- ○ Sadness
- ○ Happiness
- ○ Anger
- ○ Fear
- ○ Disgust
- ○ Surprise

Which emotion best represents the image seen here?

- ○ Sadness
- ○ Happiness
- ○ Anger
- ○ Fear
- ○ Disgust
- ○ Surprise

Which emotion best represents the image seen here?

- ○ Sadness
- ○ Happiness
- ○ Anger
- ○ Fear
- ○ Disgust
- ○ Surprise

Which image best represents the emotion "anger"?

1   2   3   4   5   6

○   ○   ○   ○   ○   ○
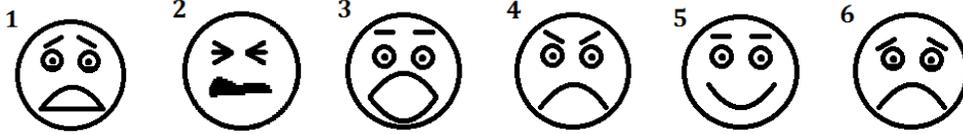
Which image best represents the emotion "sadness"?

1   2   3   4   5   6

○   ○   ○   ○   ○   ○
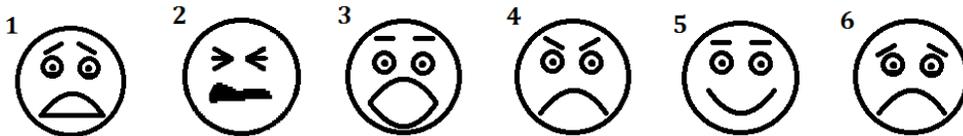
Which image best represents the emotion "fear"?

1   2   3   4   5   6

○   ○   ○   ○   ○   ○
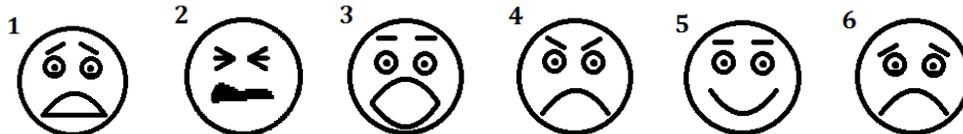
Which image best represents the emotion "disgust"?

1   2   3   4   5   6

○   ○   ○   ○   ○   ○
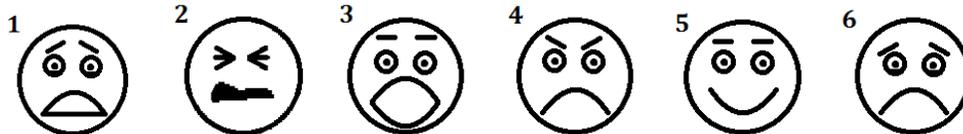
Which image best represents the emotion "happiness"?

1   2   3   4   5   6
○   ○   ○   ○   ○   ○
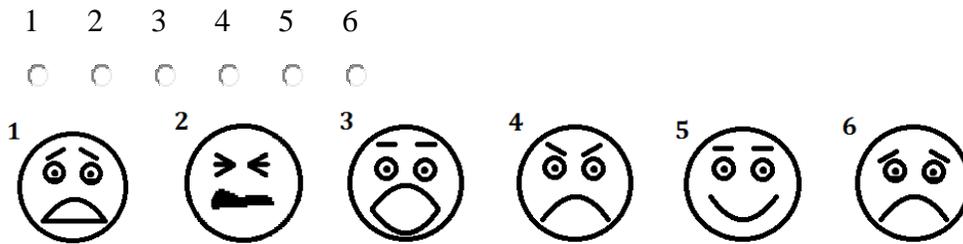
Which image best represents the emotion "surprise"?
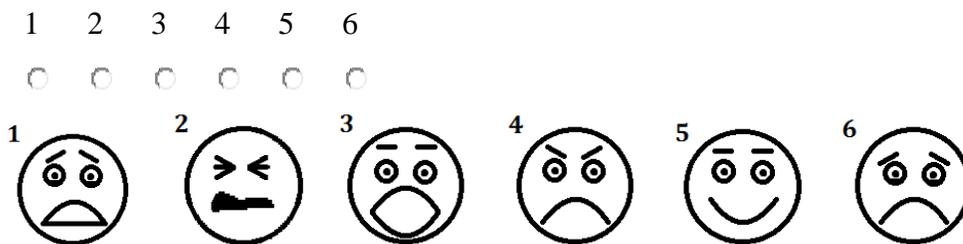
1   2   3   4   5   6
○   ○   ○   ○   ○   ○

Which emotion best represents the image seen here?

