REAL WORLD OBJECT NAMING FROM INFANT PERSPECTIVE

by

ALEXANDRA ZAKIN

A THESIS

Presented to the Department of Psychology
and the Robert D. Clark Honors College
in partial fulfillment of the requirements for the degree of
Bachelor of Arts

June 2017

An Abstract of the Thesis of

Alexandra Zakin for the degree of Bachelor of Arts
in the Department of Psychology to be taken June 2017

Title: Real World Object Naming from Infant Perspective

Approved: _____

Dr. Caitlin Fausey, Ph.D

Babies learn what words mean through experience, but what is the relevant experience? We began to answer this question by capturing infant-perspective experiences in their everyday lives at home. Infants ages 3 to 24 months (N = 4) wore a head-camera at home (M = 4.3 hours). We identified moments in which someone held an object in view and then transcribed the speech surrounding these moments (+/- 30 seconds). We hypothesized that the rate at which caregivers name objects-in view is not constant, but rather changes over this developmental period. Caregiver sensitivity to naming moments that are optimal for learning would be consistent with a growing body of evidence that social partners helpfully tune how they interact with infants (Brand et al., 2002; Fernald, 1985; Roy et al., 2009). Developmentally changing synchrony between seen objects and heard names is likely to be a key feature of relevant input to early word learning. Our hypothesis was supported in that there was an increase in the rate of in-hand object naming over the first year of life.

Dedication

I would like to dedicate this thesis to my mom, Lisa Hills. After being diagnosed with terminal cancer in May, 2016, my mom passed away on January 29, 2017. I think about her everyday and miss her immensely. My mom was a caring mother, wife, friend and clinician. My mom believed in me more than anyone and I hope this thesis makes her proud.

Acknowledgements

I would like to thank Professor Fausey, Professor Williams, and Jessica Kosie, for all their assistance, support, and understanding. I am truly grateful for their guidance. Additionally, I am thankful for the Learning Lab team, who helped me throughout this entire process. I also am grateful to all my professors and teachers who believed in me and encouraged me to challenge myself. I would also like to thank my father for his endless support and inspiration. Lastly, I would like to thank my friends and family for their encouragement and faith in my successful completion of this requirement and this journey.

Table of Contents

List of Figures

List of Tables

Introduction

William James famously said that, to the infant, the world is a “blooming, buzzing confusion” (1890). Yet from birth infants, through crying and body movement, are able to communicate. Within months they learn words, the building blocks of language. Much is known about the timing of word acquisition and language development. However, less is known about the process of “how” infants learn words.

Infants learn words through experience. This experience includes visual exposure and object naming by caregivers. But is the rate at which caregivers name held objects constant or does it vary with the age of the infant? Caregivers may demonstrate attunement with their infants by increasing their rate of naming of held objects during periods of increased learning sensitivity. It is hypothesized that caregivers facilitate word learning by variations in the rate of object naming by age. It is also hypothesized that the number of named objects to which the infant is visually exposed varies by age. The present study is unique in exploring, via the use of head cameras, object-naming through the infant’s visual perspective in a real-life setting.

Literature Review

Developmental Milestones

The identification of sensitive periods and developmental milestones provides clues into when, but not how, children acquire language. By the age of three years, children can easily learn to name new objects (Smith, Jones, Landau, Gershkoff-Stowe & Samuelson, 2002). According to Bergelson and Swingley (2011), infants between 6 and 9 months demonstrate that they know the meanings of many common nouns. Therefore, even before language production, children understand more than they can speak (Fenson, 1994). At 8 months infants can segment continuous speech into words and at 12 months they can map words to object names using co-occurrence information (Saffran, Aslin & Newport 1996; Smith and Yu, 2008). At eight months infants can decipher patterns in sequences of nonsense syllables and isolate word-like units. This indicates that infants are able to differentiate between what is a word and what is not (Saffran et al., 1996). However, a great burst in productive vocabulary comes around 18 months (Bloom, 2000). A rapid increase in vocabulary over a short period of time is considered a word spurt, or vocabulary explosion (Roy, 2013; Bloom, 2000). In order to learn words, let alone have a spurt in word learning, infants must extract relevant clues from their audiovisual environment. Yet, with all the stimuli how can infants decipher which objects pair with which object names?

Word Learning

Frequency and Exposure

Two crucial aspects of learning object names are frequency and exposure. Specifically, when objects and their names co-occur, and the more often a word is

heard, the earlier it will be learned (Baldwin, 1991; Goodman, Dale & Li 2008; Smith & Yu, 2008). Infants learn what objects go with what names by tracking word-object occurrence statistics (Smith & Yu, 2008)**.** Word learning is a slow and incremental process, which is acquired over new and old experiences (Roy, Frank, DeCamp, Miller & Roy, 2015). Thus, object names become slowly retained only after frequent exposure (Smith & Yu, 2008). Weisleder and Fernald (2013) found that speech addressed directly to the infant, more so than speech in adult conversations overheard by the child, facilitated vocabulary learning. Thus, infants with more exposure to child-directed speech learn words more quickly (Weisleder & Fernald, 2013).

In learning the names of objects, familiarity facilitates the object-label connection. Specifically, research suggests that reducing the novelty of a new object will increase the child's tendency to associate a novel word with that object (Graham et al., 2005). For example, previous studies indicate that two-year-olds are more likely to associate a new label with a pre-exposed novel object than with a never-before-seen novel object or with a familiar object. This means that the more toddlers are exposed to an object, the greater the ability they will have to name that object. Decreased novelty leads to increased toddler tendency to map a novel word to a nameless object, while new words map onto novel objects (Graham et. al, 2005).

Object Categorization

Children improve learning of object names with age and with increased attention to shape (Smith et al., 2002). Specifically, children learn object names by grouping objects into categories of shapes (Smith et al., 2002). In fact, the first 300 nouns learned by infants are categorized by shape (Samuelson & Smith, 1999). When children

associate words with shapes, they are making a first order generalization. For example, they generalize that all balls have the same shape as the ball(s) they have already learned about, or all cups have the same shape as the other cups they know.

Regarding how children categorize objects, children's categories can be broader, narrower, or overlap with adults' categories. Infants and toddlers have different basic categories than adults (Schaffer, Plunkett & Harris, 1999). The child-basic category is often narrower, meaning the child uses a more specific example in place of a larger category. Children can also have idiosyncratic categories. This difference in categories lies in the children emphasizing different object attributes than adults. In response to the child's difference in categorization, caregivers will point out the attribute of certain objects to help children categorize. Infants of twelve months associate words into categories with the exception of atypical members (hearing ''cat' and thinking of a tabby, but not a cougar; Schaffer et al., 1999). Overall, an infant's initial thought of the "norm" of a category is due to difficult lexical contrasts taking longer to develop and refine.

Caregiver Input/ Attunement

Learning words involves repetition, development, and social feedback (Hoff & Naigles, 2002). Infants make immature sounds and learn from the feedback they receive from the reaction of others. Caregivers adapt their behavior when interacting with infants, such as mothers using more eye gaze (looking longer and more often) in order to monitor infants' attention (Goldstein, Schwade, Briesch & Syal, 2010). When interacting with an infant, a mother's gaze consists of shorter, more broken up bouts for older infants (11-13 months) and longer, less interrupted bouts for younger infants (6-8

months). Also, mothers exchange objects more frequently with a child than with an adult (Brand, Baldwin & Asburn, 2002). One form of parental adaptation, motionese, occurs when parents use a special pedology when interacting with children learning objects. This practice leads to enhanced toddler imitation of the adult, suggesting that children are more receptive to learning when parents adapt to their developmental level (Brand & Williamson, 2002).

Another human adaptation to expedite language learning in infants is motherese. Motherese refers to the high-pitched and exaggerated intonation mothers produce while interacting with their infants (Fernald, 1985). Evidence of the effectiveness of motherese is indicated by infants' preference for motherese compared to typical adult conversational speech (Fernald, 1985, Goldstein et al., 2010). Thus, adaptation and attunement of caretakers could promote help word learning.

Theoretical Issues

Cross Situational word Learning (CSWL)

Cross-situational word learning (CSWL) involves co-occurring words and referents. This is a bottom up style of learning from the environment. On the other hand, sentence-level constraints (SLCL) involve word knowledge and provide the learner with highly reliable but ambiguous clues. Research suggests that complex statistical abilities can interfere with word referents from ambiguous situations (Yu & Smith, 2012). However, research also indicates that word–referent pairs can be understood even in noisy data with co-occurrences (Smith, Suanda & Yu, 2014).

