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# The Effects of Intensive Tact Instruction on Three Verbal Operants in Non-Instructional Settings for Two Children with Autism

*Helena Lydon, Olive Healy, Geraldine Leader, Dolleen-Day Keohane*

## *Abstract*

This study examined the effects of daily intensive tact instruction on the emission of verbal operants in non-instructional settings by two preschool aged children with autism. A delayed multiple probe design across participants was used to assess the effects of intensive tact instruction on the number of pure tacts, mands and, conversational units emitted in three non-instructional settings. Daily tact instruction included 100 tact learn units presented above the participants' daily instruction. Five categories of tacts were selected for intensive instruction and were presented as sets of two-dimensional stimuli. Probe sessions of 15 minutes each were conducted as pre- and post- tests following mastery of each set of tacts. Results demonstrated a functional relationship between daily intensive tact instruction and increases in the number of pure tacts emitted in non-instructional settings.

**Keywords:** autism, mands, tacts, conversational units

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## *Introduction*

It is estimated that only one half of children with autism and related disorders will acquire any speech as a mode of communication (Lord & Paul, 1997). Thus, a frequent need among children with autism is assistance in acquiring and developing effective communication skills (Scheips, Reid, Behrmann, & Sutton, 1998). Typically, a child with autism in the presence of a nonverbal cue will rarely emit a spontaneous initiation. The child will remain silent and speak only when verbally prompted by another person providing a question or a command (Ingenmey & Van Houten, 1991). However, much of daily communication is not verbally prompted. Thus, it is important to teach children to tact (label) objects or events under non-verbal antecedent control (Greer, & Ross, 2008; Matson, Sevin, Box, Francis, & Sevin, 1993; Williams, Carnerero, & Perez-Gonzalez, 2006) to support the emergence of unprompted speech and spontaneous initiation.

Research conducted by Hart & Risley (1995) found that deficits in the development of a speaker repertoire may be the product of nature or environmental factors. Their research found that children from low socioeconomic families frequently displayed deficits in verbal repertoires on entering school. The authors noted that there were significantly fewer verbal interactions emitted among children and parents in families with low levels of socioeconomic status as compared to professional families with high levels of socioeconomic status, and that verbal interactions in families that were defined as working class fell somewhere in the middle. Additionally, professional families had far more positive verbal interactions than families in either of the two other categories. The results of the study suggest that young children who have significantly fewer verbal interactions with their parents are more likely to have language delays and vocabularies that increase at a much slower rate than children who have high numbers of positive verbal interactions with their parents. We propose that children with native language disabilities have infrequent language experiences as well, and as a result lack certain verbal developmental capabilities that are foundational to the development of language (Keohane, Pereira-Delgado & Greer, in press). Intensive language experiences are necessary to remediate such deficits whatever the underlying cause (Greer, & Keohane, 2005; Greer, & Ross, 2008; Pistoljevic & Greer, 2006).

Communication training using intensive behavioral interventions has been a key focus of instruction for children with autism who present with deficits in their listener and speaker repertoires. Communication training involves teaching the vocal operants – mands and tacts, with a view to

increasing spontaneous speech emitted by the child (Pereira-Delgado, & Oblak, 2007; Pistoljevic & Greer, 2006; Schaffler & Greer, 2006). A tact is evoked by a nonverbal discriminative stimulus such as an object or event, or the relation between objects or events, and is maintained by generalised or social reinforcers (Skinner, 1957). In contrast, a mand specifies its reinforcer, is evoked by an establishing operation (EO), such as deprivation or aversive stimulation, and is maintained by specific consequences relevant to that EO (Michael, 1988).

According to Skinner (1957), each verbal operant is acquired independently and serves a different function. Establishing one operant will not automatically result in the appearance of another. For example, when an utterance is established as a tact it does not automatically follow that the utterance emerges as a mand. Skinner's theoretical analysis is supported by numerous research studies on the topic (Hall & Sundberg, 1987; Lamarre & Holland, 1985; Nuzzolo-Gomez & Greer, 2004; Sundberg, San Juan, Dawdy, & Arguelles, 1990; Twyman, 1995).

