

Facial Expression Recognition Deficits and Faulty Learning: Implications for Theoretical Models and Clinical Applications

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Abstract

The ability to recognize facial expressions of emotion is integral in social interaction. Although the importance of facial expression recognition is reflected in increased research interest as well as in popular culture, clinicians may know little about this topic. The purpose of this article is to discuss facial expression recognition literature from various fields that may be relevant to clinical formulations and applications. In addition to highlighting some of the findings relevant to particular psychological or psychiatric conditions, the authors discuss behavioral clinical implications and applications.

Keywords : facial expressions, behavioral model, emotion, social problems , psychological problems, psychiatric problems, clinical implications

The ability to recognize facial expressions of emotion is vital for effective social interaction. Facial expressions convey emotional cues (Adolphs, 2002, 2003; Darwin, 1872/1965; Ekman, 1992, 1993) and accurate recognition of these cues is a necessary step in the evaluation of interpersonal interactions and for the subsequent application of appropriate social skills (Collins & Nowicki, 2001; Hampson, van Anders, & Mullin, 2006; Philippot & Feldman, 1990). Research has shown support for the association between facial expression recognition (FER) abilities and social competency (Custrini & Feldman, 1989; Lancelot & Nowicki, 1997; Nowicki & Duke, 1994); relationship difficulties (Barth & Bastiani, 1997; Blair & Coles, 2000; Lancelot & Nowicki, 1997); and various psychological and psychiatric conditions (Blair et al., 2004; Penn & Combs, 2000; Russell, Chu & Phillips, 2006; Silver, Goodman, Knoll, & Isakov, 2004; van Beek & Dubas, 2008), including anxiety (Easter et al., 2005), bipolar disorder (Brotman et al., 2008), and psychopathology (Blair et al., 2004). Other studies have shown support for associations between FER deficits and childhood maltreatment (Pears & Fisher, 2005; Pollak, Cicchetti, Hornung, & Reed, 2000) and attachment (Cooley, 2005; Magai, Distel & Liker, 1995; Niedenthal, Brauer, Robin & Innes-Ker, 2002). According to emotions theorist Izard (2002), the inability to recognize nonverbal forms of emotion expression can negatively affect intra-and interpersonal behavior, and may serve as a risk factor for poor adjustment and future adverse outcomes.

Although the particular mechanisms underlying FER are under debate, the study of the ability to recognize facial expressions of emotion continues to be the subject of research within various fields, including psychology (Hall, 2006; Ekman, Friesen, & Tomkins, 1971; Nowicki & Carton, 1992), psychiatry (Herba & Phillips, 2004; Wang, Lee, Sigman, & Dapretto, 2007), as well as computer science and philosophy (Adolphs, 2002). Facial expression recognition research findings have been provided from varied perspectives, such as neuroscience (Wang et al., 2007); social-cognitive processing and early childhood experiences (Masten et al., 2008; Mullins & Duke, 2004; & Pollack & Sinha, 2000); as well as perception (Pollak, Messner, Kisler, & Cohn, 2009). Other researchers have integrated information from differing fields, such as social psychology and perception (Calder, Young, Keane, & Dean, 2000; Pollak et al., 2009) and behavior studies and neuroscience (Herba & Phillips, 2004). Thus, facial recognition research appears to be bridging some of the natural gaps caused by distinct fields of investigation.

The authors of this paper will attempt to present findings from FER studies that are particularly relevant for behavioral psychologists. Following a brief history of the study of FER, we highlight findings from various fields (e.g., social psychology, nonverbal processing), that focused on FER with particular clinical populations. Discussion of suggested clinical implications and applications from a clinical

behavioral perspective, and suggestions for future research directions, concludes this article on the importance of FER in clinical work.

History of Facial Expression Recognition Study

Current research and public interest in facial expression recognition stems from a rich history. Scientific study and understanding of emotion is thought to have begun in the 19th century with Charles Darwin's *The Expression of the Emotions in Man and Animals* (originally published in 1872) and G.G. Duchenne de Bologne's *The Mechanism of Human Facial Expression* (originally published in 1862) (Mayne & Bonanno, 2001). These early works focused on the important role of facial displays in emotional life and introduced the theory that emotions may be understood as biologically-based reflex behaviors serving adaptive functions. The Darwinian theory, that emotions serve to aid in survival and that facial expressions and other physiological responses serve to communicate intentions, was firmly rooted in the view of emotions as catalysts for physiological action.

More recent theorists "have begun to systematically link specific emotions to social functions" (Keltner & Haidt, 2001, p. 193). For example, Lazarus' (1991) theory of emotion emphasized the role of individual appraisal (such as how the impact of an event is evaluated in terms of self-concept and relationships) on the experience of emotion. How emotions are differentiated has been a "prominent recurrent question" (Frijda, 2004, p. 64). Izard's (1977, 1991) differential emotions theory posits that emotions have distinct neural substrates and facial configurations.

Facial expression recognition has been the topic of some special issues in academic journals (Happe, 2004), including *Behavior Modification* (Singh & Ellis, 1998). In this issue, Singh and Ellis presented several articles that provided research data on the FER ability of individuals with different clinical conditions. According to Singh and Ellis,

Understanding why some people have difficulty correctly recognizing the six basic facial expressions of emotion at a socially acceptable level is vital to helping them learn to interpret facial expressions accurately. The ultimate goal, being, of course, that we not only treat the underlying clinical disorders but also improve the quality of people's lives by enhancing their ability to engage fully in the human experience (p. 126).

Ekman (1992, 1993), known for decades of facial expression and emotion research, has made a case for the existence of basic emotions (e.g., fear, joy, sadness, anger, disgust, and surprise), which are recognizable in facial expressions. A popular television series, *Lie to Me: The Truth is Written All Over our Faces* is based on Ekman's scientific study of human facial expressions (www.fox.com/lietome). This TV hit focuses on and follows a scientist who studies facial expressions to uncover lies and truth in difficult legal cases. As well, Ekman's work has received attention from other media sources such as Time Magazine and he has several mainstream books in publication. Thus, the growing interest in the structural and functional properties of facial expressions as well as individuals' ability to recognize facial expressions is being demonstrated in mainstream popular culture and seems to parallel research interests in the topic.

Development of Facial Expression Recognition

To examine this increasingly recognized topic more deeply it is fitting to begin with the research on how facial recognition is thought to develop in childhood and throughout the life span. As well, the role of culture, class, gender and cognitive ability in FER is important to review. The following sections provide an overview of the literature on these topics.

