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A teaching procedure to help children with Autistic Spectrum

Disorder to label emotions

Kevin Conallen & Phil Reed

Swansea University

Address for correspondence: Phil Reed,

Department of Psychology,

Swansea University,

Singleton Park,

Swansea, SA2 8PP. U.K.

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Abstract

This study explored a teaching procedure designed to enable children with Autistic Spectrum Disorder (ASD) to label (tact) the emotions of others. Ten children, aged between 6.1 and 9.6 years, were taught the relevant vocabulary to label a set of emotions (e.g., *happy*, *sad*, *angry*), to match these tacts to illustrated situations, to generalize these tacts to novel situations, and to tact their own emotions. At baseline, participants showed no ability to match emotion cards to situations in which those emotions would occur. Participants were taught to tact these emotions by first matching-to-sample the facial expressions of *happy*, *sad* and *angry* to illustrations of situations which reflected each emotion. This was followed by a tacting phase, during which participants were taught to match emotion cards to particular situation cards. In the first of two generalization probes, participants were able to tact *happy*, *sad*, or *angry* when shown untrained situation cards (probe 1), and could choose those things that made them *happy*, *sad* or *angry* from an additional set of untrained illustrations (probe 2), showing an improved understanding of their own *emotions* and those of other, than was found during baseline.

Key words: emotions, tacting, private events, ASD

Children with Autism Spectrum Disorder (ASD) are often thought to have significant difficulty understanding emotion (Baron-Cohen, Golan, & Ashwin, 2009; Hobson, Ouston, & Lee, 1989; Uljarevic & Hamilton, 2013). In addition, learning emotion-language presents a challenge to these individuals (Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001; Lartseva, Dijkstra, & Buitelaar, 2014). The difficulties that children with ASD can face when attempting to label (tact) emotions can affect their ability to understand the emotions and private events of others (Baron-Cohen et al., 2001; Hobson et al., 1989). An ability to recognize and label the emotions of others is also important as it contributes to the development of a wide range of social and emotional competences in young children, such as the ability to form friendships and understand social interactions (Bauminger & Kasari, 2000; Losh & Capps, 2006), as well as reducing externalizing or disruptive behavior (Conallen & Reed, 2012; Koegel, Koegel & Surratt, 1992), improving mental health and well-being (Baker, Montgomery & Abramson, 2009), and providing an indicator of future academic success (Raver & Knitzer, 2002; Robins & Rutter, 1990).

Improvements in language ability can improve the ability of children with ASD to take the perspective of others and understand emotions (Steel, Joseph, & Tager-Flusberg, 2003; Williams et al., 2008), which may help to alleviate some of the associated difficulties noted above (see Koegel et al., 1992). Although children with ASD can show an ability to talk about their own emotions and those of others (Losh & Capps, 2006; Tager-Flusberg, 1992), they are often limited by their lack of mastery of the semantics and pragmatics related to the terms for these emotional states (Baron-Cohen, 2000; Hale & Tager-Flusberg, 2003; Lohmann & Tomasello, 2003). As a result, individuals with ASD can benefit from targeted instruction to learn to talk about emotions; from naming a feeling to expressing specific feelings in words

(Brown, Morris, Nida, & Baker-Ward, 2012; Capps, Yirmiya, & Sigman, 1992; Wainer & Ingersoll, 2011; Williams, Gray, & Tonge, 2012). The exploration of a procedure to teach children with ASD to label (tact) the emotions of others is the focus of this study.

Attempts to teach children with ASD emotional awareness and improve their understanding of the impact that emotions can have on social interactions have received attention in curricula for children with special needs. A number of curricula have attempted to address this need; for example, the use of social stories (Gray, 2006; Howley & Arnold, 2005), rating systems (Buron & Curtis, 2003; Jaffee & Gardner, 2006), speech and language approaches (Schroeder, 1996; Sonders, 2003), school-based peer modelling (Ingersoll & Schreibman, 2006), and interactive therapy-based approaches (Faherty, 2000). There does not seem to be a particular developmental level during which such approaches may be most appropriate, at least not one that has been clearly identified.

