The Prediction of Vocabulary Level by Early Declarative and Imperative Communication Acts in Young Children with Autism Spectrum Disorders

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To Ruthie and Dawson

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LIST OF ABBREVIATIONS

ADI-R: Autism Diagnostic Interview – Revised

ADOS: Autism Diagnostic Observation Scale

ASD: autism spectrum disorder(s)

CSBS: Communication and Symbolic Behavior Scales

ESCS: Early Social Communication Scales

HCSE: heteroscedasticity-consistent standard error

IBR: initiation of behavior regulation

ICA: intentional communication act

ICC: intraclass correlation coefficient

IJA: initiation of joint attention

MCDI-WG: MacArthur-Bates Communicative Development Inventory – Words and Gestures Checklist

VABS: Vineland Adaptive Behavior Scales

CHAPTER 1

INTRODUCTION

Research suggests that the development of at least some communicative speech (i.e., expressive language) by the age of 5 or 6 years is associated with better outcomes in adulthood, as are receptive language skills in early childhood (Magiati, Tay, & Howlin, 2014; see also Howlin, Mawhood, & Rutter, 2000; Mawhood, Howlin, & Rutter, 2000). Identifying early correlates of later receptive and expressive language can help identify the foundations on which language is built in children with autism spectrum disorder (ASD). One such correlate is intentional communication (Yoder, Watson, & Lambert, 2015).

Intentional communication, which includes the use of spoken and nonverbal behavior, can be challenging for individuals with ASD. Intentional communication consists of gestures, vocalizations, or symbol use that are directed at another person, as signified by posture, gaze shift, affect, and/or touch (Brady et al., 2012). Gestures and other forms of intentional communication can serve different pragmatic functions. The present study is focused on two pragmatic functions – imperative and declarative – of intentional communication acts (ICAs), and their potential link with language in children with ASD.

Rationale for Expecting Each Function to Predict Language in Children with ASD

Imperative ICAs are those whose pragmatic function is to make requests or otherwise regulate another person's behavior. When unprompted, this function is often referred to as initiation of behavior regulation or initiating behavioral requests (IBR; Mundy et al., 2007; Mundy, Sigman, Ungerer, & Sherman, 1987). Imperative ICAs can be thought of as a continuum, spanning from ordering to suggesting (Tomasello, Carpenter, & Liszkowski, 2007).

From an applied behavior analytic perspective, imperative ICAs are a subset of the concept of mands; the behavior specifies its reinforcer (Skinner, 1957). Their behavioral function can be escape (i.e., removal of aversive stimuli) or tangible reinforcement (i.e., access to a preferred item or activity). The reinforcement for imperative ICAs is socially mediated; the reinforcer is not accessible without the intervention of another person. However, in the case of imperative ICAs, the social component is not likely to be the reinforcer for the communicative behavior. Although imperative ICAs can be used to request affection (e.g., a hug), the requested consequence includes action beyond attention alone (e.g., the physical act of hugging). One example of an imperative ICA is grasping for an object that is out of reach, while vocalizing and looking to and from the object and the person from whom the action is being requested.

Declarative ICAs, on the other hand, serve to direct another person's attention, comment, share information, or share interest (i.e., initiation of joint attention [IJA]; Mundy et al., 1987; Tomasello et al., 2007). Declarative ICAs, from an applied behavior analytic perspective, are related to tacts and maintained by social attention (Skinner, 1957). An example of a declarative ICA is pointing toward an interesting object while laughing and shifting gaze from the object to the person with whom interest is being shared, then returning the gaze to the object.

Imperative and declarative ICAs both create opportunities for linguistic mapping, a type of labeling by caregivers that has been correlated with language skills in some children with ASD (Dimitrova, Özçaliskan, & Adamson, 2016; Haebig, McDuffie, & Ellis Weismer, 2013; McDuffie & Yoder, 2010; Perryman et al., 2013; Siller, Hutman, & Sigman, 2013; Siller & Sigman, 2002, 2008). Linguistic mapping after a child's use of imperative or declarative ICAs may facilitate word learning by pairing the spoken words with the referent of the words (e.g., preferred objects or interesting items or actions; Kasari, Paparella, Freeman, & Jahromi, 2008;

McDuffie & Yoder, 2010).

In addition to the hypothesis that both types of ICAs might elicit language-facilitating linguistic input from others, children who use unprompted imperative ICAs frequently might acquire words relatively rapidly for at least two reasons. First, children who request frequently via nonverbal means might be motivated to learn to use spoken language to have their wants and needs met efficiently. Second, frequent unprompted imperative ICAs signal an ability that might enhance children's ability to learn from verbal responses to their communication acts. Imperative ICAs typically require the person performing the communication act to coordinate his or her attention to both the object or action being requested and the person from whom the child is requesting. Compared to children who do not coordinate their attention, children who demonstrate coordinated attention might be more likely to attend to and learn from adult speech (i.e., input from the speaker and referent in the environment; e.g., Baron-Cohen, Baldwin, & Crowson, 1997), supporting growth of both receptive and expressive language.

There are also at least two reasons why children who use frequent unprompted declarative ICAs might learn to use relatively more words. First, declarative ICAs, too, require coordination of attention between an object and a person (Yoder & Lieberman, 2008). Thus, the advantages that the ability to use coordinated attention to object and person afford the child in language learning might explain a relation between early unprompted declarative ICAs and later language. Second, a child's use of unprompted declarative ICAs also might communicate to caregivers that he or she is generally interested in, and ready to learn information about, the surrounding environment beyond meeting his or her needs and wants. Showing this interest in activities and object spectacles might elicit frequent verbal input from caregivers about the child's current foci of attention, of which communication acts are a subset. These frequent

contributions of verbal information about the child's focus of attention might have a particularly high impact on the child's expressive and receptive language skills because they provide the child with many opportunities to process linguistic input about the same referents.

Because there is a rationale for expecting both pragmatic functions to be related to later language, the theoretical basis for predicting which function might be more related to later language is far from clear. For example, considering the core deficits in ASD, it could be that this route to language learning via unprompted declarative ICAs occurs less frequently for children with ASD relative to other children. Research has suggested that children with ASD produce significantly fewer unprompted declarative ICAs than do typically developing children (Dawson et al., 2004; Özçalışkan, Adamson, & Dimitrova, 2016) and children with non-ASD developmental delay or language impairment (Stone, Ousley, Yoder, Hogan, & Hepburn, 1997). This could be because children with ASD often have very restricted interests, thereby limiting the items of interest on which to comment (American Psychiatric Association, 2013; Yoder & Lieberman, 2008). Additionally, children with ASD might have less motivation to communicate for purely social rewards (Mundy & Neal, 2001). Therefore, it is possible that groups of children with ASD who do not speak frequently do not vary sufficiently in their use of unprompted declarative ICAs to provide a reasonable probability of detecting a real association with later language. However, the empirical review provided later in this document indicates there is very likely sufficient variance in declarative ICAs for the association between them and later language to be significant and moderate in magnitude. Thus, because children with ASD vary in the severity of impairment in the domains of social motivation, communication, and restricted interests, we expect the association between declarative ICAs and language will be present. But the same can be said for the association of unprompted imperative ICAs and language: sufficient

variance in imperative ICAs must be present to detect an association with language.

One reason unprompted declarative ICAs might have a stronger association with language than unprompted imperative ICAs is that a child's generalized tendency to use unprompted declarative ICAs (i.e., frequent sharing of interest across stimuli, settings, and people, as well as over time) might signal to caregivers that the child is eager to interact socially in communication about diverse referents. This generalized behavioral tendency could prompt caregivers to provide more frequent linguistic input about the child's foci of attention and referents of communication than they might provide to children who use fewer unprompted declarative ICAs. A child's frequent use of unprompted imperative ICAs, on the other hand, does not carry the message of the child's sharing of interest in the world, but rather in accessing the reinforcer being requested. The more instrumental nature of the interaction when interacting with a child who engages in many requests might not motivate as frequent interaction or as linguistically rich interaction as might the use of many unprompted declarative ICAs.

Empirical Evidence of the Association of Each Function and Language in Children with ASD

Because there were no available prior systematic reviews or meta-analyses on this topic, there was no definitive answer as to how strongly these two pragmatic functions of intentional communication are related to language in the population of children with ASD. Single studies provide only point estimates for the effect size of the associations of interest. Using meta-analysis, we sought to improve population estimates for the effect sizes for the associations of both pragmatic functions of intentional communication with language (Harbison, McDaniel, & Yoder, 2017). Improving the estimates of the magnitude of these associations provides improved

grounds for selecting the relative emphasis that early intervention might place on the two pragmatic functions in children with ASD. The meta-analysis included concurrent and longitudinal correlational studies to maximize the number of relevant included effect sizes, allowing maximum precision of the estimates for the population effect sizes of the associations of interest.

We asked whether imperative and declarative ICAs predicted receptive language separately from expressive language skills because the two language modalities require different skills. For example, children who use many declarative ICAs, by virtue of their interest in their environment and frequent expressions thereof, might acquire relatively large receptive vocabularies by attending to and learning from the words spoken around them and eliciting linguistic input to their attentional and communicative leads. However, these words might not be used expressively due to delays in consonant production (McCleery, Tully, Slevc, & Schreibman, 2006), limitations in oral motor skills (Gernsbacher, Sauer, Geye, Schweigert, & Hill Goldsmith, 2008), and other physical or neurological issues that inhibit the production of spoken language.

Also following our initial analyses (Harbison et al., 2017), we investigated three indicators of study quality. The first was the presence of risk for correlated measurement error, which threatens internal validity. The possibility of correlated measurement error systematically affecting the associations of language with imperative or declarative ICAs offers an alternative explanation for differing weighted mean associations and is therefore worthy of examination. The two specific risks of correlated measurement error we assessed were (a) the measurement of declarative or imperative ICAs in the same procedure as the language measure and (b) the use of parent report for both measures.

Our second question in the meta-analysis was whether longitudinal versus concurrent correlations might moderate the difference in the respective relations of imperative and declarative ICAs with language. Longitudinal research designs provide more information about potential causation than concurrent ones do because the former meets the assumption of temporal precedence of the putative cause relative to the putative effect, while the latter does not.

As a final question in the meta-analysis, we analyzed interrater reliability and interobserver agreement, important indicators of study quality. High interobserver reliability on imperative ICAs but not declarative ICAs, or vice versa, is a possible explanation for differing associations with language. Thus, we investigated the potential moderation effect that interobserver reliability might have on the difference between the associations of language with declarative versus imperative ICAs.

Using an exhaustive search method, articles in English-language journals, dissertations, theses, books, book chapters, conference proceedings, and monographs that included concurrent or longitudinal zero-order associations between imperative or declarative ICAs and expressive and/or receptive language in children with ASD below 8 years old were identified. A total of 3,627 documents were retrieved. These were screened for relevance, which resulted in identifying 23 studies that met inclusion criteria. Reliability of study selection at the title and abstract screening level was 88.2%. When screening full texts for inclusion, there was 100% agreement. Agreement at the study coding level was 95.4%.

See Table 1 for the study-level associations in the meta-analysis. The weighted mean effect size for the correlation of declarative ICAs and language was moderate and significant (r = .42; 95% CI [.34, .50]). Because the confidence interval does not include zero, we rejected the null hypothesis that declarative ICAs and language are not associated in this population. The

weighted mean effect size for the relation between imperative ICAs and language was not significant (r = .18; 95% CI [-.20, .58]). Therefore, we failed to reject the null hypothesis that imperative ICAs are not associated with language in young children with ASD. The large confidence interval for the weighted mean association of language and imperative ICAs was influenced by the low number of studies (nine) reporting on this association on degrees of freedom (see Tanner-Smith & Tipton, 2014). Because the confidence intervals overlap and the meta-regression was nonsignificant, one might mistakenly conclude that the relative strength of the two weighted mean effect sizes is similar. However, the small sample size for the imperative-language association prevented a reasonable test of the difference in effect size. Possibly due to the small number of studies for imperative ICAs and the low true variability of true effect for declarative ICAs, there was no evidence that reliability, risk of correlated measurement error, or longitudinal versus concurrent correlations moderated the associations of language with imperative or declarative ICAs. No evidence of publication bias was found for declarative ICAs, but some evidence of a publication bias for imperative ICAs was present.

Table 1

Characteristics of Studies Included in the Meta-Analysis

Reference	Participants		Number of effect sizes		Average effect size		Metric(s)	Measures	
	Average age	*N*	Dec	Imp	Dec	Imp		Language	Dec and/or imp ICAs
Bono et al.(2004)	46.7	29	1	0	.48	–	Frequency	Multiple across participants	ESCS
Carpenter et al. (2002)	48.8	12	1	1	-.52*	-.26*	Frequency	Other	Other
Charman (2003)	20.6	18	4	0	.53	–	Proportion	Reynell	Other
Dawson et al. (2004)	43.5	72	8	0	.46^	–	Frequency and scale	Vineland, MSEL	ESCS, ADOS-G
Delinicolas & Young (2007)	47.5	56	2	0	.56	–	Frequency	PPVT-III, LDS	ESCS-Abridged
Drew et al. (2007)	20.7	23	4	4	.59	.02	Proportion	Reynell, MCDI	SCATA
Gillespie-Lynch et al. (2015)	12.2	10	4	0	.19**	–	Frequency	CELF-4	ESCS
Hurwitz & Watson (2016)	44.8	20	1	0	.46	–	Proportion	PLS-4	JAP
Maljaars et al. (2011)	85.2	26	2	2	.71	-.70	Proportion	Schlichting, Reynell (Dutch)	modified CSBS
McDuffie (2004); McDuffie et al. (2005)	32.4	29	4	4	.55	.36	Frequency	MCDI	STAT
Mundy et al. (1987)	54.5	16	2	2	.56**	.59**	Scale	Reynell	ESCS
Mundy et al. (1990)	44.9	15	2	0	.58	–	Frequency	Reynell	ESCS
Murray (2001); Murray et al. (2008)	57.6	20	3	0	.33*	–	Scale	MSEL, other	Other
Özçalışkan et al. (2016)	31	23	1	1	.74	.56	Frequency	CPP	EVT
Perryman et al. (2013)	21	37	2	0	.18	–	Frequency	MSEL	ESCS-Abridged
Pickard & Ingersoll (2015)	44.8	53	9	0	.25	–	Frequency	MCDI, multiple across participants	ESCS
Schietecatte et al. (2012)	36.8	23	6	0	.06	–	Proportion	Reynell (Dutch)	adapted ESCS

Sigman & Ruskin (1999)	45	54	1	1	.51	.18	Frequency	Multiple across participants	ESCS
Siller (2006); Siller & Sigman (2008)	45.2	28	4	0	.52	–	Frequency	Multiple across participants	ESCS
Smith (2011)	49.7	19	1	0	.15	–	Frequency	MCDI	ESCS
Stone & Yoder (2001)	30.9	35	2	0	.32	–	Frequency	Composite: MCDI, SICD-R, PLS-3	PIA
Toth et al. (2006)	43.6	60	3	3	.52	.23	Frequency	MSEL	ESCS
Van der Paelt et al. (2014)	39.2	51	4	4	.32	.23	Frequency	Reynell (Dutch)	ESCS

Note. Average age is reported in months. *N* = number of participants. Dec = declarative. Imp = imperative. ICAs = intentional communication acts. ESCS(-Abridged) = Early Social Communication Scales (Mundy et al., 2003). Other = measure described but not named. Reynell = Reynell Developmental Language Scales (Reynell, 1985). Vineland = Vineland Adaptive Behavior Scales (Sparrow et al., 2005). MSEL = Mullen Scales of Early Learning (Mullen, 1995). ADOS-G = Autism Diagnostic Observation Schedule – Generic (Lord, Rutter, Goode, & Heemsbergen, 1989). PPVT-III = Peabody Picture Vocabulary Test – Third Edition (Dunn & Dunn, 1997). LDS = Language Development Survey (Achenbach & Rescorla, 2000). MCDI = MacArthur Communicative Development Inventory (Fenson et al., 1993). SCATA = Social Communication Assessment for Toddlers with Autism (Drew et al., 2007). CELF-4 = Clinical Evaluation of Language Fundamentals-4 (Semel, Wiig, & Secord, 2003). PLS-3 and -4 = Preschool Language Scale, 3rd or 4th Edition (Zimmerman, Steiner, & Pond, 1991, 2002). JAP = Joint Attention Protocol (Watson, Baranek, & Poston, 2003). Schlichting = Schlichting Test for Language Production (Schlichting, Van Eldik, Spelberg, Van der Meulen, & Van der Meulen, 1995). CSBS = Communication and Symbolic Behavior Scales (Wetherby & Prizant, 2002). STAT = Screening Tool for Autism in Two-Year-Olds (Stone, Coonrod, & Ousley, 2000).

CPP = Communication Play Protocol (Adamson, Bakeman, Deckner, & Romski, 2009). EVT = Expressive Vocabulary Test (Williams, 1997). SICD-R = Sequenced Inventory of Communication Development – Revised (Hedrick, Prather, & Tobin, 1984). PIA = Parent Interview for Autism (Stone & Hogan, 1993).

This table includes only effect sizes and, in the case of longitudinal studies, time periods included in the present meta-analysis. When studies included multiple participant groups, only the number of participants in the ASD group is reported here. For longitudinal studies, this table includes: (a) when attrition was reported, the highest number of participants, and (b) the youngest reported average age of participants.

Effect sizes are reported as Pearson's *r* unless otherwise noted. * denotes effect sizes reported as Spearman's rho. ** denotes effect sizes reported as tau in primary studies, converted here to Pearson's *r*. – denotes study did not report any effect sizes for imperative ICAs.

^ = When the Autism Diagnostic Observation Schedule was used as the measure of ICAs, the sign has been changed to reflect higher scores being associated with increased use of ICAs (rather than higher scores reflecting more impairment), in line with other assessments.

We noted an item of interest that might have driven publication bias suggested for imperative ICAs. In the set of studies reported in the meta-analysis, the most common measure of imperative and declarative ICAs was the Early Social Communication Scales (ESCS; Mundy et al., 2003). Typically, when the ESCS is used as an assessment, communication acts for IBR and for IJA (i.e., imperative and declarative ICAs, respectively) are counted. In ten studies included in the meta-analysis, the ESCS was used to report on the link between IJA and language, but not IBR and language. We had three speculations as to why this might have occurred: (a) Researchers modified the ESCS protocol and purposefully did not collect data on IBR. This was explicitly stated in one included report (Delinicolas & Young, 2007). (b) Researchers collected data for IBR but did not hypothesize that a link between imperative ICAs and language might exist and thus did not calculate the correlation between the two. (c) Researchers collected data on IBR, found that the correlation of imperative ICAs and language was nonsignificant, and opted not to report it. This third possibility presents the risk of outcome reporting bias, which is in alignment with findings suggesting publication bias for associations of imperative ICAs and language, and is especially problematic given the overall difficulty in finding a sufficient number of reports examining the potential link between imperative ICAs and language.

Remaining Questions

Because the nonsignificant average association between imperative ICAs and language could have been due to low statistical power due to insufficient number of studies, a reasonable test of the relative strength of association with language between the two functions was not possible in the meta-analysis. Additionally, there was an overreliance on a single measurement

procedure for imperative ICAs. More importantly, meta-analyses attempting to compare the strength of associations do so with an assumption that participant-sample differences among studies are less important than the precision of the estimates of those associations. A stronger test of the difference of association with language by pragmatic function is afforded by using one participant sample to test the association of declarative ICAs with later language controlling for imperative ICAs. Finally, there is a dearth of information about why declarative ICAs are related to language.

Rationale for Expecting Parental Verbal Responses to Child Leads to Mediate the Association of Declarative ICAs with Language

Investigation of the mechanisms driving the sizable association of declarative ICAs and language could provide additional insight into possible causes of communication deficits in ASD and potentially emphasize the role of parents in early communication interventions with this population. Declarative ICAs are, as previously mentioned, a way of sharing interest or information with another person. A generalized tendency to use declarative ICAs frequently might signal a readiness to learn and communicate that could cause caregivers to provide high rates of verbal responses to the child's communicative and attentional leads. Verbal responses to child communicative and attentional leads might facilitate receptive vocabulary because the caregivers' words match or are related to the child's communication or focus of attention. The receptive vocabulary then becomes the semantic basis for expressive word use.

Research Questions

The proposed study is designed to clarify the relative importance of the role that early

unprompted declarative and imperative ICAs might play in the growth of language skills in young children with ASD, and evaluate whether parental linguistic input partially explains the predictive value of unprompted declarative ICAs on language growth. In this study, I will investigate the following questions:

1. Do declarative ICAs predict later expressive and receptive vocabulary?
2. Do declarative ICAs predict later expressive and receptive vocabulary when controlling for imperative ICAs?
3. Are the correlations of declarative ICAs and later expressive or receptive vocabulary mediated by parental linguistic input?

In line with the meta-analytic findings, I hypothesize that unprompted declarative ICAs will significantly predict later expressive and receptive vocabulary. Similarly, I predict that unprompted declarative ICAs will continue to predict later expressive and receptive vocabulary when controlling for unprompted imperative ICAs, because unprompted imperative ICAs will not explain enough variance in expressive or receptive vocabulary to detract from the significant relation of declarative ICAs and vocabulary. Finally, because a tendency for a child to use unprompted declarative ICAs might elicit frequent, high-quality parental linguistic input that might, over time, enhance language learning, I predict that a significant mediation effect by parental linguistic input will be detected for the association of unprompted declarative ICAs with both expressive and receptive vocabulary.

CHAPTER 2

METHODS

Participants

The participants in the present study were a subset of the sample described in Yoder et al. (2015). The participants of that study were diagnosed with ASD using the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text rev; American Psychiatric Association, 2000) and the Autism Diagnostic Observation Scale (ADOS; Gotham, Risi, Pickles, & Lord, 2007; Lord et al., 2000). When they began the larger study, four months prior to Time 1 of the present study, they were 24-48 months old and essentially preverbal. Two criteria were necessary for a participant to be considered preverbal: (1) the use of fewer than five word roots in an unstructured 15-min sample, and (2) a MacArthur-Bates Communicative Development Inventory – Words and Gestures Checklist (MCDI-WG; Fenson et al., 2007) expressive vocabulary score of no more than 20 words. The current study was chosen to begin four months after entry into the larger study to ensure the frequency with which participants used ICAs was high enough to allow differentiation by pragmatic function.

The 62 participants in the present study are those who used at least five unprompted ICAs at Time 1, as assessed in an unstructured 15-min language sample and a session in which the Communication and Symbolic Behavior Scales assessment (CSBS; Wetherby & Prizant, 2002) was conducted. This minimum number of unprompted ICAs was established to reduce the risk of Type II error by aiding detection of variance that might otherwise be masked by extreme positive skewness of the distribution of each function's frequency. Specifically, participants with very few unprompted ICAs would not enable stable estimates of more differentiated measures of communication acts by function, and thus not afford a reasonable test of the relative predictive

strength by function. Table 2 provides descriptive information on this participant group at Time 1 and at four months prior to Time 1. The latter includes measures that were not available at Time 1, and those are provided here to describe the participant sample more fully.

Table 2

Participant Characteristics

Time	4 months prior to Time 1			Time 1		
Measure		MSEL			MCDI-WG	
	ADOS	DQ	MA	CA	Expressive	Receptive
Mean	22.62	.36	12.35	3.26	18.05	118.85
SD	3.98	.15	4.97	.60	26.29	110.67

Note. MSEL = Mullen Scales of Early Learning (Mullen, 1995). MCDI-WG = MacArthur-Bates Communicative Development Inventory – Words and Gestures Checklist (Fenson et al., 2007). ADOS = Autism Diagnostic Observation Scale (Gotham et al., 2007; Lord et al., 2000). DQ = developmental quotient. MA = mental age. CA = chronological age in years.

Research Design

I used a longitudinal correlational study design, which is necessary to evaluate the prediction of later language from early use of unprompted declarative ICAs. Although there is no way to prove a causative relation of unprompted declarative ICAs and language using a correlational design, a longitudinal correlational design provides more support for a possible causation than would a concurrent correlational design. Both designs allow examination of associations, but only the longitudinal design can establish temporal precedence, which is an

essential piece of a cause-effect relation. A strong argument can be made that confirmation of the correlational predictions is useful prior to implementing an expensive between-group randomized control trial to test the underlying causal relations.

To evaluate parental linguistic input as a potential mechanism underlying an association of early unprompted declarative ICAs and later language skills, three time points are necessary because the time period at which parental linguistic input is measured must fall in between the respective times at which unprompted declarative ICAs and vocabulary were measured (Hayes, 2013). Table 3 provides information on the spacing of the three time periods in this study, as well as the variables measured at each time point.

Table 3

Timeline of Study Design, Assessments, and Variables

Time	1	2	3
Time elapsed	Start	8 months after Time 1	12 months after Time 1
Assessment(s)	ESCS, CSBS, MCDI-WG, UCS	PCFP and PCS	CSBS, MCDI-WG, UCS
Variable(s)	Imperative and declarative ICAs, expressive and receptive vocabulary	Parental verbal responses to child leads	Expressive and receptive vocabulary

Note. ESCS = Early Social Communication Scales (Mundy et al., 2003). CSBS = Communication and Symbolic Behavior Scales (Wetherby & Prizant, 2002). ICAs = intentional communication acts. PCFP = parent-child free play session. PCS = parent-child snack session. MCDI-WG = MacArthur-Bates Communicative Development Inventory – Words and Gestures Checklist (Fenson et al., 2007). UCS = unstructured communication sample.

