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Targeting Prosodic Atypicalities Using Self-Management for Individuals with Autism Spectrum Disorders

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ABSTRACT

Targeting Prosodic Atypicalities Using Self-Management for Individuals with Autism Spectrum Disorders

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There is a considerable amount of literature reporting prosody is atypical in most individuals with autism spectrum disorders (ASD), however there is almost no literature addressing interventions for improving these prosodic atypicialities. This study used a concurrent multiple baseline design to assess whether adults with ASD could be taught appropriate prosody within the context of a self-management program. Additionally, the study assessed whether improvements in prosody would generalize outside of the intervention setting to the participants' natural environments. Data showed improvements in prosody in the clinical setting following intervention with generalization for two of three participants across settings and conversational partners. Long-term generalization occurred for all the three participants, as well. Further, a six-point normalcy scale was used to assess whether naïve observers scored any collateral gains in how natural participants' general

conversations sounded before and following the intervention. These observers rated the conversation as sounding more natural following intervention. Finally, data were collected to assess the participants' acceptability of the intervention, which participants found intervention helpful and unstressful. Results indicate that self-management may be an effective strategy for improving prosody in adults with ASD.

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I. Introduction

A. History of treatments in Autism

Kanner's original paper in 1943 first reported unique and similar characteristics for eleven individuals he identified as having "autistic disturbances of affective conduct" later termed autism spectrum disorder (ASD), who were previously considered to qualify for a diagnosis of "childhood psychosis." (Kanner, 1943). The common similarities Kanner identified in these children involved three areas: language, socialization, and restricted interests. These symptoms are considered to be on a spectrum, and may vary considerably among those with the diagnosis. Further, symptoms may change over time depending on a number of factors, including access to intervention (Lovaas, 1987), cognitive level (Gillberg & Steffenburg, 1987; Lord & Bailey, 2002), communicative level (Schreibman & Stahmer, 2013) and other presenting characteristics (Koegel, Koegel, Shoshan, & McNerney, 1999).

The incidence of children being diagnosed with autism has grown geometrically since Kanner's 1943 paper, describing eleven cases and is currently believed to occur in 1% of children in the US (CDC, 2012) with at least 1 in every 88 children qualifying for a diagnosis in 2012 (CDC, 2012). However, in May of 2013, the American Psychiatric Association modified the diagnosis to combine the social and communicative categories (APA, 2013).

Thus, there are now two, rather than three diagnostic criteria for autism, those being deficits in social-communication and restricted and repetitive patterns of behavior. As well, four of the five distinct categories were eliminated. Some suggest that this change may decrease the number of individuals that qualify for the disability, but the current recommendation is that individuals diagnosed with ASD previous to the change should retain their diagnoses (Volkmar & Lord, 1998; Huerta et al., 2012). At this time, the etiology of autism is unknown, although there is some consensus that it is a genetically based disability that may also have environmentally influences. However, most researchers focusing on the etiology of autism believe there are multiple causes, and multiple forms of the condition, and thus refer to the disability as "the autisms" (Szatmari, et al., 2007)

Prior to the 1960s, there were thought to be no forms of treatment for children and adults with autism (Herbert, Sharp, & Gaudiano, 2002), who were thought to be uneducable, and there were no scientifically based interventions for individuals with autism, thus custodial care was thought to be the only option and most individuals were institutionalized by adolescence (Herbet et al., 2002). However, early research showed that the behaviors of children with autism could be modified (Risley & Wolf, 1967; Sloan 1968; Lovass 1966: Risley, 1967; Hewett, 1966), and once researchers began looking at communication as the core deficit treatment intervention programs began showing considerable success for these individuals.

In this regard, there have been many changes in the interventions for individuals with autism, most notably, parents who were once considered the cause of their child's autism (Bettleheim, 1967) and therefore excluded from the intervention – an inaccurate belief that was widely popularized by the media – are now considered an essential part of the habilitation process (Ingersoll & Dvortcsak, 2006; Koegel & Koegel, 2012; Symon, Koegel, & Singer 2005). Further, the children themselves, who were at one time considered "uneducable" and typically committed to institutions by adolescence, now benefit from an extensive body of empirically based interventions that address the core symptoms of the disability including socialization (Schopler, & Mesibov, 1986;), communication (Koegel, Koegel, Hurley & Frea, 1992), and restricted interests (Bernard-Opitz, 1982; Schreibman & Mills, 1983)). As well, advances in the legal right to be educated and included in our society, a basic right afforded to other members of society, has helped to improve the lives in individuals with ASD (Yell, 1998). These improvements in intervention and legal advancements have provided individuals diagnosed as having autism with the increased rights and greater access to helpful interventions. In addition, as our cultural values and legal rights have changed toward more inclusion, interventions in natural environments are critical, and researchers need to focus on interventions for different skills.

In the last fifty years, there have been huge improvements made in treatments for autism. Initial research efforts only focused on the major deficit of the language delay in children with autism. First children were taught to mand, or request reinforcing items (Skinner, 1938). Research suggested that even with the best intervention programs, only about 50% of children diagnosed with autism learned to use expressive verbal communication (Prizant, & Duchan, J., 1981). This led researchers to discuss general motivational theories to focus on how we could teach children with ASD to enjoy talking and as a mean to that end, enjoy the intervention (McGee et al., 1999; Koegel, O'Dell & Koegel, 1987). Concomitantly, children with ASD started being included in schools with typically developing children, so there were some efforts that focused on developing the social skills for these individuals (Strain, 1983). In these cases, researchers had to focus on more complex aspects of language, like turn taking during conversations (Attwood, 2003; Volkmar & Klin, 2000), talking about appropriate subjects (different subjects are appropriate when speaking with an adult or teacher than a similar aged peer) (Thiemann & Goldstein, 2001), and initiating to peers under varying conditions (different at a playground than in a classroom) (Pierce & Schreibman, 1995; Baker, Koegel, & Koegel, 1998).

These many research developments and societal changes have also resulted in differences in the foci of the target behaviors. That is, the initial research efforts focused largely on behavior management (for disruptive

behaviors) and teaching mands. However, now increasing numbers of studies focus on inclusion, socialization, and social conversation, thus looking at the broader deficits in autism. In addition, while there is a significant amount of research on interventions for young children with ASD, there is still a need for research on adults and adolescents, where behaviors have been intact for many years and are often more resistant to change. In addition, while socialization has been identified as one of the core deficits in autism, there is a need for more interventions that can be implemented in schools, and in the individuals' natural communities.

In regard to socialization, while many naively believe individuals with autism prefer to be alone, the literature suggests that adults with ASD long for social relationships and often experience loneliness, but their social deficits may interfere with successful social engagement (Howlin, 2000). Often, adults with ASD are aware of their social skill deficits, and are less likely to feel satisfied with their social lives (Rao, Beidel & Murray, 2007). Further, these social difficulties often lead to anxiety and depression (Ladd & Troop-Gordon, 2003; Spence, Donovan, & Brechman-Toussaint, 1999; Savin-Williams & Berndt, 1990), which is significantly more prevalent than among individuals without autism (Segrin, 2000).