However, while many of these approaches attempt to enhance understanding of emotions and social situations by those with ASD, they do not always attempt specifically to teach a vocabulary for emotions. For example, while Social Stories have been used to promote emotional vocabulary for pupils who have hearing impairments (Richels, Bobzien, Raver, Schwartz, Hester, & Reed, 2014), there are few, if any, such documented uses of this intervention for individuals with ASD. Rather, interventions for people with ASD tend to focus on nonverbal recognition of emotions in others, often using computer-based technology (e.g., Silver & Oakes, 2001; see Ramdoss, Machalicek, Rispoli, Mulloy, Lang, & O'Reilly, 2012, for a review), and not teaching a specific vocabulary for emotions. This latter skill is often

thought to be missing or impaired in children with ASD (Baron-Cohen et al., 2001; Lartseva et al., 2014).

When teaching children with ASD to label (tact) emotions, it is often necessary to explicitly teach the relevant vocabulary for such emotions based on their public correlates, such as the behavioral expression or display of such emotion, before a generative use for the label (tact) for those emotions can be applied (see Conallen & Reed, 2012). In this study, children with ASD, who have been taught the relevant vocabulary to tact private events, were taught to label expression cards representing basic and commonly observed emotions (e.g., happy, sad, angry). These particular emotions were chosen as they represent some of the most basic and universal emotions (Ekman, 1989), and have been noted as important in previous research with this population (Gross, 2004). Following this teaching, participants were then taught to tact these emotions in response to situations involving other children, thereby, aiming to teach the children with ASD to tact the private event of others. The instruction was followed by two generalization probes, during which time the children with ASD were asked to tact the private event of another person in a novel situation, and name things that made themselves happy, sad, and angry. The first probe was designed to assess whether the ability to tact the private events of others, once shaped, could be easily generalized to novel situations that had not been taught. The aim of the second probe was to test whether the teaching procedure would generalize to being able to use the labels taught for others' emotions in order to label things that made the participants themselves have particular emotions. Given the paucity of data relating to teaching this skill, an individual multiple baseline design was thought to be the most effective way of studying this topic to establish the feasibility of such teaching

approaches through single subject design before any group comparisons were conducted.

Method

Participants

Ten children (8 male and 2 female), between the ages of 6.1 and 9.6 (mean age = 7.2 years) participated in this study. All of the children had been diagnosed with autism, by an independent Pediatrician, using the DSM-IV-TR criteria (APA, 2000), and they also had a statement of special educational needs from an Educational psychologist independent from this study, including reference to ASD. The participants had Gilliam Autism Rating Scale II (GARS-II; Gilliam, 1995) quotients of between 68 and 111 (scale mean = 100 [average autistic severity], standard deviation = 15). See Table 1 for the characteristics of the children. These data suggest that, while all participants had a diagnosis of ASD, some of the participants displayed only mild symptoms of ASD as measured by the GARS-II.

 Table 1 about here

All of the children communicated through the use of a picture symbol system, and had some manual signs in their repertoires. The participants had reasonable receptive language skills as assessed by the lead instructor, in that they could correctly respond to over 85% of the instructions given to them by the instructor. Expressive language skills had been taught previously, and all participants were using multiple-word phrases using the picture symbol or manual systems. These complex utterances using the picture exchange scheme included agent/action/object phrases

and conceptual language. Six of the children also had some limited vocal verbal repertoires to mand (request) and tact (label). However, none of the children would initiate an interaction with another child without prompting (i.e., none would respond to a request or statement made by another outside of the therapy context), and participants typically ignored the attempts of classmates and peers to engage them in even the simplest forms of interaction (e.g., eye contact). Spontaneous social language remained infrequent, and was limited to: greetings, “*thank you*“, and “*please*“, with occasional question asking. None of the children had tacted other age-appropriate *private events* (e.g., “*I’m tired*“, or “*I’m happy*“).