Variables

In this section, I describe the methods used to quantify each variable. I begin with the variables collected at Time 1: the frequency and pragmatic function of ICAs.

Declarative and imperative ICAs. Pragmatic functions of ICAs were coded from video-recorded CSBS and ESCS assessment sessions at Time 1. I planned to use the combined results of the two procedures because research suggests that when a skill is being acquired, combining the results of multiple assessment procedures provides a more stable (i.e., more reliable) estimate of that skill than does any single assessment procedure on its own (Sandbank & Yoder, 2014). The 15-min language sample was considered for inclusion in the concatenated score, but was rejected due to its documented low elicitation of unprompted imperative ICAs (M = 2.1 imperative ICAs per sample, SD 3.69).

Communication and Symbolic Behavior Scales (CSBS, Wetherby & Prizant, 2002). The CSBS is a structured assessment in which an examiner, a participant, and the participant's caregiver sit at a table in a small room in a laboratory setting. The CSBS is filmed through one-way glass; typically, the camera's point of view remains static during the session because the child is buckled into a Tripp Trapp chair. The examiner presents a number of prompts and communicative temptations designed to elicit child communication, such as (a) blowing bubbles, then presenting the tightly closed bubble container to the child; (b) pointing to pictures around the room and verbally prompting the child to look; (c) asking the child to indicate the location of the child's caregiver (e.g., "Where's Mommy?"), various parts of the child's body (e.g.,

"Where's your nose?"), or the child him- or herself (by name; e.g., "Where's Sarah?"), (d) blowing up a balloon, releasing the air, then presenting an identical deflated balloon to the child; and (e) activating a wind-up toy, then delaying additional activations until the child requests them.

Early Social Communication Scales (ESCS, Mundy et al., 2003). Like the CSBS, the ESCS is a structured assessment that takes place in a small room in a laboratory setting, filmed through one-way glass with an examiner and a participant at a table. A parent is often, but not necessarily, present in the room. The ESCS administration includes 17 contrived situations designed to elicit communication from young children. Examples of those that aim to elicit unprompted declarative and/or imperative ICAs include (a) presentation of an open picture book, (b) presentation of a sealed, transparent plastic jar containing wind-up toys(c) inflation and deflation of a balloon, followed by presentation of an identical deflated balloon.

Coding procedures. The CSBS and ESCS sessions were coded from video using identical procedures. The 5-s intervals with onsets of unprompted ICAs in the videos of the CSBS sessions were identified (i.e., unitized) by previous coders using partial interval recording; I did the same while unitizing unprompted ICAs in ESCS sessions. Thus, I also used partial interval recording in the classification process. I used the Procoder DV software (Tapp, 2006) to classify each interval with unprompted ICAs as imperative, declarative, both functions, or other function, using a flowchart (Figure 1) whose constructs are operationally defined in a coding manual (Appendix). The accuracy of partial interval recording in estimating count of a behavior can vary widely, depending on the length of the intervals used as well as the frequency and duration of the

behavior (Ledford, Ayres, Lane, & Lam, 2015; Mann, Ten Have, Plunkett, & Meisels, 1991; Yoder, Ledford, Harbison, & Tapp, 2018). However, a recent simulation study suggested that when the frequency of short behaviors that occur at low rates (e.g., unprompted ICAs by preverbal children with ASD) is accurately estimated using 5-s partial interval recording, the mean percentage error is less than 5% (Yoder et al., 2018). This is well within the confines of the acceptable 10% error suggested by Lane and Ledford (2014).

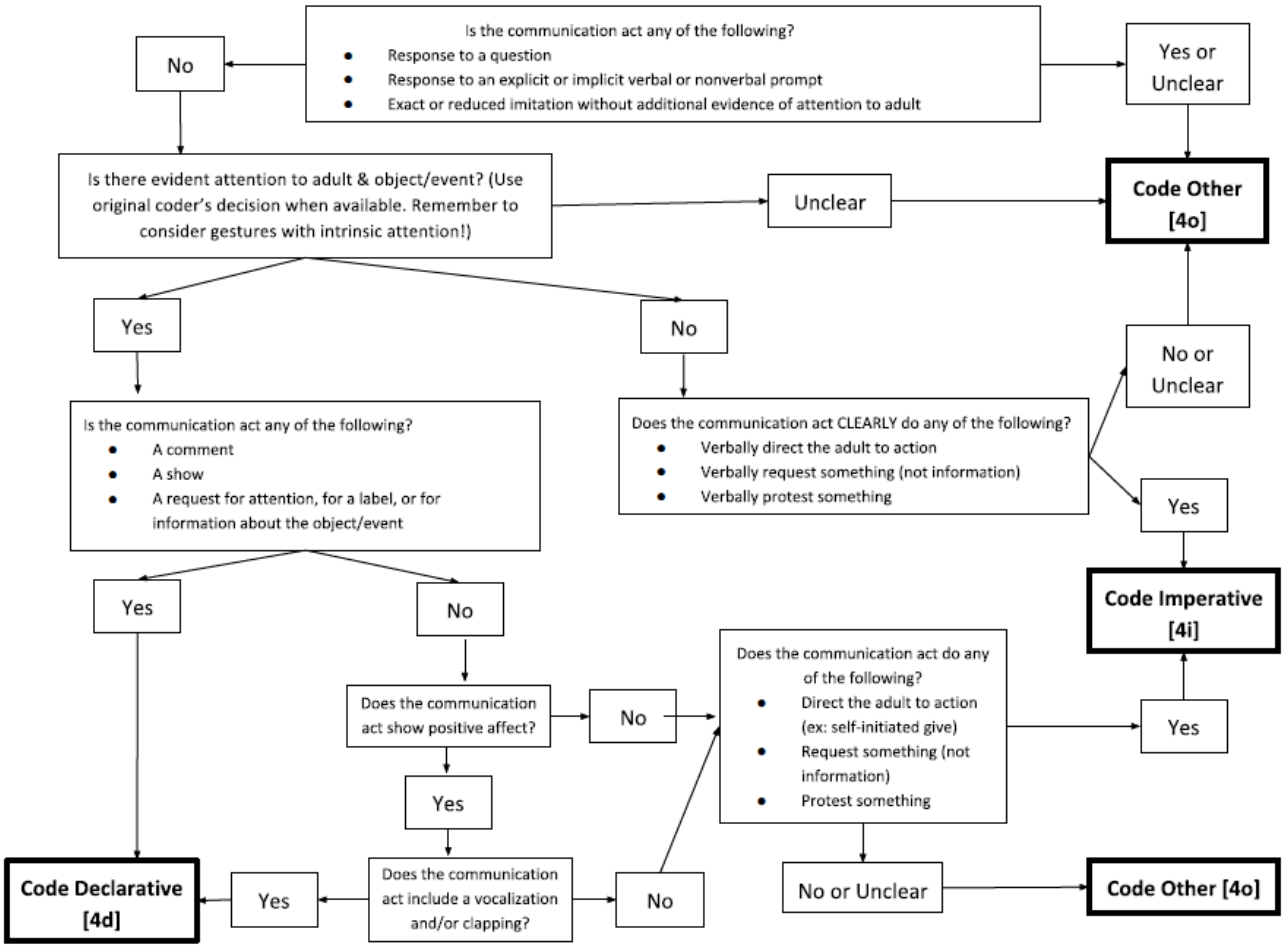


Figure 1. Flowchart for classification of communication acts by pragmatic function.

Unitizing intervals with ICAs. An interval that included the onset of an unprompted ICA (as defined by the criteria for communication acts in the Appendix), regardless of pragmatic function, was coded for the presence of an ICA. Intervals without the onset of child behavior that meets criteria for an unprompted ICA were coded for the absence of ICAs. Intervals marked as having unprompted ICAs present were then classified by pragmatic function.

Classifying intervals with ICAs. Declarative ICAs were defined in the coding manual as "self-initiated communication acts (both verbal and nonverbal) that have coordinated attention and which aim to establish a social connection through shared experience" (see the flowchart in Figure 1). Coordinated attention refers to attention to an adult and an object or event within a 3-s window. A 5-s interval that included the onset at least one unprompted declarative ICA and no imperative ICAs was scored as *declarative* in Procoder DV (Tapp, 2006). Examples of unprompted declarative ICAs included showing an object to an adult, requesting information or attention, and clapping with evidence of attention to object and adult. Generally, unprompted declarative ICAs are scored when the spectacle is being displayed. Table 4 provides descriptive statistics on the classification of intervals with ICAs in the CSBS.

Table 4.

Descriptive Statistics for Classification of Intervals by Pragmatic Function

Assessment	Function	Min	Max	Mean	*SD*
CSBS	Imperative	0	34	8.10	6.77
CSBS	Declarative	0	17	3.03	4.27
ESCS	Imperative	0	38	10.51	8.48
ESCS	Declarative	0	34	4.11	5.30
CE	Imperative	1	54	18.51	12.82
CE	Declarative	0	44	7.23	8.26

Note. CSBS: Communication and Symbolic Behavior Scales (Wetherby & Prizant, 2002). ESCS: Early Social Communication Scales (Mundy et al., 2003). CE: score concatenated across CSBS and ESCS. Min: minimum. Max: maximum.

Imperative ICAs were defined in the coding manual as "self-initiated communication acts (both verbal and non-verbal) that have coordinated attention and are meant to elicit action or cessation of action from the adult" (see the flowchart in Figure 1). Intervals with the onset of at least one unprompted imperative ICA and no declarative ICAs were scored as *imperative*. Examples of unprompted imperative ICAs included the following, when initiated by the participant: verbal requests, use of an adult's hand as a tool, transfer of an object to an adult, outward extension of a hand with palm upturned to receive an object, a reach for an object while vocalizing and coordinating attention, and protest (e.g., whining while looking at the examiner's face and pushing away a newly presented object). Generally, unprompted imperative ICAs are scored when the child requests that the spectacle be repeated.

Intervals scored as *both functions* contained the onsets of at least two unprompted ICAs, where at least one ICA met criteria for unprompted imperative ICAs, and at least one other ICA met criteria for unprompted declarative ICAs. Only 0.3% of total intervals scored in CSBS

assessments and 0.2% of total intervals scored in ESCS assessments were classified as *both functions*. Intervals scored as *other* contained only ICAs that did not meet criteria to be scored as imperative or declarative. Intervals scored as *other* or *both functions* were excluded from analysis.

Concatenation. The *a priori* criterion for concatenation of raw data was $r \geq .4$. Unprompted declarative ICAs across assessments were adequately correlated to meet this criterion ($r = .46$), so I used the sum of the frequencies of unprompted declarative ICAs in all analyses. The correlation of unprompted imperative ICAs in the CSBS and ESCS sessions approached but did not meet the criterion ($r = .38$). However, because the .40 criterion is arbitrary and because the empirical intercorrelation of imperative variables was .38, I decided to use three variables to test research questions involving unprompted imperative ICAs: ESCS, CSBS, and the sum of these.

Parental linguistic input. Parental linguistic input was coded from video in a previous project from two sampling contexts, both at Time 2: the parent-child free play procedure and the parent-child snack session. In both procedures, an instance of parental linguistic input was scored when an adult utterance was specific to the child's focus of attention (e.g., "red ball" but not "nice job"). In the parent-child snack procedure, parental linguistic input was also scored when the parent added linguistic information to the child's unprompted ICA (i.e., put a nonverbal ICA into words, repeated the child's word approximation with correct pronunciation, added words to the child's spoken ICA, or modified the word order of the child's spoken ICA). Parental linguistic responses to child leads across the two contexts were sufficiently correlated for a

concatenated score to be appropriate (r = .42; criterion: $r \geq .4$), thus the variable used was the sum of the frequencies of parental linguistic responses across the parent-child free play and parent-child snack sessions.

In the parent-child free play procedure, parent and child were given 15 min in a small room and provided with several age-appropriate toy sets such as a puzzle, books, and a toy car. The parent was given instructions to play with the child as they normally would play at home. The parent-child snack session was a 10-min session with child and parent seated at a table. Parents were instructed to interact with their child as they would at home if they were attempting to elicit the child's communication. Two cups with lids, a clear pitcher with a beverage, a sealed container with small snack items, two spoons, and a box of wipes were made available.

Vocabulary. The measure of expressive and receptive vocabulary used at Times 1 and 3 is the MCDI-WG (Fenson et al., 2007). It contains a 396-word vocabulary checklist completed by a parent, wherein the parent indicates whether the child has each word in his or her vocabulary by indicating words that a child understands, says (and is assumed to understand), or signs. Parent report allows for a more stable estimate of vocabulary, compared to what would be directly observable in a single brief observation in the research setting, because the parent's experience with observing the child's vocabulary use crosses many different settings and communicative partners and has occurred over years, rather than minutes (Tager-Flusberg et al., 2009; Yoder & Symons, 2010). I used the raw scores from the MCDI-WG for expressive and receptive vocabulary. The raw score for expressive vocabulary is the total number of words that the parent reports the child says. The raw score for receptive vocabulary is the sum of the number of words that the parent reports the child either says or understands only.

Although a few MCDI-WG assessment items have been identified as biased (i.e., parental report on a given word was predicted by whether the child had ASD or was typically developing; Bruckner, Yoder, Stone, & Saylor, 2007), research provides some support for the validity and long-term stability of the MCDI-WG as a measure of receptive and expressive vocabulary for young children with ASD. Receptive and expressive vocabulary scores on the MCDI-WG at age 24 months predicted receptive and expressive vocabulary scores at age 36 months (r = .68 and .60, respectively) in a study of 26 children with ASD (Charman et al., 2005). In the same study by Charman and colleagues, the receptive (but not expressive) language subscore on the Reynell Developmental Language Scales (Reynell, 1985) at age 7 years was predicted by receptive (r = .67) and expressive (r = .65) vocabulary scores on the MCDI-WG at age 36 months; the 36-month scores also significantly predicted scores at age 7 years on the Vineland Adaptive Behavior Scales (VABS; Sparrow, Cicchetti, & Balla, 2005) and some domains of the Autism Diagnostic Interview – Revised (ADI-R; Lord, Rutter, & Le Couteur, 1994) that were not predicted by the 24-month MCDI-WG scores. In another study, the MCDI-WG scores of 62 children with ASD at ages 2 and 3 years significantly predicted expressive and receptive language outcomes measured using other assessments that varied across participants according to developmental level, as well as scores on the VABS, ADI-R, and ADOS, at age 9 years (Luyster, Qiu, Lopez, & Lord, 2007).

Secondary Analysis Variables

As will be detailed in later sections, none of the research hypotheses were confirmed as I planned to address them. However, because multi-measure aggregate language variables were available to me, I added aggregate language variables to the set of analysis variables. Aggregate

receptive language scores at Times 1 and 3 were the average of the participant's *z*-scores for the CSBS comprehension scale and the MCDI-WG receptive vocabulary score. Aggregate expressive language scores at Times 1 and 3 were the average of the participant's *z*-scores for expressive language on the CSBS, the MCDI-WG, and a 15-min unstructured language sample.

Analysis Plan

I used correlation or multiple regression to answer the research questions. Four procedures were used to ensure that regression results were interpretable. The first was a visual examination of a scatterplot with the standardized residual on the y-axis and the predicted value on the x-axis, which provided information about normality and homoscedasticity. Two procedures were tests of multivariate normality: the Kolmogorov-Smirnov and Shapiro-Wilk tests. Acceptable normality on each test was operationalized as the coefficient having an unstandardized residual with $p > .05$. When the assumption of normality was violated, I reanalyzed that regression using robust regression, which is robust even when residuals are non-normally distributed (Rousseeuw & Leroy, 2003). The final procedure was the non-constant variance score test, which is designed to detect heteroscedasticity. When visual examination did not provide strong evidence of heteroscedasticity and the chi-square result of the non-constant variance score test had $p > .05$, I considered that set of residuals to be sufficiently homoscedastic. If normality was within acceptable limits and evidence of heteroscedasticity was present, I reanalyzed that regression using heteroscedasticity-consistent standard error (HCSE) estimation, which is robust even when residuals are heteroscedastic (Hayes & Cai, 2007). When the residuals of a given regression passed all four tests, that model was analyzed using traditional standard error estimation.

Multiple regressions. To assess whether declarative ICAs predict later vocabulary, I included early vocabulary as a predictor in multiple regression models to eliminate the variance explained by pre-existing differences in language skills. I analyzed the following two multiple regressions using SPSS 24 (IBM, 2016) when zero-order correlations supported a relation:

1. Time 1 unprompted declarative ICAs and Time 1 expressive vocabulary predicting Time 3 expressive vocabulary.
2. Time 1 unprompted declarative ICAs and Time 1 receptive vocabulary predicting Time 3 receptive vocabulary.

To assess whether declarative ICAs predict later language when imperative ICAs are controlled, I analyzed two additional multiple regressions when appropriate:

1. Time 1 unprompted declarative ICAs predicting Time 3 expressive vocabulary, controlling for Time 1 unprompted imperative ICAs.
2. Time 1 unprompted declarative ICAs predicting Time 3 receptive vocabulary, controlling for Time 1 unprompted imperative ICAs.

For all multiple regressions, a variable was considered to be a statistically significant predictor if $p \leq .05$.

Mediation effects. To analyze whether any statistically significant correlations of unprompted declarative ICAs with later expressive or receptive vocabulary are mediated by parental linguistic input, I further analyzed these relations for mediation by parental linguistic input at Time 2. Parent education and child chronological age were considered but not included as covariates in the mediation analysis because neither was associated with more than one

variable in any given mediation analysis.

Figure 2 provides a visual representation of the mediation model. The associations (i.e., paths) are represented by arrows, labeled with letters (i.e., *a*, *b*, and *c*). When a variable has two arrows leading to it, the paths are partial associations, meaning that statistical control is used to enable examination of the key association above and beyond the controlled variable's covariation with the other two variables. The coefficient of the *a* path is an estimate of the magnitude of the association of the number of unprompted declarative ICAs at Time 1 with the number of instances of parental linguistic input at Time 2. Similarly, the coefficient of the *b* path is an estimate of the magnitude of the association of the number of instances of parental linguistic input at Time 2 on receptive (or expressive) vocabulary at Time 3 controlling for the number of unprompted declarative ICAs at Time 1. The indirect effect is quantified as the result of multiplying *a* and *b*, called the *ab* path. Conceptually, it represents the effects of unprompted declarative ICAs on expressive or receptive vocabulary that are explained through parental linguistic input. The *c* path is the total effect of unprompted declarative ICAs on receptive or expressive vocabulary, both directly and through parental linguistic input. The *c′* path is the direct effect of unprompted declarative ICAs on expressive or receptive vocabulary minus the effect of parental linguistic input. The effect of parental linguistic input as a mediator will be determined to be statistically significant if the 95% confidence interval for the indirect effect does not include zero. When the indirect effect is significant, it means that there is a significant reduction of the total effect when we control for parental linguistic responses (i.e., $c - c' = ab =$ indirect effect).

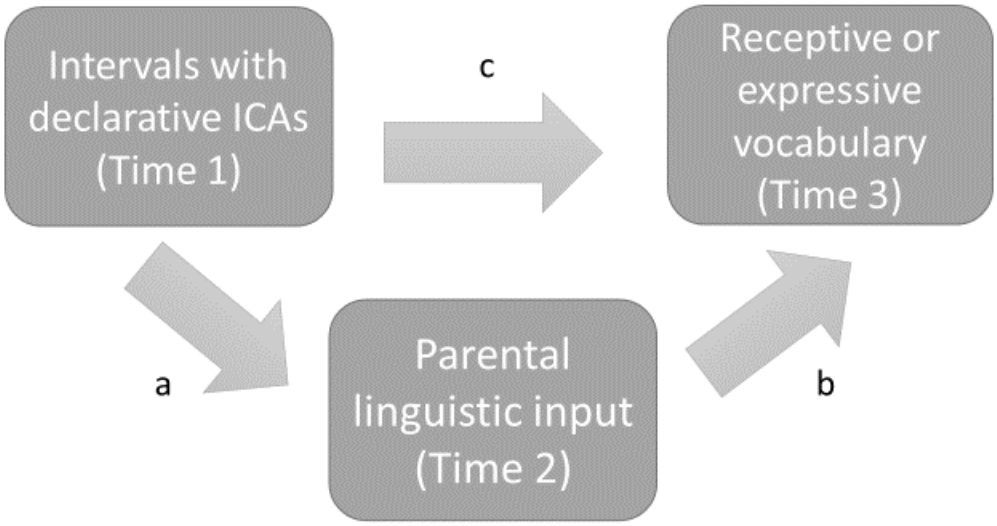


Figure 2. Mediation model.

To assess the putative mediation effect, I used the PROCESS macro for SPSS (Hayes, 2013). PROCESS estimated the coefficients using multiple regression and used a bootstrapping procedure to estimate the confidence intervals around the *ab* path. Bootstrapping was also used to test the significance of each coefficient. Bootstrapping involves randomly sampling, with replacement, the data from the original 62 participants 5,000 times to provide a chance estimate for the indirect effect and the values of the *a*, *b*, *c*, and *c′* paths. From these estimates, the program computes *p* values and confidence intervals. This procedure mimics the results of repeating the study many times, assuming the participants in the actual study are representative of the overall population (Hayes, 2013).

Reliability. To determine reliability of coding for pragmatic function of unprompted ICAs, 21% of ESCS and CSBS sessions, evenly distributed across assessments, were randomly

selected and double-coded. Formal discrepancy discussions were held each time that interobserver agreement (IOA; calculated by dividing the smaller frequency count by the larger one) dropped below 70% for unprompted declarative or imperative ICAs, assuming one or both coders recorded a minimum of five intervals with that pragmatic function. When IOA was above 70% but several classification errors were present, or when several classification errors were present but neither coder recorded five or more intervals with a given pragmatic function, those discrepancies were discussed informally. Discrepancy discussions did not affect the coding of the session being discussed (i.e., no consensus scores were used in analysis), but instead were used to maintain acceptable future reliability by limiting observer drift (Yoder & Symons, 2010).

The CSBS sessions coded by the second coder in the present study were randomly selected in a previous project in which the unprompted ICAs were identified (i.e., unitized). Using the same sessions for reliability in this project allowed errors in unitizing and classifying ICAs to be taken into account, providing a more accurate estimate of reliability than would be available if only classification errors were included.

Reliability was computed using the program Edu G (Swiss Society in Education Working Group, 2012) to obtain an intraclass correlation coefficient (ICC) for unprompted imperative and declarative ICAs in the ESCS and CSBS sessions, as well as parental linguistic responses in the parent-child free play and parent-child snack sessions. The generalizability studies that provided the ICC values accounted for differences in coders (both in unitizing and classifying) and participants (i.e., two-faceted), included main effects of coder and participant and the statistical interaction between coder × participant (i.e., absolute value of g), and allow generalization beyond data being analyzed (i.e., analysis of random effects; McGraw & Wong, 1996; Yoder, 2016).

CHAPTER 3

RESULTS

Preliminary Results

Descriptives and Intercorrelation Among Component Variables. Table 4 provides description information for the raw data for unprompted imperative and declarative ICAs in CSBS and ESCS assessments. Of interest is the low mean count for unprompted declarative ICAs in either procedure, indicating the need to concatenate across procedures.

Transformations. If univariate distributions were non-normal (i.e., skewness < |.8|; kurtosis < 3.0), variable metrics were transformed using the guidelines in Tabachnick and Fidell (2001). Log 10 transformations of unprompted declarative ICAs, unprompted imperative ICAs in the CSBS procedure, and unprompted imperative ICAs in the ESCS procedure were necessary to meet assumptions of normality. Aggregate unprompted imperative ICAs were transformed using the square root transformation. I used the square root transformation for the MCDI-WG receptive vocabulary score at Time 1 and the log 10 transformation for the MCDI-WG expressive vocabulary scores at Times 1 and 3. The MCDI-WG receptive vocabulary score at Time 3 did not require transformation. Regarding aggregate language variables, I used the square root transformation for receptive scores at Time 1 and the log 10 transformation for expressive scores at Time 3. The aggregate expressive language score at Time 1 and the aggregate receptive language score at Time 3 met assumptions without transformation. Unless otherwise specified, in the remainder of the present document, all references to variables that required transformation

refer to the transformed scores.

Reliability of coded variables. Point estimates of all ICCs for reliability of coding pragmatic function of communication acts were greater than .9. Benchmarks provided by Landis and Koch (1977) rate interrater reliability as excellent when an ICC is equal to or greater than .75. Reliability of the coded component variables for the language aggregates and parental linguistic responses were reported in the Yoder et al. (2015) paper describing the larger study.

Primary Analyses

Do unprompted declarative ICAs predict later expressive and receptive vocabulary? Table 5 provides the zero-order correlations between unprompted imperative and declarative ICAs, MCDI-WG vocabulary scores, and parental linguistic responses. To address the first research question, the reader is directed to the correlation of unprompted declarative ICAs and MCDI-WG scores at Time 3. These correlations were not significant for either receptive or expressive vocabulary.

Table 5

Zero-Order Intercorrelations of Unprompted Imperative and Declarative Communication Acts and Vocabulary

Variable	Pragmatic Function				Vocabulary (MCDI-WG)				
	Imperative				Time 1		Time 3		
	C	E	CE	Dec	R	Ex	R	Ex	PLR
C imperative		.49*	.81*	.08	.16	.32*	.39*	.39*	.35*
E imperative			.89*	.09	.10	.20	.25	.34*	.23
CE imperative				.07	.14	.27*	.36*	.38*	.35*
Declarative					.26	.21	.14	.23	-.07
MCDI-WG R T1						.58*	.83*	.39*	.19
MCDI-WG Ex T1							.57*	.74*	.26*
MCDI-WG R T3								.49*	.41*
MCDI-WG Ex T3									.40*

Note. C = Communication and Symbolic Behavior Scales (Wetherby & Prizant, 2002). E = Early Social Communication Scales (Mundy et al., 2003). CE = score concatenated across CSBS and ESCS. MCDI-WG = MacArthur-Bates Communicative Development Inventories Words and Gestures Checklist (Fenson et al., 2007). R = receptive. Ex = expressive. PLR = parental linguistic responses at Time 2. All pragmatic function variables were at Time 1.