Isolated words also play an important role in infants' language development and are a regular occurrence in infant directed speech (Brent & Siskind, 2001). Specifically,

exposure to isolated words helps in early language development and may even facilitate language learning. Word learning is defined as understanding a word's sound pattern, meaning and how the meaning and sound pattern are related (Aslin, Woodward, LaMendola, & Bever, 1996; Brent & Siskind, 2001). This is evident in the substantial number of mothers' words in isolation which are reproduced by infants (Aslin et al., 1996). Namely, in a study on language learning the first 30-50 words produced by infants were the words said by the mother in isolation (Brent & Siskind, 2001). Learning language through isolated words is just one technique, and can be used in combination with other forms of word learning.

Mutual exclusivity/disambiguation effect

It is theorized that infants assign the novel word to the novel object in view as a communication strategy which helps avoid lexical overlap (Diesendruck & Markson, 2001). An infant's tendency to select the unnamed object when hearing a novel word is known as the disambiguation effect (Merriman & Bowman,1989). Another theory is that infants assign a novel name to a novel object based on mutual exclusivity; the assumption that objects can have only one name (Markman & Wachtel, 1988). Object familiarity affects word learning by enhancing the mutual exclusivity constraint in early word learning (Fennell, 2011).

Fast Mapping vs. Slow Mapping

Infants are exposed to new objects everyday. Yet, how do infants store the names of these objects in memory? There is a bridge in word learning between fast mapping and object naming (Kucker & Samuelson, 2012). Fast mapping is the mental process in which a new concept is learned from a single exposure (as in mutual

exclusivity, described above). Meanwhile slow mapping involves additional experiences and the learner gaining a deeper understanding of the word meaning. Infants do not as easily retain fast mapped words after a short break (Horst & Samuleson, 2008). Therefore, initial fast mapping must be accompanied by a period of slow mapping. Thus, the critical link between the fast and slow mapping processes is experience (Kucker & Samuelson, 2012).

A study involving two year-olds found that fast mapping object names is a complex process for infants (Kucker & Samuelson, 2012). Learning a new word involves pulling the word from linguistic input, finding the referent for the novel word, translating this information, and then recalling it from previous experience. Namely, the infant must create a new lexical entry for the word, while extracting the environmental context, and encoding a representation of the word that links it to its appropriate category (Kucker & Samuelson, 2012). However, for slow-mapping and learning new words, auditory experiences that occur before mapping lead to familiarization and improve retention of fast-mapped words and their transition to slow mapped-words (Graf Estes, Evans, Alibali, & Saffran, 2007).

The review of the literature thus far has focused on factors which promote infants' learning of object names and theoretical explanations for such learning. This information, including information on caregiver attunement, will guide our hypotheses regarding the rate at which caregivers name objects in view. However, before formulating our hypotheses, it is necessary to understand the visual world of the infant.

Infant-perspective visual data

The visual environment of infants is created by a combination of head, eyes, and body. The majority of the time young children move their head and eyes at the same time (Nakagawa & Sukigara, 2013) although their eyes usually lead by fractions of a second (Yoshida & Smith, 2008). Placing head-cameras on children to record their audiovisual experiences is becoming more common and allows researchers to replace the tripod with the child's own body. Head-cameras provide data on visual environments from a child's perspective (Smith, Yu, Yoshida & Fausey, 2014). Specifically, head-cameras have the ability to observe the unconstrained everyday activities and perspective of infants (Fausey, Jayaraman & Smith, 2016). Head-cameras are not expensive and provide views of objects in hands and changes in perspective as the child's posture and activities change (Smith et al., 2014).

The content of the visual field of infants is predictive of the words that they will soon produce. Specifically, with the child's focus on a single object that is visually dominant, embodied attention and word learning may increase (Yu & Smith, 2012). For example, the objects in the visual field of 9 month old infants are predictive of the words they will acquire in the coming months (Clerkin et al., 2016). The process by which an infant learns a word often begins with the object catching the infant's attention and the parent then labeling the focus of the child's attention. The object grabbing the parent/child's attention cannot just appear in in the infant's visual field but must be named (Trueswell et al., 2015). It may not matter how many objects are in the visual field but how may many objects share their joint attention (Brown-Schmidt & Tanenhaus, 2008; Yoshida & Smith, 2008). However, when objects are in hand there

are fewer objects visually available to the infant (Yurovsky, Smith & Yu, 2013; Smith, Yu, & Pereira, 2011). Although when objects are in hand there are fewer objects in-view, word learning may actually be promoted.

Using head-cameras to view the world from the perspective of an infant or toddler can provide insight into how infants learn language. Specifically, head-cameras have the ability to capture the unconstrained everyday activities and perspective of infants (Fausey et al., 2016). An infant or toddler's visual field usually consists of one big, centered object (Smith et al., 2011). Previous analysis indicates that data collected from younger infants includes more faces, while older infants have a greater hand input (Fausey et al., 2016). While crawling on the floor, an infant must sit up to see social partners or objects. Meanwhile children who are able to walk have social partners and objects in view (Kretch, Franchak & Adolph, 2014). This finding is significant as faces reveal to infants the attention and emotional states of their caregivers, while hands correspond with action on the world. Thus, as infants become older they begin to observe more object-directed action moments instead of faces. This is evident through the increase of hands in view from an infant-perspective (Fausey et al., 2016). This change in perspective relates to language learning in that infants are learning not just the name but also the function of objects in view.

Rationale and Hypotheses

Infants learn words through exposure and object naming by caregivers. Caregivers may name held objects once or multiple times. The rate at which caregivers name held objects may vary with infant age. Variations in the rates in which held objects are named may correspond with caregiver sensitivity to naming periods, which may be

optimal for infant learning. Thus, variations in the rate of object naming may not be random but rather reflect caregivers' ability to change their behavior in response to infant readiness to learn. Caregiver – infant attunement may therefore play a key role in early word learning (e.g., Tamis-LeMonda et al., 2001).

This study provides initial data on variations in the rate of object naming indexed by infant age. The data was collected in a real-life setting from an infant's perspective through the use of infant head-cameras. Such data are important because implications for understanding how children learn words, establishing data for infant-caretaker word learning interactions, and identifying possible attunement disruptions or difficulties in the caregiver-infant word naming process. In addition, this thesis will guide and facilitate the design of a future, more in-depth study of this process.

It is hypothesized that the rate of naming of held objects in-view will vary by infant age. Specifically, it is hypothesized that the highest rate of object naming of held objects in-view will occur with infants around one-year of age because of the coming word spurt. It is also hypothesized that the most common named held objects in-view would vary by infant age because of differences in developmental abilities, experiences, and interests. Specifically, it is hypothesized that naming of objects that are ordinary and can easily be categorized (such as ball) will predominate in the youngest infants studied.

Methods

Participants

Infants ages 1 to 24 months were recruited (n = 34, 17 male) for the initial study in which infants wore head-cameras at home (See Table 1; See Figure 1; Fausey et al., 2016). The sample consisted primarily of white, middle-class families with stay at home mothers whose primary language is English. Infants included in the study had no history of serious illnesses or vision problems.

From the 34 participants in the initial study the author chose as participants four infants of different ages (n=4, 3 male). The age groups were selected to reflect different stages of language development. Specifically, subject A was 12 weeks old, subject B was 36 weeks old, subject C was 56 weeks old, and subject D was 113 weeks old.

Subject	Total Time (Original) hh:mm:ss	Total 1/5 HZ frames (Original)	# of frames w object in hand	# of seconds coded for language
A	5:07:15	3687	47	1,330
B	4:41:50	3382	168	5,619
C	3:31:30	2538	147	5,634
D	3:57:15	2847	476	9,954

Table 1: Subset of data from Fausey et al (2016). Seconds surrounding moments of objects-in-hand were coded in this thesis.

Procedure

Figure 1: Participants wearing Looxie head-cameras.

Name-able Regions

We identified regions of the video to listen for object names and coded thirty seconds before and after the object in hand moments (See Figure 2).