Skinner characterised spontaneous verbal initiations as pure mands and pure tacts (i.e., they are emitted under non-verbal antecedent control). One explanation for a deficit of pure mands and tacts in children with developmental disabilities can be attributed to their instructional history. Previous "tact" instruction may have been presented under intraverbal control (i.e., under the control of vocal verbal antecedents), and as a result tacts as examples of "spontaneous" speech were never actually taught. While the mand repertoire is vital to independence of the individual, increasing the tact repertoire is most essential to the expansion of verbal repertoires and more complex social behavior. Research suggests that the development of the tact repertoire is crucial to the development of a fluent speaker repertoire. It is also a key component of other speaker and listener capabilities, and ultimately plays an important role in bringing these capabilities together under joint control. The tact repertoire is required for naming (Greer, Stolfi, Chavez-Brown, Rivera-Valdes, 2005; Lowe, Horner, Harris, & Randle, 2002), naming as functionally related to reading comprehension for academically delayed middle school students (Helou-Care, 2008), conversational units (Lodhi, & Greer, 1989, Donley, & Greer), reading (Greer, & Ross, 2004; Greer, & Speckman, in press), and support for phonemic control as the source of derived relations between naming, reading and writing (Reilly-Lawson, 2008).

Another important component in developing a fluent speaker repertoire is the conversational unit. A conversational unit is defined as a category of verbal behavior that includes one full exchange between a listener and a speaker in which each participant emits both a speaker response, reinforced by the other individual as a listener, and a listener response reinforced by the other individual as a speaker (Greer, 2002). Tacts and intraverbals as parts of autoclitic frames are essential components of conversational units. And they frequently support the development of grammatical structure to language acquisition (Greer, & Speckman, in press).

The importance of developing and expanding the tact repertoire has been demonstrated to have a significant effect on other communication skills. Recent research focused on the use of intensive tact instruction for children with autism has investigated its effectiveness on increasing verbal operants (tacts, mands and, conversational units). Schaffler & Greer (2006) applied an intensive daily tact instructional protocol to increase the acquisition of audience-accurate tacts and conversational units with two middle school students. The students were diagnosed with emotional disabilities and challenging social behavior. The authors found that both participants emitted a higher number of accurate tacts and conversational units throughout the school day following the application of the intensive tact training protocol.

In addition, Pistoljevic & Greer (2006) used a delayed multiple probe to assess the effectiveness of increasing students' daily tact instruction by 100 learn units above their regular daily number of learn units. The learn unit is an interlocking three-term contingency between the teacher and the student which provides an immediate outcome measure (Greer, 1996). "The learn unit includes an opportunity to respond, a student's response, the teacher's antecedent-consequence, and the student's antecedent-consequence" (Greer, 1996, p.141). Learn units are potential operants that by definition provide and measure new learning. Results of the study found that intensive tact

instruction was effective in increasing the emission of pure tacts and mands in non-instructional settings with three preschool students with autism.

In a recent dissertation Pistoljevic (2008) showed a functional relationship between the emergence of naming and the instructional histories provided by prior intensive tact instruction and multiple exemplar training for preschool children. Additionally, the work by Pistoljevic (2008) provided a replication of the effects of “Wh?” questions on social behavior demonstrated by Reilly-Lawson & Walsh (2007). In the later study increases in “Wh?” questions and tacts were shown to be functionally related, suggesting that the intervention provided the participants with new ways to recruit attention. It is of interest to note that the authors found that the majority of the tacts emitted in the non-instructional settings were not those taught in the instructional setting.

A similar study by Pereira-Delgado & Oblak (2007) investigated the effectiveness of intensive tact instruction for three preschool students with developmental delays on the emission of pure mands and tacts. All three participants emitted low numbers of pure verbal operants during baseline probes in non-instructional settings. Following intensive, daily tact training, frequency and rates of pure mands and tacts increased during probe sessions for all three participants. This study demonstrated the effectiveness of the intensive tact protocol on acquisition of pure verbal operants with students with developmental delays.