- ○ Amazed
- ○ Rage
- ○ Trust
- ○ Hopeless
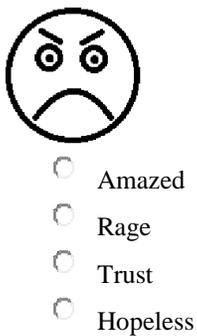
Which emotion best represents the image seen here?

- ○ Mad
- ○ Delight
- ○ Disappointed
- ○ Outrage

Question 15 of 58

Which emotion best represents the image seen here?

○ Amazed

○ Depressed

○ Trust

○ Sick

Question 16 of 58

Which emotion best represents the image seen here?

○ Rage

○ Frustrated

○ Cheerful

○ Worried

Question 17 of 58

Which emotion best represents the image seen here?

○ Worried

○ Delight

○ Embarrassed

○ Mad

Question 18 of 58

Which emotion best represents the image seen here?

○ Grossed Out

○ Amazed

○ Trust

○ Cheerful

Which emotion best represents the image seen here?

- ○ Hate
- ○ Sorry
- ○ Trust
- ○ Shocked

Question 20 of 58

Which emotion best represents the image seen here?

- ○ Hate
- ○ Delight
- ○ Amazed
- ○ Sick

Question 21 of 58

Which emotion best represents the image seen here?

- ○ Disappointed
- ○ Down
- ○ Shocked
- ○ Joy

Question 22 of 58

Which emotion best represents the image seen here?

- ○ Rage
- ○ Cheerful
- ○ Scared
- ○ Annoyed

Which image best represents the emotion "mad"?
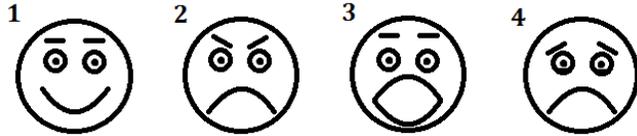
Question 24 of 58

Which image best represents the emotion "joy"?
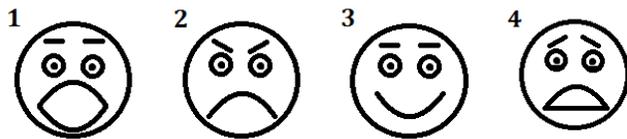
Question 25 of 58

Which image best represents the emotion "shocked"?
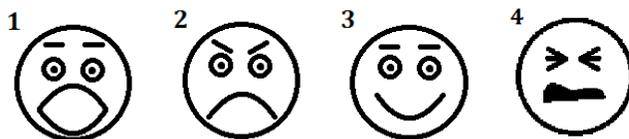
Question 26 of 58

Which image best represents the emotion "sorry"?
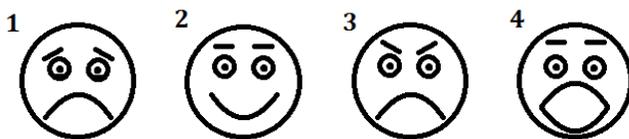
Which image best represents the emotion "depressed"?

1   2   3   4
○   ○   ○   ○
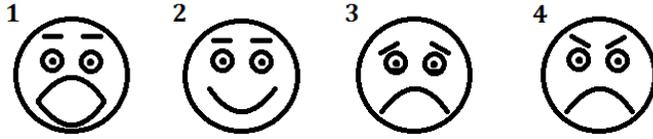
1   2   3   4

Question 28 of 58

Which image best represents the emotion "delight"?

1   2   3   4
○   ○   ○   ○
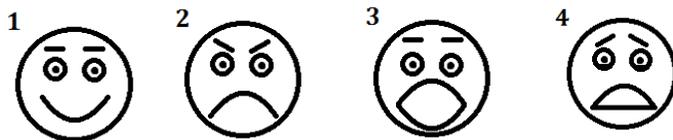
1   2   3   4

Question 29 of 58

Which image best represents the emotion "hate"?