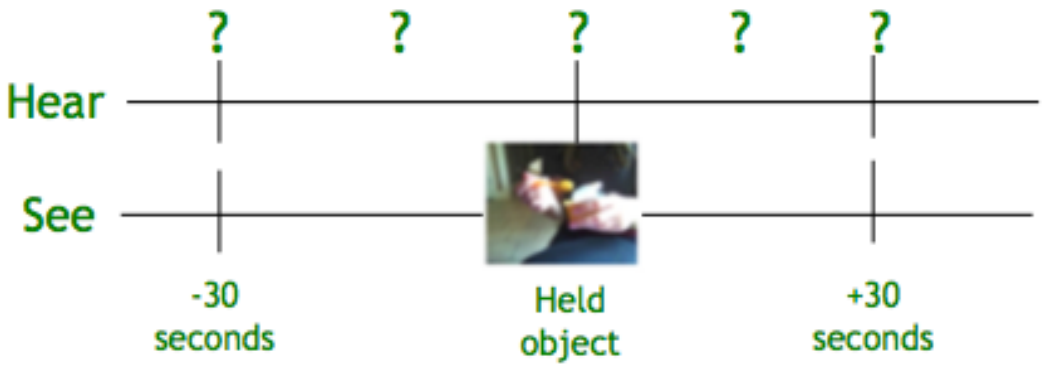


Figure 2: The basis for our R computer programming code. This figure illustrates how we anchored on an object in hand moment and extracted (+/-) 30 seconds from the object in hand moment.

Identifying named objects

The author coded approximately 6.2 hours of infant-perspective scenes as pilot data for a future study of all 34 subjects (see Table 1 for the breakdown of total video for each subject). For the sake of this study, an object was defined as a concrete, image-able, and holdable noun (e.g., ball or spoon). The coding was performed with a Mac desktop computer using the program Datavyu (datavyu.org). Datavyu is a software package for visualizing and coding behavioral observations from video data sources. A coding manual was created to establish a standard procedure for the current study and for future coders (see Appendix A).

The author watched bouts of video created by the aforementioned code. The author listened for concrete, image-able, and holdable nouns named by the caregiver. If the object in hand was named within the bout, the name and timing of the object was recorded in Datavyu. Each time an object was named was considered a naming incident and coded separately**.** A more detailed description of the coding process can be found in the coding manual (Appendix A). Coding reliability was assessed by having a second person, trained in the coding process, code 20% of bouts randomly selected from each of the four subjects. The correlation in rate of naming between the two coders was 86%.

Rate of Object Naming

Rate of naming of held objects in view was obtained by dividing the number of seconds the object was named by the number of seconds the object was seen (also, referred to as the minute that contains the object in hand). The rate of naming of held objects was then recorded on a scatter plot. The most frequently named objects in-hand

were identified for each subject and then recorded for comparison purposes (See Figures 4).

The object names coded were “cleaned” for any spelling errors. Plurals were changed to singular (e.g., strawberries to strawberry) and abbreviations were changed to the whole word (e.g., sug to sugar). For the sake of our study we did not remove adjectives from whole words (e.g., fire truck to truck). We chose to do minimal cleaning in order to preserve the infant-perspective experience. Namely, to continue the fire truck example, an infant hears a completely different name when his/her caregiver says fire truck than when the caregiver just says truck.

Results

Our data indicate that there was an increase in the rate of naming of held objects across the first year of life, with a peak around one-year-old and drop around the second year of life. Specifically, Subject A had the lowest rate of object naming (0.003) followed by Subject B (0.0055). Subject C had the highest rate of object naming (0.008). There was a drop in the rate of object naming for Subject D (0.006) (See Figure 3). The top named objects in hand for each subject can be found in Figure 4. For example, the most frequently named objects for Participant A were booties, pacifier, shoes, and sock. The top named objects for Participant B were truck, hanger, turtle, and Knox (name of dog). Participant C heard blanket, ball, sugar, chicken, and water as their most frequently named objects and Participant D heard sand, car, stamp, paper, popcorn, hand, truck, marker, and egg. Results also indicate that the number of named objects to which infants are visually exposed varies by age. Specifically, this is evident in the different number of objects named at each age, with infants at 13 months hearing the most object names from their object in hand experiences. Additionally, our results indicate that infants are exposed to more object in hand naming across their first year of life. A decrease in the rate of in hand object naming by caregivers occurred at 26 months.

Participant A had four different objects named but each just named one time, all the subjects had variability in the number of objects in-hand named. Participant B demonstrated a right-skewed distribution, as indicated by Figure 5. Participant C demonstrated a right-skewed distribution, as indicated by Figure 5. Participant D demonstrated a right-skewed distribution, as indicated by Figure 5. Although the rate of

object naming for Participant D was lower than the rate of object naming for Participant C, it was still approximately double the rate of object naming for Participant A, the youngest subject.