The current research was designed to replicate and expand the findings of Pistoljevic & Greer (2006) and Pereira-Delgado & Oblak (2007). The study used a delayed multiple baseline design across two participants with autism diagnoses, to evaluate the effects of intensive tact instruction, on three verbal operants (tacts, mands and conversational units) emitted in non-instructional settings.

### *Method*

#### *Participants*

Two participants were chosen for this study. They emitted low levels of pure tacts, mands and conversational units during non-instructional settings (lunch time, play time) and during transition periods. Both participants were diagnosed with autism by registered psychologists and attended an Applied Behavior Analysis Preschool five days per week. Participant 1 was a four-year-old boy and prior to the study emitted on average 20 pure tacts across a 5 hour and 30 minute school day. The participant had mastered the use of two autoclitics (e.g., ‘That’s a’ and ‘It’s a’) to specify a tact function. A mand repertoire was established and the participant used full sentences.

Participant 2 was a three year old girl who emitted an average of 30 pure tacts during a 5 hour and 30 minute period. However, all tacts occurred during desktop instruction time. The mands produced by Participant 2 consisted of two-word utterances (e.g., ‘Juice please’) and autoclitics (e.g., ‘That’s a’).

Both participants showed a deficit in conversational skills by not asking questions or making comments to initiate or sustain conversation with adults or peers.

#### *Setting and Apparatus*

The study took place in a public school for children with autism diagnoses. The school employed the principles of applied behavior analysis to teaching practices, curriculum selection, and behavior management. Both participants were in a classroom with four other children and instructors. Each participant received individualised instruction on a 1:1 teacher/student ratio.

During baseline and intervention probes, pure tacts, mands and conversational units were collected in three non-instructional settings; a free play area within a classroom setting, a lunch table during a lunchtime setting, and in the hallways during transition to and from different classrooms. The free play area of the classroom was a (5' x 5') section to the rear of the room where the participants had access to toys and books. Lunch was eaten at a large round table at the centre of the classroom. The school’s hallways were decorated with educational posters with a variety of themes (e.g., colors, shapes, animals, weather, body parts, actions, letters and numbers).

All tact instruction took place in the participants' classroom; the instructor and participant were seated side-by-side at a small table. Tact instruction was interspersed with the participants' regular academic instruction.

The stimuli used were 2-dimensional pictures presented on 2? X 4? cards. Multiple exemplars of each picture were used (three different pictures of each stimulus).

### *Experimental Design*

A delayed multiple probe design across participants (Horner & Baer, 1978) was used to compare the number of verbal operants emitted before and after the mastery of each set of tacts in non-instructional settings. Firstly, a combined 15-minute probe of pure tacts, mands and conversational units in three non-instructional settings was conducted for each participant in a delayed fashion (the sum of 5-minute probes in three different non-instructional settings). Secondly, following the baseline probe session, participants were taught stimulus sets as tacts to a mastery criterion. Thirdly, subsequent to each participant demonstrating mastery of a single stimulus set (all five categories with four different stimuli per category), another cumulative 15-minute probe session was conducted. The probe sessions were pre- and post-treatment tests of the effect of the intensive tact instruction on the participants' emission of pure tacts, mands and conversational units.

### *Dependent Measures*

The dependent measures were the number of pure tacts, mands, and conversational units emitted across three non-instructional settings: 1) in the school's hallways during transitions between classrooms, 2) during lunch time, and 3) in the play area of the classroom. A *pure tact* was defined as "...a verbal operant under the functional control of a nonverbal discriminative stimulus, and it produces generalized conditioned reinforcement" (Cooper, Heron, & Heward, 2007, p. 530). For example, a participant in the study might say, "That's a horse" in the presence of a picture of a horse or a toy horse, and receive reinforcement from a listener (i.e., "You're right, I see the horse, too") as the source of generalized reinforcement for the pure tact emitted. A *mand* was defined as "...a verbal operant for which the form of the response is under the functional control of motivating operations and specified reinforcement" (Cooper, Heron, & Heward, 2007, p. 530). For example, a participant might say, "Juice, please" and the delivery of the item (i.e., the participant receiving the juice) would comprise reinforcement for the mand emitted. A *true conversational unit* was defined as having occurred when two parties were a part of a verbal interlocking three-term contingency, in which the initial speaker's behavior was evoked by the environment and was reinforced by the listener/speaker response of the other individual. Similarly, the second speaker's behavior was evoked by the verbal behavior of the initial speaker and reinforced by the listener response of that individual. Each conversational unit, therefore, comprised a three-term contingency for each participant providing each with the opportunity for alternating speaker and listener responses (Donley & Greer, 1993).