1   2   3   4
○   ○   ○   ○
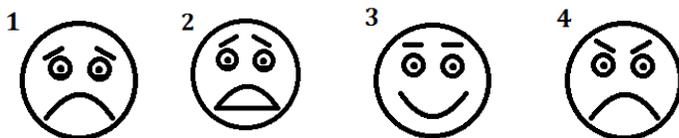
1   2   3   4

Question 30 of 58

Which image best represents the emotion "amazed"?

1   2   3   4
○   ○   ○   ○

1   2   3   4
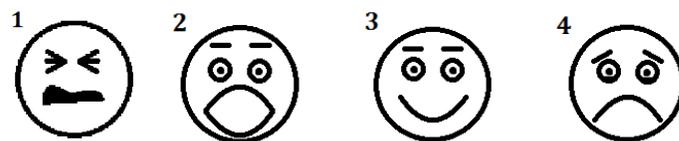
Which emotion best represents the two images shown?
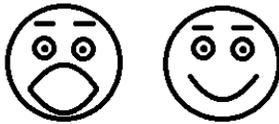
- Confused
- Delight
- Disgust
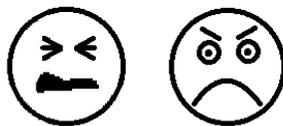- Rage

Question 32 of 58

Which emotion best represents the two images shown?
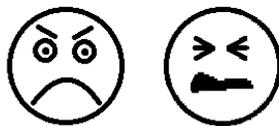
- Trust
- Amazed
- Embarrassed
- Joy

Question 33 of 58

Which emotion best represents the two images shown?

- Embarrassed
- Joy
- Cheerful
- Rage

Question 34 of 58

Which emotion best represents the two images shown?

- Relaxed
- Amazed
- Trust
- Disappointed

Which emotion best represents the two images shown?

○ Amazed

○ Frustrated

○ Relaxed

○ Delight

Question 36 of 58

Which emotion best represents the two images shown?

○ Scared

○ Annoyed

○ Love

○ Hate

Question 37 of 58

Which emotion best represents the two images shown?

○ Joy

○ Excited

○ Sorry

○ Insulted

Question 38 of 58

Which emotion best represents the two images shown?

○ Calm

○ Mad

○ Guilty

○ Delight

Which emotion best represents the two images shown?
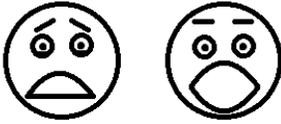
- Joy
- Scared
- Trust
- Rage

Question 40 of 58

Which emotion best represents the two images shown?

- Disappointed
- Hate
- Calm
- Love

Question 41 of 58

Which emotion best represents the two images shown?

- Delight
- Nervous
- Hate
- Glad

Question 42 of 58

Which emotion best represents the two images shown?

- Hopeless
- Calm
- Amazed
- Frightened

Which emotion best represents the two images shown?

- Trust
- Amazed
- Excited
- Worried

Which emotion best represents the two images shown?

- Rage
- Amazed
- Scared
- Calm

Which emotion best represents the two images shown?

- Careful
- Hope
- Outrage
- Sorry

Which emotion best represents the two images shown?

- Guilt
- Joy
- Calm
- Furious

Question 47 of 58

Martha feels embarrassed and depressed. What images best describe the two emotions she feels?

○   ○   ○   ○

1

2

3

4
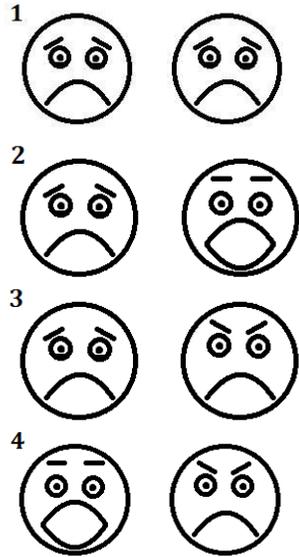
Question 48 of 58

Natasha was shocked and delighted. Which images best describe the two emotions she feels?

1   2   3   4

○   ○   ○   ○

1

2

3

4
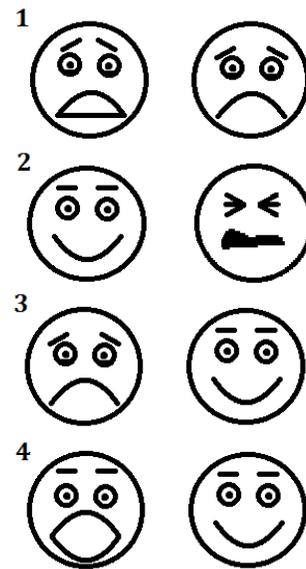
Question 49 of 58

Theresa felt worried and hopeless. What images best describe the two emotions Theresa feels?