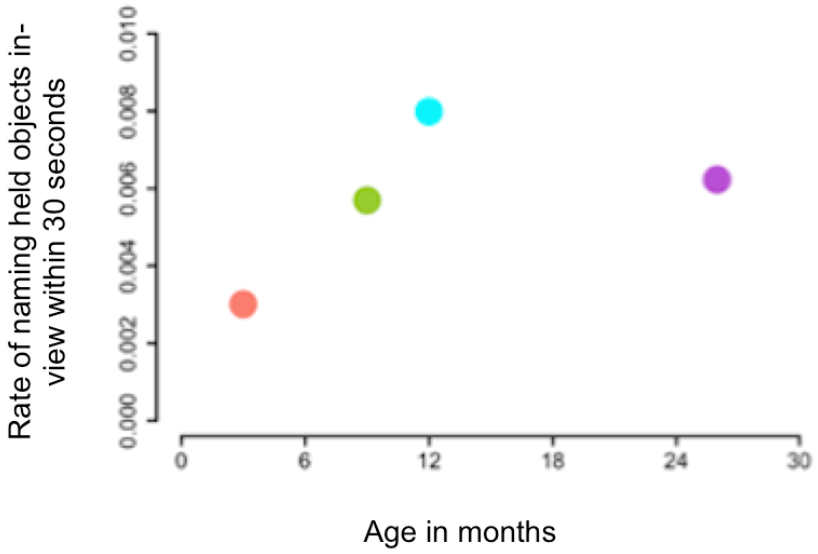
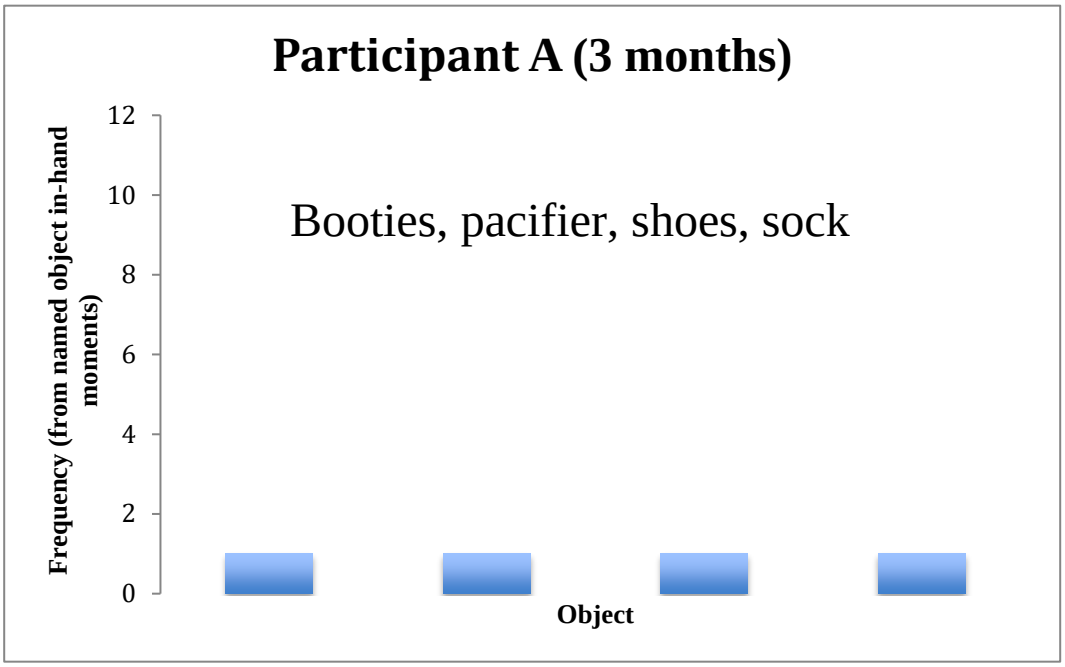
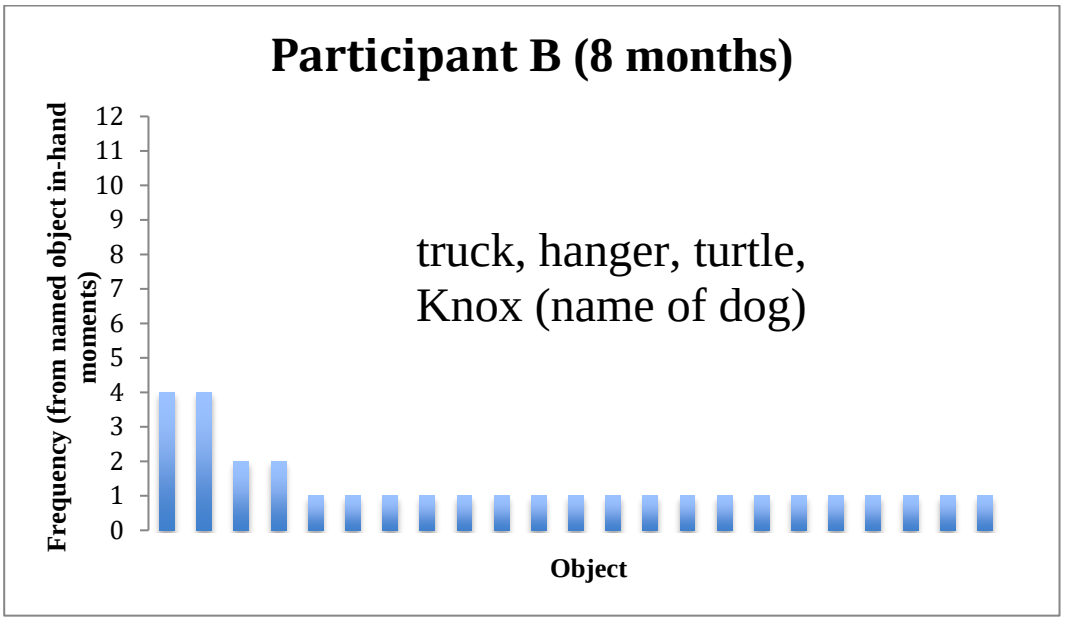
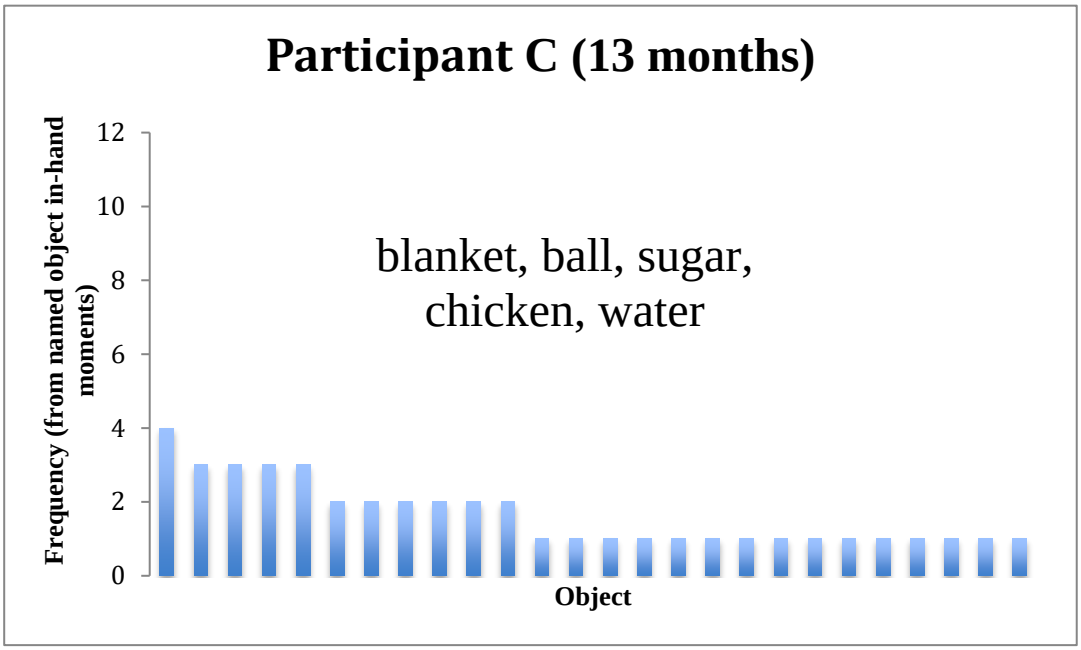


Figure 3: Changing rates of naming held objects in-view by age. Each point represents data for an individual infant.


Participant A (3 months)
Frequency (from named object in-hand moments)
12
10
8
6
4
2
0
Booties, pacifier, shoes, sock
Object


Participant B (8 months)
Frequency (from named object in-hand moments)
12
11
10
9
8
7
6
5
4
3
2
1
0
truck, hanger, turtle,
Knox (name of dog)
Object



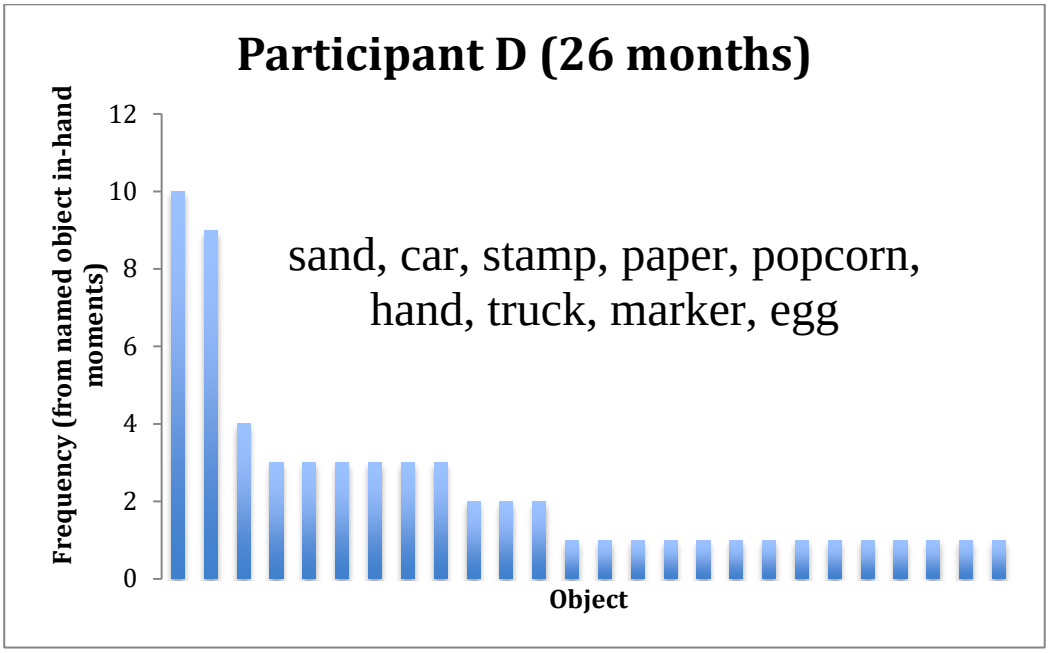


Figure 4: The four most frequently named objects for Participants A-D

Discussion

The results of this pilot study support our hypothesis that there is an increase in object naming of held objects in-view during the first year of life. Specifically, results indicate a peak in object naming around 13 months of age. This finding supports the hypothesis that variations in the rates in which held objects are named will correspond with caregiver sensitivity to naming periods which may be optimal for infant learning. These results suggest that the word learning process is not passive or one-directional but rather an ongoing dynamic between infant and caregiver with the caregiver attuned to the infant's readiness to learn.

Results also support our hypothesis that the number of named objects to which infants are visually exposed varies by age. Infants at 13 months have the most object in-hand naming moments compared to the other three subjects, suggesting a period of increased (or peak) rate of object in-hand naming, although the oldest subject had the most objects in view. The increased rate of naming of objects in hand across the first year of life parallels emerging knowledge and skills over time. The dip in rate of object in hand naming at 26 months could be explained by desensitization of these naming moments from caregivers, or by the infant using new learning techniques. Namely, the infant may have already learned the name of basic words and the caregiver moved on to describing objects with action words. For example, instead of saying the object name, caregivers may be talking more about the action or function of the object. Namely, caregivers may be more likely to say to the older infant "do you want a drink?" instead of saying "look, here's a cup" when holding a cup.