* $p \leq .05$

However, unprompted imperative ICAs on the ESCS and CSBS were predictive of expressive vocabulary. Additionally, unprompted imperative ICAs on the CSBS were predictive of receptive vocabulary. Following adjustment of the significance level using the Benjamini and Hochberg (1995) correction, statistical significance did not change for any zero-order correlates.

Do declarative ICAs predict later expressive and receptive vocabulary when controlling for imperative ICAs? Because unprompted declarative ICAs did not predict later

MCDI-WG scores, this research question was not addressed.

Are the correlations of declarative ICAs and later expressive or receptive vocabulary mediated by parental linguistic input? Because unprompted declarative ICAs did not predict later MCDI-WG scores, this research question was not addressed. To investigate an analogous question for unprompted imperative ICAs, Time 1 vocabulary was controlled if it had significant zero-order correlations with both the independent and dependent variables. As seen in Table 6, indirect effects were significant (i.e., their 95% CIs did not include zero) in three models involving unprompted imperative ICAs. This finding is consistent with the hypothesis that parental linguistic input plays a role in the relation of early unprompted imperative ICAs and later vocabulary.

Table 6

Primary Analyses: Mediated Associations of Pragmatic Function Variables on Vocabulary Through Parental Linguistic Responses

Independent variable	Covariate	Dependent variable	Total	Direct	Indirect	*a*-path	*b*-path
CSBS imperative	MCDI-WG expressive	MCDI-WG expressive	.39	.22	.17*	.37*	.76*
CSBS imperative	-	MCDI-WG receptive	160.57*	119.77*	40.8	.37*	.46*
ESCS imperative	-	MCDI-WG expressive	.92*	.66	.26*	.29*	.45*

Note. All coefficients were calculated using heteroscedasticity-consistent standard error estimation (Hayes & Cai, 2007) and are unstandardized. In all cases, frequency of parental linguistic responses was the proposed mediator. All independent variables and covariates were Time 1 scores. All dependent variables were Time 3 scores.

CSBS = Communication and Symbolic Behavior Scales (Wetherby & Prizant, 2002). ESCS = Early Social Communication Scales (Mundy et al., 2003). MCDI-WG = MacArthur-Bates Communicative Development Inventories Words and Gestures Checklist (Fenson et al., 2007).

* $p \leq .05$.

Secondary Analyses Using the Aggregate Pragmatic Function and Language Variables

Which pragmatic functions of ICAs predict later expressive and receptive language?

Table 7 provides values of *r* for correlations of aggregate language variables at Times 1 and 3 with the aggregate declarative and imperative ICAs at Time 1. The correlations with Time 1 language are included because the data are needed to justify later analyses. Both

pragmatic function variables were significantly associated with expressive and receptive language at Time 3.

Table 7

Secondary Analyses: Zero-Order Correlations of Aggregate Language Variables with Aggregate Unprompted Imperative and Declarative Communication Acts

	Time 1		Time 3	
Pragmatic function	Receptive	Expressive	Receptive	Expressive
Imperative	.18	.41*	.32*	.40*
Declarative	.33*	.28*	.28*	.29*

* $p \leq .05$

Is one pragmatic function more strongly predictive of later language than the other? When I compared the overlapping correlations, unprompted imperative ICAs were a significantly stronger predictor of Time 3 expressive language than were unprompted declarative ICAs ($Z = -2.11$, $p < .05$). No significant difference was detected in the prediction of Time 3 receptive language by declarative or imperative ICAs ($Z = -1.59$, $p = .11$). Statistical significance did not change for any zero-order correlates after adjustment of the significance level using the Benjamini and Hochberg (1995) correction.

Do the pragmatic function variables continue to predict later expressive and receptive vocabulary when controlling for each other or Time 1 language? Multiple regression results are available in Table 8. Pragmatic function variables were not significant predictors of later language when the corresponding early language variable was included in the

model. When controlling for unprompted declarative ICAs, unprompted imperative ICAs predicted receptive and expressive language. When controlling unprompted imperative ICAs, unprompted declarative ICAs predicted only receptive language.

Table 8

Secondary Analyses: Multiple Regression Findings

IV 1	IV 2	DV	Method	b 1	b 2	*SE* b 1	*SE* b 2	*t* 1	*t* 2
Dec	Exp	Exp	Robust	.06	.16	.06	.02	1.02	7.45
Imp	Exp	Exp	HCSE	.01	.15*	.01	.02	1.05	7.50
Dec	Rec	Rec	HCSE	.03	2.31*	.24	.22	.13	10.69
Dec	Imp	Rec	HCSE	.70*	.18*	.33	.07	2.13	2.58
Dec	Imp	Exp	HCSE	.15	.05*	.07	.02	2.05	3.13

Note. Coefficients are unstandardized. IV = independent variable at Time 1. DV = dependent variable at Time 3. Exp = aggregate expressive score. Rec = aggregate receptive score. HCSE = least squares regression with heteroscedasticity-consistent standard error estimation (Hayes & Cai, 2007).

* $p \leq .05$.

Are the correlations of pragmatic function variables and later expressive or receptive language mediated by parental linguistic input? Procedures used in the primary analysis to test for mediation effects were identical to those used here. Additional Time 1 variables were statistically controlled if they were significantly correlated with both the pragmatic function variable and the Time 3 language variable. Unprompted imperative ICAs were associated with later receptive language through parental linguistic responses when controlling for Time 1 declarative ICAs, but not when controlling for Time 1 receptive language. Declarative ICAs did not have a mediated association with later language. Table 9 provides

detailed information on the outcomes of mediation analysis.

Table 9

Secondary Analyses: Mediated Association of Pragmatic Function Variables with Receptive Language through Parental Linguistic Responses

IV	Covariate(s)	Total	Direct	Indirect	*a*-path	*b*-path
Imperative	-	.20*	.13	.07*	.37*	.45*
Declarative	T1 Receptive	.06	.16	-.1	.26	.82*
Declarative	Imperative	.67*	.75*	-.08	.38*	.54*
Imperative	Declarative	.18*	.1	.08*	.38*	.54*
Imperative	Declarative, T1 Receptive	.11	.07	.04	.41*	.83*

Note. All coefficients calculated using heteroscedasticity-consistent standard error estimation (Hayes & Cai, 2007). The proposed mediator was the frequency of parental linguistic responses at Time 2. The dependent variable was receptive language at Time 3. IV = independent variable.

* $p \leq .05$

CHAPTER 4

DISCUSSION

To summarize the confirmatory findings, unprompted declarative ICAs did not predict vocabulary scores. In contrast, unprompted imperative ICAs did predict vocabulary, and the relation was significantly mediated by parental linguistic input.

To summarize the post-hoc findings, both unprompted declarative and imperative ICAs predicted later expressive and receptive language. In general, however, unprompted imperative ICAs were a more useful predictor of later language skills than unprompted declarative ICAs. Unprompted imperative ICAs were a significantly stronger predictor of later expressive language than unprompted declarative ICAs. Unprompted imperative ICAs predicted both expressive and receptive language when controlling for unprompted declarative ICAs. Importantly, the association between unprompted imperative ICAs and receptive language, controlling for early unprompted declarative ICAs, was significantly mediated by parental linguistic responses. Unprompted declarative ICAs predicted only receptive language when controlling for unprompted imperative ICAs, and no mediation by parental linguistic input was detected. When controlling for language at Time 1, neither pragmatic function of ICAs predicted later language.

Differences between the Findings from the Current Study and the Predictions Based on the Meta-analysis

There are at least two classes of explanations for the surprising results from the current study. Broadly speaking, these can be broken into measurement differences and participant characteristic differences. Measurement differences can be broken into differences in the stability of variables due to use of composite versus component measures of constructs and differences in

attention to the spontaneity of the pragmatic variables during coding.

In general, there was more use of composite measures of constructs in the current study than in the extant literature. For example, I used an aggregate score from the CSBS and the ESCS as one measure of unprompted imperative ICAs. My only measure of unprompted declarative ICAs was an aggregate, as well. In comparison, no study included in the meta-analysis used an aggregate measure of imperative or declarative ICAs. Furthermore, I used composite language scores in some of the post-hoc tests. Only one study in the meta-analysis used a composite language score (i.e., Stone & Yoder, 2001). As noted in previous sections, composite scores have been shown to improve stability (as compared to scores from single measures) when the behavior being measured is still being acquired or occurs at low rates (Sandbank & Yoder, 2014), as was the case with the communicative behaviors and language in the initially low-verbal participants evaluated in the current study. In most cases, unstable estimates decrease the probability of detecting associations (Yoder & Symons, 2010). Thus, it is possible that the discrepancy between the meta-analytic results and the results of the present study is caused, at least in part, by discrepancies in stability of scores on measures of language, declarative ICAs, and/or imperative ICAs. Similarly, the correlation of unprompted declarative ICAs with MCDI-WG scores was not significant, but unprompted declarative ICAs were correlated with all four aggregate language measures; it is possible that this discrepancy is caused by differences in stability of scores.

A second possible reason for differences between expected findings, which were based in part on the meta-analysis, and actual findings is the separation of self-initiated versus prompted imperative ICAs. In many studies in the meta-analysis, no distinction was made between unprompted and prompted imperative ICAs. Prompted imperative ICAs do not represent a

tendency to communicate independently to regulate others' behavior to the degree that unprompted imperative ICAs do. That tendency toward independent communication might be what predicts later language skills, rather than the simple use of behaviors that appear to function as imperative ICAs. One method to test this hypothesis is to aggregate effect sizes for the association of language and imperative ICAs from coding systems in which only unprompted ICAs are coded (e.g., studies in which the ESCS coding system is used), and compare to an aggregate of effect sizes from comparable studies that include both unprompted and prompted ICAs (e.g., studies in which the CSBS coding system is used). The coding manuals for the ESCS and CSBS procedures are explicit enough that a valid inference can be made about whether the prompted or unprompted nature of ICAs was attended to when coding. In the meta-analysis, the average association of language and imperatives coded using the ESCS coding system (i.e., only unprompted imperatives) was 0.25. The average association of language with imperatives coded using other coding protocols was .02. In contrast to the studies used in the meta-analysis, although recordings of CSBS and ESCS procedures were used to code ICAs, only unprompted imperative ICAs were coded in the present study. Because the effect size of the association of language and imperative ICAs in the current study was similar to that seen in the meta-analysis when restricted to studies using the ESCS coding system, it is feasible that the strength of the association of unprompted imperative ICAs and language was underestimated in the meta-analysis, leading to incorrect predictions.

The third reason for possible differences in predicted findings based in part of the extant literature, and the current study findings was that within-study comparisons of associations are possible in the current study but were not possible in the extant literature. Generally, only between-study comparisons were possible in the meta-analysis. When contrasting associations,

within-study contrasts are more informative than contrasts across studies because a single participant group is used. Systematic differences in participant groups across studies (e.g., differences in developmental level) could have led to systematic differences in effect sizes in primary studies.

Some similarities and some differences in the characteristics of participants of the current study, versus those of participants in the extant literature, might have created a discrepancy between current and meta-analytic results. For example, the average age of participants in the meta-analysis was approximately 40.7 months, and the average age of participants in this study was 39.1 months. It is unlikely that an average chronological age difference of less than two months would create a significant difference in the relation between imperative or declarative ICAs and language, especially in large groups of children with developmental levels that are unlikely to correspond to chronological age, as is often the case with children with ASD. Furthermore, child chronological age was not correlated significantly with any pragmatic function or language variable in the present study. However, the 727 participants included in the meta-analysis likely represent a much broader range of communicative skills than that of the participant group in the present study. Although one exclusion criterion for the meta-analysis was description of the participants as high-functioning, there is a strong possibility that participant samples in some of the studies in the meta-analysis still included children with relatively intact language skills who were not described in ways that would have led to that primary study's exclusion (e.g., the report did not use the specific words *high-functioning* or *Asperger's*).

Strengths

The present study had several strengths. First, my hypotheses were based on a thorough synthesis of previous literature reporting on the relation of imperative and/or declarative ICAs and language in children with ASD. Second, the longitudinal nature of this study established temporal precedence of the pragmatic function of unprompted ICAs over parental linguistic input, which had temporal precedence over language. Although causation cannot be inferred from correlation alone, temporal precedence is an important part of determining causation. Third, the finding that parental linguistic input mediates the relation of unprompted imperative ICAs and language skills suggests a mechanism that partially explains their significant relation. Fourth, interrater reliability for unitization and classification of both unprompted imperative and declarative ICAs was very strong, allowing increased confidence in the accuracy of the measures of ICAs. Fifth and similarly, I used aggregate variables to examine relations of the relevant constructs, which theoretically provided more stability than single measures. Sixth, I used a relatively large participant sample (n = 62) compared to similar studies (e.g., average sample size for studies in the meta-analysis was 32), providing adequate statistical power to detect the hypothesized correlations. Finally, as previously mentioned, this study provided within-study comparison of associations that were generally unavailable in existing literature.

Weaknesses

There were also weaknesses in this study. The secondary analyses were post-hoc, which increases the probability that those findings were study-specific and are thus in greater need of replication than confirmatory findings. Not all alternative explanations for the associations I found could be eliminated, as in all correlational studies. In addition, I was aware of the hypotheses being investigated before I coded samples. However, neither I nor my reliability

coder had knowledge of specific participants' later language scores. Although participants' use of language during the Time 1 coding could potentially influence coding, the low-verbal status of children at Time 1 reduced the probability that correlated measurement error can explain the findings. The risk that correlated measurement error explained the significant findings is further reduced by the high ICCs, which indicated a low rate of unitization and classification errors affecting the reliability of ICA coding. Lastly, the finding that unprompted declarative or imperative ICAs did not significantly predict later language when early language scores were included or controlled in any model could indicate that early language influenced both ICAs and later language, making pragmatic function of ICAs an extraneous variable when predicting later language. However, controlling for early language was a very conservative test, and these findings merit further investigation.

Future Research

Future research on this topic is warranted. Replication of findings of the current study is necessary, particularly those findings that were evaluated post-hoc. Research on the degree of importance of distinguishing between prompted and unprompted ICAs when detecting the differential size of the association of language and ICAs of a specific pragmatic function would be a valuable addition to the current literature. Studies testing the existence of causality between imperative and declarative ICAs, receptive and expressive language skills, and parental linguistic input will be of critical importance. The mediated association of early unprompted imperative ICAs and later receptive language through parental linguistic responses when controlling for unprompted declarative ICAs is especially important to replicate as it could differentiate the potentially causal roles of these ICAs. Should causal roles for both declarative and imperative

ICAs be confirmed, experiments to compare the efficacy of treatments focused on each type of ICA could be worthwhile.

Clinical Implications

If the causal role of either pragmatic function of ICAs is confirmed, treatments for young children with autism should be modified to work on increasing that function. For example, if unprompted imperative ICAs play a significant causal role in language learning, it should be beneficial to address them as one component of treatment. New treatments could also be developed with the same aim. However, treating specific pragmatic functions of ICAs without addressing any other factor that contributes to language learning in children with ASD is unlikely to be efficacious. Thus I would recommend including this as one part of a multi-faceted treatment approach that also addresses input from caregivers, environmental variables, and factors that are specific to the child and can inhibit opportunities for language learning and use, such as maladaptive behavior or problems with oral motor functioning.

Appendix.

Coding Manual for Classifying Communication Acts by Pragmatic Function

ProcoderDV

ProcoderDV is the computer program you will use to watch and code the LS and CSBS videos. Please see the following information for setup and general use.

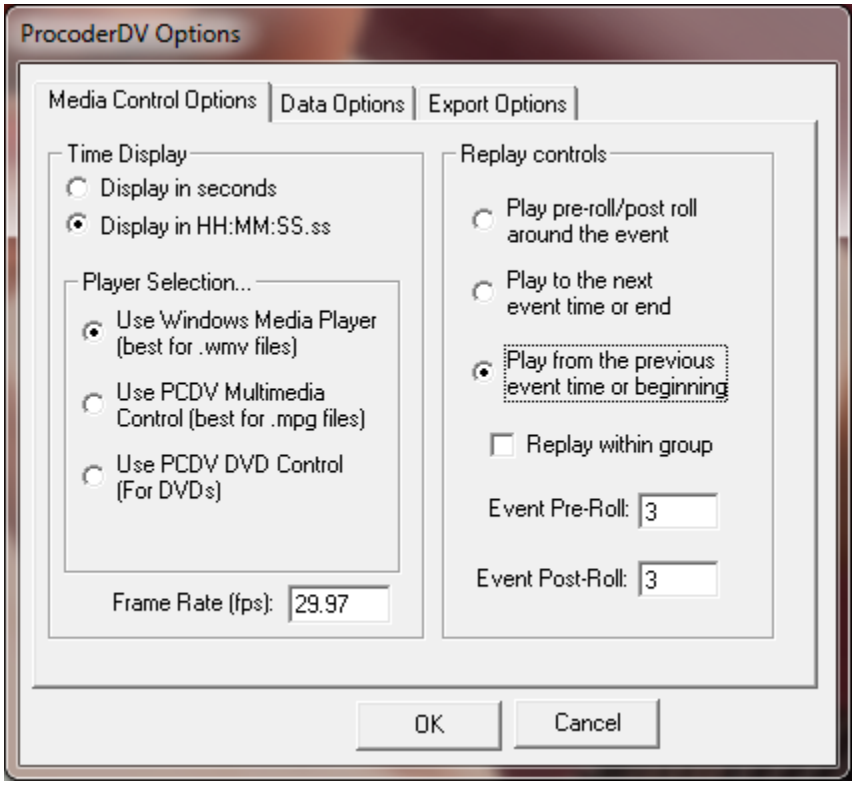
To use ProcoderDV to code, do the following:

1. Open Procoder DV (double click on the desktop icon or find it in the program menu of the computer)
2. You should get the following

Setting Procoder DV options:

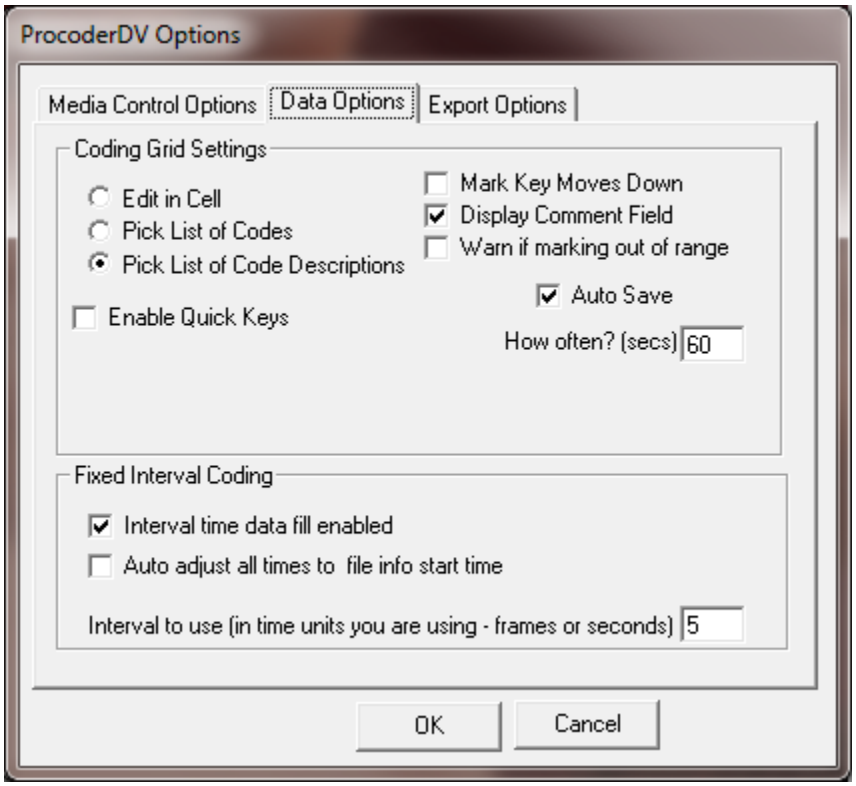
If you are using Procoder DV for the first time, you will need to check the option settings to make sure they are set correctly for interval coding (i.e., the type of coding you are doing).

From the Procoder menu bar, select “Edit” then “Option” to get the following window:



Under the “Media Control Options” tab, “Time Display” should be set for “Display in HH:MM:SS.ss”, “Player Selection” should be set for “Use Windows Media Player”, “Replay controls” should be set for “Play from the previous event time or beginning.” The event pre-roll and event post-roll don’t matter.

Select the “Data Options” tab to get the following:



Check “Pick List of Code Descriptions” and “Display Comment Field.” Check “Auto Save” and enter 60 seconds. Under “Fixed Interval Coding” select “Interval time data fill enabled.” Enter “5” in “interval to use.”

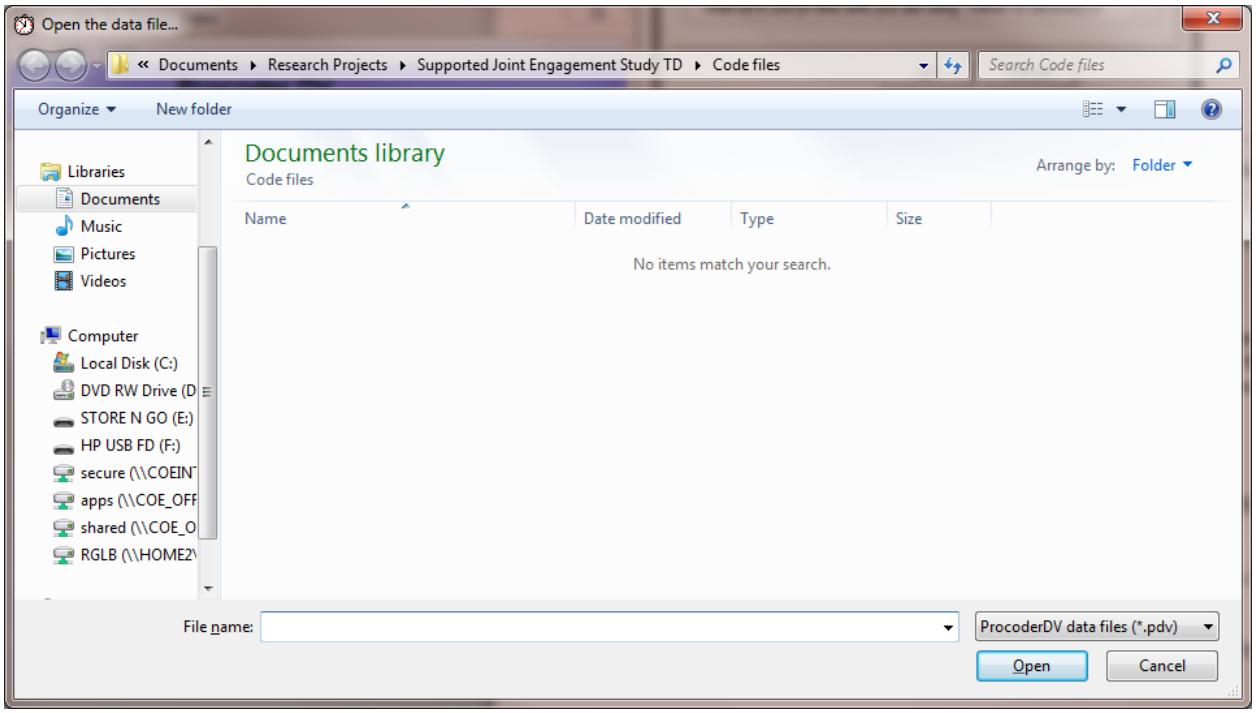
The Export Options don’t need to be changed. Select “OK” to end the Options set up.