### *Baseline Probes in Non-Instructional Settings*

Event recording was used to collect data on the number of pure tacts, mands and conversational units emitted by the participants in non-instructional settings. Initially 15-minute probes were conducted prior to the intensive tact instruction training. Reinforcement for tacts was provided in the form of verbal praise (i.e., "That is a toy, good boy/girl"). Following a mand, participants were given the requested item (i.e., a book for a brief period). Conversational units were reinforced by the listener/speaker responses as part of the interchange of both parties.

The 15-minute probe session was divided into three 5-minute observation probes conducted across the three different non-instructional settings. During the 5-minute free play probe the timer was started when the participant was in the play area of the classroom and accompanied by one other peer. During the 5-minute probe at lunch time a timer was started when the participant had finished eating their lunch while seated at the table with other peers. Finally, during a 5-minute probe in the hallway during transitions to other classrooms, the timer was started on exiting the participant's own classroom in the presence of their instructor.

### Selection of Stimulus Sets

The stimuli used as part of the intensive tact instruction were identified from a behavioral inventory for skills assessment of children with autism (Sinnott, 2003) conducted prior to the intervention. Five categories were identified. These included: occupations, transportation, clothing, locations, and food (see Table 1). A set was comprised of five categories each of which contained 4 stimuli (20 stimuli per set). Stimulus sets were identical for both participants. Probes were conducted to verify that the tact targets were not in the participants' tact repertoire prior to commencing the experiment. The stimulus probes consisted of each participant being presented with all 20 items from each of the five categories randomly. Pictures of the stimuli were presented and the participant was given no antecedent and no feedback. If the participant did not emit a correct response on presentation of the stimulus target it was considered not to be in the participant's repertoire and was selected as a target stimulus for the study.

Table 1. Stimulus sets used during intensive tact instruction sessions.

Category	Occupations	Transportation	Clothing	Locations	Food
Set 1	Photographer	Car	Hat	School	Apple
	Florist	Train	Scarf	Classroom	Banana
	Doctor	Boat	Gloves	Hallway	Cereal
	Painter	Helicopter	Jumper	Kitchen	Orange
Set 2	Mechanic	Van	Jacket	Bedroom	Bread
	Builder	Bicycle	Skirt	Bathroom	Milk
	Dentist	Motor Bike	Trousers	Sitting Room	Eggs
	Chef	Ambulance	Shoes	Dining Room	Juice
Set 3	Fireman	Crane	Boots	Garden	Pasta
	Soldier	Ice cream Van	Dress	Playground	Carrots
	Pilot	Fire engine	Belt	Beach	Grapes
	Hairdresser	Fork lift	Waist coat	Shop	Potatoes
Set 4	Farmer	Steam Roller	Shirt	Petrol Station	Broccoli
	Policeman	Horse Carriage	Tie	Train Station	Peppers
	Sailor	Tricycle	Bow Tie	Bus Station	Mushrooms
	Vet	Sled	Slippers	Fire Station	Cake
Set 5	Spaceman	Airplane	Pyjamas	Airport	Meat
	Secretary	Tractor	Shorts	Swimming Pool	Popcorn
	Blacksmith	Digger	Track suit	Post Office	Crisps
	Carpenter	Bus	Suit	Library	Biscuits

### Intensive Tact Instruction

The independent variable in the current study was increasing daily tact instruction by 100 learn units. All tacts included autoclitics (e.g., 'They are eggs'). An *autoclitic* was defined as verbal behavior that functioned to affirm, negate, quantify, or specify the effect of the speaker's behavior on the listener (Skinner, 1957). Additional learn units were interspersed with the participants' regular academic instruction. Learn units were used to teach all tact responses to the participants.