Facial expression recognition ability tends to follow a developmental path, increasing in accuracy through experiences with others and cognitive development. The ability to identify emotions from facial expressions begins in infancy, and the ability to attach labels to basic emotions begins for most children by age 18 months (Bretherton, McNew, & Beeghly-Smith, 1981). Findings from cross-sectional studies have suggested that the recognition of certain emotions (happy, sad, and angry) improves to near-adult level by age 5 years. Although the ability to distinguish more sophisticated expressions (e.g., disgust and surprise) appears to develop later, most children are able to identify and label the basic emotions of happy and angry by approximately 3 years of age (Izard & Harris, 1995).

The precise mechanisms involved in the development and processes of facial expression recognition ability are unclear and continue to be the subjects of much research. However, there is evidence for the importance of both early childhood experiences (Gibb, Schofield, & Coles, 2009; Pollak & Singh, 2002) and the development of emotion processing neural systems (Herba & Phillips, 2004) in the development of facial expression recognition abilities. How individuals process nonverbal emotion expressions and how this processing may affect social interaction and behavior has been of increasing research interest since the 1990's (Crick & Dodge, 1994; Maxim, & Nowicki, 2003; Nowicki & Carton, 1992; Plesa-Skwerer, Faja, Schofield, Verbalis, Tager-Flusberg, 2006; Pollak, & Singh, 2002).

Childhood FER deficits are risk factors for ongoing relational difficulties. As Blair (2003) summarized in a literature review on the neural communication mechanisms involved in facial expression production and recognition,

Emotional expressions allow the rapid communication of valence information between individuals. They allow the observer to rapidly learn which behaviours and objects (including foods) to approach or avoid, as well as information allowing rapid modification of behaviour according to the social environment and hierarchy. Impairment in systems that respond to the emotional expressions of others can have devastating effects (p. 568).

According to Blair, development may be adversely affected by inadequate responding to others' emotional expressions (e.g., autism, psychopathy).

Effects of Culture, Gender, Cognitive Ability and Environment

Research studies examining the associations between cultural variables and FER have focused on the universality of recognition of facial displays of emotion, as well as cultural differences (Elfenbein & Ambady, 2002; Ekman, 1994; Matsumoto, 2006). According to researcher Matsumoto (2006), "Whereas we all recognize universal emotions at levels well beyond chance, there are cultural influences on the absolute levels of recognition accuracy and on judgments of intensity and internal subjective experience" (p. 230).

Recent research of cultural differences in facial expression recognition suggested that children from economically disadvantaged homes may develop emotion recognition abilities later than children from more advantaged homes; such deficits were also related to social adjustment (Fine, Izard, Mostow, Trentacosta, & Ackerman, 2003; Izard et al., 2001). However, this apparent link may relate to other variables, such as parental attention and involvement and environmental stress. For example, in a sample of African-American preschoolers living in high stress environments, Smith and Walden (1998) found greater accuracy for fearful expressions than was expected for this age group. They theorized that recognition of fear might have been particularly important in these high stress environments. Thus, "the environment in which children develop may bias children towards the identification of specific expressions" (Herba & Phillips, 2004, p. 4).

Facial expression recognition appears to have a mild association with gender, with females having a slight advantage over males in some studies, and no advantage in others (Herba, Landau, Russell, Ecker, & Phillips, 2006; Lancelot & Nowicki, 1997; Steele, Steele, Croft, 2008; see Hall, 1978 and McClure, 2000 for reviews). Research findings have suggested that gender may moderate the relationship between emotion recognition abilities and social adjustment. For example, in a sample of 39 children in residential care for psychological problems (aged 9-14 years), lower facial expression recognition was significantly correlated with greater externalizing problems (as rated by teachers) in girls, but not in boys (Lancelot & Nowicki). These researchers suggested that females, typically more interested in social relations than males, placed greater value on social skills. Thus, social deficits, resulting in externalizing behavior problems, posed greater problems for females, than for males (Lancelot & Nowicki).

Findings from a recent study focusing on processing speed as well as accuracy found that adult females exhibited faster processing speed in identifying adult facial emotion expressions, and that this difference was particularly apparent when identifying the negative emotions of sadness, fear, anger, and disgust (Hampson, van Anders, & Mullin, 2006). A female FER advantage was also found in a study investigating the recognition of emotion in infants' facial expressions. (Babchuk, Hames, & Thompson, 1985). Findings from the Babchuk et al. (1985) study suggested an evolutionary explanation for this female advantage. Thus, FER gender differences may relate to evolutionary development and/or social learning.

Facial expression recognition develops through childhood and adolescence, as does cognitive ability. However, these processes may develop differentially (see Herba & Phillips, 2004 for a review). Some studies have suggested a lack of relationship between FER and cognitive ability (Nowicki & Duke, 1994; Nowicki & Mitchell, 1998). The development of FER involves perceptual learning and experience with emotion. Thus, spatial attention and memory recall, as well as environmental emotion – related experiences, appear to contribute to children's ability to recognize emotions displayed in facial expressions (Pollak, Messner, Kistler, & Cohn, 2009).

Facial Expression Recognition and Social Problems

Having discussed the possible avenues by which FER ability develops, this discussion now turns to the literature on the problems that occur when facial expression recognition is inaccurate. In fact, a great deal of facial expression literature has examined the connection of FER to a host of social problems. Studies have investigated the relationship between FER abilities and childhood maltreatment (Camras, Grow, & Ribordy, 1983; During & McMahon, 1991; Pears & Fisher, 2005; Pollak, & Sinha, 2002; Wismer Fries, & Pollak, 2004); and attachment (Cooley, 2005; Steele, Steele, & Croft, 2008). As well, studies have investigated the relationship between FER abilities and various behavioral, mental and emotional disorders or problems (Blair & Coles, 2000; Blair et al. 2004; Easter, et al. 2005; Edwards, Jackson, & Pattison, 2002; Guyer, et al. 2007; Lancelot & Nowicki, 1997; Nowicki & Carton, 1997; Plesa-Skwere, Feja, Schofield, Verbalis, & Tager-Flusberg, 2006; Stevens, Charman, & Blair, 2001), including anxiety (Easter, et al. 2005; Manassis & Young, 2000; Melfsen & Florin, 2002; Mullins & Duke, 2004; Philippot & Douilliez, 2005); bipolar disorder (Brotman, et al. 2008; Guyer et al, 2007; Rich, et al. 2008); psychopathology (Blair and Coles, 2000; Blair, Colledge, Murray, & Mitchell, 2001); and schizophrenia (Fullam & Dolan, 2006; Mandal, Pradey, & Prasad, 1998). Some of these studies are discussed in the following sections.