B. Prosody in Autism

One area that has been greatly understudied in regard to intervention relates to prosody, which often interferes with many aspects of life. To be specific, many adolescents and adults with autism develop difficulties with social interactions because of atypical prosody (DSM V; Shriberg et al., 2001). Wagner and Watson (2010) describe prosody as the "level of linguistic representation at which the acoustic-phonetic properties of an utterance vary independently of its lexical items." More specifically, Shriberg and researchers (2001) added different aspects of prosody to their definition such as stress, intonation, rate and flow. Prosody is used in speech to represent different grammatical meanings or informational uses (including using emphasis, asking questions), as well as affective meanings (like friendliness or confidence) (Gussenhoven, 2004). There are a variety of prosodic differences that children with ASD exhibit, including speaking in a monotone, atypical intonation, low affect, robot-like speech, and a lack of appropriate pitch control (DeMyer et al., 1973; Kanner, 1971). Researchers have noted many different prosodic abnormalities in individuals with ASD. In addition, Tager-Flusberg and researchers (2005) found that prosody might be one of the earliest signs of ASD in young children and infants. Abnormal prosody can range from small but noticeable differences to such severe abnormalities that it becomes a barrier to many social interactions and employment opportunities for these individuals, and can remain an obstacle to satisfying

social interactions and social approval throughout their lifetimes (Shriberg et al., 2001). Attempting to find a general acoustic pattern Diehl and Paul (2013) found that individuals with AS tend to speak slower than their peers. Other researchers have noted inappropriate pause times (Bellon-Harn et al., 2007) and an abnormal rising intonation in during conversation (Demouy et al., 2011). Because of these many different prosodic atypicalities, it is important to identify which inappropriate prosodic traits each individual on the spectrum exhibits before beginning an intervention. The most frequently cited among prosodic disorders in individuals with autism spectrum disorders relates to a “monotone” manner of speaking, wherein their pitch is unchanging throughout their communication (Fay & Schuler, 1980). This characteristic of prosody is often associated with emotional states, which could be a reason some feel that individuals on the spectrum do not relate well (Fay & Schuler, 1980), are uninterested in others (Muller, Schuler, &Yates, 2008), or are not pleasant to listen to or communicate with (Muller, Schuler & Yates, 2008).

Atypical prosody has not been adequately addressed in the intervention literature, to date, despite the fact that abnormal prosody has been identified as one of the central features of individuals with autism by the DSM V criteria (Baltaxe & Simmons, 1985, 1992; Rutter & Lockyer, 1967).

Despite the lack of research in this area for ASD, there is a plethora of developmental, descriptive research on prosody in typically developing

children. In fact, prosody has been shown to be an integral part of language development and develops even before phonology in typically developing individuals (Crystal, 1979; Christophe, et. al., 2001). As well, prosodic cues can play a pivotal role in language acquisition in typically developing individuals (Wells and Peppe, 2003). In addition to language acquisition, prosodic cues are an integral part of reading emotions through non-verbal communication (Koning & Magill-Evans, 2001). This is important, as individuals with Asperger Syndrome have been shown to have significantly greater difficulties with interpreting emotion from non-verbal cues and they rely significantly less of prosodic information than typically developing individuals (Koning & Magill-Evans, 2001). For example, Koning and Magill-Evans (2001) matched with twenty-one boys diagnosed with Asperger Syndrome were matched with typical peers in pairs (based on age and IQ), Konging and Magill-Evans (2001) found significant differences in social perception skills when they were asked to match pictures and videos of individuals with the affective state of the individuals (the videos had the audio filtered making the words unintelligible, but retaining prosody and vocal tone). More specifically, the individuals with Asperger syndrome relied on fewer features to determine the affective state than the typically developing group, and were able to identify significantly less, although there were no underlying categories that could be identified. Both groups used facial cues, but the group diagnosed with Asperger Disorder used far fewer voice, body or

situational cues to determine the emotion. These studies suggest that difficulties with prosody may negatively affect many areas. It has been suggested that some key core areas may be “pivotal” in that improvements in these core areas may positively affect a variety of non-treated areas. Specifically, competence in prosody may positively influence language development and communicative competence, as well as friendships and relationships through non-verbal communication and perception.

These prosodic disorders are evident in individuals with ASD from infancy and presently appear to persist throughout the lifespan (Ghaziuddin & Gerstein, 1996; Volkmar, Chawarska, & Klin, 2005). Eisdnmajer and researchers (1996) suggest that these atypicalities are found at higher rates in individuals with Asperger Syndrome than individuals with Autism. Shriberg et al. (2001) found that almost 47% of adolescents with AS suffer from severe prosodic disorders, and Simmons and Baltaxe, (1975) found similar results that 57% of individuals with AS show notable prosodic differences in their speech (segmenting, flow: See Table 1). In addition, voice differences, specifically stress and resonance negatively affect individual’s reactions’ of those with ASD. More specifically, Mesibov (1992) and VanBourgondien and Woods (1992) found that abnormal prosody is the most prominent deficit that peers notice in individuals with AS, even when their language and grammatical skills are similar to their peers. Thus, creating a difficulty in social inclusion for these individuals. Paul et al. (2005) found that cognitive

functioning or IQ of individuals with ASD was independent of those with or without prosodic disorders. That is, prosodic disorders can occur across many individuals with ASD, even those with few support needs. Paul et al. (2005) found that individuals with stress and resonance disorders were perceived as having lower cognitive functioning than those with no prosodic disorders, even though prosodic disorders were unrelated to IQ. In addition, even when children with Asperger syndrome learned to use appropriate grammatical prosody (for example, raising their voice at the end of a question) (Gussenhoven, 2004) they were still perceived as "odd" by adult listeners, when compared with typically developing peers that were matched by age and IQ (Filipe, Frota, Castro & Vicente, 2014). In this study Filipe and researchers (2014) studied children ages 8-9 with AS and matched them with typically developing peers based on age and IQ then looked at sentence type (either statements or questions) using both acoustic and perceptual measures. While children with AS showed no significant differences in acoustic tests, they were perceptually viewed as "odd", as they showed greater variability in fundamental frequency contours compared to the typically developing peers.

In addition, individuals with Asperger Syndrome scored well on a prosodic test of grammatical stress in statements (Paul et. al., 2005), and children with ASD were shown to recall stressed words better than unstressed ones (Fine et al., 1991), and were able to distinguish sentences

that were statements versus questions (Paul et al., 2005). So this points to the idea that prosodic atypicalities are not a perception or comprehension difficultly for individuals with ASD, but may actually be a strength in this population. In addition, Fine and researchers (1991) found that the prosodic atypicalities that individuals with ASD use are not associated with grammatical functions, but demonstrate a systematic misuse of the linguistic system, which points to a possibility that prosodic abnormalities may be used for a different function than rule-governed grammatical use. This leads to a suggested hypothesis, is that these prosodic differences are used for some sort of self-stimulatory purpose, suggesting that it may produce some sort of sensory reinforcer (Schreibman, L. & Charlop, M.H., 1989). For some children this hypothesis seems viable as their vocalizations are often are produced with inappropriate prosody even when not used a means of communication (Baltaxe, C.A., 1981).