Prior to intensive tact instruction the instructor presented the participant with pictures of the four items from one category. The instructor provided the participant with an echoic for the item. Once the participant achieved vocal point-to-point correspondence with the instructor's model, independent tact instruction began. During tact instruction the instructor presented the participant with the antecedent (picture of the stimulus) while the participant was attending. The participant was provided with an opportunity to respond, followed by the appropriate consequence. Correct responses were followed by the presentation of a generalized reinforcer from the participant's preferred item list. A correct response was defined as the emission of a tact in the presence of the picture presented. For



example, in the presence of a picture of a train, the participant vocally emitted “That’s a train” within 3 seconds of the presentation of the stimulus. Other responses or no response within 3 seconds were recorded as incorrect and the participant was represented with the stimulus and provided with a correction.

Instruction was carried out each day. Twenty learn units were presented for each of the 5 categories resulting in a random interspersal of 100 learn units for a complete stimulus set. Following mastery to criterion for a particular category, learn units were devoted only to the remaining categories within the set not yet mastered. The remaining categories were repeated daily until mastered or the participant received 100-learn units over regular instruction. A mastery criterion for tact instructional sessions was defined as responding correctly with at least 90% accuracy across two consecutive sessions. Once criterion was achieved on one of the training sets, a new set was introduced. Participants were required to master a complete stimulus set before intensive tact instruction began on the subsequent set.

#### *Post-Treatment Probes in Non-Instructional Settings.*

The post-treatment probes were conducted in the same manner as the baseline probes in non-instructional settings. Probes were conducted following mastery of each stimulus set (4-stimuli for each of 5 categories) in all three non-instructional settings.

#### *Inter-Observer Agreement*

Inter-observer agreement was determined by having a second observer, who independently and simultaneously recorded the frequency of pure tacts, mands and conversational units emitted during probe sessions in non-instructional settings. Interobserver agreement was calculated by dividing the total number of agreements by the total number of agreements and disagreements and multiplying by 100. Inter-observer agreement was conducted for 43% of all sessions, with a mean agreement of 98% and a range of 95% to 100%.

### *Results*

A functional relation was demonstrated between the daily intensive tact instruction and the number of verbal operants emitted across all non-instructional settings for both participants.

Table 2 shows the number of correct tact responses emitted by Participant 1 and Participant 2 for each of the five sets of stimuli during the intensive tact instruction phases. The data for Participant 1 show a range of three to five sessions per set to mastery. The data for Participant 2 show a range of three to seven sessions per set to mastery.

The learn units to criterion for each participant are presented in Table 3. Learn units to criterion for Participant 1 were consistent across stimulus sets. The data for Participant 2 showed an increase in the number of learn to criterion as mastery of stimulus sets progressed.

Figure 1 shows the number of verbal operants emitted in the three non-instructional settings for both participants. During the three days of baseline probes in the non-instructional settings, Participant 1 emitted a mean of 1.7 tacts (1, 2, 2 across the three probe sessions respectively), a mean of 1.7 mands (1, 3, 1 across the three sessions respectively) and a mean of 1.7 conversational units (2, 1, 2 across the three probe sessions respectively). Participant 1 mastered all 5 stimulus sets.

Following mastery of Set 1, Participant 1 emitted 8 tacts, 0 mands, and 0 conversational units during the post probes in non-instructional settings. Subsequent to mastery of Set 2, Participant 1 emitted 4 tacts, 0 mands, and 4 conversational units during the post probes in non-instructional settings. Following mastery of Set 3, Participant 1 emitted 7 tacts, 2 mands, and 3 conversational units during the post probes in non-instructional settings. Following mastery of Set 4, Participant 1 emitted 13 tacts, 1 mand, and 1 conversational unit during the post probes in non-instructional settings. Finally, following mastery of Set 5, Participant 1 emitted 21 tacts, 0 mands, and 1 conversational unit during the post probes in non-instructional settings. Overall, the rate of tacts emitted during the post probes in non-instructional settings for participant 1 increased sequentially as

the study progressed. However, the level of mands did not show any significant increase. An increase was observed in the number of conversational units emitted following mastery of Set 2, but a downwards trend was evident thereafter.