Using Procoder to Code

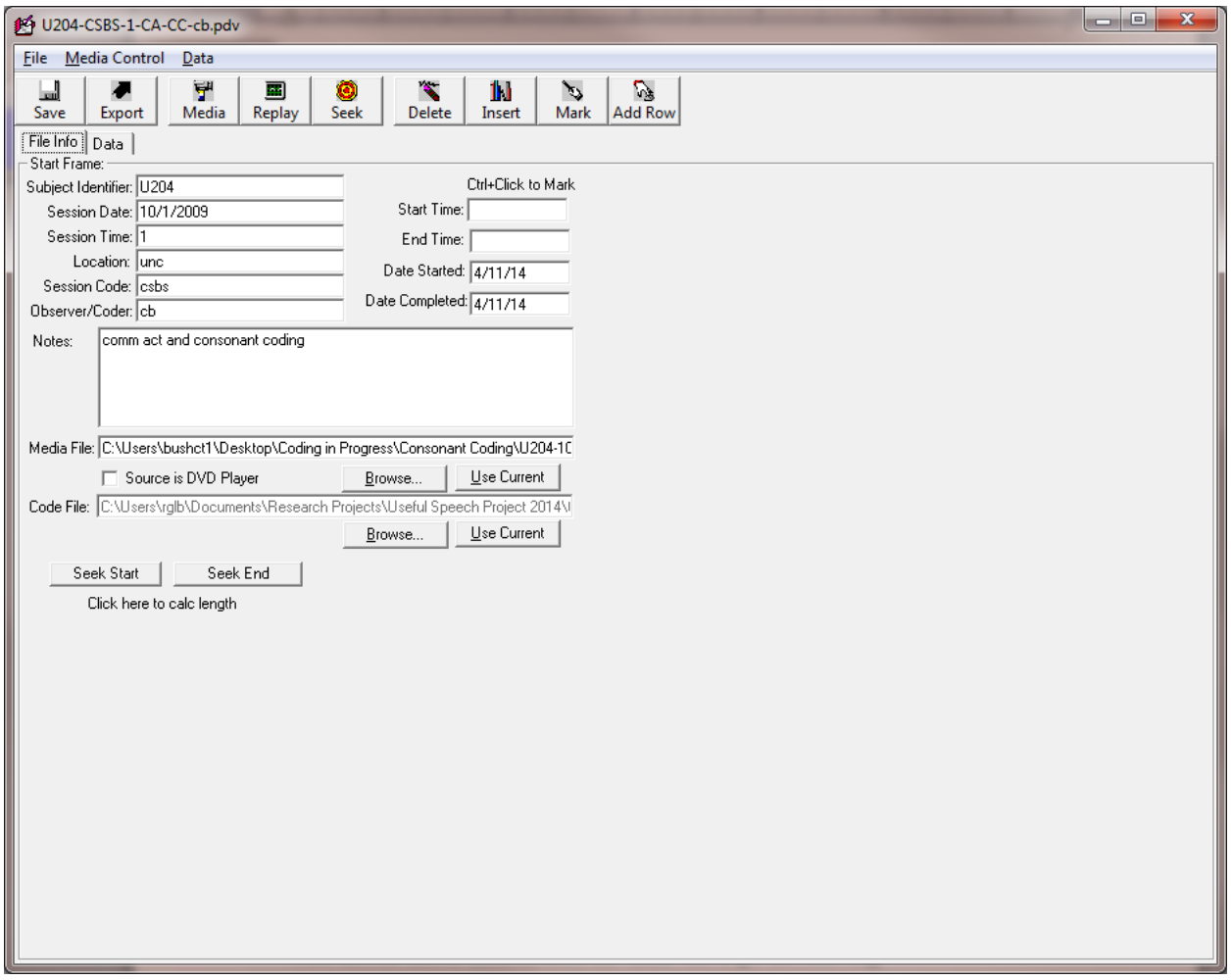
Once the ProcoderDV software options are set up, you will need to (a) open an observation file (a file containing your record of the coding for each interval), (b) open the media file (a digital record of the measurement session for the participant you are about to code), and (c) open the appropriate cod file.

Opening an Observation File

From the ProcoderDV menu bar select “File”, “Open”, and “Open a Data File” to get the following:



Navigate to the appropriate data file and click “Open.” You will get something like the following:



Media File: Click "Browse" to locate the media file on the external hard drive to be coded; a link is automatically created to this file.

A. Code File: Click "Browse" to locate the .cod file copied from the server folder and stored in a project file on your computer hard drive; a link is automatically created to this file. The pragmatic function code is labeled "pragmatic function csbs.cod" or "pragmatic function ls.cod" depending upon whether you are recoding a CSBS or LS data file.

Be sure to import the code file from the network to your computer:

1. Copy the Code files, **pragmatic function csbs** and **pragmatic function LS** (\\KRUPA\Yoder\5-USEFUL SPEECH Study\Pragmatic Function Coding\Code files), onto your hard drive
   a. Never code a file using a code file that is on the server. Doing so can result in corrupting the code file.
   b. Save the copied code file to a location that can be easily found each time you make a new ProcoderDV file.

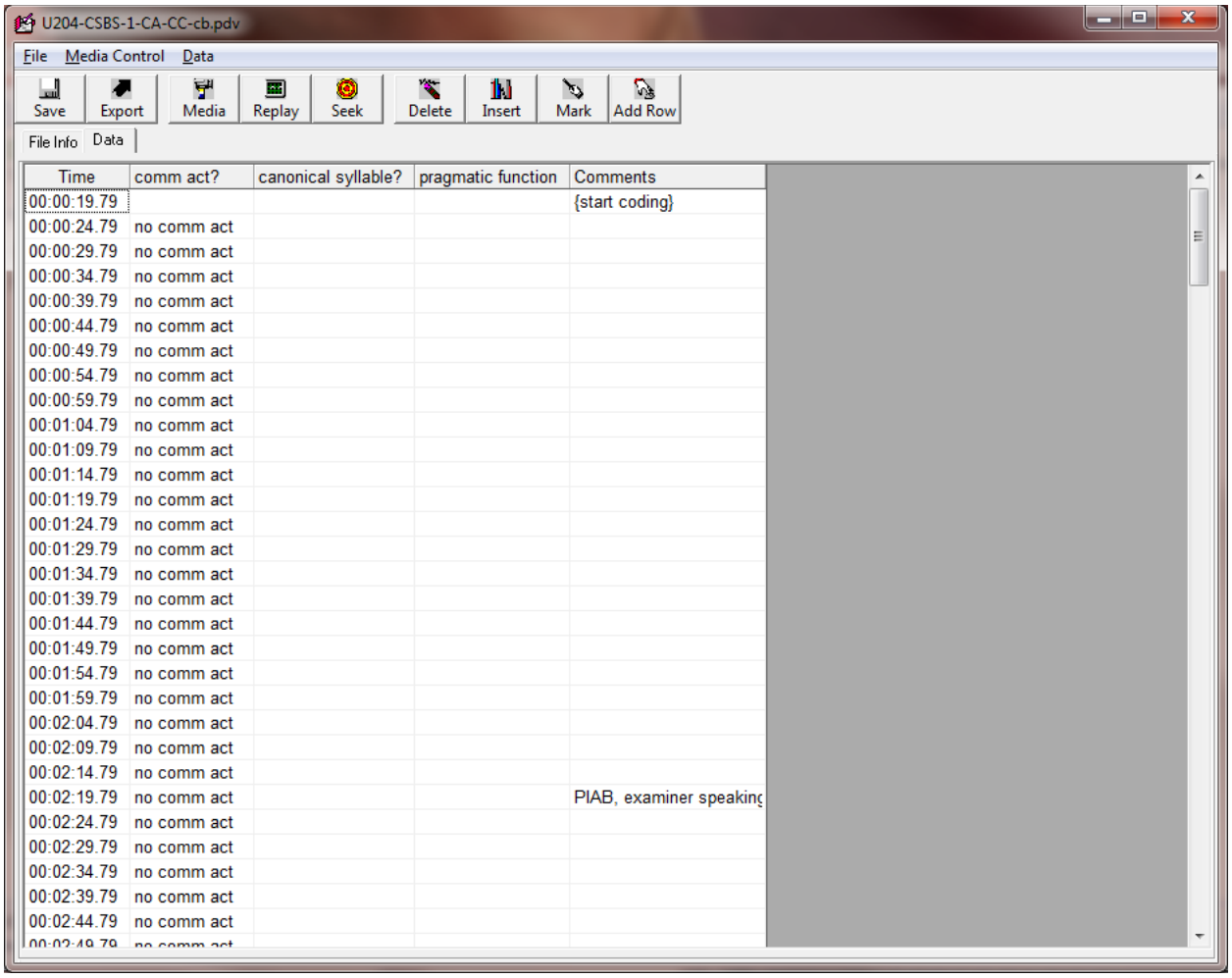
You will need to **save the data file with a new name**. Please use the following conventions:

Site initial-3 ID numbers-procedure initials-time period number-pragmatic function coding-coder initials.

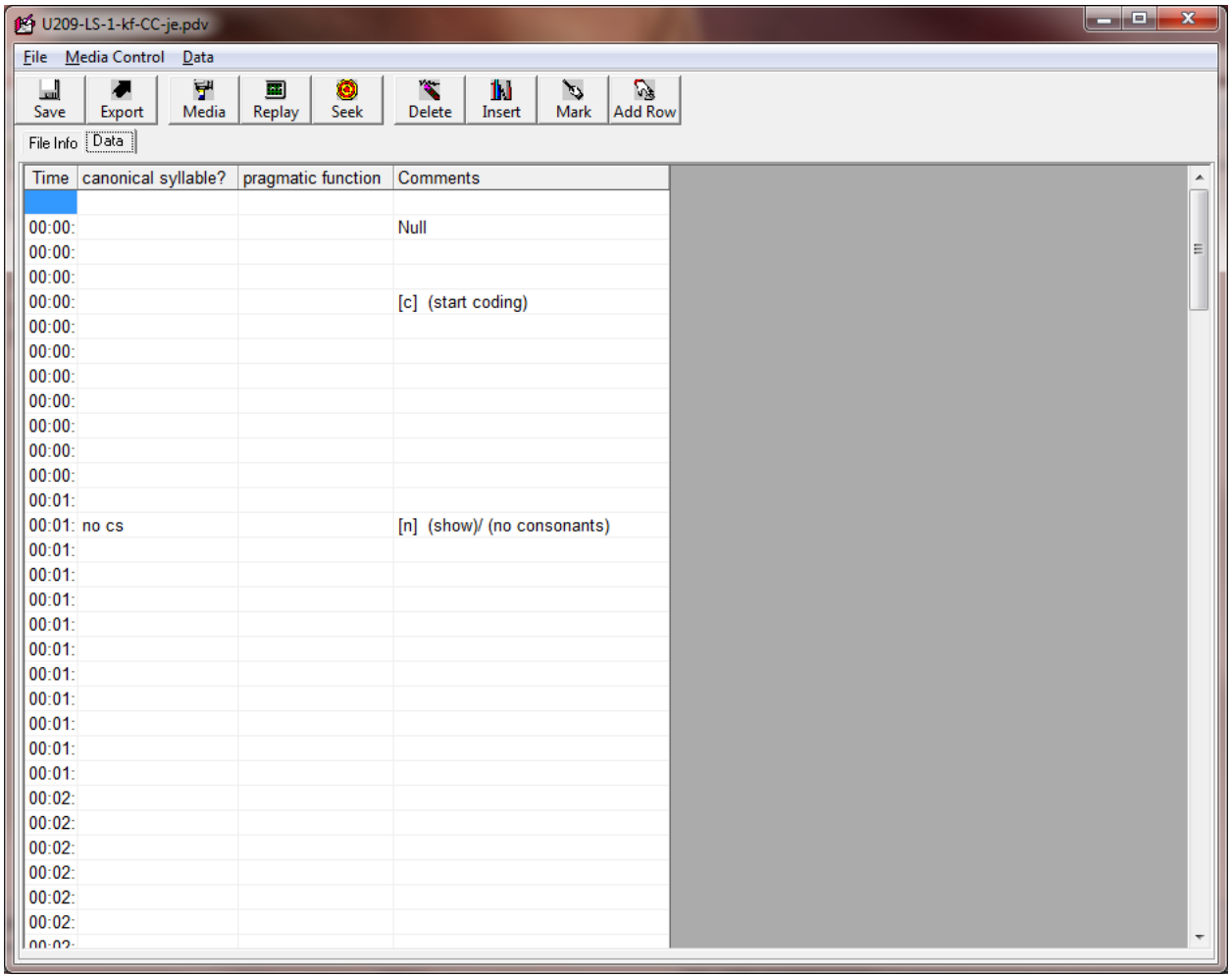
For example, for a Vanderbilt participant with the ID 001 in the CSBS procedure at Time 1 coded for pragmatic function of communication acts by Rebecca Lieberman-Betz the file name would be V001-CSBS-1-PF-RLB.

You will also need to enter new information under the "File Info" tab. Change observer coder to *add* your initials (e.g., cb/rlb). Please do not delete the original coder initials. Replace date started and date completed to reflect the date of the pragmatic function coding only (i.e., you may delete the dates of the original coding).

Once the File Info is entered and saved to your computer hard drive using the new file name, select the "Data" tab to get something like the following if coding the CSBS:



If coding a LS file, you will get something like the following:



You may adjust the width of the "Comments" field and the "Time" field by putting the cursor on the margins of the cell and holding the left mouse button down while you stretch the margin of the cells (like you would in excel).

<u>To Open Media for Coding</u>

Click on the "Media" button. The media file will open on your screen. If needed, in the media window select "control", "fit to window".

Once you have opened your data file, made changes to the file info tab, saved the file under a new file name, and linked to the correct cod and media files, you are ready to begin coding. You will begin coding in the first interval coded for a CA by the original coder.

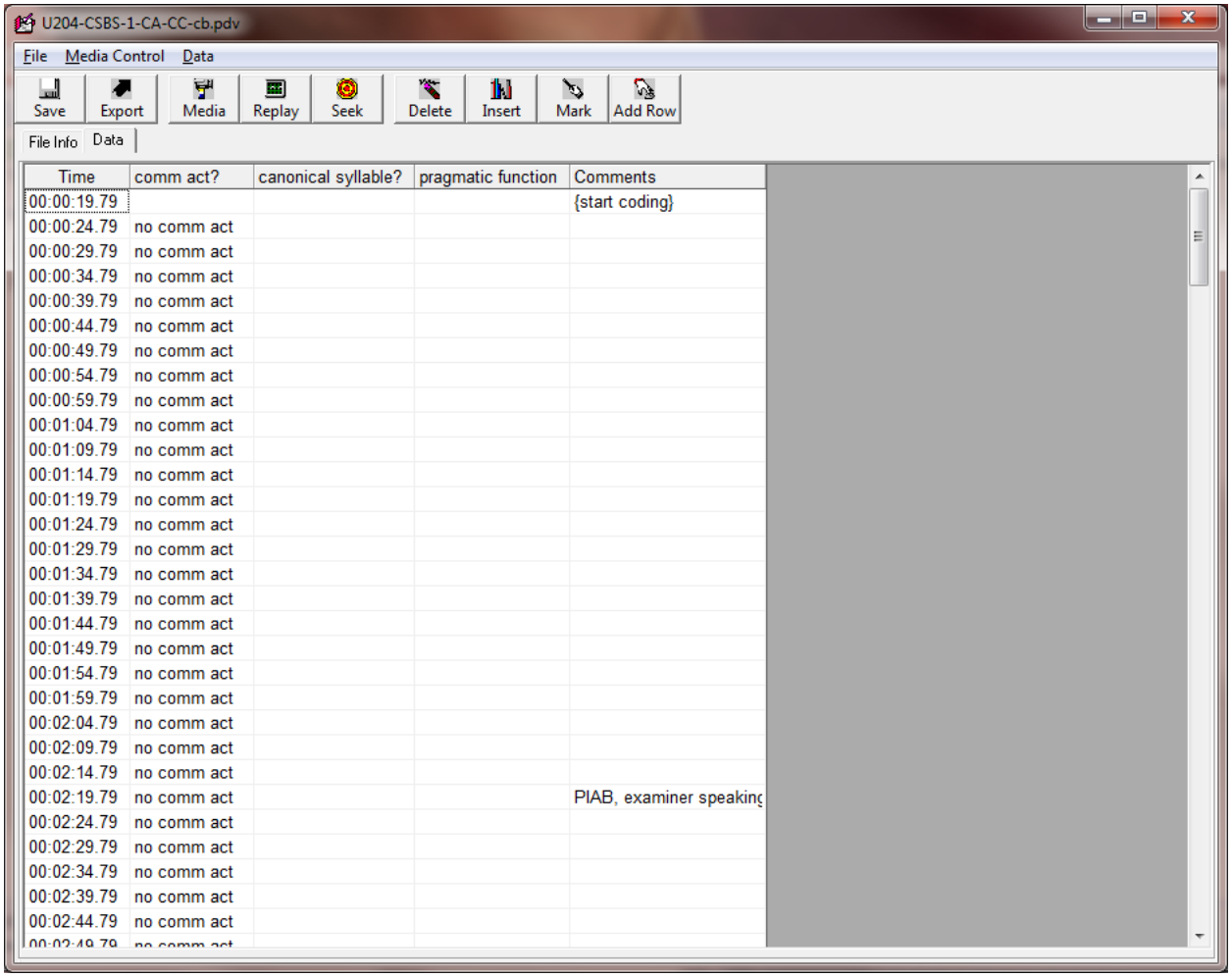
Place the cursor in the cell and use the replay function (Ctrl+A) to play the selected interval from the end of the previous interval.

Coding Pragmatic Function of Communication Acts in Interval-Coded CSBS files

Communication and Symbolic Behavior Scales files were previously coded for communication acts and canonical syllables using a partial interval recording system. Interval length is 5 seconds.

Once you have opened your data file, made changes to the file info tab, saved the file under a new file name, and linked to the correct cod and media files, you are ready to begin coding. You will begin coding in the first interval coded for a CA by the original coder.

Coding of pragmatic function will occur only in those intervals coded “comm act” in the data file. You do not need to attend to whether a canonical syllable was present.



You will view each 5-second interval containing a communication act (i.e., coded "comm act" in the original file). After viewing the entire 5-second interval, you will determine the pragmatic function of the communication act using the definitions provided below (imperative [4i], declarative [4d], or other [4o]). Once you have viewed and coded all intervals for pragmatic function of communication acts, you will save the file and copy it to the server folder.

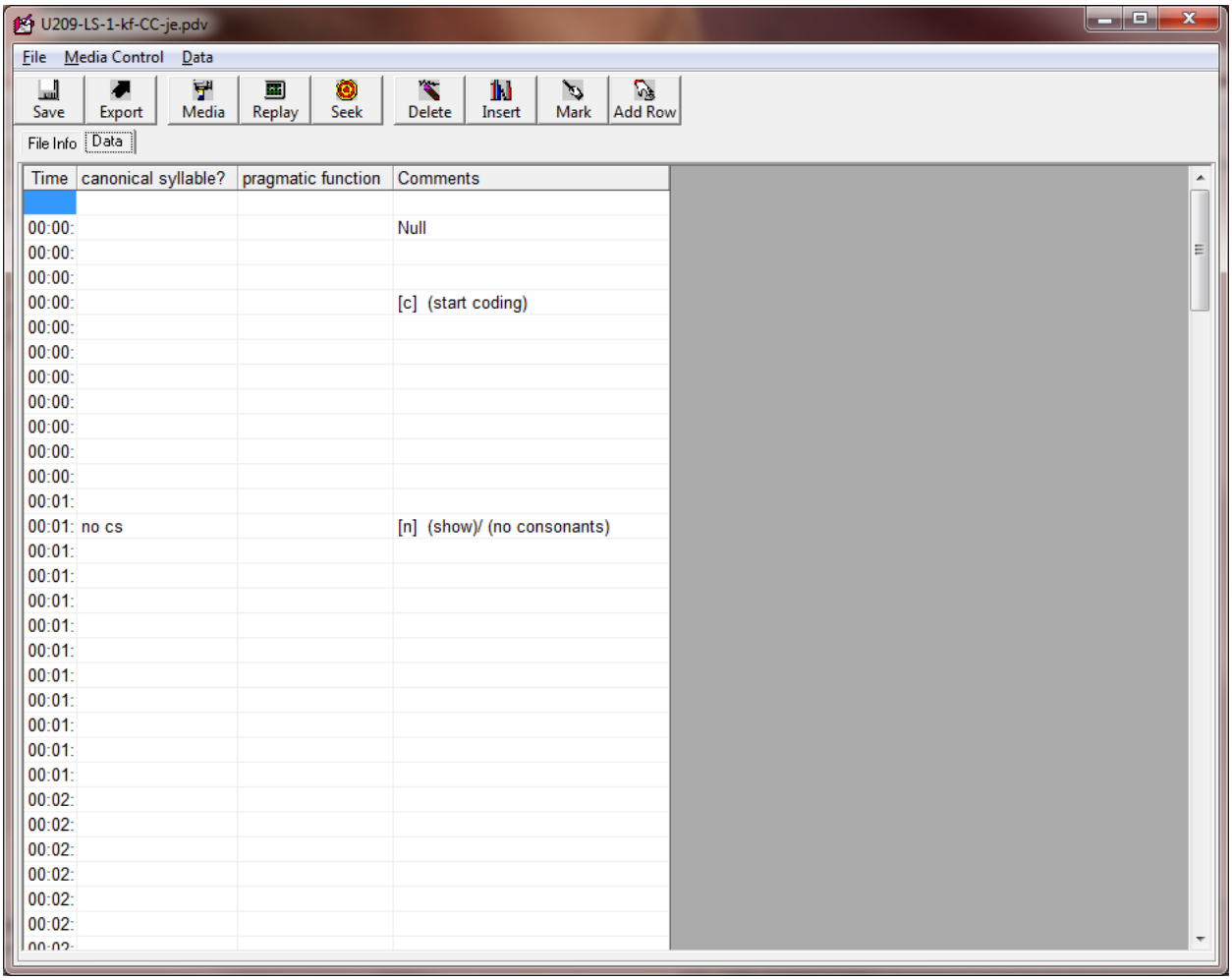
Coding Pragmatic Function of Communication Acts in Interval-Coded LS files

Language Sample (LS) files were previously coded for communication acts and canonical syllables using a partial interval recording system. Interval length is 5 seconds.

Once you have opened your data file, made changes to the file info tab, saved the file under a new file name, and linked to the correct code and media files, you are ready to begin coding. You will begin coding in the first interval coded for a CA by the original coder.

Coding of pragmatic function will occur only in those intervals containing a [n], [s], or [m] in the "comments" field and/or "yes cs" or "no cs" in the canonical syllable? field.

Communication acts from the language sample were previously coded **[n]** when they contained non-word vocalizations or imitative words, in addition to evidence of coordinated attention to object and person; **[s]** when they included a single non-imitative sign or non-imitative word; and **[m]** when they contained multiple non-imitative symbols used as part of the communication act.



You will view each 5-second interval containing a communication act (i.e., coded [n], [s], or [m] in the comments section of the original file). After viewing the entire 5-second interval, you will determine the pragmatic function of the communication act using the definitions below (imperative [4i], declarative [4d], or other [4o]).

Once you have viewed and coded all intervals for pragmatic function of communication acts:

1. Save the .pdv file to your computer.
2. Copy the .pdv file to the network: \\krupa\Yoder\Amy\pragmatic function coding\[LS or CSBS] [primary or reliability] coding.
3. Delete media files from your computer (place in recycle bin). This is the copied media file; the original media file will still exist on the server (vu1file).

Coding

There are five coding groups; each group represents a different facet of coding communication samples. We are only concerned with two (groups 3 and 4) and the details for those are included in this section.

Group 3: Types of Communication Acts [3n/3s/3m]
Group 4: Types of Pragmatic Function [4i/4d/4o]

I. Coding Group 3: Types of Communication Acts [3s/3m/3n] ****NOTE:** We are not coding (unitizing) communication acts or transcribing; we are only classifying communication acts that have already been identified.**

A. Defining Communication Acts

1. For the purposes of this study, **communication acts** will be defined as words (spoken, signed, or imitated), non-word vocalizations with evidence of coordinated attention, or one of the 15 gestures specified in this manual (pg. 70) with evidence of coordinated attention to message/referent and communication partner. We will only be coding child behaviors that meet this definition of communication.
    a. See the definitions that follow in this section for each behavior to be certain that the candidate behavior meets codeability requirements.

B. Types of Communication Acts:

1. Symbolic [3s/3m]
    a. A single non-imitated word—spoken or signed [3s]
    b. Multiple non-imitated words—spoken or signed [3m]
2. Non-Symbolic [3n]
    a. Imitated words or phrases [3n]
    b. Non-word vocalizations [3n]
    c. Gestures [3n]

C. Symbolic Communication Acts [3s/3m]

1. Symbolic communication acts are the non-imitative, referential **words** that a child speaks or signs.
    a. Conceptually, a "word" is a culturally-defined symbol that represents a consistent meaning and must be spoken with sufficient accuracy to be recognized as part of the culture's lexicon and have nonlinguistic or conversational support to indicate that the word is being used referentially.

2. The Word Rules
    a. When coding samples of children with autism, it's imperative to understand how language delay, one of the core features of the disorder, can affect the frequency and intelligibility of utterances. Production of words may be incomplete or contain inaccurate phonemes.* You'll come across child utterances that may seem like words, but are not codeable.

* Phoneme refers to the specific sounds that combine to form words.

Deciding whether a possible word is a codeable word can be difficult; for this reason, we have developed 3 "word rules" to assist coders in determining if a child's vocalization has sufficient accuracy of word approximation. If all of the word rules criteria are met, the child's vocalization may gain codeable word status.

b. Word Rules Criteria
   i. The established "word rules," are:
      - Pronunciation Threshold
      - Referential Use
      - Analyzable content

   ii. Word Rule #1: Pronunciation Threshold
      - An acceptable approximation requires sufficient similarity to the adult production of the word.
      - Accuracy/Phonetic Support
        - Phonetic support partially depends upon the syllabic structure of the child's approximation:
          - When the syllable structure is intact, at least one of the following must be present:
            - An accurate vowel (or functionally equivalent vowel approximation, see Resource B)
            - An accurate initial consonant (or child-like consonant substitution, see Resource C)
          - When the syllable structure is *not* intact, both of the following must be true:
            - The vowel nucleus must be in the appropriate position and be an accurate (or functionally equivalent) production of the adult target-vowel
            - There must be at least one accurate consonant (or approximation) in the appropriate position
        - Note: If the target word is "a" or "I," there have to be other words in the utterance that support the inference that "a" is the article and "I" is the personal pronoun.
          - If a word contains only one consonant and that consonant is omitted, the child's vocalization is not considered close enough to the word target and should not be coded.
          - Ex: A child attempts to say "at" but only produces the vowel sound. This approximation does not meet word status.

   iii. Word Rule #2: Referential Use
      - To count as a codeable "word," the child's utterance cannot be an imitation of the adult's immediately preceding communication as there is no clear referent for this imitated word.