Regardless of the underlying or maintaining variable, these prosodic flows may become a habit that evolves into a pervasive aspect of their communication throughout their lifetimes. Habits typically form in individuals by use of repeated antecedents, which trigger a certain behavior to occur (Aarts, Verplanken, & van Knippennberg, 1998; Hull, 1943; Skinner, 1938, Watson, 1914). After repeated use of this, a habit develops and the trigger becomes subconscious (Ouellette & Wood, 1998). For example, a person can develop the habit of eating a snack by walking into their break room every

late afternoon at work and having something to eat, soon just waking into the break room, or that time of day can trigger a craving for a snack. Similarly, a person can develop a habit of speaking a certain way just by entering into a social conversation.

When individuals exhibit these prosodic atypicalities, they are correlated with many negative stereotypes (see details below). Now that the language interventions for individuals with ASD has improved considerably (Koegel, O'Dell & Koegel, 1986; Koegel, Koegel, & Surratt, 1992; Delprato, 2001) many are becoming verbal (Koegel, 2000) and conversational (Koegel, Park, Koegel ref). Therefore, it is becoming increasingly important to provide effective treatments that target prosody for individuals with ASD. In addition, Shriberg (1990) found that individuals with prosodic abnormalities were significantly correlated with levels of independent living. What makes this area more challenging for individuals with ASD is the documented fact that prosodic deficits do not seem to improve even when individuals with autism have improvements in other targeted areas (Simmons & Baltaxe, 1975; Shriberg et al, 2001). Therefore, prosody needs to be addressed directly, and needs to be one of the main targets in intervention, as it can produce meaningful and socially significant outcomes for these individuals. Again, there is a paucity in the area of intervention for prosodic deficits.

Despite the fact that there is a lack of research focusing on improving prosody in individuals with ASD, there is some research in the general field of

prosody for individuals with other developmental disorders, for example, speech and language disorders (Wells and Peppe, 2003), Williams syndrome (Catterall et al., 2006), deafness (Parker and Rose, 1990). More specifically, techniques such as computer imaging, and sound devices have been used to improve prosodic disorders in children with apraxia and other motor delays, but these techniques do not seem to generalize outside of the treatment setting. For example, Thomas-Stonell, McClean and Dolman developed a computer-based speech training (CBST) program called “Stepping Stones Game,” which gives auditory and visual feedback on speech rate, including overall rate, articulation, and pause time. This game has motivating components, so that individuals appear to enjoy the game, and improving their prosody appears to be a secondary reinforcer. This game had many positive effects, and all of the participants were able to adjust their speech rates (either slower, or faster) and increase overall intelligibility during the intervention sessions. Unfortunately, the participants did not demonstrate generalization of these effects when they were in non-clinical settings (although the team anecdotally reported changes in rate for two of the three participants). This suggests the need for further studies in this area. Another type of intervention that has shown some positive gains in prosody is music therapy. Lim (2008) completed a study with over 70 individuals with autism and language disorders who received music therapy and speech therapy in order to increase their vocabularies. That is, the targeted goal was

vocabulary, and new vocabulary words were taught through songs. In addition to vocabulary growth, the participating individuals demonstrated a collateral gain of improvements in prosodic development (volume and pitch accent), and the individuals receiving music therapy improved their prosody slightly more than with speech alone. These improvements in prosody were also noted in the individuals with ASD. This suggests that some types of musical treatments may be helpful in this area. As well, the intervention may be desirable as researchers have suggested that children with ASD prefer musical stimuli over visual stimuli (Kolko, Anderson & Campbell, 1980), and other studies showed that children with ASD spent more time listening to a musical stimulus over looking at a visual stimulus (Thaut, 1987). While previous research indicates that children with ASD prefer visual over auditory cues, there seems to be an exception in regards to musical stimuli. There was no generalization or maintenance data collected for the aforementioned studies using music training, so there is further need for additional studies on this topic. In addition, there were no acceptability measures collected, so it may be important to address the interests of the participants and the age prior to beginning an intervention using music therapy, as some types may not be age appropriate for adults.

In short, the area of prosody has been largely ignored for individuals with ASD, but is important because of the stigmatization of those demonstrating prosodic atypicalites (see above). Because generalization

seems to be a barrier, interventions that increase the likelihood of generalization outside of the intervention setting and over time will be important.

C. Self-Management as a treatment for Autism

One type of intervention that has shown success in generalization of intervention gains is self-management (Pierce & Schreibman, 1994; Koegel et al., 1992). Self-management is a technique that involves use of a flexible system that can be taught as an intervention for a variety of different behaviors. Specifically, self-management is a technique used to teach awareness of behaviors, and to either increase or decrease the occurrence of them. There are a series of steps involved in the process of self-management, including a) teaching an individual to discriminate when a specific behavior has occurred versus when it hasn't occurred, b) recording this behavior and c) then obtaining a reward for successful engagement in a target behavior (Koegel & Koegel, 1990). Research has shown that it works well with many individuals (of many functioning levels, and disabilities), and can be implemented in a variety of different settings (home, school, camp) (Koegel & Koegel, 1990; Oswald, Ellis and Singh, 1995).

Self-management is an intervention that has that has been successful in treating a variety of different behaviors, including increasing on-task behaviors as well as decreasing problem behaviors in children with autism.

Self-management has also been found to be effective in treating speech impairments (specific phonemes such as /r/, /z/, and /s/) in typically developing children (Koegel, Koegel, & Ingham,1986). One benefit of teaching self-management is that the child is taught to become responsible for his or her own behaviors, and therefore no longer needs the assistance of an aide as the self-management can be programmed to occur in settings beyond the original treatment location (Dunlap, Koegel, & Koegel, 1991; Koegel, Koegel, & Parks, 1991, Riffel et al, 2005).

Because individuals with AS are able to learn and produce typical prosody in grammatical statements but not generalize, self-management, which has been affective for monitoring and generalizing a variety of different behaviors by individuals with ASD and other disabilities seems like an appropriate intervention.

In addition, young adults report enjoying using self-management to teach new behaviors to themselves, and feeling less stress when using self-management. This is important because increased stress may negatively affect individual's learning new skills (Singer, Goldberg, Hamblin, Peckham-Hardin, Barry, & Santarelli, 2002). Singer et al. (2002) found in a study on parent education, that when parents had a high level of stress it was negatively correlated with learning new skills. So, it is important that individuals learning treatment skills feel low levels of stress. Teachers and parents have reported enjoying using self-management to teach new skills

and learn new behaviors (Lin…Robinson). It is important in any intervention, especially when you are working with adults (who need to come to intervention willingly) to measure the acceptability of the intervention in order assure low stress levels are maintained.

In addition, parents of individuals with ASD report significantly higher levels of stress associated with interventions and care-giving needs for their children (Singer, Irvin, & Hawkins, 1988). Self-management changes the role of intervention from the adult to the child, reducing the amount of intervention the parent needs to do, which can relieve some parent stress due to care-taking and scheduling conflicts.

Therefore, the specific research questions were as follows:

- Is self-management intervention effective for teaching appropriate prosody to young adults with ASD during social conversation?
- Will young adults with ASD generalize appropriate prosody after interventions ends? This will be shown by percentage of correct prosodic intervals in a ten to fifteen minute conversation probe with a similar aged peer in the natural setting judged by a naïve observer.
- Will young adults make collateral gains in how normal they sound during social conversations? This will be measured in a six-point likert scale by a naïve observer (see appendix).