All the participants were receiving home-based instruction based on the principles of applied behavior analysis (ABA), and which were designed as a component program of the CABAS® systems approach to education (see Greer, 2002). This intervention also included part-time mainstream or special education school placements. Students 1, 2, and 3 were in full-time special schools; Students 4, 5, 6, 7, and 8 were in school for a three-hour morning session; and Students 9 and 10 attended a two-hour afternoon session. The ABA program was conducted as usual in these settings.

Ethical approval for this study was granted by the joint University College London/University College Hospital London Ethics Committee, and the Swansea University Psychology Ethics Committee. Consent for participation in the study was obtained from the parents of the children who were involved as participants.

Setting and Materials

A teacher with a minimum of one year’s experience teaching in ABA home programs always ran the sessions and was supervised by a senior Behavior Analyst.

Sessions were conducted by the teacher who was also the child's regular ABA therapist, twice per day, five days per week, each emotion-teaching session lasted about 20 min, and the data was collected by the teacher and the supervising behavior analyst. The program lasted until particular mastery criteria had been satisfied (see below), but the mean number of sessions given was 42.0 (\pm 8.98; range 22-55). The teacher delivering the procedure worked from a set of instructions regarding the procedures to be followed in order to promote adherence to the protocol and treatment fidelity.

The research was conducted in the participant's homes, and was designed to be fully integrated into their home-based ABA programs. Typically, each room where the training was conducted contained a work table, and a set of chairs, program materials, and a book case, on which toys and reinforcers were clearly displayed in transparent bins, labelled with picture symbols identifying what materials were contained in each box.

 Figure 1 about here

A set of laminated 2 x 2 inch cards, each with a drawing of a boy's face for either: happy, sad, or angry, modified from the Black Sheep Press®, Pragmatics 1: Emotions, were used for these 'expression cards (see top panel of Figure 1 for some examples). These stimuli have been validated and used extensively in previous teaching and research settings for emotions. These emotions were included as the participants had previously been taught to use these cards and were familiar with them. They also seemed to represent important basic emotions (Ekman, 1989) that would be helpful to label in many settings (Conallen & Reed, 2012; Gross, 2004).

There were also a number of situation cards, each representing a simple line drawing of a context that could be labelled as producing one of the three emotions (i.e., happy, sad, or angry). Happy situations included situation cards for: 'It's the boy's birthday', 'The boy's friends have come to play', 'Mummy bought the boy a puppy', and 'He did well in school'. Sad situations cards included drawing for: 'His friends won't let him play', 'His sister is being horrible to him', 'He fell and hurt himself', and 'His balloon burst'. Angry situations included representations for: 'Someone broke his pencils', 'Someone drew on his drawing', 'Someone walked on his sand castle', and 'Someone ate all the sweeties'. Some examples of these are shown in the bottom panel of Figure 1.

Procedure

A multiple-baseline procedure followed by generalization probes to assess the effectiveness of the procedure across novel settings was used in this study.

Baseline - Tacting the Private Event of Others (A)

During each session of the baseline phase, participants were presented with 20 trials. During each trial, three situation cards were placed on the table in front of the participant. There was one card from each type of situation. These cards were chosen randomly for each trial, with the exception that each card representing each of the three situations was presented 5 times. Once the situation cards were presented, the participant was given one expression card (either happy, sad, or angry) that represented one of the emotions depicted in the situation cards. These expression cards were selected randomly for each trial, with the exception that each emotion was selected at least 6 times during a session. The participant was asked to place the

emotion card on the situation card that it represented using signs and vocal requests appropriate to that participant. If the participant placed the expression card on the situation card that depicted that emotion, then the participant was scored as correct. If the expression card was placed on the situation card that was inappropriate, or no response was made in 10s, then the participant was scored as incorrect. Following this, the situation cards were removed, and a 5s inter-trial interval (ITI) ensued, and the next trial commenced. No feedback was given during this phase.