- See pg. 69 for specifics about coding imitations.
- An exception to the non-imitativeness restriction is expanded imitations. An **expanded imitation** is similar to the adult's previous utterance but adds additional words or changes the words in the adult's utterance (such as adding an article or pluralizing the noun). Expanded imitations are coded as symbolic communication acts.
  - Ex: A: Look at that car
    C: Look at cars

- The proposed word-target for the child's approximation must be used in a semantically and pragmatically conventional manner, not as a possible idiosyncratic child meaning.
  - Ex: A child consistently uses the word "milk" to mean "I want" in multiple contexts. "Milk" in this case does NOT meet the referential use word rule criteria and is not codeable.
  - To determine if a word is used in a semantically appropriate manner, the examiner must determine that there is either:
    - Immediate nonlinguistic support
      - **Nonlinguistic support** means that just before, during, or after the word is said, there is visual evidence providing context for the word target. The child may be looking at the referent object or commenting on an action or event temporally close to the vocalization (within 3 seconds).
      - Ex: The child is looking at a jar of bubbles and says "buh." The child's gaze at the bubbles gives nonlinguistic support for the word-target "bubbles."
    - Conversational support
      - **Conversational support** means that the word-target is supported by the conversation either through the child's approval of an adult's interpretation or through further elaboration on the topic that provides more clarity. We use conversational support especially with an absent referent, as nonlinguistic support is unavailable.
      - Ex: The child says "buh." The adult asks, "You want bubbles?" The child nods in affirmation. Even though there are no bubbles visible, the child confirms the adult's interpretation by nodding, which provides conversational support for the word-target "bubbles."
      - There may be times when the adult misinterprets a child's attempted word. You should code the adult's word target *conservatively*.

        Ex: Child points to a barn and says, "Fmm," and looks to the adult. The child's non-word vocalization is unclear, and the adult responds to the child saying, "Oh, friend! Yes, we are friends." In this case, "fmm" would **not** be coded as a word, as there is neither non-linguistic nor true conversational support.
      - There may also be times when the child's parent is present for the LS or

CSBS administration and provides word-target suggestions for absent referents. Before coding the parent's suggestion, be certain the child's production of the word meets all other word rules criteria and remember to be conservative.

Ex: Child looks to the star rattle and and says, "Gooh," then looks to the adult. The child's non-word vocalization is unclear, but the child's parent tells the examiner, "Oh that's how he says star." In this case, "Gooh" would **not** be coded as a word as the child's production of the word does not meet the pronunication threshold and there is neither non-linguistic nor true conversational support.

- The word-target must have a unique phonetic shape compared to all other words within the same sample.
  - If a child's approximations for two different referents sound exactly the same, only the first production and the following vocalizations that refer to that same, initial referent are considered to meet criteria for word use.
  - Ex: A child says "hoss" while playing with a horse towards the beginning of a sample, then later says "hoss" while evidently referring to a house.
    - Only code the initial production of "hoss" referring to horse and any later productions for which the word-target is undoubtedly "horse." Any productions of "hoss" in this sample that are not clearly related to horses should be considered unintelligible.
  - The coder should code whichever word first occurs in a pragmatically and semantically appropriate context.
    - We don't expect coders to go back over the file and "correct" a code file due to the word candidate being used for a potentially different meaning later in the session. Just don't count the later uses as words.
- The word-target must be the only suitable candidate for the child's approximation.
  - Ex: A child requests toys from a box which contains a ball and a set of blocks. The child says "bah," which could plausibly refer to the box, the ball, or the blocks. Because the approximation meets the word rules criteria for all three word-targets, the coder should consider this utterance unintelligible.
    -
- Small Words
  - When coding small words, remember the word must be clearly appropriate and developmentally plausible (rather than simply "conceivably appropriate").
    - Coders should apply their knowledge of language development and other language performance within the sample to judge the feasibility of a hypothesized word-target.
      - For example, if the child's age equivalency score is under 20 months, it is unlikely that the child uses multi-word phrases. In order to credit a child with an age equivalency score under 20 months with a multi-word

utterance, the utterance must be clearly articulated.

- Articles, auxiliary, and copula verbs that meet the approximation rules are counted *only* if the words they modify also meet word rules criteria. Coding these small words can be difficult in terms of coder reliability. For that reason, articles, auxiliary, and copula verbs may be counted as words without the words they modify *only if* there is a higher level of evidence to support the child's use of the word—there must be clear linguistic support.
  - Example: child is describing toys and says "This is blue. This is red. (Unintelligible) is (unintelligible)."
    - The third utterance would count as "x is" only because the child has just previously used the same verb/sentence structure, which gives us more support for coding the word "is" alone.
- Remember: Place-holders such as "um" or "uh" are not coded, as they do not pertain to any referent.

iv. Word Rule #3: Analyzable Content

- Any potential word target must be considered analyzable, meaning:
  - The word target must not be listed under unanalyzable content (pg. 85)
  - The word target must be in the Merriam-Webster English dictionary or be one of the accepted "Child-Like" words (See Resource D)
- For further information on analyzable content, see pg. 85 of this manual.

3. Non-imitative Signs [3s/3m]
   a. In this coding manual, conventional signs are those that are accepted in American Sign Language (ASL; see http://www.aslpro.com/[†]).
   b. Like spoken words, a child may try to approximate a given sign. A child's hand movements are classified as signs when:
      i. The hand movement and location with respect to the rest of the body are like the conventional sign.
         - The hand shape does not have to match the conventional sign exactly, but the movement and location of the sign should be a close fit, given the child's motor limitations.
         - Two-step signs require the child to only complete one-step of the sign.
           - Ex: The sign "dog" is to pat one's leg and then snap. A child can only pat his leg and still have the sign coded as long as other criteria are met (such as semantic appropriateness).
           - Ex: Patting the table when signing "dog" is considered an appropriate adaptation, given the constraints of the Tripp Trapp chair and the child's inability to pat his/her leg while sitting.

[†] See Resource A: Signs and Sign Approximations for more information on acceptable ASL signs

c. Like spoken words, both actual signs and their approximations are coded without the need for the child to demonstrate attention to adult and/or attention to object/event IF the signs are not imitated and if they meet the referential word rule.

d. In order to code a sign, be certain that:
   i. The sign does not have the same shape as another sign coded earlier in the video for the same child.
      - If this occurs, the coder should code whichever sign is most pragmatically and semantically appropriate.
      - Apply the protocol outlined on pg. 61 for similar productions of signed word approximations.
   ii. The word being signed is in the unabridged Merriam-Webster English dictionary, which includes some interjections and highly routinized speech that can be reproduced in the manual modality.
   iii. It does not qualify as an imitation; this includes when the child signs an adult's immediately preceding orally produced word (or vice versa).
      - Ex: If the adult says, “Do you want more cookies?” and the child signs, “more,” this is coded as in imitation.

   iv. The coder must determine that the child is using the sign in a semantically and pragmatically conventional manner (not as a possible idiosyncratic child meaning).
      - The coder must determine that the context of the discourse and/or play is appropriate for this sign to be used.
      - The sign must be truly appropriate and developmentally plausible, rather than simply “not inappropriate” or “conceivably appropriate.”

e. If a word is both signed and spoken, it should be treated only as a spoken word.
f. When judging whether a possible signed form should be given signed word status, judges should apply their knowledge of:
   i. The child’s language development
   ii. The child’s vocabulary
   iii. A general attitude of conservatism

g. Overgeneralizations of Signs
   i. A “possible sign” may be accorded sign status in some contexts because of its semantic and pragmatic appropriateness, yet not be judged as a word in other contexts. This occurs when the child uses the same sign in accurate contexts as well as in contexts that appear to be overgeneralizations.
      - Ex: If the child appropriately uses the sign for “horse” and then points to a cow and makes the same sign, the latter sign would also be given word status. The child’s second use of the sign “horse” appears to be an overgeneralization (semantic neighbor) when pointing to the cow.

ii. If a child's use of a sign does not reflect an understanding of the word, it may be judged as a non-word, even in those few contexts in which semantic and pragmatic conditions make word status plausible.
- Ex: If the child signs "horse" indicating a horse but also uses that same sign shape in reference to objects which are not close semantic neighbors of "horse" (such as door, chair, want, etc.), it would not be given word status in any context.
  - Consider coding as a non-symbolic communication act [3n] if there is evidence of coordinated attention.

h. Gestures‡ with Sign-like Qualities
   i. More vs. Claps
   - If the child claps during or immediately following bubbles being blown, these hand movements will be considered claps (and not a sign for "more") if the child is smiling and/or laughing and there is coordinated attention. Code [3n].
   - If the child claps during or immediately following the bubbles but is not laughing and smiling, these acts would be considered a sign for "more" and be coded as [3s].

   ii. Pointing & Pantomiming
   - If the child points to himself, this should not be coded as the sign "me;" it should be coded [3n] as a proximal point, assuming it meets the criteria to be coded as a communication act.
   - If the child puts his hand to his ear to indicate "telephone," this should be coded as a sign, not pantomime.

D. Non-Symbolic Communication Acts [3n]
1. A **non-symbolic communication act** is any of the 3 following communication cues that also show coordinated attention to a referent and the communication partner:
   a. Non-word vocalization
   b. Imitated word or sign
   c. Gesture recognized in this manual

2. Attention
   a. Coordinated Attention
      i. **Coordinated attention**, for our purposes, refers to the child displaying evidence of sequential or simultaneous attention to both a person and an object or event within 3 seconds of his communication act.
      - For **sequential coordinated attention**, the evidence of attention to object and adult must occur within 3 seconds of one another without the occurance of any possible distractions to potentially influence the child's shift in attention; the shift must be of the child's initiation.

‡ See pg. 70 for a full list of acceptable gestures.

- Ex: The child displays uninterrupted attention to object…makes a vocalization/gesture…displays attention to adult ("…" represents 3 second intervals)
- Ex: The child displays uninterrupted attention to adult…displays attention to object…makes a vocalization/gesture
  - Note: The order of attention shifts may vary as long they occur within 3 seconds of one another without disruptions.
- Gazes to "another focus of attention" need to last at least 1 second for us to code a shift in attention. This criteria applies to any coded look or gaze, not just for attention to adult.
  - A temporal criterion (e.g. 1 second) helps coders determine whether a gaze shift is sufficient to be considered a "change in focus of attention." There would need to be more than a momentary fixation of the child's gaze for the gaze shift to be considered a "change in focus of attention" and thus considered a gaze shift.
    - "Momentary" gaze shift within a communication act occurs when a child displays a transitory look or glance toward another entity "on the way" from one focus of attention to the other. We do not count momentary gaze shifts as sufficient evidence of attention.

- For **simultaneous coordinated attention**, the child shows evidence of attention to an object or event *while* showing evidence of attention to an adult.

ii. Our study has defined specific standards of what constitutes "evidence of attention." See below.

b. Attention to Adult

i. Attention to adult, in order to be coded, may be directed toward the examiner or the parent.

ii. Attention to the adult is evidenced when a child:

- Gazes to the adult's face
- Answers an adult's question
- Imitates the adult through word or sign
- Uses one of the gestures that shows intrinsic attention to adult (pg. 72).

iii. The following elaborates upon the list above.

- A **gaze to the adult's face**, in order to count as sufficient evidence of attention to adult, is defined as the child looking at the adult's face without the adult doing something to draw the child's attention.
  - Use the orientation of the child's eyes and face to determine if the child is looking at the adult's face.
  - If there is a question as to whether the child is looking at the adult, then do not code. REMEMBER TO BE CONSERVATIVE.

- If there is an object within an "imaginary box" delineated by the adult's shoulders and top of the adult's head, it becomes difficult to distinguish between gaze to object and gaze to adult. In these instances, the coder must be able to see clear and distinct evidence of attention to adult and attention to object through eye shift.
    - If eye shift is ambiguous, assume the child is looking at the object instead of the adult's face.
    - Ex: The adult pretends to drink from a cup, then lowers it below her chin but still holds it within the "imaginary box" around her head. The child looks at the adult's face above the cup, then *clearly* lowers his gaze and looks at the cup. We would consider this as both a look to adult and look to object since there was a clear eye shift.
    - Ex: The adult pretends to eat fruit and the child looks to the area around the adult's face. Since we cannot determine if the child is looking at the adult, the fruit, or both, we do not code attention to adult.

- An **answer to an adult's question** that it is "precise and accurate" shows attention to adult.
    - The answer can be spoken, signed, or gestural as long as it precisely and accurately answers the question.
    - Such acts show attention to the adult as evidenced by the accurate answer to the question.
        - Note: By "accurate" we mean that the child's answer pertains to the adult's question and is a logical response.
            - Ex: An adult holds up a blue ball, asking, "What color is this?" Without looking up the child says, "green." Although the child's answer is technically incorrect, it is considered "accurate" in terms of attention because it clearly shows that the child was listening and is responding to the adult's question.
    - Ex: Adult holds up a puzzle and a car and says, "Which toy do you want first?" The child looks and points to the car without looking at the adult. Because this is an appropriate gestural response that precisely answers the question, attention to adult has been met (and a communication act can be coded because there is also attention to object).
    - Note: Even if a child's vocalization is temporally proximal to the adult's question (within 3 seconds of the offset), it does not necessarily show attention to adult's question if the "answer" is inaccurate.
        - Ex: An adult holds up a blue ball, asking, "What color is this?" Without looking up the child says, "meow." The child's response, though within 3 seconds, is inaccurate and does not show evidence of attention to adult.
- A **complete or reduced imitation** of the immediately preceding adult utterance counts as evidence of attention to adult.
    - See Coding, pg. 69 for more details on imitation.

- A **gesture** that shows attention to adult (see pg. 72).

c. Attention to Object/Event
   i. An object or event refers to:
      - Any physical item (such as a toy, chair, door, etc.)
      - Any auditory or visual events that occur in or within earshot of the testing area

   ii. Attention to object is demonstrated when the child:
      - Looks at an object
      - Deliberately moves an object
      - Deliberately manipulates an object
        - Simply touching, holding, or picking up an object without looking or manipulating it does not qualify as attention to object
      - If an object is not in the visual field of the camera, the child can meet the criteria for attention to object if the adult verbally interprets the child's look or distal point as evidencing attention to object.
        - Ex: The child looks off-screen, points, looks to the adult, and vocalizes. The adult says, "You see the light?"
        - Ex: The child looks off-screen, points, looks to the adult, and vocalizes. The adult **does not** respond to the child or name the object of the child's focus; this would not be considered a communication act because there is insufficient evidence of the child's attention to object. Do not code.
          - In these cases, the responsibility lies upon the interacting adult to confirm attention to object since it is off-screen.
          - The same rule would apply if the child's back is to the camera and the coder cannot reliably judge if the child is attending to an object.

   iii. Attention to an event is demonstrated when the child:
      - Looks to a physical act performed by the adult
      - Actively looks to or seeks out the source of an auditory event
        - Ex: While in the testing room, sirens can be heard outside. The child looks up from play to the adult, vocalizes, and looks around the room for the source of noise.

d. Intervening and Potentially Influencing Adult Behaviors (IPIAB)
   i. Adult behaviors may interrupt and/or potentially influence child behaviors which would otherwise be codeable as communication acts. These **intervening and potentially influencing adult behaviors (IPIAB)** may affect child communication acts that involve sequential coordinated attention.
      - When a communication act involves a gesture or a non-word vocalization, the necessary attention components cannot be prompted or cued by adult vocalization or movements which could be viewed as "potentially influential." The child's look

must be independent of the adult's behavior.

- Ex: A child looks at a car and vocalizes. The adult says "car," and the child looks to the adult.[§]
- The adult's verbalization potentially usurps the child's attention to the adult. We are uncertain if the child would have looked to the adult independently had the adult not spoken. Do not code as a communication act.

ii. The following is an exhaustive list of adult behaviors that may intervene and potentially influence one or more key behavioral components of an otherwise codeable communication act:

- Gross movements in head/body (getting up out of seat, moving head, shoulders, trunk to examine or get something on other surface, raising arms, etc.)
- Vocal or verbal communication acts
- Moving object of interest, especially into the child's line of sight or into the square near the adult's face.

iii. "Intervening" vs. "Potentially Influencing"

- If an adult behavior is **both** intervening *and* potentially influencing, we do not consider the child's surrounding behaviors for communication act coding, as we cannot be sure if the child would have independently met all criteria for a communication act without the IPIAB.
- Intervening
  - An adult's behavior is considered to "intervene" or interrupt if it occurs AFTER some key behavioral components of the child's possible communication act and BEFORE others (eg., after a gaze to the examiner's face and before a gaze shift to an object).
  - It is possible for an adult behavior to be intervening but not potentially influencing. Intervening-but-not-potentially-influencing adult behaviors do not affect the codeability of a child's potential communication act.
    - Ex: The child claps after putting in a puzzle piece. The adult crosses and uncrosses her legs. The child then looks to the adult's face.
      - Although the adult's behavior does intervene (comes after the clapping and before the child's gaze shift), it is unlikely to have influenced the "missing component" of the otherwise codeable communication act (attention to the adult's face).
- Potentially Influencing
  - An adult behavior included in the exhaustive list above is considered "potentially influential" if it may have brought about some "missing" component(s) of an otherwise codeable child communication act.

[§] Assume each behavioral component described in the examples of this section occurs within 3 seconds of one another.

- Ex: A child produces a non-word vocalization, then looks to an adult's face, but then shifts his gaze to an object *only after* the examiner begins to move or shake the object.
    - This combination of behaviors should not be coded as a communication act because the adult's manipulation of the object may have usurped the child's attention. We cannot assume that the child would have looked at the object within 3 seconds of his gaze to the adult's face had the adult not moved the object.

- Note: If an adult's potentially influencing behavior occurs before or after all components necessary for a child's communication act, the communication act should be coded because the potentially influencing behavior does not interrupt the communication act.
- See the table on the following page for additional examples

Components of Child Communication Act	IPIAB—NOT CODEABLE	Potentially Influential Behavior Does not Intervene—CODEABLE	Intervening Behavior is not Influential—CODEABLE
Gesture + Attention to Adult	• The child shakes his head. • Adult begins to shake her own head and verbalize, "Oh, you don't like that!" • Child looks to adult. The adult's behavior intervenes and may have influenced the "missing component" (gaze to adult's face) of the otherwise codeable communication act.	• The child shakes his head, then looks to the adult's face. • After child has initiated gaze to the adult's face, the adult shakes her head and says, "Oh, you don't like that!" The adult's behavior does not come between the child's head shake and gaze to the adult's face.	• The child shakes his head. • The examiner hands the child a toy. • The child gazes to the adult's face. • The adult then says "Oh, you don't like that!" The adult's behavior (handing the child a toy) comes between the child's gesture and gaze to the adult's face but probably did not cause the latter.
Gesture + Coordinated Attention	• The child proximally points to the bubble bottle. • The adult begins to move her head and torso down towards the child. • Simultaneous with the adult's movement, the child looks to the examiner's face. The IPIAB begins after the child's point and before the child's gaze shift. The adult's movement could have influenced the child's gaze to her face.	• The child proximally points to the bubble bottle, then looks to the adult's face. • After the onset of the child's gaze to her face, the adult moves her head and torso down towards the child and says, "Bubbles!" The adult's behavior does not intervene.	• The child proximally points to the bubble bottle. • The child's *mother* moves her torso down towards the child. • The child then shifts his gaze from the bubble bottle to the *examiner's* face. Although the mother's behavior does intervene, her movement is unlikely to have influenced the child's attention to the examiner's face.
Non-word vocalization + Coordinated Attention	• The child looks to the examiner's face. • The examiner shakes the bubble bottle and moves it closer to the child. • After the onset of the adult's movement, the child shifts his gaze to the bubble bottle and produces a non-word vocalization. The onset of the adult's behavior comes *after* the child's gaze to her face and before the onset of the child's vocalization and gaze shift to the object. Shaking the bottle may have influenced the child to shift his attention to the object.	• The child looks to the examiner's face, then shifts his gaze to the bubble bottle and produces a non-word vocalization. • After the onset of the vocalization, the examiner shakes the bubble bottle and moves it close to the child. The adult's behavior does not intervene.	• The child looks to the examiner's face. • The examiner asks the parent, "Does he like these?" • After the onset of the adult's utterance, the child shifts his gaze to the bubble bottle and produces a non-word vocalization. The examiner's statement came between the child's shifts in gaze, but it is unlikely that the adult utterance influenced the child's gaze to the object and his vocalization.

3. Non-word vocalizations
    a. A **non-word vocalization** is a sound, other than a word, where there is evidence of eggressive phonation (sound made during exhaling) and voicing (vocal folds vibrate to give voice to a sound).
        i. The sounds "p," "f," "t," "k," or "h" have no voicing. These vocalizations are hard to get reliable on if they are the only sound made; coder reliability is more dependable if they are produced along with a vowel (which has voicing).
    b. We don't code whispered sounds that are usually voiced when said loudly enough.
    c. Voiced laughs, voiced sighs, and voiced cries can be considered non-word vocalizations if there is accompanying evidence of coordinated attention.
        i. If a child uses words while laughing/sighing/crying, those words are codeable and should be coded as long as they meet word rules criteria.
    d. Non-word vocalizations cannot consist of reflexive, vegetative sounds resulting from burps, hiccups, coughs, sneezes, throat clearings, trills, raspberries, or clicks with the tongue.
    e. Ingressive phonation (vocalization made while inhaling) will not be credited as a vocalization.
    f. Any unintelligible content produced by the child that does not meet the word rules criteria can be coded as non-word vocalizations if there is evidence of coordinated attention.

4. Imitations
    a. An **imitative word** is a word approximation that otherwise meets the definition of a word (see word rules, pg. 57) and is an exact or reduced imitation of an immediately preceding adult utterance.
    b. The adult model that is considered "immediately preceding" must end no more than three seconds before the onset of the child's imitated utterance and the imitation may not be usurped by any event or topic shift.
    c. An imitative word is treated as a non-word vocalization because it is not clearly meaningful or referential.
        i. Imitated words or reduced imitations require attention to object/event in order to be coded; attention to adult is implied.
        ii. Ex: The adult says "Oh look, a cow!" Within 3 seconds, the child says "cow" while looking at the cow figurine.
    d. Types of imitated words:
        i. An **exact** imitation is a child utterance that includes all of the words in the adult's immediately preceding utterance. The degree to which the child's word approximation is like the adult model need only meet word rules criteria.
            - Ex: A: Look at that car
                C: Look at that car (said within 3 seconds, with attention to object)
        ii. A **reduced imitation** is a child utterance that contains one or more of the words from the immediately preceding adult utterance and does not add any additional words or variations.
            - Ex: A: Look at that car.

C: Look car (said within 3 seconds, with attention to object)

e. Remember: Immediate echolalia is considered an imitation when it meets the criteria for imitated words/word approximations. It is codeable if there is also evidence of a child's attention to an object/event.

5. Codeable Gestures
   a. **Gestures** are non-symbolic communication acts that are coded [3n].

   b. The following is an exhaustive list of actions identified as "gestures" for this project:
      i. Some gestures do not intrinsically convey communication; they require evidence of attention to both a referent and a communication partner in order to be coded.
      ii. Other gestures intrinsically show attention to the message that they convey because the meaning is already defined by the culture (i.e., conventional gestures). Other, unconventional gestures can show attention to an object because they are directed to or involve touching the object. To be codeable, these gestures only require additional evidence of attention to the communication partner (for our purposes, an adult).
      iii. Another group is comprised of gestures that already show attention to object *and* communication partner by virtue of touching or moving objects toward an adult or by moving the adult toward an object.

   c. Gestures Requiring Evidence of Attention to Object and Adult
      - **Tapping with fingers/hand** in an attempt to get the adult to attend to an object or event. Includes tapping, or touching (one tap is sufficient) with finger or fingers, palm, or back of hand. The entity being tapped can be an object or person or part of either.
        - Example: Adult asks "Where's the hat?" Child touches the doll's head with palm of his hand.
      - **Claps:** A clap must consist of hand-to-hand contact which occurs two or more times in order to be coded as such. Flapping of hands in a clapping-like gesture where contact is not made or the bringing of hands together to rest (in which contact between hands is made only once) cannot be coded as a clap.
      - **Reaching**: A reach must be open-handed involving an extended arm and a momentary, expectant pause by the child. The child's hand may open and close as part of the reach. The intention of the act may be imperative or declarative. A reach is not scored if either of the following occur:
        - The child touches the desired object without the adult's assistance
        - An object is in the "reaching" hand
      - **Proximal pointing:** Child refers to an object by touching it with a finger.
        - The index or middle finger must be extended, must touch the referent, and finger must be separated from the adjacent fingers. It is not necessary to

actually see the finger make contact with the object if it is clear that the object has been touched (eg., the object moves or spins).
    - At least two of the adjacent fingers should be curled under or arched up.
    - When the child is using the extended index finger to operate a toy (e.g., cash register buttons), this is not a proximal point.

ii. Gestures Requiring Evidence of Attention to Adult Only

- **Distal point**: In a distal point the index finger or thumb is extended towards the object/person of interest, or a group of unspecified objects. The other fingers should be clearly separated from the index finger or thumb making the point obvious.
- **Shh** gesture
- **Head nod (yes) or head shake (no)**
- **Wave**
- **Shoulder shrug**
- **Pantomime-like actions & depictive gestures**: Pantomime is the use of a part of the body to imitate an object (or the use of an object) or to act out a meaning *without the object being present*.
    - Ex's:
        - Pretending to brush one's hair without a hairbrush
        - Moving arms in a "rocking baby" movement without a doll
        - Fingers "walking" like a mouse in "walk-mouse-creep-mouse"
        - Finger plays such as "Here's the church, here's the steeple..."
        - Blowing a kiss.
- **Moving object toward adult:** Since this gesture intrinsically shows attention to object (child purposefully moves the object), the only additional evidence it needs to be coded a communication act is attention to adult (usually looks to adult).
    - When seated across from each other, the child must move the object across the midline of the table. If seated in any other arrangement, the object must be moved at least half the distance between the two.
    - The child *does not need to release the object* if the move is considered an "offer" or "rejection" that is not received by the adult listener.
    - If the child begins to move the object to the adult then changes his mind, **this is not coded.**
    - A 'move' is different from a 'give' in that the object is not placed in the adult's hands. However, objects are often moved for the same presumed reason as a give.