Facial Expression Recognition and Maltreatment

Researchers have found associations between FER and early maltreatment (childhood abuse and/or neglect) (Camras, Grow, & Ribordy, 1988; Masten et al., 2008; Pears & Fisher, 2005; Pollack, Cicchetti, Hornung, & Reed, 2000). Studies that compared groups of maltreated and nonmaltreated

children, found maltreated children to have lower emotion recognition accuracy (Camras, Grow, & Ribordy, 1983; During & McMahon, 1991; Pears & Fisher, 2005; Pollak, Cicchetti, Hornung, & Reed, 2000; Pollak, & Sinha, 2002). For example, Pears & Fisher, (2005) examined FER in 60 children (aged 3-5 years) with histories of maltreatment and 31 children without such histories. They found significant between groups differences; the maltreatment group displayed overall FER deficits. This significant finding was maintained, even when controlling for age and intelligence. Additional studies found that children with maltreatment histories compared to children without such histories were less accurate in the recognition of facial displays of emotions (Camras, Grow & Ribordy, 1988; Wismer Fries, & Pollak, 2004) In addition, Camras et al. found that children with histories of abuse were rated by teachers as less socially competent than their peers, suggesting that the social difficulties exhibited by these children may be linked with FER deficits.

Theorizing that particular types of childhood maltreatment predisposed individuals to deficits in the recognition of specific emotions, Pollak, Cicchetti, Hornung, and Reed (2000) examined FER accuracy for specific emotions. They found that children with physical abuse histories displayed a misattribution bias for the recognition of anger. They discussed this finding as an early adaptive strategy developed by children who grew up with violence. Because facial expressions of anger conveyed threat and early recognition of these anger cues could be important, these children may have become sensitized to or vigilant for facial expressions of anger. Pollack et al (2000) suggested, "For the physically abused child, displays of anger may be the strongest predictor of threat; however, increased sensitivity to anger could result in decreased attention to other emotional cues" (p. 679).

In this same study, Pollak et al. (2000) found that children with histories of neglect were less able to discriminate emotional expressions than either children with physical abuse histories or a control group. In a different study, children who had experienced early deprivation in institutional orphanages also appeared to have deficits in emotion recognition (Wismer Fries, & Pollak, 2004). As a group, they were inaccurate when attempting to identify happy, sad, and fearful expressions. Overall FER deficits in children with histories of neglect may be related to minimal interaction with caretakers. Thus, these children may have had little opportunity to observe and integrate facial expressions of emotion. In summary, researchers and theorists have posited that FER deficits may arise as early adaptive strategies adopted by infants reared in impoverished or traumatizing environments (During & McMahon, 1991; Hodgins & Belch, 2000).

Facial Expression Recognition and Attachment

Interested in how individuals with varying attachment styles organize and regulate emotions and behavior, some attachment researchers began to investigate how individuals perceive and process emotionally salient information. A few studies have examined the relationship between FER and attachment patterns, styles, or disorders (Cooley, 2005; Magai, Hunziker, Mesias, & Culver, 2000; Magai, Distel, & Liker, 1995; Fraley, Niedenthal, Marks, Brumbaugh, & Vicary, 2006; Niedenthal, Brauer, Robin, & Innes-Ker, 2002; Steele, Steele, & Croft, 2008).

For example, a recent study explored FER abilities of children with secure versus insecure attachment (Steele, Steele, & Croft, 2008). Infant-mother attachment (secure vs. insecure) was assessed in infancy, and FER was assessed five years later. At age 6 years, children rated as having insecure attachments were more likely to misidentify facial expressions of emotion than were children rated as having secure attachments. Specifically, the researchers found that children who had insecure-resistant attachments in infancy were less accurate than children with either secure or insecure-avoidant infant attachments in the recognition of happy. The researchers theorized that the organization of infants' working models of attachment include templates of facial expressions seen and experienced by infants in the first year of life. Thus, facial expression recognition deficits or biases may persist through time and continue to influence interactions and relationships.

Attachment researchers theorized that facial recognition abilities began as adaptive strategies learned during early attachment relationships. For the child living in an unpredictable and/or violent home, being able to anticipate threats (i.e., subtle changes in facial expressions) may be an adaptive survival strategy. From an attachment theory framework, infants learn strategies to manage attachment processes and distress. Infants with avoidant attachment may learn to minimize expected aversive (or painful) outcomes by distancing themselves from the source (attachment figure) of the expected pain (Bowlby, 1969, 1982). Thus, avoidant attachment may include a lack of attention for the negative emotions displayed via facial expressions. Support for this was found in a study of infant secure versus avoidant attachment (Koulomzin, et al. 2002). In addition, researchers Ainsworth, Blehar, Waters, and Wall (1978) found that the adaptive style of the avoidant infant “biases her or him somewhat away from the mother’s face” (p. 17). This behavior may result in deficits in facial expression recognition.

In studies with adults, some researchers have found associations between adult attachment styles and FER (Fraleley, Niedenthal, Marks, Brumbaugh, & Vicary, 2006; Magai, Distel, & Liker, 1995; Niedenthal, Brauer, Robin & Innes-Ker, 2002). Specifically, Magai et al. (1995) found that secure attachment was associated with better overall accuracy, avoidant attachment was associated with general FER deficits, and anxious attachment was associated with a particular deficit in the ability to recognize anger. Fraley et al. (2006) examined the relationship between attachment styles and FER accuracy in terms of sensitivity. Using computerized facial expressions that gradually morphed from neutral expressions to one of three facial expressions (happiness, sadness, or angry), participants indicated the point at which they recognized the emotion expression and then labeled the emotion. They found that anxious attachment was associated with faster recognition times (sensitivity) and with poorer recognition accuracy. However, facial recognition accuracy increased for this group when participants were instructed to wait longer (as long as those in the secure group) to identify the emotion. Based on this finding, Fraley et al. theorized that FER deficits in individuals with anxious attachment styles may be related to a heightened vigilance for emotion cues, as well as a tendency to make premature (and inaccurate) emotion judgments. It appears from the aforementioned studies related to maltreatment and attachment that FER is affected by the social learning environment and may be used in managing that environment.

Facial Expression Recognition and Behavioral or Psychological Problems

As facial expressions serve as cues for understanding others’ experiences and for subsequent application of social behaviors, research has shown that social behaviors may be associated with or mediated by FER abilities (Marsh, Kozak, & Ambady, 2007; Philippot & Feldman, 1990). Further, research studies have shown associations between specific deficits and particular psychological conditions. Findings from studies that investigate FER in relation to psychological conditions may enable researchers and clinicians to learn more about how FER deficits may impact social, emotional and behavioral disturbances within these psychological and psychiatric conditions.