Prompted Match-to-Sample (B)

During the teaching phase of match-to-sample, the procedure described above was continued; that is, three situation cards were on view, and the participant had to match an expression card that they were given to one of the three situation cards. However, two additional procedures were introduced for this teaching phase – a prompting procedure and praise feedback for a correct response. A gestural prompt guiding the expression card to the correct situation card, along with a verbal prompt (e.g., “*put the happy face with the boy who is having his birthday*”), was provided for all participants on each trial. The verbal prompt was used to help condition the listener-response to both the expression tact and that of the situation, which would be required during the tacting phase. To be scored correct, following the prompt, the participant was required to place the expression card on top of the appropriate situation card. If the expression card was correctly matched to a situation card, the child was reinforced with verbal instructive praise (e.g., “*well done, the boy is happy because it’s his birthday!*”). A response was incorrect if the expression card was placed on an inappropriate situation card, or if no response was emitted within 10s. No correction procedure was adopted. Following each trial, there was a 5s ITI. Each

session comprised 20 trials, and the teaching phase was maintained until three consecutive sessions at 100% correct was achieved.

Independent Match-to-Sample (C)

During the independent match-to-sample phase, the verbal-gestural prompt was discontinued, and the participants were required to match the expression card to one of the three situation cards on display without the prompt assistance. If the expression card was correctly matched to a situation card, the child was reinforced with verbal instructive praise (e.g., “*well done, the boy is happy because it’s his birthday!*”). An incorrect response was defined as not matching-to-sample expressions with target situations correctly, or not making a response within 10s. No correction procedure was adopted. There were 20 trials per session, with an ITI of 5s, and this phase was maintained until three consecutive sessions at 100% correct was achieved.

Tacting the Private Events of Others (D)

The tacting phase (D) followed the independent match-to-sample phase. There were 20 trials in each of these sessions. In this phase, three emotion cards, one each for happy, sad, and angry, that were used in Phase A, B, and C, were presented to the participants, along with three cards depicting non-emotions (e.g., items) which were used as irrelevant stimuli. These were chosen at random for each trial. The participant was then shown one situation card representing one of the three emotions. The situation cards were presented in a random order, with the exception that there were at least 6 presentations of situation cards from each emotion. They were then asked, by sign and verbal request appropriate to the child, to tact the private event

represented by the situation card by presenting the emotion card that matched the situation card to the instructor. Each presentation of a situation card was also accompanied by a verbal cue. For happy, these cues included: “*it’s his birthday, how does he feel?*”, “*his friends have come to play, how does he feel?*”, “*mummy has brought home a puppy, how does he feel?*”, and “*he did well at school, how does he feel?*”. Sad antecedents included: “*his friends won’t let him play, how does he feel?*”, “*his sister is being horrible to him, how does he feel?*”, “*he fell and hurt himself, how does he feel?*”, and “*his balloon burst, how does he feel?*”. For angry, antecedents included: “*someone broke all of his pencils, how does he feel?*”, “*someone drew all over his picture, how does he feel?*”, “*someone walked on his sand castle, how does he feel?*”, and “*someone ate all of the sweets, how does he feel?*”. In order to be scored correct, participants were required to choose from the happy, sad and angry expression cards that they had, and to exchange them with the instructor in reply to the question. The teacher’s response for correct matching was to reinforce the behavior with a full echoic description of the match (e.g., “*the boy is happy because it’s his birthday, or the boy is sad because the balloon burst*”, etc.). An incorrect response was defined as presenting an expression card that did not match the situation, offering an irrelevant response (e.g., a picture card that was not a facial expression), or emitting no response. No correction procedure was adopted. The teaching phase was maintained until three consecutive sessions of 100% correct was achieved.

Maintenance Assessment (A)

During this phase, the baseline conditions were re-introduced, and the participants were presented with 20 trials per session, during which the three situation

cards (one each for happy, sad, and angry) were presented simultaneously. The participants were then asked by sign and verbal request to place the expression card that they had been given on top of the appropriate situation card. The expression cards were given to the participants in a random order from trial to trial, with the exception that each emotion was presented at least 6 times during a session. No feedback was given during this phase. This phase was employed to assess the degree to which the taught behaviors had been established and would be maintained without reinforcement. This phase continued for 4 sessions.