- Will the intervention procedures be viewed as acceptable to participants in this study?

II. Method

Participants

Participants in this investigation were three individuals diagnosed with Autism Spectrum Disorders according to the DSM-V definition (APA, 2013) by an outside agency and referred to the UCSB Koegel Autism Center for intervention. The participants were selected because each individual showed inappropriate prosody in their speech that was perceived by others to be interfering or distracting. It was likely that this prosodic deficit was preventing them from engaging in social conversations and developing relationships with peers. A prosodic deficit was defined individually for each participant, because all behaviors were idiosyncratic. Past researchers have tried to identify an overarching prosodic deficit in individuals with AS, but have not been able to find a classification for overall prosody deficits (Bonneh et al., 2011). A more detailed definition of each individual's prosodic deficit is provided below (Table 1) based on definitions by Crystal (1969) and Quirk et al. (1985).

Table 1. Definitions of Different Prosodic Deficits

Fluency or rhythm	The smoothness, consistency, syllable lengthening, and rate of the message
Phrasing	Chunking the speech continuum
Prominence	Highlighting words or phrases
Vocal Intensity	The loudness or softness of the message
Blocks	Difficulty in recollection, or interruption of a train of thought or speech
Intonation	The melody of speech
Example: Appropriate behaviors: Flow: Speech that is smooth, consistent, and uninterrupted during delivery of the message. Inappropriate behaviors: Speech that is so unclear the message is not understood, or has interruptions after the start of the message.	

In regard to academics, all individuals were receiving passing grades in university courses (grades of C or higher in all academic courses at a four year university), and desired friends at the time of treatment. All individuals provided consent in agreement with human subjects for themselves or their adult children prior to the start of intervention. An explanation was given to all of the participants about what the study entailed and how it would be conducted.

Participant 1 (Richard) (22, Caucasian, male) demonstrated the inappropriate use of pauses, syllable and word repetitions, as well as blocks during the start of an utterance or beginning of a sentence (Laver, 1994). Richard's speech sounded very similar to verbal stutters. His mother and the Disabled Students Program at the University of California at Santa Barbara referred Richard to the Koegel Autism Center at the start of college because

Richard was he had no friends, social activities, and difficulty with hygiene. Richard was able to pass out of all of his major classes (Mathematics) at the start of college because his academic advisor believed that he “knew more than the teachers”. In college Richard received high honors in his courses, and had been accepted to graduate school in mathematics for the next year.

Participant 2 (Peter) (26, Caucasian, male), spoke with loud vocal intensity. His sister reported being embarrassed to go in public with him because he repeated private or embarrassing topics at such a loud volume everyone stared at him. He had been diagnosed with autism according to the DSM IV criteria at the Koegel Autism Center and had been receiving services from the Koegel Autism Center for almost fifteen years. Peter had initially been referred to the Koegel Autism Center from his special education teacher for social deficits and extreme restricted interests. At the start of intervention, Peter had recently graduated from a four-year college and was not able to obtain a job despite many applications to waiter at restaurants and bag groceries at grocery stores at the time of this study. At the start of intervention, he recently obtained a job working for his family at a marketing agency.

Participant 3 (Harry) (22, Hispanic, male) demonstrated the inappropriate final syllable lengthening in his speech (Laver, 1994). This makes his speech much slower than normal (with each thought he lengthens the final syllable). At the start of intervention, Harry had recently graduated

from a four-year college, and received honors for his academic skills. He was referred to the Koegel Autism Center, because he had not been able to make a single friend in four years of college, despite many failed attempts to join clubs, and meet friends on campus and in classes. Harry had co-morbid disorders of depression, and prior to treatment had suicidal thoughts because of his lack of friends, and reported thinking of suicide often when bored and alone. He was being treated at the Koegel Autism Center for social and restricted interest deficits for six months prior to the start of prosody intervention. After Harry graduated college, he moved home with his parents, because he could not find a roommate to live with at the time of this intervention. At the start of intervention, he was living at home with his dad in the Los Angeles area for three months, and had not engaged in any social activities.

There are only males in this study consistent with the 4-1 diagnosis of males with autism over females.

Peer Confederates

The peers were naïve to the experimental hypothesis, but were aware that the participant was self-managing behaviors and were able to report whether or not self-management was occurring (although they did not provide any feedback or reminders to the participant). The reason for the peers in this study, were so the participant could practice their prosody in a variety of

generalization settings. Peers were recruited through research assistant program offered through UCSB. Peers provided consent in agreement with human subjects.

Design

In order to allow for flexibility of the research design in applied sessions (Watson and Workman, 1981), and to ensure that there was no possibility of interdependence of the baselines (Kazdin, 2011) a concurrent multiple baseline design was used to address research questions. In accordance with the multiple baseline design, prior to the start of intervention, baseline measures were staggered across participants: three sessions for Richard, and seven for Harry, and five for Peter. The design also included generalization probes to assess prosody with new conversational partners in different environments after participants reached 80% appropriate prosody during intervention sessions. Peers were volunteers at the Koegel Autism Center, who received training in social communication with individuals on the spectrum, but no training in prosody treatments. The peers received iPod touch video cameras or small video cameras in order to videotape sessions in the natural environment.

Setting and Materials

Intervention sessions took place in a clinic room in the Koegel Autism Center at UC Santa Barbara, and also in the participants' natural environments. The clinic room had a small table, chairs, sofas, and windows. A small video camera was placed on the table and all sessions were recorded for later analysis. A self-management device was also used during session. This was either a piece of paper and a pen or a wrist counter that recorded up to ninety-nine responses.

The generalization settings took place around the university campus where the participants had lived when the study began. These included, restaurants in the community, the beach, and clubs around campus. These were places where the individuals already attended on a weekly basis.

Procedure

Baseline

Baseline consisted of videotaped conversation samples between the participant and a similarly aged peer with whom the participant was familiar. The conversation sample lasted approximately ten minutes or longer and the clinician discussed a variety of everyday topics such as school, how their weekends were, clubs and activities. No special instructions were given and the conversational partner, who was naive to the experimental hypothesis of the study, was asked to chat with the participant for fifteen minutes. Because

most of our clients had few or no social interactions during baseline, we offered to pair them with a similar aged peer each week, who participated in weekly scheduled activities throughout baseline and treatment. Two of three participants chose not to have a peer present (possibly because of travel to UCSB each week from home towns). If the participant chose to not have a peer, they were asked to chat with either a parent, interventionist or friend for a minimum of one hour each week.

Assessment of prosody

An assessment was done by a licensed speech pathologist, who was trained in prosodic disorders and identified the most prominent prosodic disorder after watching three ten minute video clips of participants. Reliability data was collected by a second therapist who was also trained in Autism Spectrum Disorders and assessment of Autism.