Schizophrenia

Impairment in the recognition of emotions via facial expressions in individuals with schizophrenia is well-documented (Borad, Martin, Alpert, Brozgold, & Welkowitz, 1993; Bozikas, Kosmidis, Anezoulaki, Giannakou, & Karavatos, 2004; Dougherty, Barlett, & Izard, 1974; Fullam & Dolan, 2006; Kohler, et al. 2003; Mandal, Pradey, & Prasad, 1998; Meyer & Kurtz, 2009; Wölwer, Streit, Polzer, & Gaebel, 1996), and this impairment is considered a component of poor social functioning (Hooker & Park, 2002). The FER impairment in schizophrenia appears to affect individuals’ ability to interpret most emotions from facial expressions, a few studies have found deficits in the ability to interpret specific (i.e., sad and fearful) facial displays of emotion (see Fullam & Dolan, 2006 and Meyer & Kurtz, 2009 for reviews).

Researchers have been interested in understanding more about how the misinterpretation of emotional and social cues may contribute to the functional manifestations of schizophrenia (e.g. misinterpretation of facial expression cues may have a role in social avoidance, the formation of delusions, occupational difficulties, etc.) (Johnston, Katsikitis, & Carr, 2001). In addition, researchers have been interested in the relationship between FER and neurocognitive processing, investigating the possibility that FER may represent a generalized deficit in the perceptual processing of faces (Salem, Kring, & Kerr, 1996; Johnston et al., 2001) or a specific deficit in the processing of emotional stimuli (Borod, Martin, Alpert, Brozgold, & Welkowitz, 1993), and whether FER may be related to the general neurocognitive impairment in schizophrenia (Bozikas, Kosmidis, Anezoulaki, Giannakou, & Karavatos, 2004; Kohler et al., 2003). For example, Bozikas et al. (2004) investigated the relationship between FER and basic neurocognitive processes in 35 individuals with schizophrenia and found associations between FER and executive functioning measures. Extending this research, Meyer and Kurtz (2009) found that FER mediated the relationship between attention and social skill, and explained variance “beyond that accounted for by elementary neurocognitive functions more generally” (p. 178). Thus, research findings have suggested that there are complex relationships between FER, specific neurocognitive processes, and social functioning in individuals with schizophrenia.

Social Anxiety

Several research studies have found associations between FER abilities and anxiety disorders (Easter et al., 2005; Melfsen & Florin, 2002; Mullins & Duke, 2004; Silva, Allan, Beauchamp, Maschauer, & Wokman, 2006; Simonian, Beidel, Turner, Burkes, & Long, 2001; Winton, Clark, & Edelmann, 1995), and others have not (Manassis & Young, 2000; Philippot & Douilliez, 2005). Recent research with specific types of anxiety disorders, suggests that continued precision in participant selection may enable researchers to understand more about the apparent discrepancies in results. One area of recent research interest is that of FER and social anxiety.

According to cognitive models of social anxiety, situational anxiety interferes with processing ability (Mullins & Duke, 2004). Experiencing social anxiety, would then predict increased errors in FER. Studies have had mixed findings. For example, increased social anxiety (experimentally induced) was associated with FER deficits (Veljaca & Rapee, 1998; Winton, Clark, & Edelman, 1995); specifically, individuals with social anxiety tended to demonstrate a negative bias, identifying positive and neutral facial expressions as negative when experiencing heightened anxiety. Although two other studies found FER deficits in children with social anxiety (McClure & Nowicki, 2001, Simonian, Beidel, Turner, Burkes, & Long, 2001), a recent study with female undergraduates did not (Mullins & Duke, 2004).

Research in this area is fairly recent, and some researchers have theorized that varied findings may relate to methodological differences in the study of FER and social anxiety. Studies that have assessed the amount of time it took to make attributions have suggested that FER difficulties may be related to slower processing. Melfsen and Florin (2002) investigated the relationship between FER and social anxiety in a group of children aged 8 - 10 years. The group with social anxiety and a control group were shown facial expressions (happy, sad, angry, disgusted, and neutral) and were instructed to select whether each expression was positive, negative, or neutral. Although the researchers did not find significant differences in the FER accuracy between socially anxious and nonanxious children, they found that the socially anxious group performed more slowly and tended to attribute more emotion to neutral expressions. Similarly, Mullins and Duke (2004) proposed that

A tentative explanation, based on our study, would be that socially anxious individuals process nonverbal information more slowly than nonanxious individuals. The consequences of slower processing time may be subtle, but noticeable, differences in social performances that lead to unpleasant encounters. Repeated exposure to clumsy and

unnerving social encounters will lead to anxious anticipation and avoidance of subsequent encounters (p. 29).

Bipolar Disorder

Due to the psychosocial impairments often exhibited by individuals with bipolar disorder, research studies have investigated FER in individuals with this condition (Bozikas, Tonia, Fokas, Karavatos, & Kosmidis, 2006; Getz, Shear & Strakowski, 2003; Guyer et al., 2007; McClure, Pope, Hoberman, Pine, & Leibenluft, 2003). Facial expression recognition deficits in adults with bipolar disorder have been well documented, and findings suggest that such deficits are not specific to the recognition of particular emotions (Bozikas et al., 2006; Getz et al., 2003). Recently, studies have examined FER in children and adolescents with bipolar disorder (McClure et al., 2003; Rich et al., 2008). Findings from these studies suggested that compared to controls, youth with bipolar disorder needed significantly more intensity/emotional information to identify facial expressions of emotion (Brotman et al., 2006; Rich et al., 2008), made more FER errors (McClure et al., 2005), and FER deficits were exhibited across emotions (Brotman et al., 2008). However, some studies have reported misattribution trends. For example, one study found that youth with bipolar disorder tended to exhibit negative misattribution biases, identifying neutral expressions as hostile (Rich et al., 2006), and a different study found that youth with bipolar disorder tended to exhibit negative attribution biases (i.e., misinterpretation of happy, sad, and fearful expressions as angry) when viewing photographs of children's faces, but exhibited no such biases when viewing adults' facial expressions (McClure et al., 2003).

Guyer et al. (2007) examined the FER abilities of various psychiatric disorders in 252 children and adolescents aged 7-18 years with various psychiatric disorders. Using a standardized FER measure consisting of photographs of adult and child facial expressions, Guyer et al. found that those with bipolar disorder and those with severe mood dysregulation each displayed FER deficits when compared to those with depressive disorders, attention-deficit/hyperactivity and/or conduct disorder, and controls.

Using a different FER measure, Brotman et al. (2008) investigated FER abilities among youth with bipolar disorder, at risk of bipolar disorder, and with no disorder. The FER measure, a computerized program that presented facial expressions that morphed from neutral to emotion expressions, allowed for examination of the amount of emotional intensity required for facial recognition. The researchers found that both the group with bipolar disorder and the group at risk for bipolar disorder exhibited significant and nonspecific FER deficits, and that they required significantly greater intensity of emotion to recognize facial expressions of emotion. In summary, individuals with bipolar disorder appear to have FER deficits that may be related to inadequate social interactions, as well as to dysfunctional neural circuitry (Guyer et al., 2007).