Generalization Probe 1 – Untrained Situations

This generalization probe tested participants' ability to label novel situation cards using novel expression cards. During this probe, a set of untrained happy, sad, and angry situation cards were employed. These were simple line drawings representing different situations that could be labelled as producing happy, sad, or angry feelings. There were four new situation cards for each of the three emotions, which were for sad: 'The other children are laughing him', 'His friend is ignored him', 'His brother broke his toy', and 'No one liked his drawing'; for angry: 'Someone pushed in front of him in the line', 'The boy pushed him during play time', 'The boy had to clean up the mess while the other children went out to play', and 'The other boy ran away with my ball'; and for happy: 'He answered the teacher's questions correctly', 'Every one helped tidy up the classroom before play time', 'He finds his friend before school starts', and 'He gets an invitation to a birthday party'. There were also a set of untrained expression cards, which were color photographs of children with happy, sad, or angry expressions. There were four photographs for each emotion, and on each trial the participant was given a random picture from each

emotion (i.e. they had three expression cards, but these differed from trial to trial). There were also a set of ten distractor photographs of items familiar to the participant, and the participant was also provide with a random selection of three of these cards for each trial.

The situation cards were presented to the participant one at a time (as in the tacting phase), in a random order across participants, and the participants were asked: “*how does he feel?*”. A correct response was taken to be the participant selecting and presenting the photograph of the person with the emotion corresponding to that on the presented situation card from the set of six emotion/irrelevant cards that they had. An incorrect response was where the selected emotion card did not match the situation card, or no response was elicited from the participant for 5s. No feedback was given during this phase. There were 20 trials in this phase.

Generalization Probe 2 – Tacting own Private Events

The second generalization probe tested the participants’ ability to label how they would feel in novel situations. On each trial, participants were given three situation cards – one each for happy, sad, and angry – that had not previously been used. In total, there were four situation cards for each emotion, and the situations depicted were based on the known characteristics and preferences of each participant, and hence were idiosyncratic for each child (e.g., going shopping, playing with crayons). The participants were also given three (from a set of six) novel distractor cards not representing emotional situations – these cards were selected randomly for each trial. The instructor would then ask through sign and verbal request: “*what makes you happy/sad/angry?*”. Participants were required to choose, from the six situation/irrelevant cards on display, what made them happy, sad, or angry, and to

exchange the appropriate situation card with their teacher in response to the question. A correct response was scored when the participant selected a happy situation card when asked: “*what makes you happy?*”, a sad situation card, when asked: “*what makes you sad?*”, and an angry situation card when asked: “*what makes you angry?*”. No feedback was given, and there were 20 trials in this phase.

Treatment Fidelity and Inter-Observer Agreement

Treatment fidelity was established by the lead therapist sampling 20% of the sessions in each phase for all of the therapists while they were occurring, to ensure that procedures were being followed. In no cases were the teaching procedures noted to be different from that specified.

Inter-observer agreement was calculated using Cohen’s Kappa to control for chance agreements, calculated across 100% of the sessions for each of the children. A value of 0.7 or greater is generally taken as reflecting strong agreement. The Cohen’s Kappa for the baseline (A) phase had a mean across participants of 0.97 (range = 0.88 to 1.0); for teaching match-to-sample (B), the mean was 0.99 (range = 0.96 to 1.0); for independent match-to-sample (C), the mean was 0.98 (range = 0.92 to 1.0); for tacting (D), the mean was 0.88 (range = 0.66 to 1.0); for the maintenance assessment (A), the mean was 0.95 (range = 0.82 to 1.0). Agreement for generalization probe 1 (*untrained situations*) had a mean of 0.88 (range = 0.68 to 1.0); and for the generalization probe 2 (*tacting own private events*), the mean was 0.91 (range = 0.86 and 1.0). Thus, agreement was good or high in all phases of the study.