1   2   3   4

○   ○   ○   ○

1

2

3

4
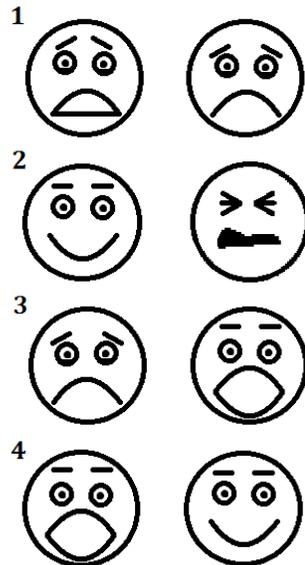
Question 50 of 58

Tom disliked his co-workers and thought they were nasty. What images best describe the two emotions Tom feels?

1   2   3   4

○   ○   ○   ○

1

2

3

4
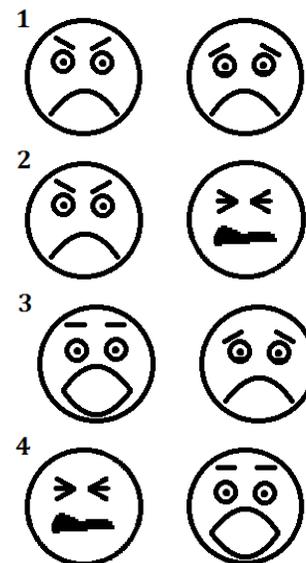
Gloria lost her temper and was embarrassed. What images best describe the two emotions Gloria feels?

1 2 3 4

○ ○ ○ ○

1

2

3

4
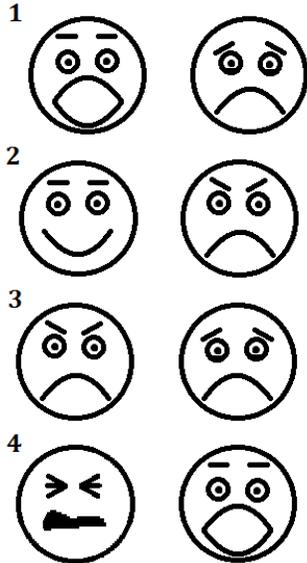
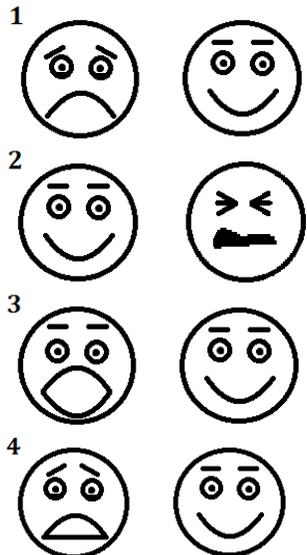Robert felt grossed out and nervous. What mages best describe the two emotions Robert feels?

1 2 3 4

○ ○ ○ ○

1

2

3

4
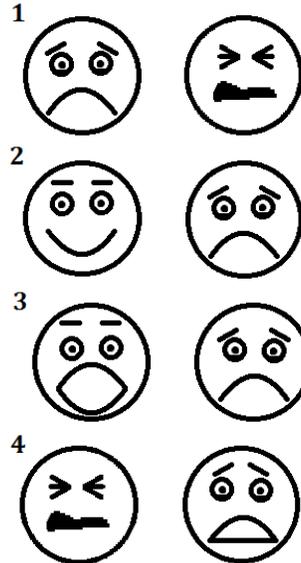
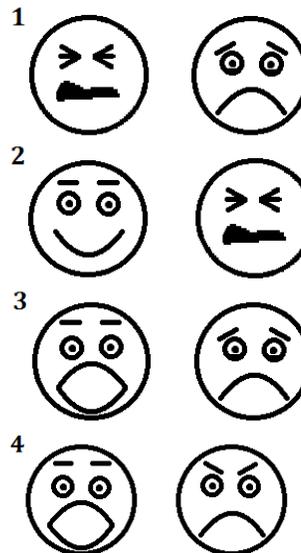Derrick felt worried and proud. What images best describe the two emotions Derrick feels?