Intervention

The self-management procedures followed the manualized instructions described in Koegel, Koegel and Parks (1992). Step 1. Teach identification of the target behavior. Participants were taught how to discriminate the appropriate prosody versus their inappropriate prosody. Individuals were first shown examples of appropriate versus inappropriate prosody and asked to identify which one was appropriate. A session had correctly spoken

sentences interspersed with sentences with prosody errors and might sound like this “I….wen…went to the beach today’, did I pause in that sentence or did I speak fluidly?” Next, they were asked questions and evaluate whether their own prosody was appropriate/inappropriate. Step 2. Teach Recording of Target Behavior. Participants were shown how to use their self-management device (either a wrist counter or a sheet of paper and pen), and were taught to track their own points during the session. Step 3. Use Self-management device. Participants were asked to practice short sentences using the appropriate prosody, and to identify if the prosody was appropriate prosody after each utterance. If the participant forgot to use their self-management device after an appropriate utterance, the clinician prompted him or her, by pointing to the device or log. After approximately three sessions, interventionists were able to completely fade their prompting. If inappropriate prosody was used, the interventionist gave the participant an opportunity to restate the sentence on his or her own, before he or she marked their device. If the participant still had inappropriate prosody after the prompt to repeat the utterance, the interventionist modeled the appropriate prosody and had the participant repeat the sentence, then monitor the utterance with appropriate prosody. Step 4. Fade the presence of the treatment provider. Once the participants were able to independently use the self-monitoring device without prompting, fading began by programming self-management in other settings. In order to program the occurrence of self-management into natural settings

(the beach, familiar restaurants and coffee shops college town) each participant was asked to use the correct prosody and to monitor it outside of the clinical setting. Participants continued to engage in weekly activities of their choice, such as going for a walk, out to dinner, or getting coffee with their peers. These sessions lasted between thirty minutes to one hour. If the participant chose to not have a peer mentor, he was asked to schedule an activity with a relative or friend who they had previously chosen at baseline. The participants brought their self-management devices and practiced without the presence of the interventionist. In order to motivate the participant to engage in self-management they were provided with an opportunity to pick from a list of rewards (hanging out with a peer, going on a bike ride, going to an arcade, etc) if he or she self-managed in their natural setting. If the individual did not want to go on activities with a peer, others in his natural setting were taught to do the same thing as the peer. Step 5. Fade the self-management device. After the participant was able to use appropriate prosody during three consecutive probes, the self-management device was no longer used.

Dependent Measures

Data were collected on three dependent measures:

Appropriate Prosody: Appropriate prosody was measured during fifteen-second intervals, where the participant had to engage in a minimum of

a two-word utterance. Each fifteen-second interval was coded for whether the behavior did or did not occur (with a + for appropriate prosody and a – for inappropriate prosody) for approximately a ten-minute conversation probe (or longer if intervals had to be deleted for lack of utterance), with a minimum of 38 intervals where the participant engaged in more than two-word utterances.

Normalcy: Normalcy was coded on a six-point likert scale. Normalcy was taken to measure social validity of the participant's prosody. A naïve observer rated the participant on how normal they sounded after watching a ten-minute conversation clip (see appendix for scale).

Acceptability: Participants rated how much they liked the intervention on a six-point likert scale after five intervention sessions (see appendix for scale).

Fidelity of implementation

Clinician

The clinician videotaped intervention sessions and an undergraduate followed a checklist of the manualized program (Koegel, Koegel & Parks, 1992) which consisted of the steps detailed above (identifying and teaching behaviors, recording the occurrence of behaviors, and rewarding the behaviors) in order to assure accuracy of intervention program.

Participant

Each participant was trained via a manualized treatment (Koegel, Koegel, & Parks, 1992) and sessions with feedback during the first three sessions. During one-third of all sessions, a licensed speech pathologist, who was trained in self-management, observed videotapes or watched in-vivo sessions of the participants to make sure they were correctly monitoring their prosody. The independent researcher was given a definition (listed in table 1) about what appropriate prosody was.

Reliability

Reliability was calculated on one-third of all treatment sessions by a licensed speech pathologist. The independent therapist independently watched videotapes of one-third of the sessions in baseline and intervention and recorded data. For the purpose of calculating reliability, if the therapist and the researcher gave the same answer for the time-interval, they were in agreement.

III Results

Prior to the start of intervention all of the participants showed little to no correct prosody during their social conversations. However, following the implementation of the self-management intervention, all three participants immediately increased in the number of intervals they were able to engage in appropriate prosody. Further, all demonstrated stimulus response generalization of appropriate prosody during new conversation topics to peers unassociated with the intervention in non-treatment settings. Results for each dependent measure are described in detail below.

Appropriate Prosody

Figure 1 shows the percentage of fifteen second intervals the participants engaged in appropriate prosody during representative conversational probes. Data were collected over a period of ten to twenty two during baseline, appropriate prosody for Participant 1, Richard, hovered just below 20% during all baseline points. However, at the start of intervention there was a rapid increase in the percentage of intervals with appropriate prosody. Richard increased from baseline mean of 16.1% of intervals with appropriate prosody to a mean of 69% (Range 61.2%-86%). of intervals with appropriate prosody during intervention. Further, generalization probes (noted by the diamond symbols on the graph) showed that he continued to use appropriate prosody in other non-treatment settings during novel

conversations with different peers. In addition, Richard maintained his appropriate prosody during a long-term follow-up probe collected two months after intervention was discontinued. This maintenance probe was also collected in a non-intervention setting with a new peer while he engaged in novel conversation.

Similarly, Participant 2 did not use any appropriate prosody throughout the baseline period. That is, all sessions were scored at 0% during all of the baseline sessions. Immediate improvements occurred during the first intervention session, and he was able to improve his appropriate prosody to 100%. Participant two required the least amount of teaching. He already had the ability to lower his voice without any training, the only area that required some training was teaching him how to whisper. After three clinical session probes with appropriate prosody being scored at 100% a generalization probe indicated that the skills were not being used in novel settings with a peer. Following two more clinic sessions with probes at 100%, he demonstrated generalization to during conversations with peers in a setting where intervention had not occurred. A follow-up probe three months after intervention was discontinued, showed that improvements maintained. That is, he was scored as using appropriate prosody during 86% of the intervals in a generalization setting with a novel peer and new conversation topics.

During baseline Participant 3 averaged 4% (range of 0%-17%) of appropriate prosody. In addition, in five of the eight baseline probes he scored

0% of intervals with appropriate prosody. During intervention he immediately increased to 45% of appropriate prosody, and averaged after fourteen sessions 72% with a range from 45-95%. It is also noteworthy that Participant 3's intervention gains showed a steady improvement throughout the sessions with the last two points above 95% of intervals with appropriate prosody.