Psychopathy

Findings from several research studies of psychopathy suggested that facial expression recognition deficits and biases are important influences in the social problems exhibited by individuals high in psychopathy (Blair & Coles, 2000; Stevens, Charman, & Blair, 2001). These individuals, known to lack empathy and exhibit insensitivity to others' experiences and feelings, exhibited facial expression recognition deficits. For example, among a group of 37 participants (aged 9-15 years) with severe behavioral and emotional difficulties, those with high pathology scores demonstrated less FER accuracy than those with low pathology scores; in particular, the group of high pathology scorers was significantly less likely to accurately identify sad and fearful facial expressions (Stevens et al., 2001). It may be that the lack of ability to recognize sadness and fear contributes to a lack of empathy or that insensitivity prevents these individuals from attending to or interpreting facial expressions.

Similarly, among a group of 55 adolescents (aged 11-14 years) attending mainstream school in London, Blair and Coles (2000) found that participants with higher levels of affective-interpersonal disturbance and impulsive behavior/conduct problems, as determined by elevated scores on the Psychopathy Screening Device (PSD), were less likely to recognize sad and fearful facial expressions than those with non-elevated PSD scores. Regression analysis with PSD score as the dependent variable suggested that only when emotion recognition scores of sad and fearful were added to a model that included mental age and other emotions (happy, surprise, disgust, and anger) did the model reach significance; the final model explained 35% of the variance in PSD scores. The researchers discussed these results as predicted by the Violence Inhibition Mechanism (VIM; Blair, 1995). According to Blair and Coles (2000), “disruption to a neurocognitive system that processes sad and fearful expressions can lead to antisocial behavioural problems” (p. 431). Although in normal childhood development, sad and fearful facial expressions function as punishments for behaviors that caused them (e.g., a parent displays a fearful facial expression upon seeing a child climb onto a counter), children who are less sensitive to these expressions will be less punished by them, and therefore less apt to refrain from the behaviors. Blair’s VIM model integrates information from neurocognitive studies as well as behavioral principles.

Findings of the relationship between a deficit in the recognition of sad facial expressions and psychopathology were also supported in subsequent studies (Blair et al., 2004; Hastings, Tangney, & Stuewig, 2008; Woodworth & Waschbusch, 2008). For example, in a study with a prison sample, a high pathology group compared to a lower pathology group exhibited significantly more facial expression recognition difficulty in overall accuracy, with specific deficits in the recognition of both sad and happy expressions (Hastings, Tangney, & Stuewig, 2008).

In summary, findings from FER studies investigating associations between FER and psychopathy, and other clinical conditions discussed previously, have provided support for the importance of FER. In the following section the authors apply a behavioral perspective to some of the literature described above. The behavioral critiques and possible interpretations of the existing literature will be discussed, with a particular focus on the functional aspects of recognizing emotion in facial expressions.

Behavioral Perspective

Many fields within the social sciences have studied and emphasized the importance of the ability to interpret facial expressions and use them to provide non-verbal information about emotions. Behaviorists may be critical of this research because it is based on the assumption of the existence of several hypothetical constructs and mentalist terms that are not operationally defined nor directly observable and measurable. When researchers state that facial expressions provide non-verbal information about emotions they seem to be implying that emotions are some internal force unlike behavior, which we cannot directly observe. Behaviorists would instead view facial expressions as a form of emotional behavior that can be operationally defined, observed and measured. For example, to accurately identify the emotion of happy the person would look at the facial expression of smiling and say happy. Thus, the facial expression of smiling is considered an emotional behavior. Non-behaviorists would want them to conclude that the emotion of happy is much more than just smiling. Behaviorists would agree that happy is a class of behaviors of which smiling is but one form. In addition, because the function of behavior is of prime interest/importance to behaviorists, theories that emphasize the functional aspects of facial recognition may be most appealing. As is clear in the theoretical formulations made by researchers in the previously discussed studies, the functional significance of FER is important.

Although researchers and theorists vary in the import applied to facial expressions as displays of emotion versus functional signals, there is a view of facial expressions that does not make the assumptions that either the recipient consciously interprets the meaning of the expression made by the sender or that these facial expressions need to be classified as representing underlying “emotions.” One such view, the Behavioral Ecology View (Fridlund, 1986, 1991; see Fernandez-Dols, 1999 and Fridlund

& Russell, 2006 for reviews), considers facial expressions to be simply signals that cue the actions of others. There is support in evolutionary theory for this view in that these displays must benefit both the sender and receiver and attention to these displays would co-evolve “only if those displays provided mutually beneficial signals of contingent future action” (Fridlund & Russell, 2006, p.310).

Another objection from the behavioral ecology view to research that makes the assumption that FER provides the recipient with non-verbal information about emotions is that the human face is certainly not a completely and continuously open representation of the internal state of the signaler. Phylogeny would dictate that indicators of internal emotional states would be edited and extinguished to serve the signaler, for purposes of social appropriateness, social deviance, efficient and privacy. Thus, only facial expressions that serve the signaler in gaining something desirable (i.e., employment, the trust of a confidant, the favor of a lover, etc.) or avoiding something aversive (i.e., conflict, rejection, danger, etc.) would survive.

Still another objection is that much research on the recognition of facial expressions is conducted using posed facial displays in isolation. Accurate interpretation would most likely depend on motive of the signaler and context in which the emotion was displayed. According to Fridlund (1991), “the preponderance of the evidence suggests faces serve social motives regardless of emotional state” (p. 77). For example, for a particular facial display, fear may be interpreted in one context and anger in a different context. While the signaler may be experiencing the emotion of fear, the facial display may signal anger because the motive is to ward off the threat of potential danger.

Much research on the recognition of facial expressions documents that children from abusive homes show deficits in FER (Camras, Grow, & Ribordy, 1988; Wismer Fries, & Pollak, 2004). Rather than viewing these as deficits of cognitive constructs such as “appraisal processes”, “preverbal memories” or “internal working models” as many attachment theorists might, behaviorists would define these deficits as faulty learning. In other words, certain facial expressions have either: 1) not been modeled or imitated or 2) been discriminative stimuli (Sd) for the delivery of reinforcement or punishment. For example, a facial expression that would typically be viewed by most people as sad behavior is viewed instead as angry behavior. Thus, this angry behavior may serve as an Sd for an aggressive response that will be negatively reinforced by resulting in the removal of the aversive stimulus (the person with angry behavior walks away).