*Table 2.* Number of correct tacts per session during the intensive tact instruction phases for Participants 1 and 2.

<b>Category</b>	<b>Participant 1</b>	<b>Participant 2</b>
<b>Occupations</b>	<b>Correct Tact Responses</b>	<b>Correct Tact Responses</b>
Set 1	16, 20, 20	17, 20, 20
Set 2	16, 19, 20	18, 20, 20
Set 3	15, 17, 17, 19, 20	12, 20, 19
Set 4	8, 15, 20, 20	9, 18, 20
Set 5	6, 15, 20, 20	12, 13, 16, 20, 20
<b>Locations</b>	<b>Correct Tact Responses</b>	<b>Correct Tact Responses</b>
Set 1	16, 20, 20	16, 19, 20
Set 2	15, 19, 18	12, 17, 20, 19
Set 3	18, 17, 18, 19	10, 16, 20, 20
Set 4	15, 19, 20	10, 16, 20, 20
Set 5	16, 18, 20	15, 15, 18, 20
<b>Transportation</b>	<b>Correct Tact Responses</b>	<b>Correct Tact Responses</b>
Set 1	17, 20, 18	17, 17, 20, 20
Set 2	16, 20, 18	17, 19, 19
Set 3	17, 17, 19, 19	18, 17, 18, 20
Set 4	12, 20, 20	13, 15, 20, 19
Set 5	17, 20, 18	10, 15, 12, 15, 16, 18, 18
<b>Clothing</b>	<b>Correct Tact Responses</b>	<b>Correct Tact Responses</b>
Set 1	17, 20, 20	16, 18, 20
Set 2	17, 20, 19	13, 19, 19
Set 3	16, 20, 19, 20	16, 18, 20
Set 4	15, 20, 19	10, 18, 10, 18, 20
Set 5	17, 20, 20	17, 15, 17, 15, 20
<b>Food</b>	<b>Correct Tact Responses</b>	<b>Correct Tact Responses</b>
Set 1	17, 20, 20	17, 19, 20
Set 2	17, 20, 19	17, 17, 20, 19
Set 3	19, 17, 19, 20	15, 20, 20
Set 4	17, 20, 20	17, 17, 20, 20
Set 5	16, 20, 19	17, 20, 20

*Table 3.* Learn units to criterion for each stimulus set for Participants 1 and 2.

<b>Participant 1</b>	<b>Learn Units to Criterion</b>	<b>Participant 2</b>	<b>Learn Units to Criterion</b>
Set 1	60	Set 1	64
Set 2	60	Set 2	68
Set 3	84	Set 3	68
Set 4	64	Set 4	80
Set 5	64	Set 5	100



Participant 2 mastered all 5 stimulus sets. During the three days of baseline probes in non-instructional settings, Participant 2 emitted 6, 8, 0 tacts (mean = 4.66), 1, 4, 2 mands (mean = 2.33) and 5, 3, 0 conversational units (mean = 2.66) in non-instructional settings, respectively (see Figure 1). Following mastery of Set 1, Participant 2 emitted 2 tacts, 2 mands, and 4 conversational units during the post probes in non-instructional settings. Subsequent to mastery of Set 2, Participant 2 emitted 19 tacts, 2 mands, and 1 conversational unit during the post probes in non-instructional settings. Following mastery of Set 3, Participant 2 emitted 12 tacts, 1 mands, and 3 conversational units during the post probes in non-instructional settings. Following mastery of Set 4, Participant 2 emitted 13 tacts, 2 mands, and 0 conversational units during the post probes in non-instructional settings. Finally following mastery of Set 5 the participant emitted 6 mands, 16 tacts and 1 conversational unit. Overall, the rate of tacts emitted during the post probes in non-instructional settings for Participant 2 increased following the introduction of the intensive tact instruction. However, similar to Participant 1 no significant increase in mands or conversational units was evident.