Results

Figures 2 about here

Figure 2 shows the total number of correct responses (shown as a percent correct), out of a possible 20 opportunities, for baseline (A), teaching match-to-sample (B), independent match-to-sample (C), tacting (D), maintenance assessment phases for all three emotions (individual data is available in the supplementary materials). Inspection of these data reveals that, during the baseline phase, there was a low mean rate of correct responses for the participants. This relatively low score compares poorly to the correct responses seen during teaching in the teaching match-to-sample phase, and in the independent match-to-sample phase). In all of the teaching phases, all participants achieved criteria of 100% correct for three sessions. During the maintenance (tacting) phase, correct responding decreased when compared to the match-to-sample phases, but it nevertheless was maintained for three consecutive sessions of 100% of independent responding. During the maintenance assessment phase, the ability to tact the private events of others was successfully maintained for five consecutive sessions. There were no pronounced differences between the participants or between the emotions trained in terms of the pattern of acquisition or maintenance of responding.

A two-factor repeated-measures analysis of variance, with emotion type and phase as factors, was conducted on these data. This revealed no main effect of emotion, $F < 1$, $partial\ eta^2 = .052$, nor interaction between emotion and phase, $F(8,72) = 1.07$, $p > .30$, $partial\ eta^2 = .106$. However, there was a significant main effect of phase, $F(4,36) = 1161.12$, $p < .001$, $partial\ eta^2 = .992$. Protected independent t-test revealed that the only significant differences between the phases

were between the baseline phase, and each of the subsequent phases, smallest $t(29) = 54.04$, $p < .001$, $d = 10.35$.

Figure 3 about here

Figure 3 shows the mean percentage correct responses during the two generalization probes. These generalization probes tested the participants' ability to tact untrained scene cards (probe 1), and to tact their own private events, by identifying those scenes that made them happy, sad, or angry. During the first probe, a mean of around 75% correct responding was recorded across participants. There appeared to be no great differences across participants (see supplementary materials) or between correct responses for the three emotions, and all were higher than the group of scenes measured in the initial baseline (A). A two-factor repeated measures ANOVA, with emotion type and phase, was conducted on these data along with those from the baseline phase. This revealed a significant main effect of phase, $F(1,9) = 1443.86$, $p < .001$, $partial\ eta^2 = .994$, but no main effect of emotion type, $F(2,18) = 1.03$, $p > .30$, $partial\ eta^2 = .103$, and no interaction between the two factors, $F < 1$, $partial\ eta^2 = .017$.

The second probe to determine whether participants could tact scenes that made them happy, sad or angry, resulted in a mean of around 75% correct. As in the first probe, there was no great difference in the level of correct responding across participants, or between the emotions. A two-factor repeated measures ANOVA, with emotion type and phase, was conducted on these data along with those from the baseline phase. This revealed a significant main effect of phase, $F(1,9) = 610.52$, $p <$

.001, *partial eta*² = .985, but no main effect of emotion type, $F < 1$, *partial eta*² = .099, and no interaction between the two factors, $F < 1$, *partial eta*² = .019.

Discussion

This study investigated whether it was possible to teach children with ASD to directly tact emotions in others, and measured generalization across untrained situations was also taken, followed by an opportunity to tact those some things that made the participants happy, sad and angry. Overall, the results show that the introduction of the procedure designed to teach tacts for emotions and their associated situations conditioned children with ASD to the language of emotions. The children's ability to tact the private events of others, as represented in each of the scenario cards, improved as a result of the training. Moreover, these tacting skills could be generalized to novel situations, across the same emotion expressions, and they also appeared to assist children to associate tacts for emotions to their own emotional response to situations. The tacts for private events, which were targeted for teaching in this study, were successfully conditioned across participants, and applied to the public correlates of the behavior of others. Thus, these findings suggest that, in a controlled setting, and following targeted instruction, children with ASD were able to tact the facial expressions for happy, sad, and angry, and attach these tacts to situational cues offered in a series of contrived scenarios.