The present study contributes to our understanding of how infants learn the

names of objects. Our findings are consistent with previous research indicating that the names of objects which infants learn first are those which are highly prevalent in their view (Clerkin et. al.). For example, the top objects in hand named for Subject A (tied) were booties, pacifier, shoes, and sock. Meanwhile, the top objects in hand named for Subject B (tied) were brochure and car seat. The top object in hand named for Subject C was blanket, while the top object in hand named for the oldest infant, Subject D, was sand (see figures 4-7). As infants age, visual exposure to less ordinary objects increases and there is also exposure to a greater number of objects.

Our results relate to current theoretical issues in developmental psychology, including learning and memory for early words. For example, working memory begins at six months and increases as infants mature (Reznick, Morrow, Goldman, & Snyder, 2004). The increasing working memory of infants is consistent with a linear increase in object in hand naming by caregivers during the first year of life, which corresponds with infants' word spurt and growing vocabulary (Roy, 2013; Bloom, 2000). However, increasing working memory does not account for the drop in object naming after a peak around one year. Attention during infancy also impacts performance on a variety of tasks, including recognition and memory (Reynolds & Romano, 2016). However, if attention, along with working memory, is increasing with age, why would the rate of object naming by caregivers drop-off after a possible optimal period? (Richard & Cornise, 2000).

Although it was not appropriate to conduct statistical analysis with only four subjects, results can be statistically analyzed in future studies which utilize a greater number of participants. Based on present limited results, we predict a linear relationship

in the rate of object naming during the first 12 -14 months. However, because there was a peak in the rate of object naming around 13 months followed by a drop-off, we predict that when the timeline is expanded to two years, the rate of object naming will show a quadratic relationship.

The study of caregiver naming of held objects in-view has real-world implications. This is evident in the importance of contingent responding which helps predict the timing of children's language milestones (Tamis- LeMonda, Bornstein, & Baumwell, 2001). With enough data, a norm can be established for the rate of caregiver object naming for infants at different ages. This norm for typically developing infants and toddlers could be helpful in identifying and understanding when infants are experiencing delays in learning words. For example, if an infant is evidencing a word learning delay, a home observation might be conducted during which a record of held object in-view naming by caregivers is made. Such an observation might indicate that caregivers are not optimally attuned to their infants, as indicated by a low rate of object naming when those objects are in the child's view. With information collected from such a home observation, an appropriate intervention, such as parent training, could be designed.

The low number of subjects in the present study is a limiting factor. Use of a greater number of subjects would lead to greater confidence in the reliability of the results. Each point on the scatterplot represents the rate for a single subject of named object in-hand words by a caregiver (see Figure 3). However because this study's purpose was to serve as a pilot for future research, there is merit in its limited results. Future research should repeat this study but with more subjects. With results from a

greater number of subjects, baseline data can be established for variations in the rate of object naming by age.

Characteristics of the subjects are also a limiting factor. The results could likely look different if our subjects were not typically developing, middle-class infants with no history of vision problems. Namely, the peak rate of object naming may shift to a younger or older age period based on characteristics of the infant. Specifically, it is hypothesized that infants with vision problems, attachment issues, or of a lower socioeconomic level would have a peak shifted to the right, meaning their optimal period of object naming would be at an older age.

In addition to future research on object naming with typically developing children, research could be conducted on children with developmental delays, such as those with Autism Spectrum Disorder. Use of head-cameras with an ASD infant population could help researchers better understand the world of these infants, including their interactions with caregivers. For example, children with ASD may be exposed to a lower rate of object-in hand naming. The rate of object naming for children with ASD, and any changes in the rate over time, could be compared with the pattern for typically developing children. These data would help us understand if children with ASD also have a peak period in the rate of object naming, and if the rate is shifted in an earlier or later direction.

In short, our hypothesis that there would be an increased rate of named held-objects in view over the first year was supported. According to our pilot data, the rate at which caregivers named objects-in view was not constant, but rather varied with infant age. This suggests that developmentally changing synchrony between infant and

caregiver may be relevant to in early word learning. This observation is consistent with prior findings that, through behaviors such as motionese and motherese, caregivers modify their infant-directed actions and speech (Brand et al., 2002, Fernald, 1985). It is also consistent with the finding that the length of caregivers' utterances demonstrates a temporal relationship with the child's development (Roy, Frank & Roy, 2009) and that sentences get longer over the first year and a half (Huttenlocher, Vasilyeva, Waterfall, Vevea & Hedges, 2007). Future research might address behavioral or attentional cues infants may send, and caregivers pick up, that precipitate the period of increased rate of naming of held objects in view.

Appendix A: Coding Manual

Coding Manual for Everyday

Holdable Object Naming

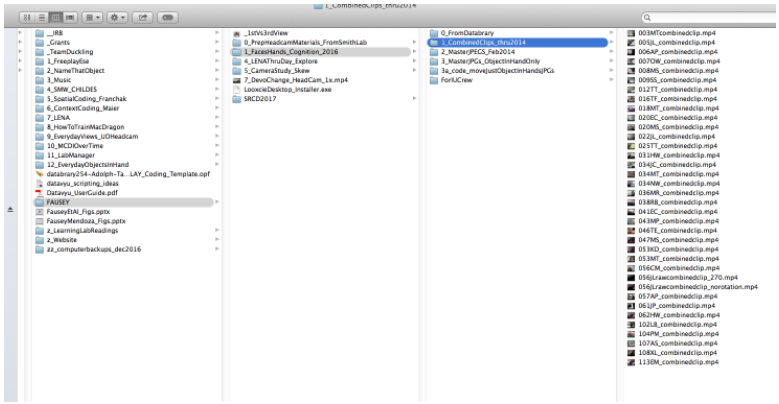
1

Save Often!

2

Finding & adding your files

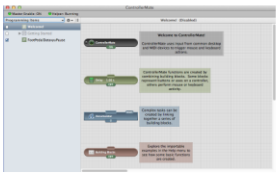
- Log on to Learning Lab server
- Go to FAUSEY → 1_FacesHands_Cognition2016→ 1_CombinedClips_thru2014→ select your file → drag to desktop



3

Controller Mate (Foot Pedal)

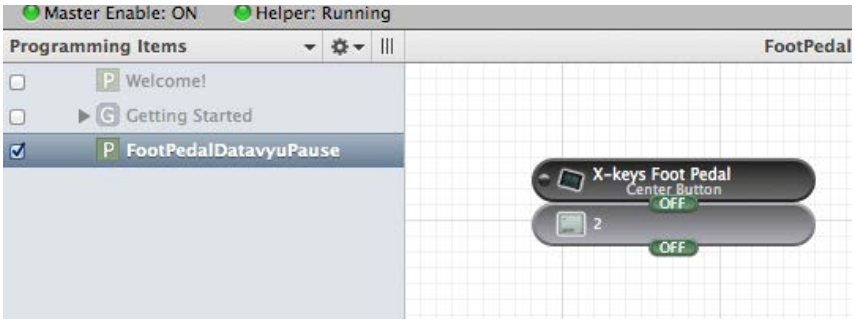
- Open up controller mate – foot pedal



4

Controller Mate Continued

- Make sure FootPedalDatavyuPause is checked



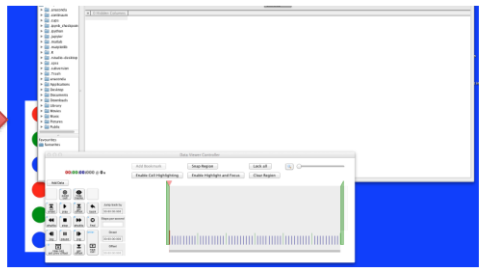
FYI: good tutorials online
http://www.orderedbytes.com/controllermate/example/#tutorial

Opening Datavyu

6

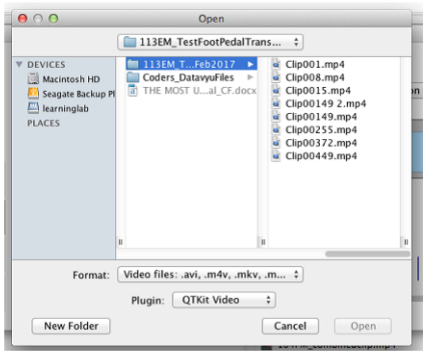
Opening Datavyu

This screen should pop-up

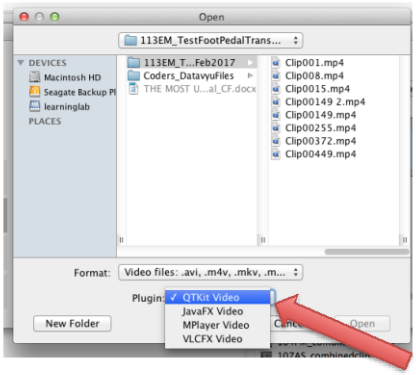


Click “Add Data”

How to get your data into Datavyu



When you click “Add Data”, it’ll look like this.