1 2 3 4

○ ○ ○ ○

1

2

3

4

Keith felt confused and mad. What images best describe the two emotions he feels?
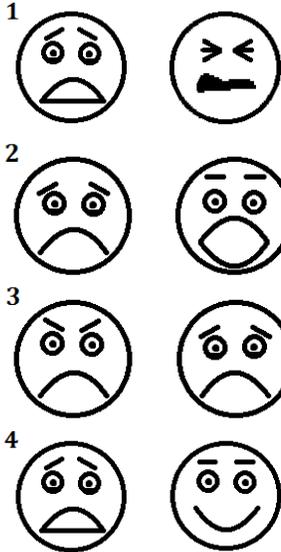
1 2 3 4

○ ○ ○ ○

1

2

3

4

Raymond felt mad and disappointed. What images best describe the two emotions he feels?
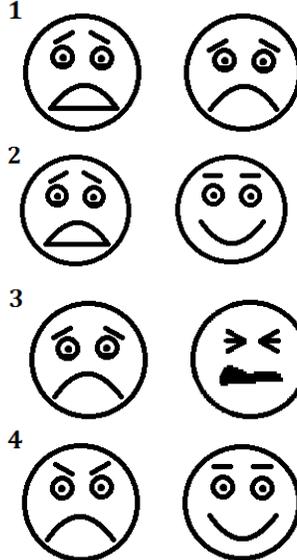
1	2	3	4
○	○	○	○

Fiona felt nervous and hopeful. What images best describe the two emotions she feels?

1	2	3	4
○	○	○	○

David felt sorry and shocked. What images best describe the two emotions he feels?
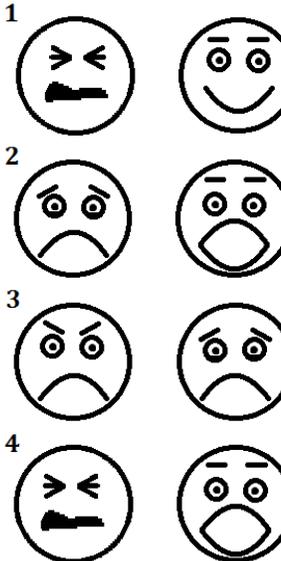
1	2	3	4
○	○	○	○

John felt scared and lost his temper. What images best describe the two emotions he feels?

1	2	3	4
○	○	○	○
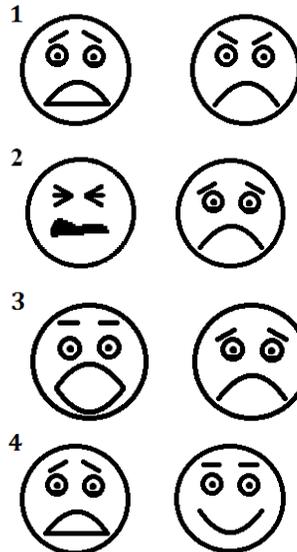
Table 1.

Raw EPIQ Scores and Significance by Group and Section.

	Basic Emotions			Complex Emotions					Total EPIQ Score
	Section A (1-6)	Section B (7-12)	Basic Emotions Subtotal	Section C (13-22)	Section D (23-30)	Section E (31-46)	Section F (47-58)	Complex Emotions Subtotal	
Control Group (*n = 24*)	*M* = 5.21 SD = 0.93	*M* = 5.75 SD = 0.53	*M* = 10.96 SD = 1.20	*M* = 9.79 SD = 0.51	*M* = 7.92* SD = 0.41	*M* = 14.79* SD = 1.06	*M* = 10.33* SD = 1.74	*M* = 42.83* SD = 2.81	*M* = 53.79* SD = 3.39
Exp. Group (n = 22)	*M* = 5.36 SD = 0.95	*M* = 5.41 SD = 0.67	*M* = 10.77 SD = 1.31	*M* = 9.5 SD = 0.74	*M* = 7.5* SD = 0.86	*M* = 13.14* SD = 2.78	*M* = 8.45* SD = 3.39	*M* = 38.59* SD = 6.45	*M* = 49.36* SD = 7.20

* indicates a significant difference in mean EPIQ scores between groups, p<0.05