FER deficits may be considered by behaviorists to be responses to Sd for punishment that signal the occasion for avoidance responses. These learned responses are negatively reinforced in that, for example, they aid children in the avoidance of abuse or similar aversive situations. As such, these children are not exhibiting patterns of behavior as a result of “cognitive distortions” but because of an observable pattern of reinforcement history. According to the behavioral model, children with “insecure attachment” may be more likely to exhibit avoidance behaviors and thus these children will be afforded few opportunities to attend to, observe and correctly identify facial signals. With this avoidance by the child or because of abusive and/or neglectful parents or both, there were also probably fewer conversations about facial expressions as a component of emotional behavior than in the typical household. For example, the parent and child may not have experienced conversations in which the mother said, “You hurt Johnny’s feelings. See how sad he looks. Please say you’re sorry” or “Sally sure looks angry. Maybe you better give her back her toy.” Thus, rather than “insecure attachment” being a construct that explains why children having “working models of attachment” or “templates of facial expressions”, it may be that the same learning experiences that result in exhibiting behaviors that make them appear “insecurely attached” also result in inaccuracies in identifying facial signals.

In summary, several researchers and theorists emphasize the functional relevance of facial expressions. One perspective, the behavioral ecology view, considers facial expressions to be simply signals that cue the actions of others rather than assuming the existence of emotions as underlying facial

expressions, that facial expressions do not provide unedited representation of internal motives or feelings, and that the signals received are context-specific and based on learning history. Accurate identification of facial expressions (by the recipient) as a component of emotional behavior (by the signaler) in behavioral terms means that facial expressions (as the Sd) provide signals to the receiver of the type of response that will be differentially reinforced or punished. This means that the individual who receives the signal will react in such a way as to gain reinforcement or to avoid punishment based on the individual's learning history. As such, behaviorists might suggest that individuals would benefit from interventions that enhance signal detection based on context and correction of faulty learning through the use of Sds, reinforcement, modeling, feedback and practice.

Summary

Although it appears from numerous studies that although FER improves as an aspect of development for some individuals, this has not been the case for all individuals. The presented findings suggest that for individuals with certain psychiatric conditions, as well as for individuals who have histories of maltreatment, the ability to recognize emotion from facial expressions may be impaired. For individuals with deficits or biases in the ability to recognize emotion from facial expressions, there may be corresponding social impairments. For example, FER abilities for a particular emotion (e.g., anger) may be underdeveloped in an adolescent with a history of neglect. In this case, it might be important to assess the effect this skill deficit might have and how this information could guide treatment interventions. The FER skill deficit (recognition of anger in facial expressions) may impact the individual's behaviors with teachers, family members, and peers. Not recognizing the angry facial expression as a cue, this individual may not learn to modify his/her behavior and may behave in ways that others see as disrespectful. This, in turn, may affect how others behave toward him/her. Similarly, when one individual in a dyad (i.e., parent/child) exhibits a FER skill deficit for recognizing sadness in facial expressions, the other individual may view him/her as insensitive, uncaring, or unresponsive.

Facial expression recognition may be affected by attention, motivation, and bias. Some studies suggested that heightened vigilance to certain emotion cues may predispose individuals to make erroneous interpretations of facial expressions. In one such study, compared to other attachment classifications, participants with anxious attachment exhibited faster recognition times as well as poorer accuracy for FER (Fraleigh, Niedenthal, Marks, Brumbaugh, & Vicary, 2006). However, instructing participants (rated as having anxious attachment) to wait longer before interpreting facial expressions resulted in improved accuracy. Koulomzin et al. (2002) also illustrated the importance of attention and personal salience in their study with avoidant attachment in infants, as they found that infants with avoidant attachment styles with FER deficits tended to turn their gaze away from caretakers' faces.

Although precisely how FER develops remains unclear and continues to be the subject of research studies, there is compelling evidence for the importance of early childhood socialization experiences (Gibb, Schofield, & Coles, 2009; Pollak & Sinha, 2002) and the development of emotion processing neural systems (Herba & Phillips, 2004) in the ability to recognize emotion from facial expressions. There are several different theoretical conceptualizations held by the various researchers who study FER. Although many emphasize an aspect of emotion, most views include a functional or social perspective of the development and processes involved in FER. The behavioral ecology view may be most closely aligned with behavioral theories in that there is not the assumption of underlying emotions. Nonetheless, these views do not need to be considered mutually exclusive. Perhaps facial expressions have both emotional (expressive) and social functions (see Fernandez-Dols, 1999 and Fridlund & Russell, 2006 for reviews on the behavior ecology view).

Understanding more about aspects of FER, such as how development occurs, what neurocognitive processes may be involved, and how FER abilities and deficits contribute to psychosocial functioning will have important clinical implications. As is the case with many areas of research, various

fields of study make valuable contributions to increasing understanding of complex processes. Although necessarily brief, this discussion of the recognition of emotion via facial expressions highlights the relationship between FER and various psychological or psychiatric conditions, and concludes with consideration of some clinical implications and treatment recommendations for FER in clinical practice, and implications for future research.

Clinical Implications

Assessment

Although numerous studies have reported associations between FER ability and social functioning, few have focused on treatment (Russell, Chu, & Phillips, 2006). Social skills training does not necessarily include specific training in the recognition of facial expressions. In fact, there may be an underlying assumption in the client's ability to recognize facial expressions. Because social competency relies upon accurate recognition of emotion, it seems important to assess this ability prior to developing interventions. Proper assessment of these recognition skills enables clinician to develop individualized intervention plans.

Dynamic interaction between assessment and treatment

Standardized assessments, including the previously mentioned instruments as well as recently published computerized measures (see Silver and Oakes, 2001 and Ekman, 2003), are available for brief clinical assessment. Many instruments include photographs of specific emotions, and some include these emotions displayed with varied intensity. Many of these instruments have been tested and revised to increase reliability and validity. Computerized training instruments include assessment as well as educational information (e.g., corrective feedback) aimed toward increasing participants' FER skill.

There may also be benefits in performing in-vivo assessments of clients' abilities and possible biases. Clinicians are aware of the importance of nonverbal communication, and regularly use their abilities in facial expression recognition. For example, noting discrepancies in a client's facial expression and statements (e.g., appearing angry while reporting to feel happy and calm) and observing responses to others' facial expressions (e.g., a client appearing angry in response to a parent's expression of sadness) may inform responses and interventions. In addition to observing clients' apparent responses to facial expressions of emotion, clinicians may also begin understanding how clients perceive or interpret facial expressions by asking them. This type of inquiry is not uncommon in clinical work focused on enhancing communication with dyads. For example, when discussing an emotion-laden event with a parent and teenager, clinicians may ask how one is interpreting the facial expression of the other. Through this process, clinicians can gain a clearer understanding of particular interpretive biases that are affecting dyadic communication. Asking clients how they perceive the facial expressions of another also allows for correction.