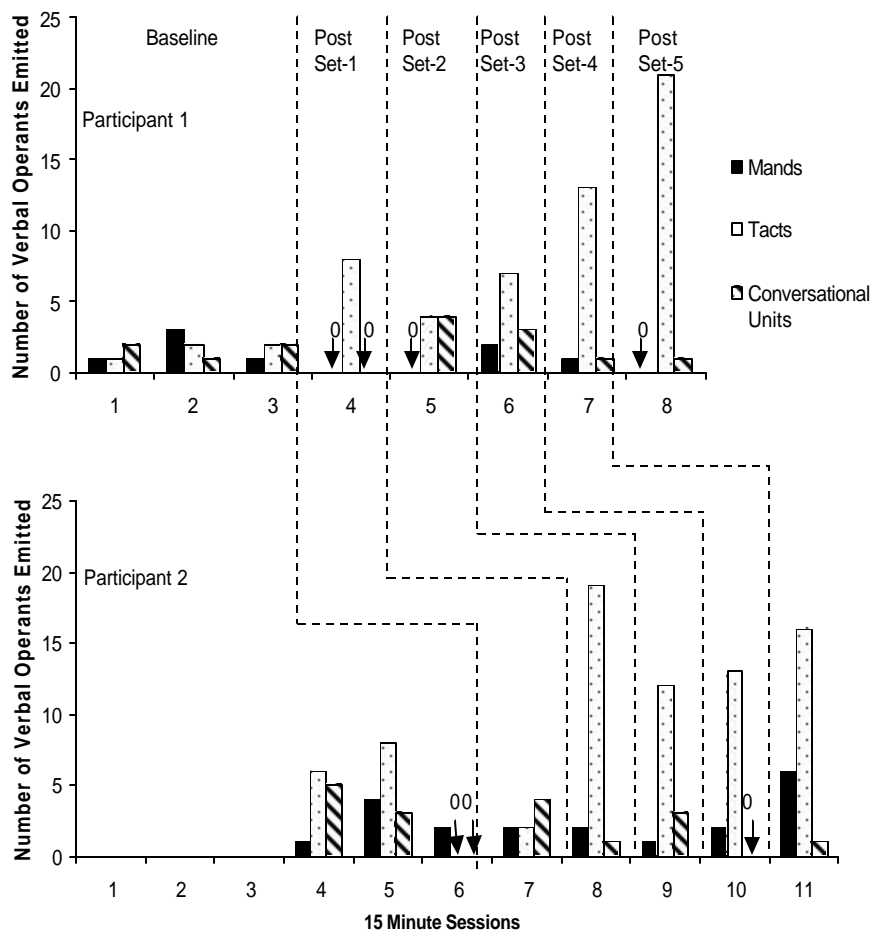


Figure 1. Number of verbal operants emitted by Participants 1 and 2 during pre- and post- probes in non-instructional settings.

### Discussion

The results of the delayed multiple probe design across participants suggests that a functional relationship exists between the daily tact training and the number of tacts emitted in non-instructional settings. The results are consistent with the findings of Pistoljevic & Greer (2006) and Pereira-Delgado and Oblak (2007). The data for Participant 1 showed a progressive increase in the number of

tacts following the mastery of each set. The data for Participant 2, however, showed a significant increase in tacts in non-instructional settings only after mastery of Set 2 had occurred.

In contrast to research by Pistoljevic & Greer (2006) and Pereira-Delgado & Oblak (2007) the current research did not demonstrate a functional relationship between the daily intensive tact instruction and the number of mands emitted. The emission of mands is not a target of the procedure, however, and it may be that increases in mands in some prior studies were a result of other factors. Similarly, in contrast to research by Schauffler & Greer (2006) the current study did not demonstrate a functional relationship between the daily intensive tact instruction and conversational units. That research, however, was conducted with language delayed middle school students. And, although the participants in that study were language delayed in terms of variety and quantity of vocabulary words and usage they had other verbal capabilities that the participants in the present study did not have. Conversational units are possible only when the necessary prerequisite cusps and capabilities are in place (Greer & Speckman, in press; Pistoljevic, 2008; Keohane, Pereira-Delgado & Greer, in press). The results of the current study suggest that the three and four year old participants did not yet have the verbal developmental capabilities that provide the foundations for the emergence of conversational units.