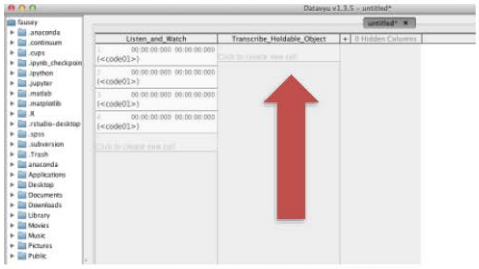


We are using QuickTime so click QTKoit and then select your video

8

Creating Cells

Click 'Enter' or '0' on THIS keypad to create new cells

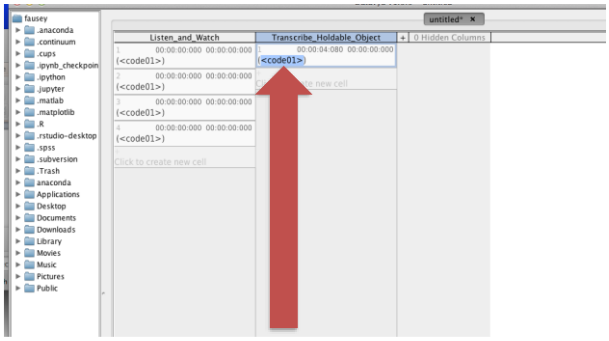


This is where you will enter object names as you hear them in the video

Click here!!

9

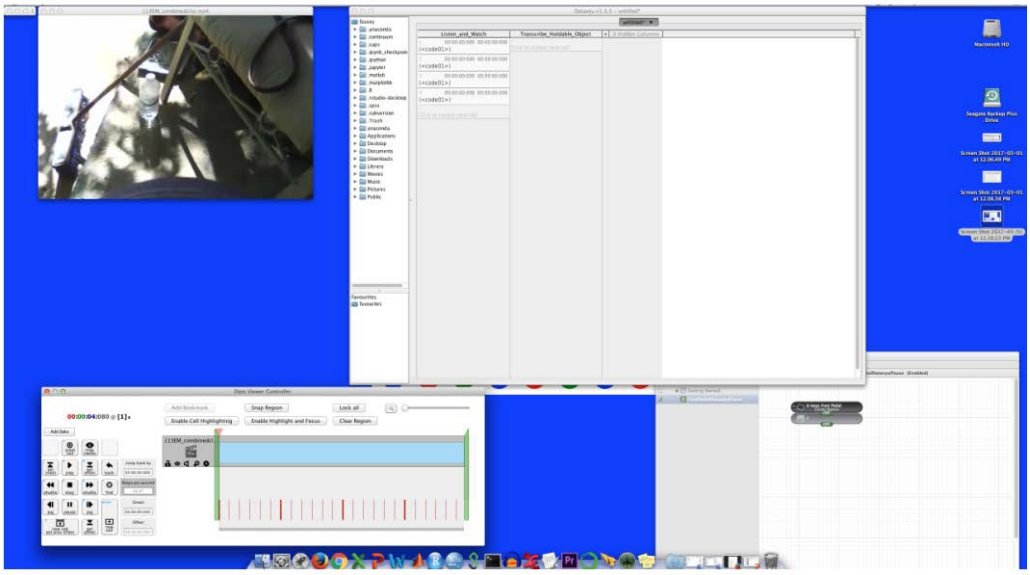
How to enter object names



Code object names here in blue <code01>

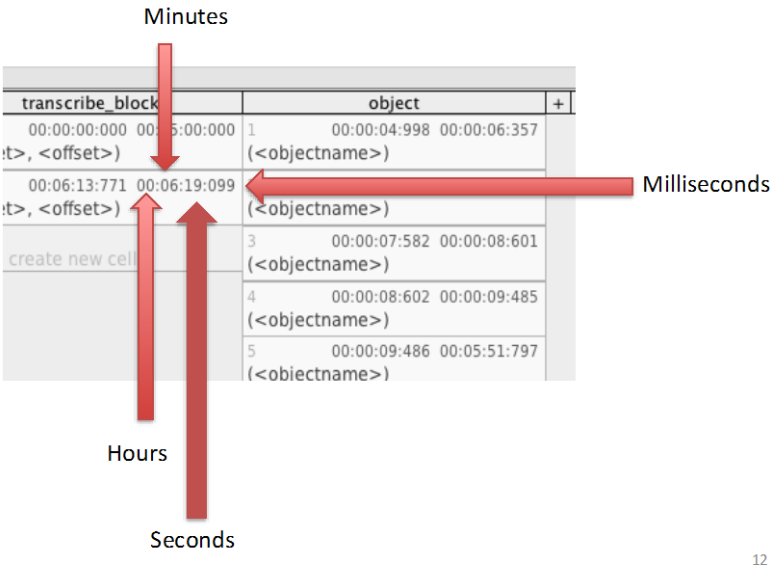
10

What your screen should look like



11

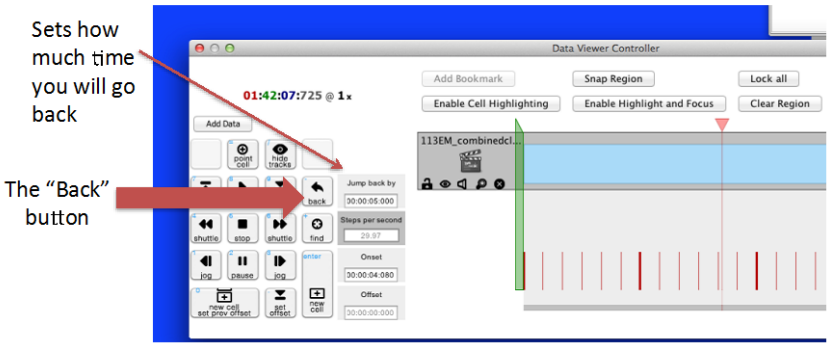
How time works in Datavyu



12

If you need to move back

- DO NOT CLICK JOG!!! This messes up the timing of the video
- Instead click “Back” and the video will jump back by our set time of 5 seconds



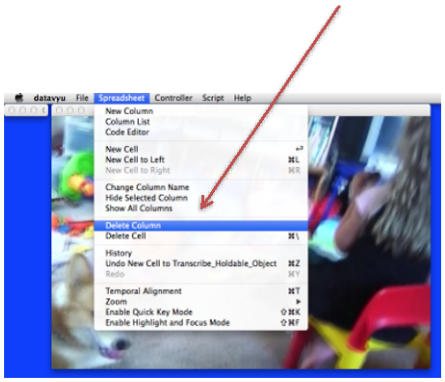
13

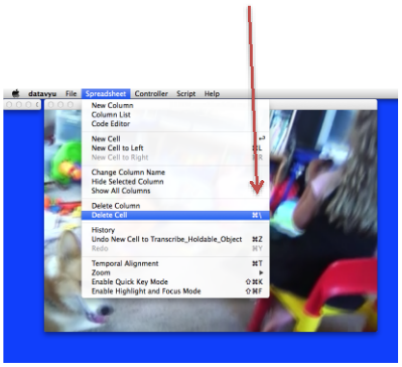
How to delete a column or cell in Datavyu

- Click “Spreadsheet” in the top left hand corner of the screen

- Then Click either “Delete Column” or “Delete Cell”

Do not delete columns already in template





14

Foot Pedal

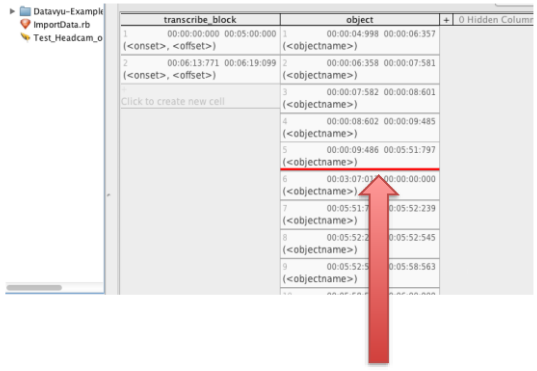
Press here to stop/start the video

15

If you see a red line

RARE and should not happen

- If this does occur talk to someone on the Team
- This means the time of the cell <u>above</u> the line is out of order (e.g. you cannot go from 9 min to 5min)



16

Datavyu Notes

- Note if there are sync issues with the audio/ video at any point(s) of coding.
  - If there are serious sync issues stop coding and email AZs and Caitlin
- Datavyu reportedly changes frame rate randomly. At beginning of coding session, coder should set the frame rate to 29.97

17

How to save your Datavyu file

- "yourlastname_subjectclip#"
  - E.g. zakin_113EM08
- Save to desktop
- THEN drag to server
  - In the folder: 12_EverydayObjectsinHand→3_Transcription→2_ OBJECT_CODING→ Folder with your name on it

Save often!