These data suggest that children with ASD can be taught the language of emotions, and develop a basic understanding of emotional states. This study offers some support to the suggestion that children with ASD can differentiate between emotions (Lartseva et al., 2014; Sigman & Ruskin, 1999), but require more time and prompts in order to perform the appropriate labelling (see Baron-Cohen et al., 2001;

Capps et al., 1992; Lartseva et al., 2014). The fact that such an ability can be directly taught using this procedure, and that the learned responses generalize across novel situations and to the participants own emotions, suggests that such a teaching procedure may be helpful in helping people with ASD in this domain, and may reduce subsequent problems that are associated with an inability to label emotions (see Baker et al., 2009; Connallen & Reed, 2012). That the current procedure was tested with relatively low functioning individuals with little spoken language may also imply that it may be helpful in situation where more complex procedures relying on verbal instructions procedures may be inappropriate (cf. Howley & Arnold, 2005; Williams et al., 2008). The findings in the present study tested the ability of children with ASD to tact the private events of others, based of situations where representation matched expectation, offering additional evidence that learning governing convention is possible, whereas their ability to successfully generalize this skill to untrained stimuli might provide some insight into their ability to transfer referencing information, imbedded in the unfamiliar situations.

With this study, it has been suggested that as these skills can develop in sequence, and that an understanding of the language of emotions can be generalized to tact the public correlates of the behavior of others. It is often thought that ‘privileged access’ or ‘special knowledge’ of the private events is needed in order to effectively teach the language of emotions (Catania, 1988). Instead, what may be learned are the relevant words for these tacts from others, who only had access to the public correlates to the events when they were teaching these tacts (Catania, 1988). It is because of this, when teaching children with ASD to tact private events, that the relevant vocabulary, based on thee shared correlates, might need to be taught, before a generative use for that tact can be applied (McHugh, Barnes-Holmes, & Barnes-

Holmes, 2004). Due to inconsistent access to the private events and their public correlates, it is often difficult to shape and maintain the language of emotions, although Catania (1998) argues that the relation between tacting a public event and tacting a private event is similar to the relation between tacting when both speaker and listener have access to what has been tacted, and tacting to which only the speaker has access. These difficulties, both theoretical and developmental, are ever more acute when applied to the social, emotional language development of children with ASD (Howlin, 1986), and yet it remains important to explore the language of emotions, in order to improve emotional literacy, which may also be a predictor of social and academic success (Robins & Rutter, 1990).

There are some limitations to this study and additional work that needs to be conducted that should be acknowledged. Clearly the current study was conducted on a relatively small sample, and extension of this work to a broader range on individuals may help to clarify the extent to which the results may be generalized. The sessions were not taped for offline coding of responses, and this introduces a possibility of coder bias, due to the coders not being blind to phase of the study. However, that almost all of the responses improved from near zero baselines, to close to 100% in the appropriate teaching phases suggests that any result is not the product of bias tipping marginal improvements into larger ones. Nevertheless, the introduction of this procedure would be an improvement in future studies.

More research is needed to define and validate the use of tacts for private events, and to develop additional tactics for teaching children with ASD to tact the private events of others, with greater understanding and meaning, while improving joint attention skills and the understanding of the socially derived meaning of emotion. Future study needs to be undertaken to address the validity of these findings, and to

extend the range of emotion tacts beyond happy, sad and angry. In addition, some test of the degree to which participants could generalize from the teaching stimuli to natural settings would also be a step forward in assessing the potential impact of this work. It should also be noted that the current study did not measure receptive language with a quantitative measure, and this assessment could be added to future research work in the area.

The present results should be interpreted in the context in which they were measured, and not as an indication that the participants have learned a generative understanding of private events of others under investigation, but instead as an indication that teaching needs to address the deficits that children with ASD experience in understanding the emotions of others. The current intervention might be one way to address this needs, and has the advantage that it can be taught within existing ABA programs.

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Figure Captions

Figure 1. Examples of line drawings representing emotions (top panel) and scenes associated with emotions (bottom panel).

Figure 2. Mean percentage correct for performance on all phases of the study for each of the three emotions. Error bars = 95% confidence intervals.

Figure 3. Mean percentage correct on both probe phases of the study for each of the three emotions. Probe 1 = novel situation; Probe 2 = tacting own private events. Error bars = 95% confidence intervals.