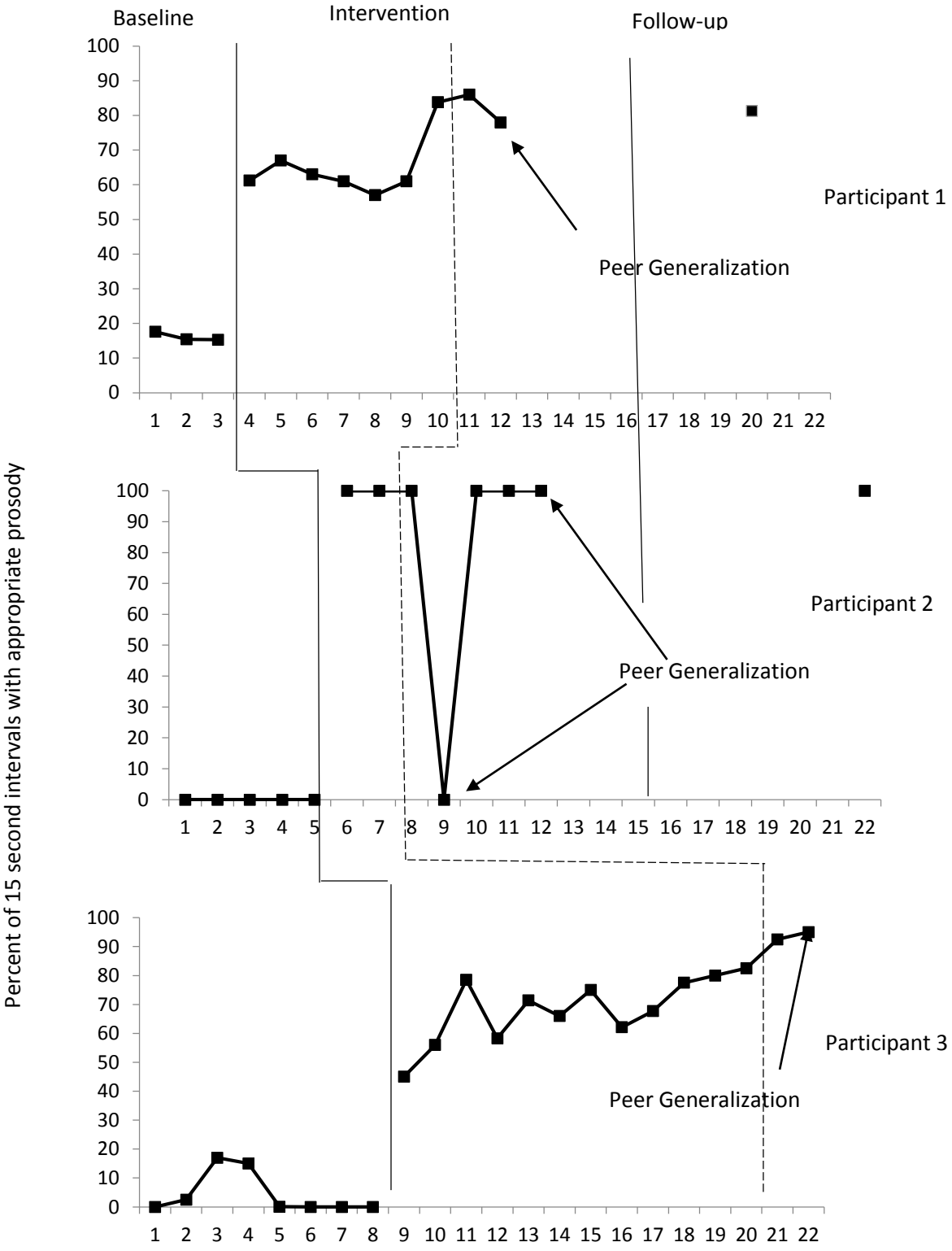


Figure 1 Intervals with Appropriate Prosody during a ten minute conversation

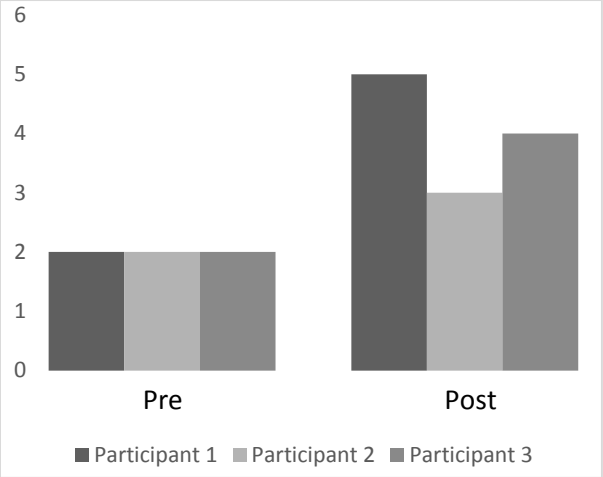
Normalcy

Participants were also rated for social validity on a normalcy scale. All participants increased in how normal they sounded after intervention or stayed consistent in all areas related to prosody, and increased in the amount of interest in the conversation. The results are shown in Figure 2 below.

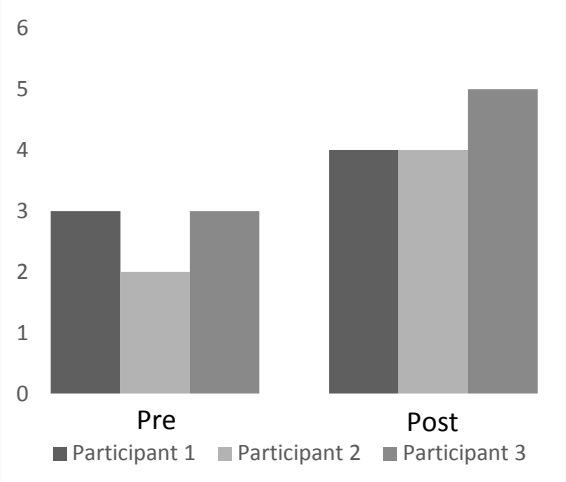
Participant One's rate and flow increased from 2 or (abnormal) to a five (normal), his interest increased from a 3 (slightly abnormal) to a 4 (slightly normal), and overall he increased from a 2 (abnormal) to a 4 (slightly normal) during his intervention session.

Participant two's rate and flow increased from a two (abnormal) to a three (slightly abnormal), his volume of voice increased from a two (abnormal) to a five (normal), his interest increased from a two (abnormal) to a four (slightly normal), and overall increased from a two (abnormal) to a four (slightly normal).

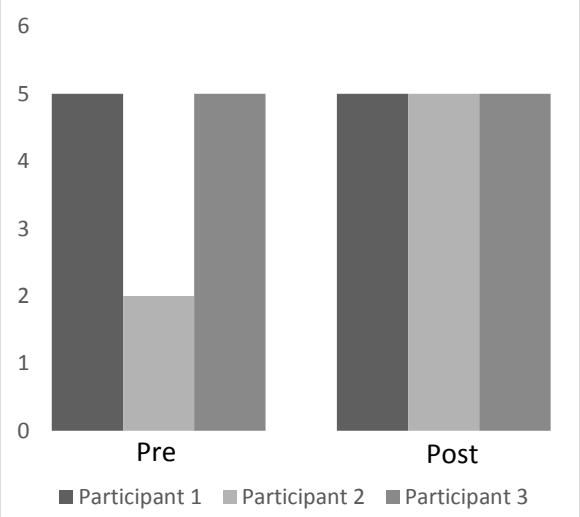
Participant three increased in rate and flow from a two (abnormal) to a four (slightly normal), his volume of voice stayed consistent at normal, his interest increased from a three (slightly abnormal) to a five (normal) and overall he increased from a two (abnormal) to a four (slightly normal).