These findings corroborate the functional independence of verbal operants as described by Skinner (1957). Similarly, several experiments have found that children with developmental delays do not demonstrate this capability (Hall, & Sundberg, 1987; Lamarre, & Holland, 1985; Sundberg, San Juan, Dawdy, & Arguelles, 1990; Twyman, 1995).

A potential account for divergent outcomes of the current and previous research may be drawn from Skinner's theory of verbal behavior (1957), in that occurrences of responses depend on the presence of specific antecedents and consequences in the environment. It is not possible to compare the current and previous studies with regard to the opportunities to emit mands or conversational units. For example, it is possible that the establishing operations for mands were not present or that too few opportunities for conversational units were presented during the 15-minute probe sessions. Therefore, future research may consider calculating verbal operants as a percentage of opportunities presented. A further analysis of these factors is warranted.

The current research demonstrated that when the participants were taught to tact stimuli in an intensive fashion, to compensate for prior missing language opportunities, the children's vocabularies expanded significantly and as a result they emitted more complex language as the best example of truly social behavior. The categories of tacts were selected based on a behavioral inventory conducted prior to the outset of the study. Interestingly, tacts emitted by participants during the non-instructional settings were not the tacts that they were taught during tact instruction. The tacts emitted were from their existing repertoire. This is consistent with findings from prior research (Reilly-Lawson & Walsh, 2007). The tacts emitted were of stimuli in the students' natural environment (i.e., objects or toys in the classroom, pictures in a book, or stimuli on the walls). As a result of the intensive tact instruction the participants learned to emit tacts as a means of recruiting generalized reinforcement in the form of social attention from adults. Thus, the participants became progressively more under the control of adult attention and it is suggested that this resulted in the emission of more tacts in the natural environment. This finding is consistent with prior studies.

The results of the current research are similar to those of Pistoljevic & Greer (2006), and Pereira-Delgado & Oblak (2007). They demonstrate the effectiveness of intensive tact instruction on increases in tact repertoires in non-instructional settings. The intensive tact protocol may be an effective means of increasing verbal operants, by compensating for missing language opportunities. Its application is suitable for children with developmental delays as well as children who lack rich language interactions in early years as prescribed by Hart and Risley (1995). The current research suggests one method to bridge the gap in the acquisition of new vocabulary for children with a variety of language delays, and provides teachers with a daily instructional target, to teach a significant number of tacts each day.

Overall, the lack of spontaneous speech among children with developmental disabilities is cause for serious concern as the production of mands, tacts and, conversational units are critical to the future development of communication skills. The current research in conjunction with previous research (Pistoljevic & Greer 2006; Pereira Delgado & Oblak, 2007; Schauffler & Greer, 2006, Reilly-Lawson & Walsh, 2007) suggests that increasing the number of teaching opportunities for pure tacts and mands leads to a greater number of reflexive verbal interactions for children with autism and other communication delays. This would also facilitate the recruitment of more social attention from adults and peers in the environment, thereby creating more opportunities for children to participate in verbal exchanges and ultimately participate more fully in the social community.

In particular, the acquisition of an extensive tact repertoire is critical to the development of complex verbal capabilities. The tact repertoire is a pre-requisite for the development of higher order operants such as Naming (Greer, Stolfi, Chavez-Brown, Rivera-Valdes, 2005; Lowe, Horner, Harris, & Randle, 2002, Pistoljevic, 2008), conversational units (Lodhi & Greer, 1989), grammar (Greer, & Speckman, in press), and reading (Greer & Ross, 2008). Future studies should continue to examine the effects increasing the tact repertoire and the expansion of complex verbal capabilities.

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