- Moving the object toward the adult does not include the child moving an object to another object either in front of the adult or to an object in the adult's hand unless the act is dependent on the adult's presence (e.g., putting object in a bag the adult is holding would not be coded).
    - Ex: A prompted "move" occurs when the adult has his/her hand(s) out/open in expectation of the object and the child pushes the object toward the adult.

      The child's compliance with the adult's non-verbal prompt shows evidence of attention to adult.
- Throws to the adult should be considered a move as long as the child does so intentionally, with the purpose of having the adult complete some action such as catching, hitting, or returning.
    - Ex's: A child bats a Nerf ball with a stick to a stick in the adult's hand for the adult to bat it back
    - A child rolls a ball to the adult.
    - These *do* count as moves towards adult and require attention to adult (look to adult) to be coded as communication acts.
        - The child would not have moved the Nerf ball to the other stick or rolled the ball (with the expectation for it to come back) if the adult was not present.

iii. Gestures with Implicit Attention to Both Object and Adult

- **Upturned palm:** The palm should be upturned as if to say "give that to me." There should be an expectant pause in which the child waits for the adult to react. The upturned palm must not be part of an act designed to retrieve an object independently.
- **Giving object to adult:** The coder can see or CLEARLY infer from the context that the child has a grasp on the object AND moves the object in the direction of the adult.
    - There must be at least a brief moment when they are both touching the object OR child drops the item into the adult's upturned hand in an intentional and controlled way.
    - An object must be deliberately transferred *to* an adult by the child rather than just placed on the floor in close proximity of an adult. Placing an object on the floor by an adult does not constitute a "give."
    - Two planes of movement constitute gives:
        - Upward movement of the object
        - Forward movement of the object towards the recipient.
- **Showing an object to the adult:** The child must extend the object toward the adult with momentary pause. The intention of the act must be solely to "show" the object. The adult is not expected to take or do anything with or to

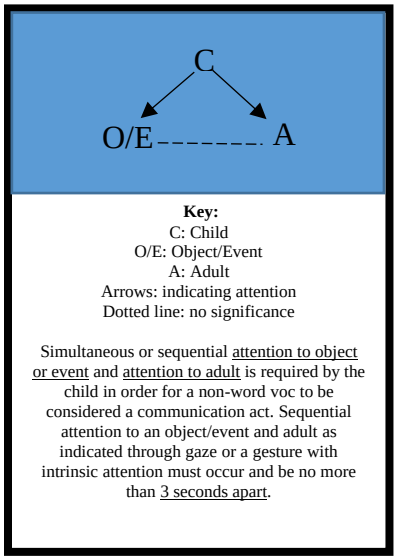
the object except to look and perhaps to comment upon it.

- Only one plane of movement is needed to constitute a show:
  - Upward movement of the object
    OR
  - Outward movement of the object

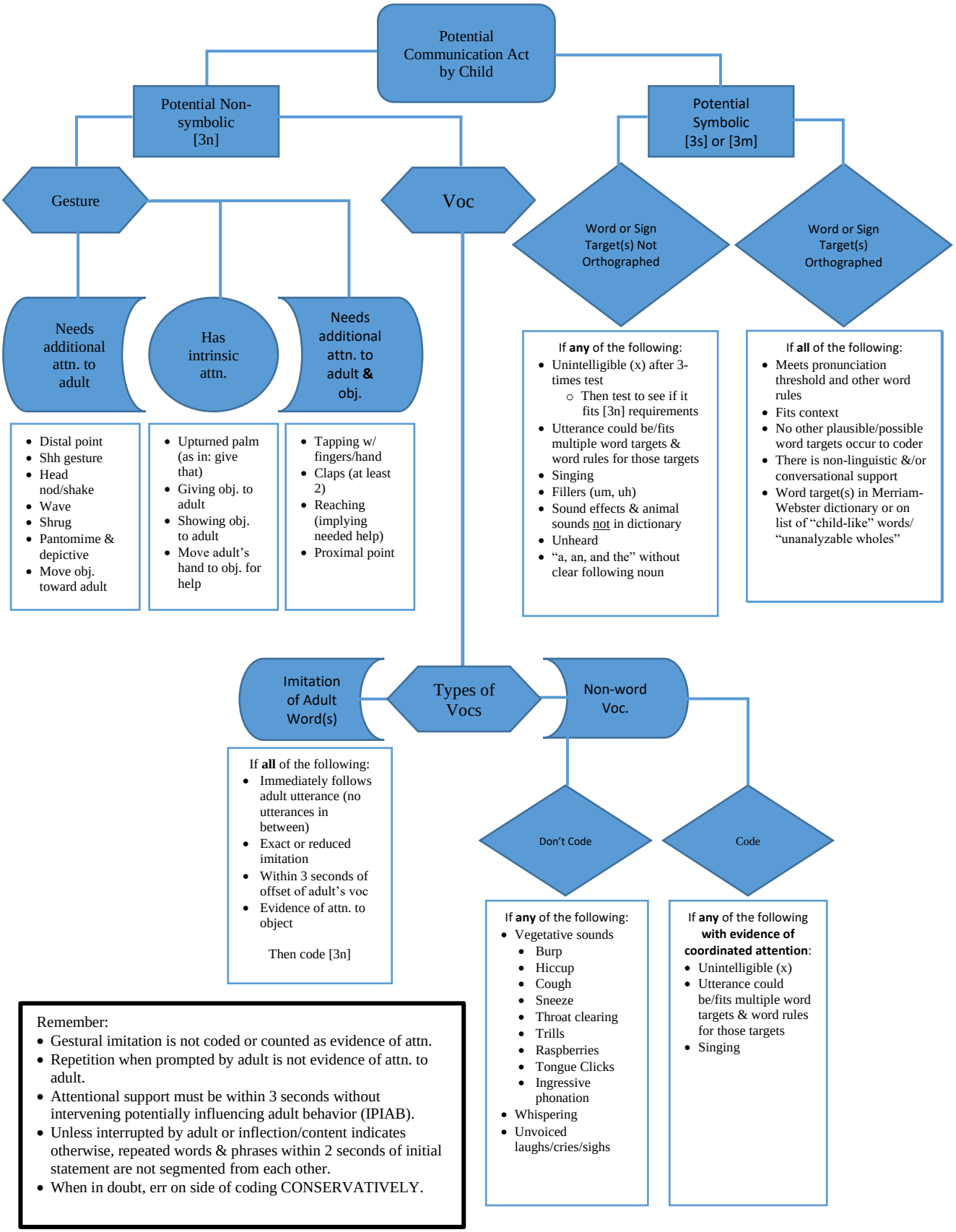
- **Hand as tool:** Moving an adult's hand to an object to be operated or opened. Child grasps or leads the adult's hand to touch or toward the object that the child apparently wants opened, operated, or retrieved.

6. Illustrative Flow Charts
    a. The charts on the following few pages were created to aid the coder in applying the communication code to the LS and CSBS samples. These charts do not replace the information above, but summarize the information visually.

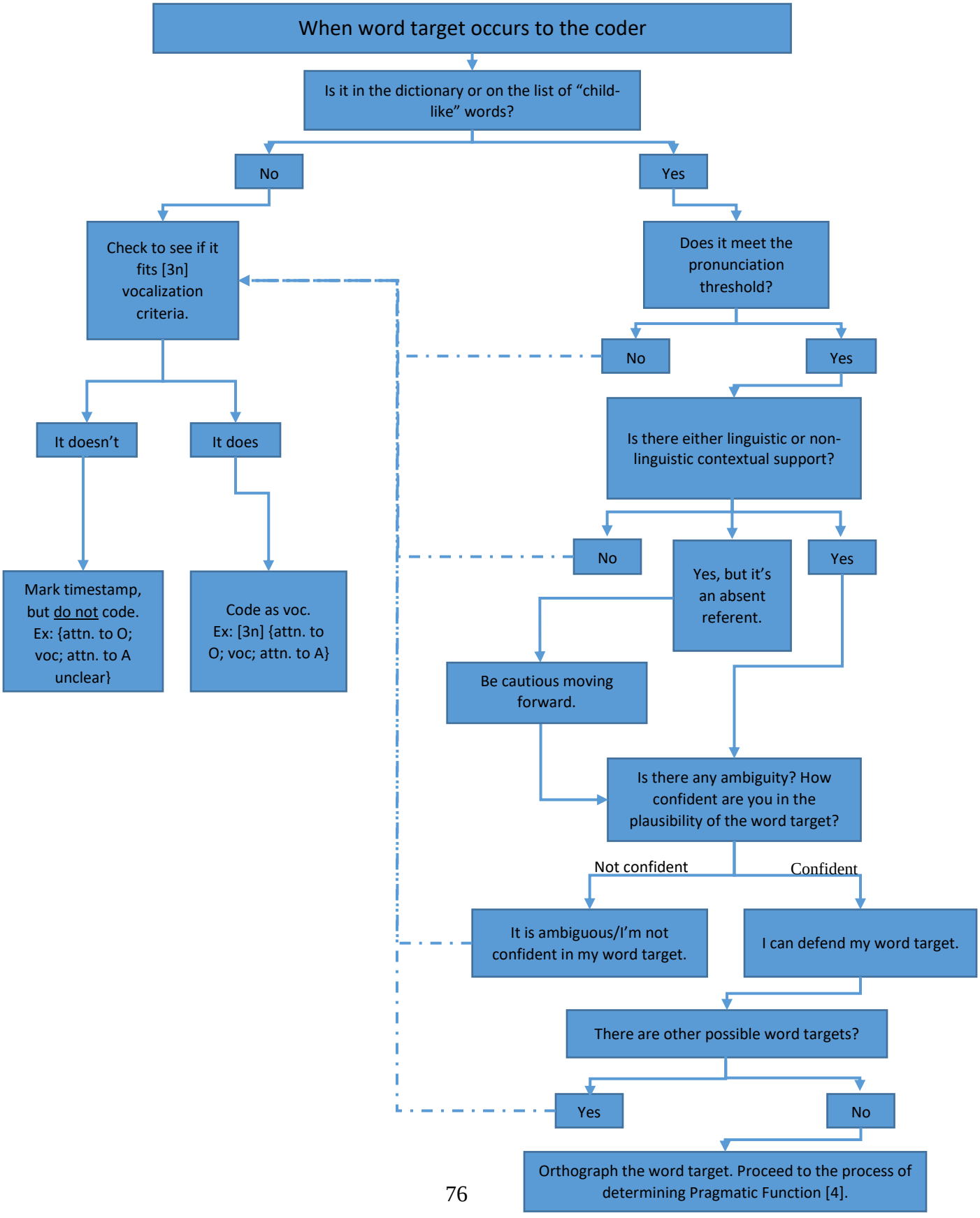
        i. Coordinated Attention Diagram



ii. Symbolic/Non-Symbolic Coding Tree



iii. Determining Word Target Tree



II. Coding Group 4: Type of Pragmatic Function [4i/4d/4o]

A. For each coded communication act, we also designate a corresponding "pragmatic function," or the behavioral purpose of performing the act.

B. Definitions of Self-initiated "Imperative," "Declarative," and "Other" Pragmatic Functions[**]

1. Imperative [4i]

a. **Imperative pragmatic functions** are self-initiated communication acts (both verbal and non-verbal) that have coordinated attention and are meant to elicit action from the adult.

b. Imperatives must do at least one of the following:

i. Direct the adult to action

ii. Request something (such as an object or action; not request information)

iii. Protest something

Protesting can be conceptualized as

- a request for an object to be removed, or independent removal of an object by the child
- a request for an activity/event to stop (including stopping the onset of a new activity)

Positive affect is not present when protesting (see operational definition of positive affect on page 79 of the manual). Unless there is a verbal request that clearly serves as a protest, there must be evident attention to adult and object/event to qualify as protesting.

In the examples of protesting below, assume that all child actions occur in close enough temporal proximity to count as a single communication act.

Examples:

- Object removal
  - Examiner puts an object on the table in front of the child. Child whines, moves the object toward the examiner (more than half of the distance between examiner and child) and looks at the examiner's face.
  - Examiner brings out a new toy. Child frowns, looks at the examiner's face, and shakes his/her head no.
  - Examiner gives child a ball. Child looks at the ball and says "no ball."
  - Examiner gives child a ball. Child looks at the examiner's face, picks up the ball, and throws it without showing positive affect.
- Stop or change event or activity
  - Examiner begins playing the xylophone. Child puts his/her hand over the examiner's hand and moves it away from the xylophone to stop the examiner from continuing to play.
  - Examiner begins blowing up a balloon. Child sees this and says "no balloon."

Nonsymbolic communication acts that we classify as imperative include:

[**] For the purposes of this manual, self-initiated imperative pragmatic functions, self-initiated declarative pragmatic functions, and other self-initiated pragmatic functions will be labeled as "Imperative," "Declarative," and "Other."

iv. Self-initiated give
- For the purposes of our coding, we will assume that any time a child hands an object to an adult without prompting, the child expects *some* form of action from the adult—even if that is just to hold the object or take/remove it.

v. Upturned palm (with the expectation of receiving an object)
vi. Hand-as-tool
vii. Other gestures with evidence of coordinated attention that meet "imperative" criteria

c. Examples
i. Symbolic
- Ex: A child looks to his mother, then to her purse, and says, "gimme snack."

ii. Nonsymbolic
- Ex: A child is holding the jar of beads and is unable to open it. He places it in the adult's hands.

2. Declarative [4d]
a. **Declarative pragmatic functions** are self-initated communication acts (both verbal and non-verbal) that have coordinated attention and which aim to establish a social connection through shared experience.
b. Declaratives are *purely social* and must do at least one of the following:
i. Comment on an object or event
ii. Request a label or information about an object or event
- We consider requests for information/labels as social in nature because they involve the sharing of knowledge between parties.

iii. Request attention from the adult
c. Nonsymbolic communication acts that we classify as declarative include:
i. Shows
ii. Clapping *if* there is evidence of positive affect and social connection
iii. Other gestures with evidence of coordinated attention that meet "declarative" criteria
d. Examples
i. Symbolic
- Ex: A child is stacking blocks, then gazes to the adult and says "look!"
  - Words like "look" and "watch" call attention to the speaker but do not require any action from the listener other than to attend. Thus, they are declarative if there is evidence of coordinated attention.

ii. Nonsymbolic
- Ex: A child is playing with a doll, then holds it up to show the adult.

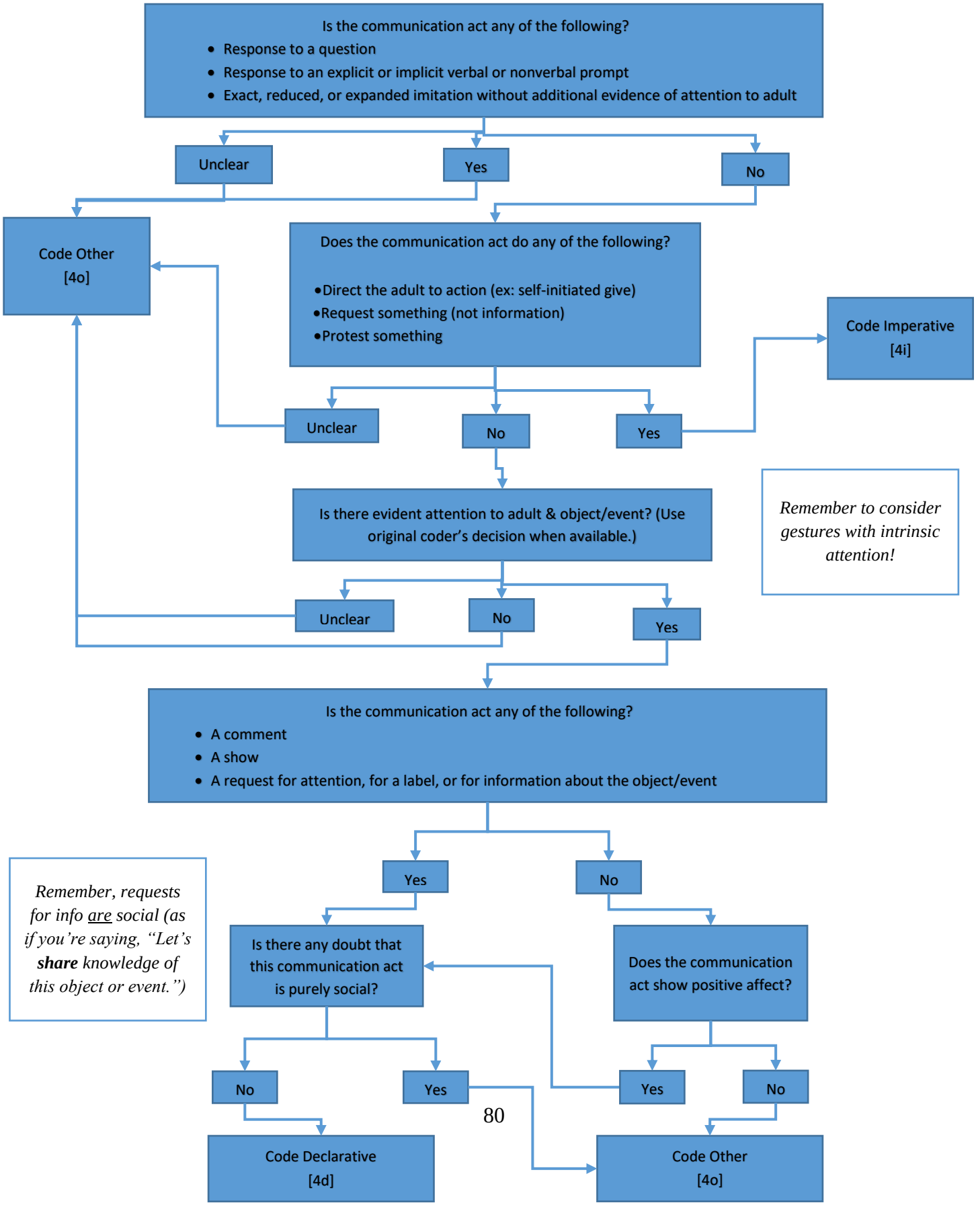
3. Other [4o]
a. Pragmatic functions classifed as "**Other"** include a child's response to an adult's question, prompt, or signal; imitations (reduced, exact, and expanded) without additional evidence of attention to adult; and all communication acts (symbolic or nonsymbolic) that do not satisify the criteria for "imperative" or "declarative" pragmatic functions.

b. This includes acts that:
    i. Appear to be requests or social bids, but do not have coordinated attention.
    ii. Have an unclear function.
c. In addition, [4o] is *always* coded in the following situtatons:
    i. Any responses to an adult's question
    ii. Any responses to explicit or implicit verbal or non-verbal prompts
        - Note: This includes all of the child's responses to an adult's prompt or signal given in the reciprocity section of the CSP.
    iii. Imitations without additional attention to adult

4. Coding intervals with more than one communication act:
    a. Code "both" if an interval at contains least one declarative and at least one imperative.
    b. Code "declarative" if an interval contains at least one declarative, with any other communication acts classified as "other."
    c. Code "imperative" if an interval contains at least one imperative, with any other communication acts classified as "other."
    d. Code "other" only if all communication acts in the interval are classified as "other."

5. **Always** refer to the Pragmatic Functions Coding Tree that follows this section.
    a. The tree mentions "positive affect." This project has operationalized affect as:
        i. Negative affect: Whining, fussing, crying (tears), tantrumming, frowning
        ii. Positive affect: Laughing or smiling
            - Laughing: If the child laughs unambiguously, there is "positive affect."
                - If the child produces a vocalization and the coder is unsure whether it is a laugh, it qualifies only if there is other support in the child's expression to lead one to believe it is a laugh (usually smiling).
            - Smiling: A third of the child's mouth must be visible to determine a smile. If 1/3 of the child's mouth is visible and the child smiles unambiguously, there is "positive affect."
                - If the child's expression resembles a smile but the coder is unsure about whether or not it is one, there is "positive affect" only if *all* of the following are true:
                    - It appears to the coder that the expression accompanies positive feelings in the child
                    - The "smile" is held for a count of at least 1/2 second (measured by the length of time it takes to say "ten")
                    - The "smile" can be distinguished from the child's overall expressions surrounding the act in question
                    - The "smile" is not transitory with something in the child's mouth (like food)

i. Pragmatic Function Classification: Imperative [4i], Declarative [4d], and Other [4o]



II. Coder Protocols:
   A. Determine who will be the primary coder and who will perform reliability checks (or be the "reliability coder").
      1. The primary coder will do the majority of coding, but both primary and reliability coders should follow all "Coder Protocols."
      2. It is possible for there to be more than one primary coder. The primary coders will then be responsible for completing regular reliability checks on one another.

   B. Before coding, become familiar with each of the toy sets used in the samples.
      1. Specific details of the toys may provide clarity to word-targets and contexts of play.
      2. If you do not have access to the toys, review the administration manuals of each assessment as these manuals contain photos of the toy sets.

   C. Code in a quiet place with the headphones pre-approved by your PI. `
      1. Use Sony Professional MDR-7506
      2. Never use earbuds or non-approved headphones to code a sample
      3. Limit distractions:
         a. Turn cell phone on silent/off, minimize/close-out email, close door, and keep noises in office to a minimum.
         b. Never code while listening to music

   D. Code in sections
      1. Watch the video in sections before you begin applying this code.
         a. Never begin coding a video without previewing parts of the video first. Coding a video that you have not previewed can lead to incorrect conclusions, invalid word-targets, or overall assumptions about the adult/child interactions that would otherwise not be made if the coder had previewed parts of the video first.
         b. NOTE: do not watch the entire video before coding, as this may lead to coder-reliability issues. It is best to only watch it in small sections.
         c. While previewing the video, be an active observer:
            i. Look for context
            ii. Listen for word-targets
            iii. Watch the child's eyes and hands (where is the child looking; watch for gives, shows, and other gestures; what toys is the child manipulating; etc.).
            iv. Observe the child's abilities (is he verbal, does he say multi-word phrases, does he look to the adult).
            v. Listen and watch the adult's interactions with the child (what is the adult saying, what is she looking at, how is her interaction with the child effecting the child's play).
            vi. Listen for outside noises or events that might influence the child's play/communication
      2. You may choose to preview the video in several ways:
         a. <u>Temporally</u>: Watch the first 2 minutes of the video uninterrupted, then stop the media and go back to code those 2 minutes. Afterwards, watch the next 2 minutes uninterrupted and go back and code. Continue on in this manner for the remainder of the sample.

i. 2 minutes is the recommended length of viewing time, but you may choose to watch the video in intervals of time that are shorter or longer than 2 minutes.
ii. Be certain to watch the video in no more than 5 minute intervals.

b. Content
i. Child's focus of play: Watch the video uninterrupted as the child plays with his first toy selection. When the child abandons the first toy for a new toy, stop the media and code the child's play with the first toy. Afterwards, watch the next section of media until the child selects another new focus of play. Stop the media and go back to code what you've just previewed. Continue on in this manner for the remainder of the sample.
ii. Adult's assessment administration: In the CSP, the adult will give four prompts and three signals. Watch the video uninterrupted up until the adult gives the first prompt. Stop the media and code the portion of the video up until the prompt. Then watch the media until the adult gives the second prompt. Stop the media and go back to code this section. Continue on in this manner for the remainder of the sample.
iii. Note: do not watch more than 5 minutes at a time while using either one of these two methods. If the child's focus of play or the adult's administration between prompts lasts more than 5 minutes, opt for using the temporal method described above.

E. Finishing a coded file: Once a video file has been completely coded through ProcoderDV, take the following steps:
1. Review ProcoderDV file for any spelling or coding mistakes!

2. Place a copy of the completed .pdv file on the network: \\krupa\Yoder\Amy\pragmatic function coding\
i. LS: \\krupa\Yoder\Amy\pragmatic function coding\LS [primary/reliability] coding\
ii. CSBS: \\krupa\Yoder\Amy\pragmatic function coding\CSBS [primary/reliability] coding\
3. Delete the copy of the video from your computer (NOTE: the video **should still be saved on the media server (VU1file)!**).