Attention, motivation, and bias

Aspects of assessing FER that may be relevant to subsequent interventions are attention, motivation, and bias. Attention plays a large role in the acquisition of FER skills, and may be related to motivation. By attending to a stimulus (i.e., facial expression), the individual receives valuable information that may be used for subsequent direction of action. Selective attention, via eye gaze, is used in the acquisition of facial expression recognition, and may be an avenue of intervention to improve this ability. Particularly for individuals who have learned gaze avoidance as a strategy to limit distress, interventions aimed toward limiting gaze avoidance could benefit attempts to improve facial expression recognition.

Another aspect of attention that clinicians may evaluate is whether clients appear to have general attention problems or have attention difficulties specific to emotion communication or nonverbal information. Having this information may inform intervention. For example, perhaps a client has more facility to attending to vocally expressed information. In this case, interventions may include verbalizing emotional expressions as they are matched with facial expressions. Clinicians may also evaluate clients' attention in terms of eye contact or gaze. Perhaps diminished eye contact or gaze is a factor in a client's ability to recognize emotion from facial expressions. In this case, interventions may include strategies to promote or increase eye gaze.

Behaviorists realize the importance of motivation in learning new skills. When developing FER assessments or interventions, clinicians may use this knowledge to shape learning. In a small, randomized controlled trial to examine the effect of a computer program to improve emotion recognition and prediction in individuals with autism or Asperger syndrome, improvement reaching significance was found in the areas that focused on predicting emotions and emotion recognition of cartoon expressions. However, there was not significant improvement in the recognition of emotion from photographs. The researchers noted that this lack of improvement suggested a limitation of the program (i.e., unclear discrimination of certain emotions in the photographs). However, it may also be because individuals with autism are more likely to be interested in cartoon faces than human faces. Understanding this, clinicians could begin interventions with cartoon faces and gradually and purposefully pair familiar human faces with these cartoons, and then progress to unfamiliar faces. There is some research evidence that, in general, familiarity improves FER (Herba, Landau, Russell, Ecker, & Phillips, 2006). Including photographs of familiar people, such as parents or partners, as they display emotion expressions, could be useful in motivating clients.

Understanding the role of bias or specific FER deficits (e.g., misattribution of anger to facial displays of sadness, poor ability to recognize anger in facial expressions) may increase clinicians' understanding of client's social skills impairments and enable them to develop individualized treatment interventions. Understanding a client has a poor ability to recognize sadness or fear in facial expressions, for example, suggests that his/her social interactions are affected by this deficits. Facial expression recognition may also reflect information that is personally salient to an individual. For example, in individual who is sensitive to rejection or who has a strong need to belong may exhibit biases in FER. Indeed, studies found that sensitivity to rejection seemed to promote FER bias (Downey & Feldman, 1996; Downey, Freitas, Michaelis, & Khouri, 1998).

Clinical Interventions

Since rapid development of *emotion knowledge* (abilities in discriminating emotions and understanding the emotions in context, e.g., Izard et al., 2001) occurs around the ages of 4 and 5 years, interventions may be beneficial at this time (Sullivan, Bennett, Carpenter, & Lewis, 2008). Sullivan et al. (2008) suggested that interventions for this age group include "structured opportunities to discriminate and become sensitive to emotion expression in context" (p. 305). Providing photos of facial expressions and brief video clips of interactions including facial displays of emotion, the clinician may be able to assess the client's abilities in this area, and identify specific areas for intervention. For example, individuals found to have general FER deficits (such as those found in some children with histories of neglect), may benefit from increased exposure to emotion expressions and their labels. Individuals with deficits in the recognition of particular emotions, however, may benefit from interventions targeted on these emotions. Interventions may require additional strategies, such as providing reinforcement for one or all of the following: directing the gaze of his/her eyes to the photo and maintaining this gaze, asking the child to make the same expression, imitating the targeted facial expressions, and asking the child to tell a story that may result in this emotion.

Although there appear to be periods of critical development, FER development does not appear to be limited to these periods. In fact, Herba & Phillips' (2004) literature review of emotion expression recognition and neurological development in normal and psychiatric populations integrated information from various studies, and concluded that, "Overall, results indicate a continued development of the recognition of emotional expressions into adolescence and adulthood, particularly of the more subtle aspects of this process, including speed of processing" (p. 1195).

Behavioral Interventions

The behavioral literature is replete with evidence of the efficacy of using techniques such as modeling, prompting, and reinforcement in educational settings (Alberto & Troutman, 2006), in everyday life (Austin & Carr, 2000), for children with ADHD (Barkley, 2006), for individuals with schizophrenia (Bellack, 2007); for children with behavior problems (Bellack, Hersen & Kazdin, 1990), for weight control problems (Lebow, 1991); for parent training (Schaefer & Briesmeister, 1998), and for individuals with developmental disabilities (Thompson & Iwata, 2005), to name just a few. Thus, individuals with deficits in facial expression deficits are likely to respond well to reinforcement, in the form of verbal praise, physical contact (i.e., hand shake, high fives), tokens (i.e., points that can be traded in for money, toys, gift certificates, etc.) or special activities (i.e., outings, movies, shopping) contingent upon attending to and accurately identifying facial expressions.

Clinicians should consider the impact that specific contingencies may have on clients, particularly regarding attention. For example, Penn and Combs (2000) found that the FER skills of persons with schizophrenia improved with either contingent monetary reinforcement or use of facial feedback. However, participants who received both reinforcements actually performed worse on an emotion discrimination task at post-test. The researchers suggested that combined reinforcement (having participants focus on imitating facial expression and on receiving monetary contingent reinforcement) might have prevented participants from attending to the emotion discrimination task. Therefore, it is important to consider the ramifications of too many treatment elements at once due to the potential for distraction.

Cognitive Behavioral Methods

Cognitive behavioral methods also show promise as ways to promote FER improvement. The procedures of reinforcement, modeling, role-playing, and self-evaluating have been used in social skills instruction (Kendall, 1993; Smith, 2002) and could be easily applied to training in facial expression recognition. Meichenbaum and Goodman (1971) demonstrated the importance of using self-instructional training along with modeling when using these cognitive-behavioral strategies with children who had problems with impulsive behavior. They modeled how to "think out loud" and evaluate the outcome of their own behavior, as well as teaching the children to use these strategies. Other researchers have used cognitive-behavioral techniques with adolescents with behavior disorders (Etscheidt, 1991) and children who are aggressive, hyperactive or impulsive (Lochman, Nelson, & Sims, 1981; Robinson, Smith, Miller, & Brownell, 1999; Smith, Siegel, O'Connor, & Thomas, 1994).