Table 1: Subject, age, sex, diagnosis, Gillian Autistic Index score (high scores are more severe), percentile rank (low scores mean ASD is less severe), probability of ASD, and method of communication

Subject	Age/ Sex	Diagnosis	Autistic Index	Percentile Rank	Probability	Method of Communication
1	6.1 Male	Autism & developmental dyspraxia	70	2	Below Average	PECS
2	6.3 Male	Autism	85	16	Below Average	PECS Vocal Verbal
3	7.0 Male	Autism & unspecified communication disorder	100	50	Average	PECS
4	6.5 Male	Autism & developmental dyspraxia	68	1	Very Low	PECS
5	7.8 Male	Autism	80	9	Below Average	PECS Vocal Verbal
6	6.1 Male	Autism	93	32	Average	PECS Vocal Verbal
7	6.1 Male	Autism	111	77	Above Average	PECS Vocal Verbal
8	9.4 Male	Autism	110	75	Above Average	PECS Vocal Verbal
9	7.2 Male	Autism	85	16	Below Average	PECS Vocal Verbal
10	9.6 Female	Autism & unspecified communication disorder	110	75	Above Average	PECS Manual Sign

Figure 2

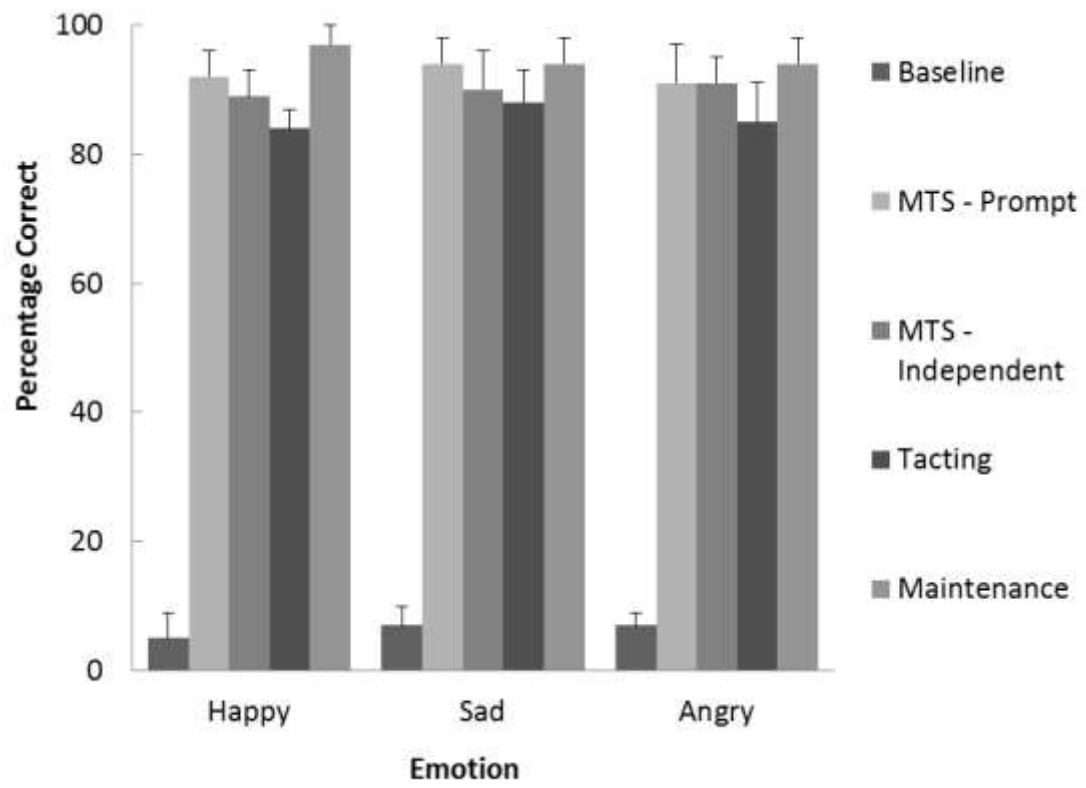


Figure 3