4. Obtain the information needed for data entry:
a. Fill out a pre-made summary form (see Resource G; template also stored at \\krupa\Yoder\Amy\pragmatic function coding\forms)
i. This summary form will be used in obtaining the information necessary for the data entry on each coded video file.
ii. The following information will be used in data entry:
- Participant ID
- Date of assessment
- Coder's initials
- Duration of assessment
- Number of each type of pragmatic functions

b. Enter the following information into the Pragmatic Function Coding Log; do NOT enter any summary statistics for the samples you have just coded—it may unintentionally bias the

reliability coder:
   i. Initials
   ii. Date coded
c. Set summary aside for reliability

F. Reliability
1. In this project, 20% of all coded files will be coded for reliabilty; once a set of 5 video files has been collected, one of the 5 files will be selected randomly for reliabilty.
   a. To be considered reliable, the ratios of each of the coder's pragmatic function data (see data points listed above) must be greater than or equal to 0.85 (small/large).
      i. Ratios involving numbers less than 5 will be recorded as V < 5
         - Ex: 2/3 = V < 5
         - V < 5 will be considered reliable
            - Ex: The primary coder has a weighted frequency of 3 and the reliability coder has a weighted frequency of 4. This ratio of 3/4 = 0.75, but we will record this as 3/4 = V < 5, and it will be considered a reliable value.
         - Note: if the denominator of this ratio is 5, then, take the following considerations:
            - The numerator is ≥ 4, 4/5 = 0.80, which is reliable.
            - The numerator is < 4, the ratio is not reliable.
               - Ex: 3/5 = 0.60, which is not reliable.

   b. Enter the following information into the VU Coding Log after reliability coding has been completed:
      i. Initials
      ii. Date coded
      iii. Reliability ratios

   c. After reliability for the selected file is complete, the set of 5 files will be ready for data entry. See data entry manual for further instructions.
      i. Save the reliability .pdv file to a specific folder designated on your computer.
      ii. Place a copy of the completed reliability .pdv file on the network: \\krupa\Yoder\Amy\pragmatic function coding
         - CSBS: \\krupa\Yoder\Amy\pragmatic function coding\CSBS reliability coding
         - LS: \\krupa\Yoder\Amy\pragmatic function coding\LS reliability coding
      iii. Delete the copy of the video from your computer (NOTE: the video **should still be saved on the media server (VU1file)!**).

2. Unreliable files
   a. If the file is unreliable, each coder must stop coding primary samples until the two coders can meet to discuss all discrepancies between the files.
      i. Each coder will fill out a coders' discrepancy summary form (see Resource G) and print the ProcoderDV file before meeting.

b. Together, the primary and reliability coders will discuss the coders' discrepancy forms and review the video file side-by-side.
c. If the discrepancies are large, they may choose to code the video file side-by-side to create a consensus file.
    i. Labeled: Project ID – Time/Month period - coders' initials – consensus
        - Ex: V518-T3-CSP-mwec-consensus
d. If the two coders have three consecutive files that are unreliable, both coders must retrain and obtain three consecutive files at reliability before they can code again independently as primary coders.

Analyzable vs. Unanalyzable Words

A. Analyzable
    1. Analyzable speech includes any audible approximation of a word that is in the Merriam Webster English dictionary, meets the word rules (pg. 66), and which has a substantial amount of contextual and/or linguistic support.
        a. In general, an adult's response to a child's utterance should not dictate what you code. Rather, use the adult's response to suggest possible targets to test against the word rules and other criteria.
        b. Here are a few helpful hints for determining if a child's word approximations are analyzable:
            i. Sometimes one must hypothesize what the child might be trying to say in order to code his words. The following questions are helpful in this process.
                - What is the context?
                - What did the adult just do or say?
                - What did the child just do or say?
                - What are their eyes doing?
                - What are their hands doing?
                - What might the proposed word target be?
        c. NOTE: It is not uncommon for children with autism to talk to themselves. Their speech is not directed toward the adult and does not change based on the adult's responses or interjections. This speech can still be coded if it meets the word rules criteria (see coding section of this manual).

B. Unanalyzable
    1. Unanalyzable speech should *not* be included in analysis.

    2. Unintelligible
        a. **Unintelligible speech** is not understood because of phonological errors; does not meet the word rule.
        b. Ex: A child's communication act is one utterance composed of an unintelligible portion, followed by several distinct, intelligible words, followed by another unintelligible portion.
            i. If the only intelligible portions of an utterance are small words such as articles, pronouns, or prepositions, the more conservative coding decision is to consider the entire utterance unintelligible.
        c. If a child says a multiple word phrase, but only one word is intelligible, code as [3s], not [3m].
            i. Ex: Child says, "Car (unintelligible)". The coder can determine that the child did say more than the word "car," but should only credit the child with a single word utterance. Do not count the unintelligible indicator "x" as a word when coding symbolic communication acts.
            ii. Code → [3s] car x
        d. REMEMBER: coders should be conservative when coding word approximations—if you're debating whether or not the child said a particular word target, consider it unintelligible.

e. In general, coders should examine a particular vocalization in the media file **NO MORE THAN 3 TIMES** to determine whether it is a gloss-able (transcribe-able) word which meets the word rule criteria.
    i. It may be helpful for the coder to slow down the media playback speed during these times of review.
f. If the coder is still not clear after 3 repetitions, she should consider that utterance to be a **non-word vocalization** instead of a word.
    i. The coder should then consider the child's focuses of attention surrounding the non-word vocalization (time frame: 3 seconds before → 3 seconds after the voc.) to determine if it is a codeable non-symbolic communication act ([3n]).

3. Unheard
    a. **Unheard words** may be due to noise in the room (e.g. toy noise, ambient noise, adult interruption) or environmental noise (e.g. siren, noise outside of testing area), blocking the coder from clear dialogue audio.
    b. These utterances should NOT be coded if you cannot properly hear them.
    c. Ex: a child says "I have that (potential word spoken under toy noise so that the child's voice is completely inaudible or unclear)."
        i. code → I have that {unheard}
    d. If a child says a multiple word phrase, but only one word is audible, code as [3s], not [3m].
        i. Ex: Child says, "Car (unheard)". The coder can determine that the child did say more than the word car, but should only credit the child with a single word utterance as the coder has no way in deciphering if the unheard word would have appropriately met the word rules.
            - Code → [3s] car {unheard}

4. Singing
    a. Singing is not coded because it is not clear whether or not the child is using the words to convey a meaning or to socially communicate.
    b. If the child has coordinated attention while singing, it can be still be coded as a nonsymbolic communication act.
        i. Example: a child sings "The wheels on the bus go round and round…" while looking back and forth between the car and the adult.
    c. Without coordinated attention, the song does not qualify as a communication act and is not coded.
        i. Example: a child sings "The wheels on the bus go round and round…" while looking to the car, but he does not look to the adult.

5. Non-referential Language
    a. **Non-referential language** occurs if a child appears to be communicating about a subject outside of the testing room.
    b. Be particularly cautious when coding non-referential language.

i. Look for a higher level of nonlinguistic and/or conversational support to back your word target argument.
ii. The adult may try to provide context for the utterance, but remember: only use this as guidance in your coding, not confirmation.
iii. REMEMBER TO BE CONSERVATIVE!

6. Fillers
   a. Fillers are not coded even though they are in the dictionary.
   b. Examples: “um,” “uh”

7. Sound Effects and Animal Sounds
   a. Sound effects or animal sounds are not coded UNLESS they are in the Merriam-Webster English dictionary.
   b. Note: words like “crash” and “oink” ARE words in the dictionary. Refer to the dictionary for decisions on coding animal sounds and sound effects.

Segmenting

I. Segmenting is the separating of child’s utterances in ProcoderDV.
   A. The coder must decide if the child’s actions or words are to be considered as a single act or are to be coded as 2 or more separate acts. It is important to know when one child communication act ends and when another begins.
      1. Decisions on whether or not to segment these acts influences the length and frequency of communication acts.
         a. Not segmenting often enough may inflate the child’s mean length of utterance (MLU)
         b. Segmenting too often may inflate the child’s weighted frequency and number of communication acts.
         c. Appropriately segmenting child communication acts is vital to achieving coding reliability.
      2. The following guidelines will assist the coder in making segmenting decisions.

II. General Guidelines to Segmenting:

   A. Segmenting guidelines for when the child has multiple, uninterrupted communication acts:
      1. Often it is difficult to determine whether an act is one continuous act or two or more acts that occur in rapid succession.
      2. Segment the child’s communication acts if any of the following situations occur:

         a. There is at least a 2 second pause in the child’s vocalizations, gestures, or talking.
            i. 2 second pauses are often taken as a signal in the conversation for the other person to take a turn.

         b. There is a change in focus of attention

i. A change in the child's focus of attention is an indication of a change of interest or thought.

c. There is a change in pragmatic function
   i. Ex: Child says, "I like goldfish" and then within 2 seconds gives the adult a ball.
      - These two acts are seemingly unrelated and do not share the same pragmatic function. No pause is necessary to segment these two utterances.
      - Code these separately→ [3m] I like goldfish
        [3n] {give}
   ii. Ex: Child says, "Play," and then within 2 seconds gives the adult a ball.
      - Code as one communication act → [3s] play {give}
      - These two acts carry one message and should be coded as one communication act; do not segment them as there is *no* change in pragmatic function.
      - Per this coding manual, the heavier weighted item will always receive credit (i.e. in this example [3s]).

d. There are multiple messages in one utterance
   i. If there are two messages and one refers to what just occurred and the other is meant to elicit a response, to elicit a new action by the adult, or to draw the adult's attention to a new topic, segment as two utterances. No pause is necessary to segment these two utterances.
      - Example: The adult asks, "Which block do you want?" The child responds "blue block let's stack them."
        - Code these separately → [3m] blue block
          [3m] let's stack them
   ii. Acknowledging words in responses to questions:
      - An acknowledging word is when a child responds "yes" or "no" to an adult's immediately preceding verbal or non-verbal prompt.
      - The following are examples of possible responses to the adult asking the child if he/she wants a snack. The child can respond in a number of different ways; note the segmenting in each of these possible responses (assume there is no 2-second pause between the child's words):
        - Child responds with an acknowledging word + a phrase, which carry the same message. Do not segment.
          - Code as one communication act → [3m] yeah I want a snack
          - Code as one communication act → [3m] no I don't want a snack
        - Child responds with an acknowledging word + a phrase, which carry different messages. Segment.
          - Code separately → [3s] yeah
            [3s] cheerios
            - The child answers the adult's question and then elaborates upon his answer by giving a snack preference.

- Code separately → [3s] no
  [3s] play
  - The child answers the adult's question and then provides an additional comment.

iii. If you are in doubt of whether the child's utterance contains one or more messages, attempt to fill out the child's utterance with an "adult-like" response.
- *Note: The parenthetical phrases below represent the possible "adult-like" responses. These parenthetical phrases should not appear in the ProcoderDV Transcription file; instead, do this on a sheet of scrap paper.*
- A: Do you want a snack
  C: [3s] yeah *(I want a snack)*
  C: [3s] *(the snack I want is)* Cheerios
- A: Do you want a snack
  C: [3s] no *(I don't want a snack)*
  C: [3s] (*I want to)* play

e. There is conflicting prosodic information
i. Prosodic information is another way to refer to inflection, pauses, and rhythm in speech.
ii. In general, falling intonation occurs at the end of declarative sentences and rising intonation occurs at the end of interrogative sentences.
iii. If you are uncertain of how to consider inflection when segmenting, ask yourself, "When the child was finished speaking, did I expect him or her to say more?"
- If yes, more than likely the child was using an upward inflection. **Do not** segment this utterance from the following utterance (as long as the following utterance does not meet any of the other conflicting prosodic information points listed above).
- If no, more than likely the child was using downward inflection. Segment this utterance from the following utterance.

iv. Remember, at times, children with autism have irregular prosodic function, so inflection alone is not enough to determine segmenting. In such cases, apply the above general guidelines and remember to be conservative.

f. Use "adult grammar" as a guide to segment a child's utterances.
i. Even if one utterance is comprised of 2 phrases which both have the same pragmatic function, follow the rules of grammar and segment the phrases.
- Ex: The child says "me try that you help me"
  - Code these separately→ [3m] me try that
    [3m] you help me

B. Segmenting guidelines for when adult actions are present during the child's communication acts:
1. Here, we impose a turn-taking structure on the exchange, as the child is often responding to something the adult is saying or doing.

a. Remember: at times, children with autism don't always understand the idea or purpose of turn-taking in speech, which can make segmenting difficult.
b. In such cases, apply the general guidelines and remember to be conservative.

2. Adult speaks over the child
   a. If the adult begins to talk over the child while the child is speaking, only segment if the adult's utterance causes a disruption in the child's focus of attention.
      i. Ex: The child is examining a few trains. While he is talking about the trains, the adult speaks over the child and says, "Look at these blocks!"
      ii. The adult's comment can affect the child in one of two ways:
         - The adult's comment **does not** cause a shift in the child's attention. The adult's interjection does not influence segmenting.
            - C: [3m] I like red train/s and green train/s
            - C: [3m] trains go really {really} fast ***(Overlapping, A: Look at these blocks)***
         - The adult's comment **does** cause a shift in the child's attention and the child shows interest in the adult's blocks. Segment the child's utterances with the change of attention.
            - C: [3m] I like red train/s and green train/s
            - C: [3m] trains go really > (***Overlapping, A: Look at these blocks)***
            - C: [3m] yeah let's play with blocks
   b. There may be times that the adult talks over the child and the child's speech cannot be deciphered. Refer to p. 94 of this manual to review "unheard speech."

3. Refer to pg. 65 of this manual for more on how "Intervening Potentially Influencing Adult Behavior" affects segmenting a child's communication acts.

III. Exceptions to the General Guidelines
   A. Segment the following instances only if there is a pause of two seconds or greater between the two communication acts (each of these cases are exceptions to the rules provided in the general guidelines):

1. Vocatives
   a. Vocatives are nouns used to get the listener's attention to oneself, such as calling a person's name and then delivering a message.
   b. Ex: Child says, "Mom help;" this can be segmented in 1 of 4 ways:
      i. Child is directing the utterance towards his/her parent as a request for assistance. In this example, the child does not pause more than two seconds between the two words.
         - Code as one communication act → [3m] mom help
      ii. Child is not directing the utterance towards his/her parent as a request for assistance. In this example the child does not pause more than two seconds between the two words and the meaning is unclear (is the child using a vocative or possibly saying something else, such as, "Mom helped/helps/is helping me"?).

- Code as one communication act → [3m] mom help

iii. Child is directing the utterance towards his/her parent as a request for assistance. In this example, the child does pause for 2 or more seconds between the two words.
- Code separately → [3s] mom
  [3s] help
- Child pauses for two seconds; segment even if there are no adult intervening CAs.

iv. Child is not directing the utterance towards his/her parent as a request for assistance. In this example, the child does pause for 2 or more seconds between the two words, giving the two words an unclear connection (in this instance, segment even if the words do seem connected).
- Code separately → [3s] mom
  [3s] help
- Child pauses for two seconds; segment even if there are no adult intervening CAs.

2. Single-word directives
   a. Words used to direct the listener's attention, such as "look" or "watch." Even if the child is not looking at the adult, we will assume he/she is directing the adult, as these words hold inherent meaning as directives.
   b. Ex: Child says, "look broken."
      i. Child is directing the comment towards the adult and is commanding the adult's attention. In this example, the child does not pause between the two words.
      - Code as one communication act → [3m] look broken

      ii. Child is directing the comment towards the adult and is commanding the adult's attention. In this example, the child does pause for 2 or more seconds between the two words.
      - Code separately → [3s] look
        [3s] broken
      - Child pauses for two seconds; segment even if there are no adult intervening CAs.

3. Attentional Devices
   a. Words used to call the listener's attention to oneself. Even if the child is not looking at the adult, we will assume he/she is calling the adult attention as these devices are inherently attention-seeking.
   b. Ex: Child says, "hey stop"
      i. In this example, "Hey" is the attentional device and "stop" is a directive.
      ii. Child is directing the comment towards the adult and is directing the adult's attention. In this example, the child does not pause between the two words.
      - Code as one communication act → [3m] hey stop

      iii. Child is directing the comment towards the adult and is directing the adult's attention. In this example, the child does pause for 2 or more seconds between the two words.
      - Code separately → [3s] hey
        [3s] stop

- Child pauses for two seconds; segment even if there are no adult intervening CAs.

4. Tag-questions
   a. Tag questions are used in spoken language, but are not often found in written speech.
   b. These devices are not always meant as questions, but instead are more often understood as requests for confirmation. Tag questions are used as a way of asking the other person to make a follow-up comment.
   c. Tag questions are only segmented from their declarative utterance if there is a two or more second pause.
   d. Ex: Child says, "This is a ball, right?"
      i. If the child says this utterance without pausing for two or more seconds:
         - Code as one communication act → [3m] this is a ball right
      ii. If the child says this utterance and pauses for two or more seconds between the statement and question:
         - Code separately → [3m] this is a ball
           [3s] right
         - Child pauses for two seconds; segment even if there are no adult intervening CAs.

B. Segment the following instances using these specific guidelines (each of these cases are exceptions to the rules provided in the general guidelines and do not strictly follow the "2 second pause" pattern described above):

1. Listing
   a. At times, children will form lists, such as listing the colors on a toy or listing their favorite food items for lunch.
   b. If there are clear prosodic transitions (pauses, rhythm, stress, and intonation of speech) indicating the end of an utterance, then transcribe each item separately.
      i. Falling intonation at the end of the list signals the end of an utterance; any utterances following this falling intonation would be segmented from the group
      ii. Rising intonation signals that that the list is not complete; any utterances following this rising intonation would not be segmented from the group.
      iii. Intonation in this manual will be represented with arrows.
         -  Shown over a word = falling intonation is being used on that word
         -  Shown over a word = rising intonation is being used on that word
   c. How to segment lists:
      i. Falling intonation:
         - Ex: "Child says, "I want to eat apples, bananas, carrots."
           - Child uses falling intonation at the end of carrots to signal he/she did not intend to list any more items.
           - Code as one communication act → [3m] I want to eat apple/s banana/s carrot/s
         - Ex: Child says, "I want to eat apples, bananas, (child pauses for < 2 seconds) carrots."

- Child uses rising intonation in the word bananas to signal he/she did intend to list more items.
- Code as one communication act → [3m] I want to eat apple/s banana/s carrot/s

ii. If the child uses the word "and" do not segment the utterance, regardless of intonation and pausing:
- Code as one communication act → [3m] I want to eat apple/s, banana/s, and carrot/s

iii. There is a pause of two or more seconds between the items:
- Code separately → [3m] I want to eat apple/s *(2 second pause)*
  [3m] banana/s carrot/s

2. Counting
   a. Rote counting: the child beings to count organically without any prompting; here the child is not counting items.
      i. If there is not a pause of two or more seconds between the numbers, then the series of numbers is coded as one communication act.
         - Code as one communication act → [3s] one {two, three, four}
         - Use the same convention even if the child counts out of numerical order.
           - Code as one communication act → [3s] one {three, four, two}

      ii. If there is a pause of two or more seconds between the numbers, then segment the numbers:
         - Ex: Child counts "One, two" (pauses for two or more seconds) three, four."
           - Code separately → [3s] one {two}
             [3s] three {four}
         - Use the same convention even if the child counts out of numerical order.
           - Ex: Child counts "One, three" (pauses for two or more seconds) two, four."
             - Code separately → [3s] one {three}
               [3s] two {four}

      iii. There are instances when you will need to segment the child's counting by following his/her inflection regardless of any pausing between the numbers:
         - When the child's inflection declines (in an exaggerated fashion) at the end of a number, the following number will be coded separately.
           - [3s] one {two, three} *(number three said with downward inflection)*
             [3s] four
         - Note: When in doubt about child's inflection dictating segmenting of lists, ask yourself "Am I expecting something to come after that number?"
           - If the answer is yes, do **not** segment from previous numbers, even if child's inflection is irregular
             - Ex: In this example, "three" is said with upward inflection and indicates that there are more numbers to follow
             - Code as 1 CA → [3s] one {two, three, four}
           - If the answer is no and there is another number utterance afterwards, segment the final/"surprise" number only.

- Ex: “Three” is said with downward inflection and indicates to coder that there is nothing to follow; then, a following number is spoken. Pausing between the numbers is not necessary to segment in this example.
  - Code 2 CAs → [3s] one {two, three}
    [3s] four

- If all numbers are said in monotone, segment the numbers according to pausing.

b. One-to-one counting: the child counts items one by one, assigning a number to each item.
   i. Ex: Child counts the number of crayons: “one” (referring to first crayon), “two” (referring to second crayon), “three” (referring to third crayon).
      - Child typically “refers” to each of the items by pointing to the item, transferring the item, or showing the item to the adult.
   ii. If there is not a pause of more than two seconds between the numbers, then the series of numbers is coded as a single communication act. Note: in this example, the child does not say “one crayon.” He says “one” labeling the first crayon and “two” labeling the second crayon (the following two examples apply even if the child is counting out of numerical order).
      - Ex: one-to-one counting (i.e. the child is counting crayons <2 seconds apart)
        - Code as one communication act → [3s] one {two, three, four}
        - Code as one communication act → [3s] one {three, four, two}
   iii. If there is a pause of more than 2 seconds between numbers in one-to-one counting, the coder will segment the utterance. Note: in this example, the child does not say “one crayon.” He says “one” labeling the first crayon and “two” labeling the second crayon (the following two examples apply even if the child is counting out of chronological sequence):
      - Ex: one-to-one counting (i.e. the child is counting crayons >2 seconds apart).
        - Code separately → [3s] one *(referring to crayon number one)*
          [3s] two *(referring to crayon number two)*
        - Child pauses for two seconds; segment even if no adult intervening CAs
      - Ex: The child is counting four crayons and pauses for longer than two seconds between the third and fourth crayon.
        - Code separately → [3s] one {two, three}
          [3s] four
        - Child pauses for two seconds; segment even if no adult intervening CAs
   iv. If the child includes a corresponding noun along with each number: each item counted is coded separately. Segment regardless of intonation and pausing.
      - Code separately → [3m] one crayon
        [3m] two crayon
        [3m] three crayon
        [3m] four crayon
   v. In one-to-one counting, if the child precedes the last number in the list with “and,” all numbers are coded in the same line (none in brackets) regardless of intonation, pausing,

and direct object labeling.

- Code as one communication act → [3m] one two three and four
- Code as one communication act → [3m] one crayon two crayon and three crayon

3. Repeated words
   a. When a child's utterance has repeated words or phrases that are less than two seconds apart and are not separated by intervening adult communication act, code as one utterance.
      i. Example:
         - Child repeats a phrase:
            - Code as one communication act → [3m] I want go home {I want go home}
         - Child seems to "get stuck" on a particular word in a sentence:
            - Code as one communication act → [3m] I want to go {go, go, go, go} home
   b. Code repeated words or sentences as separate utterances only when one of the following applies:
      i. Separated by a two-second pause or longer
         - Ex: child says, "No, no, no, no." All "no"s are said with at least two seconds between them and the adult does not intervene between the child's utterances.
            - Code separately → [3s] no
              [3s] no
              [3s] no
              [3s] no
         - Ex: child says an animal sound multiple times, without pausing for more than 2 seconds.
            - Each "quack" is said less than two seconds apart and the adult does not intervene between the child's utterances.
            - Code as one communication act → [3s] quack {quack x 8}

      ii. Topic referent has shifted
         - Ex: child points to different objects around the room while repeating the phrase "I want that."
            - Code separately → [3m] I want that {pointing to teddy bear}
              [3m] I want that {pointing to fire truck}

      iii. Adult utterance intervenes
         - Example of intervening gesture: The child is holding a jar of cheerios, says "open, open," and the examiner then reaches her hand out toward the child. The child then says "open" again.
            - This would be coded as two acts. The first "open, open" is considered a single word (because it is repeated with fewer than 2 seconds between the words). The second act is segmented from the first act by the examiner's outstretched hand, and so the third production of the word "open" is transcribed a second time.
            - Code separately → [3s] open {open}

[3s] open

- Example of intervening adult utterance: The child says “gimme” multiple times. The word is repeated at 1 second intervals and the topic did not shift, but the adult intervened.
    - Code separately → [3s] gimme {gimme} *(A: Give you what?)*
      [3s] gimme {gimme}

Resources

Resource A: Signs and Sign Approximations

I. Below is a list of grammatical signs as found in A Basic Course in American Sign Language (Humphries et al., 1980). These may occur during an assessment. Familiarize yourself with these signs at aslpro.com.

Animals
Alligator
Bear
Bee
Bird
Butterfly
Cat
Caterpillar
Cow
Chicken*
Duck*
Dog
Elephant
Fish
Giraffe
Goat
Gorilla
Hippo
Horse
Kangaroo
Lion
Monkey
Owl
Penguin
Pig
Rabbit
Rooster
Seal
Sheep
Snake
Spider
Turtle
Zebra

Colors
Black
Blue
Grey
Green
Orange
Pink
Purple
Red
White
Yellow**

Clothing
Coat
Dress
Gloves
Hat
Mittens
Pants
Shirt
Shoes
Socks
Sweater
Watch

Food
Apple
Banana
Bread
Carrot
Corn
Cheese
Chocolate
Hamburger
Ice cream
Lemon
Milk
Orange
Pizza
Peach
Peas
Strawberry
Tomato

People
Baby
Boy
Clown
Dad
Girl
Man
Mom
Woman

Other Objects
Book
Bed
Chair
Clock
Cup
Fire
Flag
Flower
House
Moon
Plate
Stars
Telephone
Toilet
Tree

Other Relational Signs
All done/Finish[a]
Big
Down
Little
More[a]
Up

Toys
Ball
Balloon
Bubbles
Blocks
Doll
Drum
Kite
Piano
Puzzle
Robot
Rocket
Slide
Swing
Trumpet

Vehicles
Bicycle
Boat
Bus
Car
Motorcycle
Train
Truck
Tractor
Wagon

Verbs
Drink[a]
Eat[a]
Fall
Go[a]
Help[a]
Look
Open[a]
Play[a]
Sit
Sleep
Stand
Stop
Swing
Wash

*Must be different from bird
**Must be different from one-handed "play" sign.

a: see table on the next page

Sign approximations are coded according to the procedures in the manual (pg. 60). Hand shape does not have to match the conventional sign exactly, but the movement and location of the sign should be a close fit, given the child's motor limitations. This table has a description of possible sign approximations that a child may produce.