18

Transcribing Notes

- Put on headphones. Begin listening at a comfortable volume for you.
- **Adjust** the volume according to what is going on in the video
- If you cannot hear something turn the volume ALL the way up
- If you listen to a section 5x and cannot understand it, move on and do NOT code that word!

19

How do we define an object?

- **A concrete, imageable, and (in most cases) holdable noun or object**

- E.g. ball, spoon

Top 10 MCDI Words

Words you are likely to hear:

- Ball
- Car
- Shoe
- Tummy
- Banana

21

What counts as an object?

- YES, people
  - E.g. “mommy”or “baby”
- YES, names & nicknames
  - E.g. “cinderella” or “lily+bug” in reference to child
- YES, bodyparts
- YES, an object on a media source (TV, electronic toy, etc.)
- YES, include brands (coco+puffs)

22

What is NOT an object?

- A non-concrete, non-imageable, and non-holdable noun
  - E.g. “song”, “art”
- NO events
  - E.g. “wedding” or “party”
- NO colors
- NO numbers
- NO ambiguous pronouns
  - E.g. “it” or “that”
- NO places
  - E.g. “beach” or “house”
  - E.g. “bedroom”, “bathroom”
- We are NOT coding “ME” or “You”

23

Additional Guidelines #1

- Possessives?
  - **NO,** code only the main word
    - E.g. “baby’s bowl” would get one entry as “bowl”
- Plurals?
  - **YES,** code the word in the form it occurred in
    - e.g.“blocks”
- Proper Nouns?
    - **YES,** include book titles and characters
    - E.g. Clifford the Big Red Dog
    - ONLY if it is obvious and you don’t have to think about it

24

Additional Guidelines #2

- Other languages?
  - **NO, we only code object words spoken in English**
- Expressions?
  - **USUALLY NOT** object words unless the expression can be taken literally
  - E.g. "Cat got your tongue" nouns are **NOT** coded
  - DO include "boy/girl" in "good boy/girl"
- Repetitions?
  - **YES,** code all repetitions of object names in video

25

Ambiguous speech #1

- Verbs as objects: If a word could be a verb OR an object word **AND IS AMBIGUOUS**, include it but make a comment (ex. Do you wanna drum? **: verb as object)
- * Do NOT code if the sentence is NOT ambiguous. Ex: In the sentence "Let's brush your hair", 'brush' is clearly used as a verb and is NOT ambiguous; it should NOT be coded.
- * If a word is ONLY an object word (can't be used as another part of speech, ex. "car" can't be a verb) but is used in a strange syntax (ex. "Let's play car"), code it but make a comment (**: atypical syntax).

26

Ambiguous Speech #2

- Hard to tell what caregiver is saying?
  - E.g. “beamo” or “beanball’”
  - If you think you know what the word is code it
- Typing “xxx” vs. when to just skip?
  - Type “xxx” if you think the word is a noun

27

Code exactly what you hear

- We are coding ALL speech not just Child-Directed Speech (CDS)
- ONLY code when an ADULT is speaking
  - E.g. No siblings, nor the target child
- Diminutives (kid versions of words like 'ducky'): If a word is not in the dictionary, add “y” for singular and “ies” for plural.

28

Spelling?

- Use **New Oxford American Dictionary** for spelling reference, whether a word is a compound word or not, etc… (e.g. firetruck vs. fire truck). This is the built-in dictionary on Macs.
- Review spelling only at the END of coding sessions.

29

Formatting?

- Compounds:
  - Put a + between words in compounds (e.g. sweet+potato)
  - **Do NOT include simple adjectives (little+red+train) but do include informative modifiers (lego+man).**
- Punctuation:
  - Don't include ANY punctuation (besides + as described above). Just leave it out! Examples: Wheres+babys+belly+button, Mr+bear

30

Capitalization

- Coded words cannot have more than one capital letter, and only the first letter may be capitalized.
- Only book titles and character/toy names may be capitalized. Compound book titles and characters (ex. Little Blue Truck) should be coded with a capital on the first word only (ex. Little+blue+truck).
  - If a book character has a prefix in it, make sure to use a plus sign and not a period (e.g. Mr. Ted the bus driver would be Mr+ted).
- **Any nouns that are not characters or titles (ex. iPad, TV, Band Aid) should be in lower case** (ex: ipad, tv, band+aid). Exceptions below:
  - Names of countries (which aren't coded by themselves, but can be determiners, e.g. U+s+flag)

31

Training Examples:

- **Goal**: Listening to long uninterrupted speech and how to focus in on coding object name nouns only.
- Common words: spoon, ball, cup & book

32

Code This!

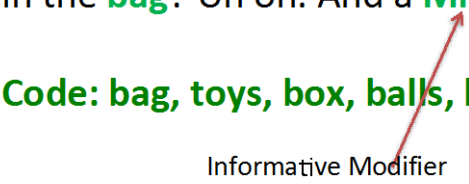
Subject: 056JL

Clip0025.mp- start at 0:00:45

How to find clip: Log on to server → 13_EverydayObjectsinHand→3_Transcription → Example_Clips→ 056JLClip0025.mp4

"You're gonna put **toys** in the **bag**? Your **toys** are in the **box** right now. Here's more **balls**. Do you wanna put these **balls** in the **bag**? Uh oh. And a **Mickey mouse**!"

Code: bag, toys, box, balls, bag, Mickey+mouse



Informative Modifier

33

Do NOT Code: Adjectives

Subject: 009SS

Clip0080.mp4- start at 0:00:34

How to find clip: Log on to server → 13_EverydayObjectsinHand→3_Transcription →Example_Clips→ 009SSClip0080.mp4

"she's a **cutie** with the big **cheeks**."

Code: cutie, cheeks

Do NOT code: big (adjective)

34

Do NOT Code: Numbers

Subject: 043MP

Clip005.mp4-start 0:00:00

How to find clip: Log on to server → 13_EverydayObjectsinHand→3_Transcription →Example_Clips→ 043MPClip005.mp4

"Do you want **mama** to do it with you? **Mama** do it with you? Yeah? Four five six seven eight. Then there's nine. Counting's really great. With numbers. When you know numbers."

Code: mama

Do NOT code: four, five, six, seven, eight, nine (not imageble depiction of numbers)

Numbers (not imageable)

35

Do NOT Code: Events

Subject: 036MR

clip0080.mp4 0:00:00

How to find clip: Log on to server → 13_EverydayObjectsinHand→3_Transcription → Example_Clips→ 043MPClip005.mp4

"afterwards. And that's been going on quite a few months. Originally took him to the **vet** they said it was probably gingivitis, gave me the **wipes** and then last month I had to bring my other **dog** in to get a like little fatty **tumor** removed so they said go ahead and bring him in and they'll do a dental cleaning. And cuz it wasn't clearing up um so they did that and they noticed under **anesthetic** it was very sensitive"

Code: vet, wipes, dog, tumor, anesthetic

Do NOT code: gingivitis, months, dental cleaning (not holdable, not imageable, do not code events)

36

Do NOT Code: Non - Imageable

Subject: 007OW

Clip00122.mp4- start at 0:00:28

How to find clip: Log on to server → 13_EverydayObjectsinHand→3_Transcription→Example_Clips→ 007OWClip00122.mp4

"no, oh the pig song from little Einstein?"

Code:

Do NOT code: pig, song, Einstein (descriptor, non-imageable, proper name of T.V. show)

37

Finished?

- SAVE your work!!
- Review spelling
- Drag your work to the SERVER: 12_EveryDayObjectsInHand→ 3_Transcription →2_OBJECT_CODING→the folder with your name on it

- **ONCE THE DATVYU FILE IS ON THE SERVER PLEASE DELETE FROM DESKTOP!**

38

Works Cited

Aslin, R. N., Woodward, J. Z., LaMendola, N. P., & Bever, T. G. (1996). Models of word segmentation in fluent maternal speech to infants. *Signal to syntax: Bootstrapping from speech to grammar in early acquisition*, 117-134.