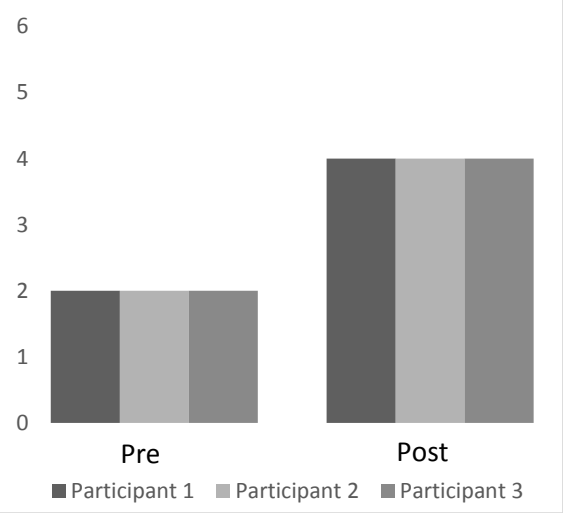
How normal did the participant's flow and rate sound?



How interested did the participant sound?



How normal did the participants volume of voice sound?



Overall, how normal did the participant sound?

Figure 2 Normalcy ratings

Table 2

Normalcy Ratings

	Participant 1		Participant 2		Participant 3	
	Baseline	Treatment	Baseline	Treatment	Baseline	Treatment
How normal did the participant's flow and rate sound?	2 Abnormal	5 Normal	2 Abnormal	3 Slightly Abnormal	2 Abnormal	4 Slightly Normal
How normal did the participants volume of voice sound?	5 Normal	5 Normal	2 Abnormal	5 Normal	5 Normal	5 Normal
How interested did the participant sound?	3 Slightly Abormal	4 Slightly Normal	2 Abnormal	4 Slightly Normal	3 Slightly Abnormal	5 Normal
Overall how normal did the participant sound?	2 Abnormal	4 Slightly Normal	2 Abnormal	4 Slightly Normal	2 Abnormal	4 Slightly Normal

Acceptability

Table 3 shows the acceptability of interventions. The self-ratings for how much the participants liked the interventions are shown below in Table 4. Richard rated the intervention a 5 on a 6-point scale (1-6 points). He said that he felt very little stress and agreed with enjoying the intervention sessions. In addition he also agreed that he used his skills outside of the intervention settings. Participant two rated intervention a 6 on a 6 point scale and a 1 for the amount of stress he felt during intervention. Participant three also rated stress during intervention at a 1 meaning he felt no stress during intervention. Refer to appendix for the normalcy scale, and that he agreed that the intervention was helpful for him.

Table 3

Acceptability Ratings

	Participant1	Participant 2	Participant 3
I enjoyed participating in the intervention	5 Agree	6 Strongly agree	6 Strongly agree
This intervention was helpful for me	5 Agree	6 Strongly agree	6 Strongly agree
I felt stressed participating in this intervention	1 Strongly Disagree	1 Strongly disagree	1 Strongly disagree
I would recommend this intervention to others	5 Agree	6 Strongly agree	6 Strongly agree

Fidelity of Implementation

Clinician

After following a manualized program and checklist, fidelity of implementation for the clinician was calculated at 100% for all three participants.

Participant

Fidelity of implementation for the participant was calculated with a mean of 80% and a range of 75-100% for participant one. As the participant increased in their ability to self-manage, their ability to self-manage correctly also increased. For participant one, the final two sessions where the participant used the self-management device were calculated at 100% fidelity of implementation. For participant two, the final three sessions were calculated at 100%, and for participant three, the final session was calculated at 100%.

Reliability

Reliability of inter-rater observation was calculated with a mean percent agreement of 85% (with a range of 80-100%). Kappa was calculated in order to further establish reliability of this measure and yielded a score of K= 0.7247.

IV Discussion

The first research question, is self-management intervention effective for teaching appropriate prosody to young adults with ASD during social conversation showed that appropriate prosody (i.e., disfluencies and blocks, voice volume, and vowel lengthening) improved during a self-management intervention. The second research question, will young adults with ASD generalize appropriate prosody after intervention ends across peers and settings showed that participants were able to generalize their gains across different peers and settings; long-term follow-up probes suggested that participants were able to maintain appropriate prosody after intervention ended. The third research question, will young adults make collateral gains in how normal they sound during social conversation showed that participants made collateral gains on normalcy ratings during a social conversation scored by naïve observers. The final research question, will the intervention procedures intervention procedures were viewed as acceptable by the participants in the study.

This study shows that the self-management intervention improved atypical prosody in these young adults and they were able to generalize their prosody to other peers and settings. In addition, naive peers rated these

individuals as sounding more normal overall, and showing more interest overall in their conversations after treatment than in their baseline sessions.

Individual Differences

While the major findings listed above characterize each of the adults in the present study, there is some heterogeneity with respect to the time it took for participants to make gains in each of their prosodic atypicalities. What participant two learned in ten minutes, Participant three learned in three weeks. This may possibly be related to the amounts of intervention each participant had received prior to intervention or the strength of the habit for each participant. However, overall the learning curve was quite rapid considering that the participants had used incorrect prosody for most of their lives. Future research could focus on prosody in younger children where the habits of speaking certain ways may be weaker; because of less practice (Yerkes & Dotson, 1908) this may possibly decrease the length of intervention. On the other hand, more mature individuals may respond more rapidly to intervention, particularly because they may be aware that atypicalities are interfering with their independence, the likelihood of getting a job, and interpersonal relationships (Zager & Alpern, 2010; Mueller, Schuler & Yates, 2008).

Another interesting issue relates to the high prevalence of prosodic difficulties in individuals with autism (Simmons & Baltaxe, 1975). It is

unknown why prosodic abnormalities are so frequently seen in autism. One hypothesis is that there is a discrepancy between the production and identification of prosodic flow, because children on the spectrum can identify appropriate prosody, even when they can't produce it (Paul et al., 2005; Fine et al., 1991). Therefore, even though there is a receptive understanding of what is appropriate versus inappropriate prosody, production continues to be a challenge (Baltaxe, 1981). One could hypothesize about why this disconnect between receptive and expressive use occurs. For example, many children with autism have difficulty attending to all of the relevant cues of a stimulus, also described as "overselective attention" (Lovaas, Koegel & Schiebman, 1979). It might be possible that receptive tasks where attention is focused just on one cue is within average range, but during expressive communication when many cues need to be exhibited simultaneously the task is more challenging, this is supported by the fact that the participants could not identify the prosodic atypicality prior to intervention. Another possibility relates to a core symptom, social difficulties in individuals with autism spectrum disorder. This may make imitation more difficult, particularly when communication in general is challenging. Imitation is a social skill that is learned early in life that is a possible deficit in children with autism (Smith & Bryson, 1994). Another hypothesis might be that these prosodic differences are learned, and reinforced, and actually have a function. For some individuals the behavior may function as avoidance or escape of social

demands being placed on them while in others attention may have been provided early on and thus inappropriate patterns were reinforced. Finally, it may be that these prosodic differences provide some sort of self-stimulatory function, which has been hypothesized to produce sensory reinforcement. Although this did not seem to be the case in the present study, it could be that during the early language learning years some type of sensory reinforcer occurred and therefore the behavior was maintained. It may be worthwhile to find the cause of the problem, for example, if the cause is avoidance, then there can be an intervention teaching only speech where appropriate prosody occurs and slowly fading in some less preferred topics early in life, so that prosodic atypicalities never become an issue.