Possible Sign Approximations	
Signs	**Examples of Additional Acceptable Approximations**
Drink	▪ Touches thumb to side of mouth
Eat	▪ Touches index finger to mouth
Open	▪ Twists both flat palm-down hands once so that the palms are facing
Help	▪ Raises both closed fists
More	▪ Claps flat hands ▪ Taps/places index finger or thumb against palm of opposite hand
All done/Finish	▪ Places one forearm on top of other forearm with fingers pointing in opposite direction ▪ Rotates wrists of both hands with fingers spread
Play	▪ Child uses only one hand
Go	▪ Child moves index finger from pointing up to pointing away from body
Stop	▪ Child uses one hand only, palm must face to the side

*Of note: Touch happens early in signing
Hand shape often different
Location of sign approximation with respect to trunk has to be the same as traditional sign

Interpreting Signs

There may be times when a child appears to be signing a word or phrase that the clinician does not understand during the assessment and the coder has difficulty interpreting later. The website http://www.handspeak.com/word/asl-eng/ may be helpful in interpreting this possible sign.

1.) First, identify a handshape of the ASL word based on the dominant hand (see ASL Handshape Chart on the following page), regardless of the one-handed or two-handed production.
2.) Next, identify the child's hand-movement (see options in drop down box).
3.) Finally, identify a location of the base part of the body where the dominant hand makes contact or close contact (see options in drop down box).
4.) Press Search and view each of the video options to see if any the suggested signs fit the conversation contextually. Code accordingly.
5.) If the child's hand movements are not represented in any of the videos and are none of the approximated signs given in the chart above, it is possible the child making a non-communicative hand movement. In that case, the hand movement is not a codeable communication act. Code conservatively and only credit the child with true communication.

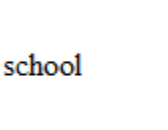
ASL Handshape Chart

0-num	0-flat	1-baby	0-babyflat	0-babyc	1-num	1-claw
						
opinion					for	recently

1-claw2	1-d	1-bend	1-g	1-i	1-thumb (L)	2-num
						
apple key	dating		nut (as in pea-brained)			

2-bend	2-claw	2-close	2-cross	3-num	3-claw	3-bend
						
	doubt gum	uncle	rocket realize	lousy awkward	bug mischievous	ha-ha

3-flat	3-inverse	3-k	4-num	4-close	4-claw	4-bend
						
no			leak	beer	rake	

5-num	5-close	5-claw	5-half	5-bend	5-c	6-num
						
mother+father	school		video-	seem	look-for	wine

6-claw	6-inverse (y)	7-num	7-8	7-open	8-num	8-inverse
						
weird	forever	nerd	hippopotamus		silver	enmity

8-open	9-num	9-open	10-thumb	10-a	10-s	10-t
advantage touch	fruit		girl sports	attitude	bicycle	

Resource B: Vowels

I. Process of determining functional Equivalence of Vowels

A. When the child produces a vocalization that is a potential word, first determine what word the child is attempting.

B. Next, pronounce the *target* vowel (or adult vowel) of the word the child is possibly attempting (sometimes it helps to say the sound to yourself aloud).

C. Find the target vowel on the vowel chart below and note the numbers beside the vowel.

D. Find the child's production on the chart and determine whether any of the numbers on the chart match one of the numbers for the *target* vowel.

E. If the child's vowel is functionally equivalent to the adult target and all other semantic, pragmatic, and phonetic (e.g., consonantal) criteria have been met, code the child's production as a word (as indicated in this manual).

II. Functional Equivalence Chart:

Front Vowels	Central Vowels	Back Vowels
/i/ (1) as in "h**e**" or "n**ee**d"	/ɝ; ɚ/ (3, 4) as in "h**er**" or "h**ur**t;" "dinn**er**"	u (5) as in "wh**o**" or "sh**o**e"
/I/ (1, 6) as in "h**i**t" or "h**i**m"	/ʌ; ə/ (3, 4) as in "h**u**t" or "h**u**m;" "en**e**my"	ʊ (5) as in "h**oo**d" or "sh**ou**ld"
/e/ (1, 2) as in "h**a**y" or "s**a**y"	/aɪ/ (3,4) as in "h**i**" or "b**y**e"	/o/ (4, 5) as in "h**o**e" or "s**o**ap"
/ɛ/ (2, 3, 6) as in "h**ea**d or "s**ai**d"	/aʊ/ (3,4) as in "h**o**w" or "b**ou**nce"	/ɔ/ (4, 5) as in "c**a**ll" or "b**a**ll"
/æ/ (2, 3) (as in "h**a**t" or t**a**p")	/oi/ (3,4) as in "b**o**y" or "t**o**y"	/a/ (3, 4) as in "h**o**t" or "d**o**t"

A. Diphthongs: a dipthong is a sound made by combining two vowels, specifically when it starts as one vowel sound and goes to another.

1. Note that diphthongs in Southern dialects tend to be produced as single vowels. Many single vowels in Southern dialects are *heavily* diphthongized).
   a. aɪ (3, 4) (as in "hi" or "bye" in standard dialects)
   b. aʊ (3, 4) (as in "how" or "bounce")
   c. oi (3, 4) (as in "boy" or "toy")

III. "R" colored vowels:

A. "R-colored vowels**"** is a term used to describe the change in quality of a spoken vowel immediately followed by the consonant r.

B. Examples of R-Colored Vowels

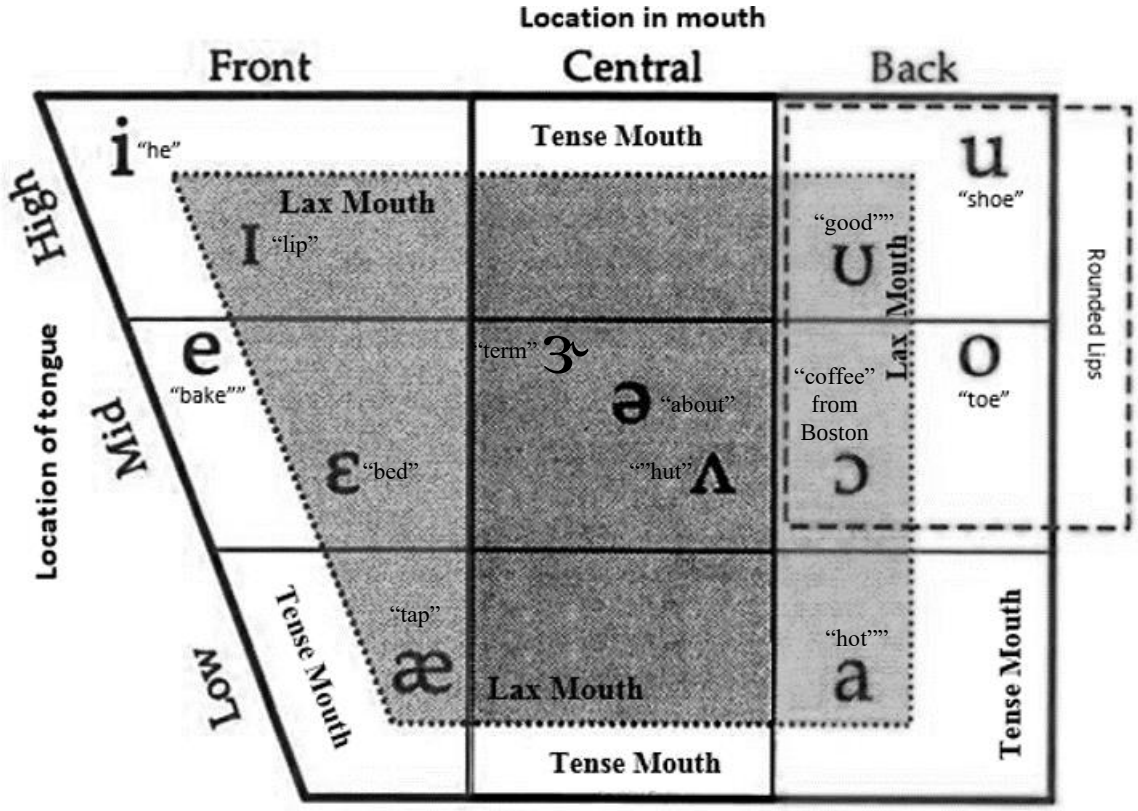
Examples of R-Colored Vowels			
Word	IPA: Vowels + r	Word	IPA: Vowels + r
Air	ɛər	Cheer	Ir
Are	ar	Cure	ʊr
Oar	ɔr	Cord	ɔr
Ear	Ir	Far	ar
Ire	aɪr	Fair	ɛr
Our	aʊr	Herd	ɝr
Pur	ɝr		

IV. Placement of vowels in mouth:

A. Color Key:

1. Small Gray Inner Trapezoid: the mouth and lips are lax (I, ɛ, æ, ɝ, ə, ʌ, ʊ, ɔ, a)
2. Larger White Bordering Trapezoid: the mouth and lips are tense (i, e, o, u)

B. Slowly say each of the words in quotations aloud to hear each of the vowel shapes accurately



Resource C: Consonants and the Most Common Speech Sound Errors Found in Young Children's Early Meaningful Speech Productions

I. Substitutions:

Lip Sounds:	
Target Sound:	Produced as:
m	m (i.e., usually correct)
w	w (i.e., usually correct)
p	b, at the beginning or middle of a word (e.g., "pie"→ "bie" or "happy" → "habby")
b	p, at the end of a word (e.g., "bib"→ "bip")
f	p or b (e.g., "fat" → "pat" or "five"→ "bive" or "knife"→ "nipe")
v	p or b (e.g., "very" → "bery" or "five"→ "fibe")

Tongue on Teeth Sounds:	
Target Sound:	Produced as:
"th," as in "think"	t or d or f or s (e.g., "bath"→ "bat," "bad," "baf," or "bas")
"th" as in "this"	d or t (e.g., "that" → "dat" or "tat")

Tongue Behind the Teeth Sounds:	
Target Sound:	Produced as:
t	d, at the beginning and middle of words (e.g., "toy" → "doy," "top" → "dop")
d	t, at the end of words (e.g., "bad" → "bat," "hide" → "hite")
s	t or d (e.g., "see" → "tee" or "dee," "miss" → "mitt," "missing"→ "mitting" or "mittee")
z	t or d (e.g., "zoo" → "too" or "doo," "fuzzy" → "puddy" "bust"→ "biddy," or "buzz" → bud)
l	"d" or "w" for "y," at the beginnings or middle of words; usually omitted or changed to a vowel, like "oh" at the end of words (e.g., "lime" → "dime" or "yime" or "wime," "bubble" → "bubboh," "call" → "kaw" or "kaoh")

Tongue on the Mid-Palate Sounds:	
Target Sound:	Produced as:
sh	t or d (e.g., "shoe" → "too" or "doo," "washing" → "wating" or "wadding," and "push"→ "put")
ch	t or d (e.g., "chew" → "tew," "watch" → "watt," or "match"→ "mat")
j	t or d (e.g., "jam" → "dam," "badge" → "bad," or "judge"→ "dud")
y	y (usually correct, but sometimes d) (e.g., "you" → "dou," "yoyo" → "dodo," or "yeah"→ "deah")
r	w at the beginning and middle of words; usually omitted at the end of words (e.g., "run" → "wun," "mirror" → "miwoh," "ride"→ "wide," or "car" → "kaw" or "kaoh")

Tongue on the Back-Palate Sounds:	
Target Sound:	Produced as:
k	t or d (e.g., "key" → "tey" or "dey"," "kick" → "tit" or "dit," "back"→ "bat," or "yucky" → "yutty" or "yuddy")
g	t or d (e.g., "go" → "do," "get" → "tet," "give"→ "tive," or "gar" → "daw")
"ng" (as in king)	n (e.g., "king" → "keen," "bang" → "ban," or "song"→ "tawn,")

II. Other Patterns:
   A. Final Consonants: Often omitted altogether (*Final consonant deletion)*
      1. Ex: Car → "caw"
      2. Ex: Bad→ "bae"
      3. Ex: Knife→ "knye"
   B. Unstressed syllables; Often omitted altogether (*Weak syllable deletion*)
      1. Ex: Around → "wownd,"
      2. Ex: Tomato→ "mato"
      3. Ex: Banana→ "nana"
      4. Ex: Giraffe → "waffe"
   C. Consonant blends: Often changed to a single consonant (*Cluster reduction*)
      1. Ex: Please → "peas" or "pea"
      2. Ex: Blue → "bue,"
      3. Ex: Sky → "kye" or "gye,"
      4. Ex: Friend → "fen" or "pen"
   D. Words with two or one sound are often changed to be the same as or similar to more consonants another, yielding a within-word consonant repetition or "near" repetition. (*Assimilation* or *Consonant Harmony*)
      1. Dog → "dod" or "gog,"
      2. Kitty → "kicky" or "titty,"
      3. Money → "momey"
   E. More than one of these changes can occur in a single word,
      1. Susan → "tutu" (s → t plus *consonant harmony*)
      2. Laughing → "yappee" (l → "y", f → p, and *Final consonant deletion*)
   F. Remember:
      1. Common sound substitutions for "n" and "h" sounds have been omitted in the above because they are so rarely misarticulated. These two sounds are among the five or 10 most frequently BABBLED sounds across all languages of the world. So, they're usually there in English kid's first words.
      2. When SUBSTITUTION errors do occur, [m] would be the most common substitution for [n]. Nasals are readily confused.
      3. For [h], the most common error is omission in which case you just have a vowel. Another consonant substituted for [h] is extremely rare. Some kids have strong patterns of favorite sounds; so [t] might substitute for a whole lot of sounds, including [h]. But there's no obvious substitution alternative for this sound.

III. Placement of English Consonants in the mouth:
   A. Place of Articulation:
      1. **Bilabial** - uses both lips to create the sound such as the beginning sounds in pin, bust, well and the ending sound in seem**.**
      2. **Labiodental** - uses the lower lip and upper teeth; examples include fin and van.
      3. **Interdental** - creates sound between the teeth such as the and thin.
      4. **Alveolar** - is a sound created with the tongue and the ridge behind the upper teeth; examples include the beginning sounds of tin, dust, sin, zoo, and late and the /n/ in scene.
      5. **Palatal** - uses the tongue and the hard palate to create the following sounds: shin, treasure, cheep,

jeep, rate and yell.

6. **Velar** - makes the sound using the soft palate in the back of the mouth; sounds include kin, gust, and the -ng in sing**.**
7. **Glottal**- is a sound made in the throat between the vocal cords such as in the word hit

B.Manner of Articulation: The manner of articulation means how the sound is made using the different places of articulation, tongue placement, whether the sound is voiced or unvoiced and the amount of air needed.

1. **Stops** - air coming from the lungs is stopped at some point during the formation of the sound. Some of these sounds are unvoiced, such as pin, tin, and kin; some of these are voiced, such as bust, dust and gust.
2. **Affricates** - are combinations of stops and fricatives. Cheap is an example of an unvoiced affricate and jeep is an example of a voiced**.**
3. **Fricatives** - restricted air flow causes friction but the air flow isn't completely stopped. Unvoiced examples include fin, thin, sin, shin, and hit; voiced examples include van, zoo, the, and treasure**.**
4. **Nasals** - as expected, the air is stopped from going through the mouth and is redirected into the nose. Voiced examples include seem, seen, scene, and sing.
5. **Liquids** - almost no air is stopped; voiced exampled included late and rate.
6. **Glides** - sometimes referred to as "semi-vowels," the air passes through the articulators to create vowel like sounds but the letters are known as consonants. Examples include well and yell.

C. IPA Consonants Chart

IPA Consonants								
Placement →		**Bilabial**	**Labiodental**	**Interdental**	**Alveolar**	**Palatal**	**Velar**	**Glottal**
Stops	**Voiceless**	p			t		k	ʔ
	Voiced	b			d		g	
Affricatives	**Voiceless**					ʧ = "ch" as in chair		
	Voiced					ʤ = "j" as in judge		
Fricatives	**Voiceless**		f	θ = "th" as in thistle	s	ʃ = "sh" as in hush	h	
	Voiced		v	ð = "th" as in this	z	ʒ = "s" "treasure"		
Nasals		m			n		ŋ = "ing" as in "king"	
Liquids	**Lateral**				l			
	Flap				ɾ			
	Retroflex					r		
Glides (semi-vowels)		w				j = "yuh" sound for y		

Resource D: Spelling Convention for "Child-Like" Words

Some codeable words that children say are not found in the dictionary. The list below represents "child-like" words that are codeable even though they are not spelled in the conventional manner.

AINT

ALLDONE

ALLGONE

ALLTHROUGH

ATTA (for that/'s a)

BETCHA ("I betcha I can.")

BOOBOO

BOOM (conventional noise for loud crash or explosion)

C'MON (child said " 'mon")

COCKADOODLEDOO

DOCTOR

FIXINA ("fixing to")

GIDDYUP (go verb)

GONNA

GOTCHA

GOTTA

GRANDMA/GRANDPA (child said mawmaw or pawpaw)

HAFTA

HEY

HI

HOORAY

HUH (as in requesting clarification)

LET'S (not typed with a /)

LIKETA

LOOKIT

MISTER

MISSES

MISS

MOM/DAD (child said mama or dada)

NOPE

OH

OK ("okay" - Don't put period between the letters)

OOH ("Ooh, pretty!")

OOPS (child said "oopsy")

OUGHTA ("Oughta do that")

OW ("ouch, that hurts")

POW (conventional noise for gunshot)

SPOSTA ("supposed to")

TRYNTA ("trying to")

TV (Don't put periods between the letters)

UHHUH (indicating "yes")

UHOH (something bad just happened)

UHUH (indicating "no")

WANNA

WHATCHA ("whatcha doing?")

WHEE

WHOA (for "stop" or for excitement)

WHOOPS (child said whoospy)

WOE (for exclaiming distress)

WOOHOO

WOW (as expression of excitement, interest, wonder, pleasure)

YEAH (for "yes")

YEA (as in "yay" for praise)

YEP (for a short, clipped "yes")

Resource E: Conventions for Unanalyzed Wholes

Words and word combinations are learned by children as unanalyzed wholes rather than as multiple word utterances. The list below represents unanalyzed wholes that are codeable as a single communication act. Note that in *all* cases, proper names are coded as one word.

Single Words:

ALLDONE
ALLGONE
ALLTHROUGH
BIGBIRD
BURGERKING
CASHREGISTER (always one word)
CHEERIOS (always one word, never Cheeri-o's)
COOKIEMONSTER
DOCTORFRED
FIREENGINE
FRENCHFRY
HOTDOG
ICECREAM
KITTYCAT
KOOLAID
MISTER
MISTERJONES
MISSES
MISS
MISSMONICA
NIGHTNIGHT
OHNO
OSCARTHEGROUCH
PLAYDOH
READYSETGO* Unless segmented by 3 separate actions
SHUTUP
STOPSIGN
TEDDYBEAR
THANKYOU
TRASHCAN
TV

2 Words:

CHOOCHOO TRAIN
FIRE STATION
FRIED CHICKEN
GAS STATION

Resource F: IPIAB Table

Intervening and Potentially Influencing Adult Behavior Summary Table

Components of Child Communication Act	IPIAB—NOT CODEABLE	Potentially Influential Behavior Does not Intervene—CODEABLE	Intervening Behavior is not Influential—CODEABLE
Gesture + Attention to Adult	• The child shakes his head. • Adult begins to shake her own head and verbalize, "Oh, you don't like that!" • Child looks to adult. The adult's behavior intervenes and may have influenced the "missing component" (gaze to adult's face) of the otherwise codeable communication act.	• The child shakes his head, then looks to the adult's face. • After child has initiated gaze to the adult's face, the adult shakes her head and says, "Oh, you don't like that!" The adult's behavior does not come between the child's head shake and gaze to the adult's face.	• The child shakes his head. • The examiner hands the child a toy. • The child gazes to the adult's face. • The adult then says "Oh, you don't like that!" The adult's behavior (handing the child a toy) comes between the child's gesture and gaze to the adult's face but probably did not cause the latter.
Gesture + Coordinated Attention	• The child proximally points to the bubble bottle. • The adult begins to move her head and torso down towards the child. • Simultaneous with the adult's movement, the child looks to the examiner's face. The IPIAB begins after the child's point and before the child's gaze shift. The adult's movement could have influenced the child's gaze to her face.	• The child proximally points to the bubble bottle, then looks to the adult's face. • After the onset of the child's gaze to her face, the adult moves her head and torso down towards the child and says, "Bubbles!" The adult's behavior does not intervene.	• The child proximally points to the bubble bottle. • The child's *mother* moves her torso down towards the child. • The child then shifts his gaze from the bubble bottle to the *examiner's* face. Although the mother's behavior does intervene, her movement is unlikely to have influenced the child's attention to the examiner's face.
Non-word vocalization + Coordinated Attention	• The child looks to the examiner's face. • The examiner shakes the bubble bottle and moves it closer to the child. • After the onset of the adult's movement, the child shifts his gaze to the bubble bottle and produces a non-word vocalization. The onset of the adult's behavior comes *after* the child's gaze to her face and before the onset of the child's vocalization and gaze shift to the object. Shaking the bottle may have influenced the child to shift his attention to the object.	• The child looks to the examiner's face, then shifts his gaze to the bubble bottle and produces a non-word vocalization. • After the onset of the vocalization, the examiner shakes the bubble bottle and moves it close to the child. The adult's behavior does not intervene.	• The child looks to the examiner's face. • The examiner asks the parent, "Does he like these?" • After the onset of the adult's utterance, the child shifts his gaze to the bubble bottle and produces a non-word vocalization. The examiner's statement came between the child's shifts in gaze, but it is unlikely that the adult utterance influenced the child's gaze to the object and his vocalization.

Resource G: Summary Forms

Summary Statistics Form for Pragmatic Function Coding

Underline one: CSBS T2 CSBS T4 LS T2 LS T4

Participant ID: _____

Date of assessment:_____ Coder initials _____

Duration of assessment (hh:mm:ss.ss) _____

Number of intervals with imperatives_____

Number of intervals with declaratives_____

Number of intervals with both _____

Number of intervals with other pragmatic function _____

Discrepancy Summary Form

File Name	
Primary Coder Initials and date coded:	
Reliability Coder Initials and date coded:	
Pragmatic function: imperative [4i]:	Small/large = _____ / _____ x 100 = _____ % Reliable
Pragmatic function: declarative [4d]:	Small/large = _____ / _____ x 100 = _____ % Reliable
Pragmatic function: other [4o]:	Small/large = _____ / _____ x 100 = _____ % Reliable
Pragmatic function: both:	Small/large = _____ / _____ x 100 = _____ % Reliable

Coded by Primary, not by reliability (give time-stamp):	**Coded by reliability, not by primary (tally w/ time-stamp):**
[4i]:	[4i]:
[4o]:	[4o]:
[4d]:	[4d]:
[both]:	[both]:
Notes/Summary of Discussion	

Resource H: Complete Circle of Coding

Obtaining Media [already complete for this project]:

-Media is recorded at each site (UCD, UW, and VU)
-Media is uploaded from SD Card OR Media is uploaded to PRS4 remotely from UW and UCD; media upload from both sites occurs *every* Friday.
-Media is edited using Adobe Premiere Pro and Adobe Media Encoder on HossDog PC located in RM 240.
-Edited media is put on the PRSA4 network (if VU media, edited media also is placed on corresponding SD card).
-Edited/Non-edited media from VU, UCD, and UW is placed on HossDog back up
-Media tracking, VU Coding log, and New Coding Log excel sheets are updated
-Media is logged on VU coding log; log is arranged in sets of 5
-Media is ready to be coded (media files are found on vu1file and copied from vu1file to personal desktop each time a media file is coded through ProcoderDV).

Primary Coding of Media [VU: Amy]:

-Files are coded using ProCoderDV according to the order found in the VU coding log. Code each set of 5 then wait for reliability. Save ProCoderDV files in in "reliability pending" folder.
-Once a set of 5 is complete, primary coder will email reliability coder informing her that reliability is needed.
-Completed files are logged on the pragmatic function coding log and the New Coding Log (the date for the New Coding Log is updated with each entry).
-Summary sheet is completed and placed in "reliability pending" folder
--All ProcoderDV files are saved on Krupa and in personal PC folders
--Copied media is removed from desktop once file is coded (ensure original version of file still exists on the vu1file server).

Reliability Coding of Media [VU: Jena]:

-Once a set of 5 for LS/CSBS is complete, the entire set is in "reliability pending" folder.
-A reliability check is conducted on a random session (predetermined by previous coders) in each the completed set of 5
-Reliability file is saved on personal computer and uploaded to "Reliability completed" folder. Summary sheet and ProCoderDV files from primary coder are moved to "reliability completed" folder.
--Reliability numbers are logged on the VU coding log and the New Coding Log
--All Procoder and Mooses files are saved on Krupa and in personal PC folders
--Copied media is removed from desktop once file is coded (ensure original version of file still exists on the vu1file server).

Data Entry [VU: Amy]:

-Summary and reliability files are printed.
-Data entry is completed on each file; date of data entry is recorded in data entry log and on each summary sheet.
-Once data entry is completed for the set of 5 and attached reliability, VU coding log is updated.
-ProCoderDV files (including primary and reliability) and summary sheet files are moved to their respective places in the "LS/CSBS complete" folder.
- Summary sheet and reliability file printouts are stapled together, then filed.
-LS/CSBS complete charts in the tray in Amy's office are updated using marker, and the date the charts are updated is reflected on a sticky note on the wall by the charts

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