Baldwin, D. A. (1991). Infants' contribution to the achievement of joint reference. *Child development, 62*(5), 874-890.

Barbaro, K. D., Clackson, K., & Wass, S. (2016). Stress reactivity speeds basic encoding processes in infants. *Developmental Psychobiology,, 58*(5), 546-555.

Bergelson, E., & Swingley, D. (2012). At 6–9 months, human infants know the meanings of many common nouns. *Proceedings of the National Academy of Sciences, 109*(9), 3253-3258.

Bloom, P. (2000). *How children learn the meanings of words* (Vol. 377). Cambridge, MA: MIT press.

Brand, R. J., Baldwin, D. A., & Ashburn, L. A. (march 2002). Evidence for 'motionese': Modifications in mothers' infant-directed action. *Developmental Science, 5*(1), 72-83.

Brent, M. R., & Siskind, J. M. (2001). The role of exposure to isolated words in early vocabulary development. *Cognition, 81*(2), B33-B44.

Brown□Schmidt, S., & Tanenhaus, M. K. (2008). Real□time investigation of referential domains in unscripted conversation: A targeted language game approach. *Cognitive science, 32*(4), 643-684.

Clerkin, E. M., Hart, E., Rehg, J. M., Yu, C., & Smith, L. B. (2016). How everyday visual experience prepares the way for learning object names. *2016 Joint IEEE International Conference on Development and Learning and Epigenetic Robotics (ICDL-EpiRob)*

Datavyu. (n.d.). Retrieved May 11, 2017, from http://www.datavyu.org

Diesendruck, G., & Markson, L. (2001). Children's avoidance of lexical overlap: A pragmatic account. *Developmental psychology, 37*(5), 630-641.

Estes, K. G., Evans, J. L., Alibali, M. W., & Saffran, J. R. (2007). Can infants map meaning to newly segmented words? Statistical segmentation and word learning. *Psychological science, 18*(3), 254-260.

Fausey, C. M., Jayaraman, S., & Smith, L. B. (2016). From faces to hands: Changing visual input in the first two years. *Cognition*, *152*, 101-107.

Fennell, C. T. (2011). Book Review: How children learn to learn language McCune Lorraine, Oxford University Press: Oxford, 2008; 288 pp.: 9780195177879. *First Language*, *31*(4), 508-511.

Fenson, L., Dale, P. S., Reznick, J. S., Bates, E., Thal, D. J., Pethick, S. J., & Stiles, J. (1994). Variability in early communicative development. *Monographs of the society for research in child development*, i-185.

Fernald, A. (1985). Four-month-old infants prefer to listen to motherese. *Infant behavior and development*, *8*(2), 181-195.

Goldstein, M. H., Schwade, J., Briesch, J., & Syal, S. (2010). Learning While Babbling: Prelinguistic Object□Directed Vocalizations Indicate a Readiness to Learn. *Infancy*, *15*(4), 362-391.

Goodman, J. C., Dale, P. S., & Li, P. (2008). Does frequency count? Parental input and the acquisition of vocabulary. *Journal of child language*, *35*(03), 515-531.

Graham, S. A., Turner, J. N., & Henderson, A. M. (2005). The influence of object pre-exposure on two-year-olds' disambiguation of novel labels. *Journal of child language*, *32*(01), 207-222.

Hills, T. (2013). The company that words keep: comparing the statistical structure of child-versus adult-directed language. *Journal of child language*, *40*(03), 586-604.

Hoff, E., & Naigles, L. (2002). How Children Use Input to Acquire a Lexicon. *Child Development*, *73*(2), 418-433.

Horst, J. S., & Samuelson, L. K. (2008). Fast mapping but poor retention by 24-month-old infants. *Infancy*, *13*(2), 128-157.

Huttenlocher, J., Vasilyeva, M., Waterfall, H. R., Vevea, J. L., & Hedges, L. V. (2007). The varieties of speech to young children. *Developmental psychology*, *43*(5), 1062.

James, W. (1950). *The principles of psychology*. New York: Dover Publications.

Jayaraman, S., Fausey, C. M., & Smith, L. B. (2015). The faces in infant-perspective scenes change over the first year of life. *PloS one*, *10*(5), e0123780.

Koehne, J., & Crocker, M. W. (2015). The Interplay of Cross-Situational Word Learning and Sentence-Level Constraints. *Cognitive science*, *39*(5), 849-889.

Kretch, K. S., Franchak, J. M., & Adolph, K. E. (2014). Crawling and walking infants see the world differently. *Child development*, *85*(4), 1503-1518.

Kucker, S. C., & Samuelson, L. K. (2012). The first slow step: Differential effects of object and word-form familiarization on retention of fast-mapped words. *Infancy*, *17*(3), 295-323.

Markman, E. M., & Wachtel, G. F. (1988). Children's use of mutual exclusivity to constrain the meanings of words. *Cognitive psychology*, *20*(2), 121-157.

Merriman, W. E., Bowman, L. L., & MacWhinney, B. (1989). The mutual exclusivity bias in children's word learning. *Monographs of the society for research in child development*, i-129.

Nakagawa, A., & Sukigara, M. (2013). Individual differences in disengagement of fixation and temperament: Longitudinal research on toddlers. *Infant Behavior and Development*, *36*(4), 728-735.

Ramey, C. T., & Ramey, S. L. (2004). Early learning and school readiness: Can early intervention make a difference?. *Merrill-Palmer Quarterly*, *50*(4), 471-491.

Reznick, J. S., Morrow, J. D., Goldman, B. D., & Snyder, J. (2004). The Onset of Working Memory in Infants. *Infancy*, *6*(1), 145-154.

Reynolds, G. D., & Romano, A. C. (2016). The Development of Attention Systems and Working Memory in Infancy. *Frontiers in Systems Neuroscience*, *10*.

Roy, B. C. (2013). *The birth of a word*.

Roy, B. C., Frank, M. C., Decamp, P., Miller, M., & Roy, D. (2015). Predicting the birth of a spoken word. *Proceedings of the National Academy of Sciences*, *112*(41), 12663-12668.

Roy, B. C., Frank, M. C., & Roy, D. (2009). Exploring word learning in a high-density longitudinal corpus.

Saffran, J. R., Aslin, R. N., & Newport, E. L. (1996). Statistical learning by 8-month-old infants

Samuelson, L. K., & Smith, L. B. (1999). Early noun vocabularies: do ontology, category structure and syntax correspond?. *Cognition*, *73*(1), 1-33.

Smith, L. B., Jones, S. S., Landau, B., Gershkoff-Stowe, L., & Samuelson, L. (2002). Object name learning provides on-the-job training for attention. *Psychological Science*, *13*(1), 13-19.

Smith, L. B., Suanda, S. H., & Yu, C. (2014). The unrealized promise of infant statistical word–referent learning. *Trends in cognitive sciences*, *18*(5), 251-258.

Smith, L., & Yu, C. (2008). Infants rapidly learn word-referent mappings via cross-situational statistics. *Cognition*, *106*(3), 1558-1568.

Smith, L. B., Yu, C., & Pereira, A. F. (2011). Not your mother's view: The dynamics of toddler visual experience. *Developmental science*, *14*(1), 9-17.

Smith, L. B., Yu, C., Yoshida, H., & Fausey, C. M. (2015). Contributions of head-mounted cameras to studying the visual environments of infants and young children. *Journal of Cognition and Development*, *16*(3), 407-419.

Tamis-LeMonda, C. S., Bornstein, M. H., & Baumwell, L. (2001). Maternal responsiveness and children's achievement of language milestones. *Child development*, *72*(3), 748-767.

Trueswell, J. C., Lin, Y., Armstrong, B., Cartmill, E. A., Goldin-Meadow, S., & Gleitman, L. R. (2016). Perceiving referential intent: Dynamics of reference in natural parent–child interactions. *Cognition*, *148*, 117-135.

Weisleder, A., & Fernald, A. (2013). Talking to children matters early language experience strengthens processing and builds vocabulary. *Psychological science*, *24*(11), 2143-2152.

Yoshida, H., & Smith, L. B. (2008). What's in view for toddlers? Using a head camera to study visual experience. *Infancy*, *13*(3), 229-248.

Yu, C., & Smith, L. B. (2012). Modeling cross-situational word–referent learning: Prior questions. *Psychological review*, *119*(1), 21.

Yurovsky, D., Smith, L. B., & Yu, C. (2013). Statistical word learning at scale: The baby's view is better. *Developmental Science*, *16*(6), 959-966.