Regardless of why these habits develop, prosodic abnormalities can become stigmatizing for these individuals. Adults with autism are increasingly attending college, but their social participation and integration in the university is below the level of students without disabilities (Dillon, 2007). So, even if individuals with ASD learn appropriate communicative skills, they may not be able to practice them at similar rates as their typically developing peers. That is, without peer interaction adults with autism may not get the feedback necessary to help them change their behavior. While two of three participants in this intervention were able to practice outside of the clinic without peer support, one participant was paired with a similarly aged student, and was able to practice prosody outside of the clinic. This shows that as long as

these individuals have someone to practice their prosody with, they may not need a peer assigned to them. One intervention that can be used to increase the number of social activities that individuals with ASD attend is to pair them with similar-aged, neuro-typically developing peers to attend activities with them as support. It would be interesting to assess whether adding self-management of appropriate social behaviors, such as prosody, could increase the amount of time that individuals with ASD are practicing appropriate behaviors (Koegel, Ashbaugh, Koegel, 2013). Koegel, Ashbaugh and Koegel discussed the use of structured social planning to increase the amount social activities individuals participated in, it's possible that structured interventions, like self-management could also be used to increase other appropriate social behaviors.

Another important issue relates to the method that resulted in the change in prosody. This study demonstrated that self-management is an effective intervention for prosodic deficits in individuals with ASD. A higher percentage of appropriate prosody was seen during intervention and also in generalization clips with typically developing peers. Self-management was chosen as an intervention because of its past effectiveness in generalization of behaviors in individuals with ASD (Pierce & Schreibman, 1984; Koegel & Koegel, 1990; Sanders & Glynn, 1981). It may be possible that intervention for prosody may not be effective unless some sort of self-control is in effect to assure that appropriate prosody occurs across settings and often enough to

break well established speech habits. In addition to self-management being an effective intervention, both in the clinic setting, and for generalization to the natural environment, participants reported enjoying the intervention.

Social Validation

Furthermore, one participant's parent emailed to notify that she noticed a substantial change in her son's speech, and reported that it was significantly easier to have a conversation with him. The same client also noted in his Acceptability Scale that he believed the intervention was extremely helpful for him, and he "used his new skills frequently." In addition, normalcy ratings were extremely significant in this study. It seems as that prosody is heavily weighted when judging how typical a person seems. These results mirror the results of Paul and researchers (2005) when looking at the perceptions of individuals with appropriate prosody. In addition, in this study Paul and researchers (2005) found that many typically developing adolescents were embarrassed to mimic certain types of prosody (such as baby talk) but individuals with ASD did not seem to mind imitating these sounds. This further suggests that prosody may weigh heavily on perception and feelings.

Limitations and areas for Future Research

There are several limitations of the present study. First, the adults that participated for the most part had a high level of motivation to improve their

social lives and to have an intimate relationship. They understood that their prosody may be effecting their abilities to engage in meaningful relationships and therefore appeared to have the motivation to change their prosody, and actually use their self-management tools outside of their sessions, as evidenced by reported practice outside the clinic sessions. Further research to understand the relationship between ongoing self-monitoring, rate of monitoring, and willingness to monitor and positive outcomes may be fruitful. For example Participant 3 appeared to be the most motivated to increase in his appropriate prosody, suggested by his reports of frequent practice, so he required no reminders outside of intervention. Participants 1 and 2 reported l lower levels of monitoring their appropriate prosody outside of interventions. For Participant 2, this may have resulted in a lack of generalization during the first probe. Thus, more research to assess individual differences may yield some interesting results.

Another limitation for this study was that some prosodic elements may be difficult to maintain over time. While this study did collect data several months after the completion of intervention, long term maintenance was not assessed. For example, long term maintenance has been elusive in the field of stuttering (Guitar & Bass, 1978; Lincoln & Onslow, 1991) and thus it may be that Participant 1, who had frequent blocks and disfluencies may not be able to maintain his gains over time. Thus, longitudinal research is important.

Another limitation of the study was the small number of participants. While we can be fairly certain that the intervention was responsible for the changes, as baseline probes were quite stable, the participants in the present study were homogeneous. Further research assessing whether the present intervention would be effective with individuals with autism with greater support needs is important. Also, replicating the intervention using a randomized clinical trial may be helpful to understand whether the intervention is significant with a group design.

Additionally, many young adults with ASD spend little to no time with peers (Bauminger & Shulman, 2003; Koning & Magill-Evans, 2001; Little, 2002). Finding and recruiting peers was relatively easy for this study, because it was implemented in a University setting. However, if there are no peers present, or the individuals decides that he or she does not want to meet with a peer (Participant 3), then the participant can practice their skills with whoever he or she spends the most time with. For example, participant three chose to practice with his mother (and also practice saying statements in his car and when he was home by himself) outside of his treatment sessions. Finding and recruiting a peer was relatively easy for this study, because hundreds of University of California at Santa Barbara undergraduate students apply for research assistant positions each quarter. Undergraduates are selected based on GPA and experience, and then interviewed and selected based on personality and motivation level. If there are no peers present, or

the individuals decides that he or she does not want to meet with a peer (participant three), then the participant can practice their skills with whoever he or she spends the most time with. For example, participant three chose to practice with his mother (and also practice saying statements in his car and when he was home by himself) outside of his treatment sessions.

Another area of importance relates to the how often the participants should monitor their speech. More research should be done on the most effective interval for self-management. It is possible that too lengthy of time periods may not allow the participant to maintain appropriate prosody or correctly self-manage intervals, and too short of intervals may interfere with speech flow as well. In addition to this, the way data is taken is also very important. For example, participant two was working on his speech volume, and the video camera placement picks up volume differently when placed in different areas, so all of his data was taken in-vivo in order to maintain higher reliability and more accurate data.

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Appendix

Normalcy Scale

During this conversation, how normal did the participant's flow and rate sound?

1	2	3	4	5	6
Very Abnormal					Very Normal

During this conversation, how normal did the participant volume of voice sound?

1	2	3	4	5	6
Very Abnormal					Very Normal

During this conversation, how interested did the participant sound?

1	2	3	4	5	6
Very Disinterested					Very Interested

During this conversation, overall how normal did the participant sound?

1	2	3	4	5	6
Very Abnormal					Very Normal

Comments:

Acceptability Scale

I enjoyed participating in this intervention (using self-management to monitor prosody)

1 2 3 4 5 6

Strongly Disagree Strongly Agree

Comments: _____

This intervention was helpful for me

1 2 3 4 5 6

Strongly Disagree Strongly Agree

Comments: _____

I felt stressed participating in this intervention

1 2 3 4 5 6

Strongly Disagree Strongly Agree

Comments _____

I would recommend this intervention to others

1	2	3	4	5	6
Strongly Disagree					Strongly Agree

Comments: _____