Cognitive remediation alone, however, may not result in FER improvement. For example, in a study with individuals with schizophrenia that compared the effectiveness of a cognitive remediation program with a FER training program improvement was associated only with FER training; there was no significant FER improvement in the cognitive remediation group (Wölwer et al., 2005). Although there were significant effects of cognitive remediation (i.e., improved verbal memory), these effects did not result in improved FER. Wölwer et al. suggested that to improve FER in individuals with schizophrenia, specialized programs that target FER would be more beneficial interventions than cognitive retaining programs.

Instructional Methods

Instructional methods developed specifically for improving the ability to recognize emotions from facial expressions may be beneficial as well. For example, using a computerized training program originally developed for children with autism (Emotional Trainer; e.g., Silver & Oakes, 2001) to investigate the effect of emotion training on the FER of individuals with schizophrenia, researchers found that brief training was effective (Silver, Goodman, Knoll, & Isakov, 2004). This pilot study with 20 male participants with chronic schizophrenia found that emotion training was associated with significant improvement in FER, but was not associated with changes in cognitive functions. According to Silver et al. (2004), these findings suggest that FER may represent emotion processing that may be distinct or separate from other cognitive functions. Individuals who appear to have heightened sensitivity for certain facial expressions (e.g., misattribution of anger to neutral or sad expressions) may benefit from interventions aimed toward increasing sensitivity to other expressions, such as happy, sad, or fearful expressions.

Modeling, Imitation, and Role-playing

Clinicians could model the interpretation of facial expressions (“Those protruding lips and eyes gazing downward make her look like she is sad.”) as well as the appropriate response (“Maybe I could ask her if she’s okay and offer to do something for her.”). Imitation and role-playing gives clients the opportunity to practice new skills and to receive feedback in a safe environment. Clinicians can model or role-play the interpretation of facial expressions and appropriate responding to those exhibiting the expressions with their clients individually or in groups. Incorporating perspective taking and narratives in order to broaden individuals’ repertoire of expression recognition may be beneficial adjuncts to specific FER training.

Examples of Facial Expression Recognition Treatment

As is recommended and customary for clinical interventions, strategies aimed toward improving FER should be client-centered and individualized. Often, clinicians know of or learn about standardized programs that may be individualized to meet their client’s treatment needs. Examples of such programs are now discussed.

A program developed for children at-risk for conduct problems, the “Tools for Getting Along Approach”, used modeling, feedback, and both guided and independent practice (in both pairs and small groups) to help elementary students to manage anger and aggression (Conduct Problems Research Group, 1999). One component of the approach involved teaching students to recognize their own and others’ anger in facial expressions, voice intonation and body language. A second component was the use of self-statements, beginning with overt and leading to covert statements, to cue themselves as to how to respond. In doing so, they trained themselves to be their own coaches in situations in which their own and others’ anger leads to disruptive and aggressive behavior. Students also used self-reinforcement (a self-administered point system) as part of a “Tool Kit” to reward themselves for practicing their new skills independently at school and in their homes to promote generalization. Although anger recognition was just a small part of this program, and anger was the only targeted emotion, the same methods could be used as a model for the training and generalization of improved FER abilities.

Computer-based FER training has shown some effectiveness in improving participants’ ability to correctly identify emotion expressions displayed by the face. This discussion includes brief descriptions of three of these programs and provides references for additional information. This is not meant to be an exhaustive list of possibilities, but rather, a highlighting of potential sources for computer-based FER training.

The Emotion Trainer (e.g., Silver & Oakes, 2001), a multimedia computer program, was developed to improve FER in individuals with autism (Silver & Oakes) and has been adapted for use with individuals with schizophrenia (Silver, Goodman, Knoll, & Isakov, 2004). Overall, these studies found that training was effective in improving FER accuracy. The program is interactive and includes corrective feedback. Using a small, randomized controlled design (with two groups of 11 children aged 12-18 years), Silver and Oakes found that with 10 sessions of training, the autism group improved in recognizing emotions in cartoon but not human faces. In their study with 20 male hospitalized individuals with schizophrenia, Silver et al. (2004), found that 3 sessions of training with an adapted version of the Emotion Trainer resulted in FER improvement.

A different computer program, a brief micro-expression training tool (METT; Ekman, 2002), was found to be effective in improving FER accuracy in individuals with schizophrenia. According to Russell, Chu, & Phillips (2006), the METT was also available for training police in the United Kingdom. The training is a computerized, self-administered instrument that provides instruction about the differences in facial expressions and correction feedback. Russell et al. suggested that training programs such as the METT could be useful adjuncts to clinical therapy. Ekman (2003) reported that large increases in accuracy were attained from brief training (less than one hour).

Other computer programs used in research studies include still photographs of human facial expressions without corrective feedback. These programs could be used and adapted for clinical practice. For example, the face emotion identification task (FEIT; Kerr & Neale, 1993), which consists of photographs of six facial expressions (happy, sad, angry, afraid, surprised, and ashamed) was used in combination with two behavioral contingencies (monetary rewards and facial imitation) in Penn and Combs' (2000) study with 40 hospitalized individuals with schizophrenia. As noted previously, the use of either contingency appeared to be effective. Another instrument, The Diagnostic Analysis of Nonverbal Accuracy 2 (DANVA 2; Nowicki, 2000; Nowicki & Duke, 1994) has been used to assess FER, as well as vocal tones and postures, in several studies (Maxim & Nowicki, 2003; Nowicki & Carton, 1992, 1993). This program includes both adult and child facial expressions for happy, sad, angry, and fearful, as well as for low and high intensity facial expressions. As with the FEIT, the DANVA could be adapted for use in clinical practice. For example, the training can begin with the use of photos and move to recognition in natural contexts.

As outlined in this section, there are many treatment options available to clinicians, specifically to clinical behaviorists when working with clients to assess or improve FER. Given the importance of this topic, behaviorists and other clinicians need to be informed and aware of the problems created by inaccurate recognition of emotions in facial expressions and the potential for intervention to improve this skill.

Directions for Future Research

As the authors have attempted to demonstrate, integrating knowledge from various research fields will enhance understanding of FER development and processes, as well as enable researchers to investigate the relevant correlates of FER deficits. It is important to gain understanding of the dynamic relationship between the ways individuals perceive or interpret facial expressions of emotions (or have simply learned to respond to social signals) and the quality and types of interactions they have. How this relationship influences psychological or psychiatric disturbances continues to be investigated, and contributions from several fields should increase clinicians' abilities to intervene more effectively.

In addition, several researchers (Silver, Goodman, Knoll, & Isakov, 2004; Russell, Chu, & Phillips, 2006) noted that a gap in our current knowledge of the potential benefits of computer-assisted facial recognition training is information regarding the generalizability of improved assessment performance. Gaining more knowledge from research efforts aimed toward improving generalizability

and more precise determination of the functional correlates of FER holds promise for future clinical application.

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