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COMMUNICATIVE BEHAVIOR OF A FIVE-YEAR-OLD CHIMPANZEE ON THE VERGE OF A LINGUISTIC BREAKTHROUGH

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During the period covered by this paper,[1] Bow[2] was a five year old male common chimpanzee who had been cross-fostered in a human household since he was a month old. He had a human foster mother and a human sister two-and-a-half years older than he. He had been immersed in human culture and human language. The languages he had been exposed to since infancy were Hebrew (the household language), Chinese (spoken by guests during visits of two months and six months respectively), and English (used as an inter-language with guests in the household as well as with volunteer interns and caretakers who stayed for periods of about three months each). While Chinese had been discarded due to lack of volunteer speakers, Bow was passively competent, for purposes of comprehension, in both English and Hebrew. Hebrew was the language in which he appeared most fluent. All participants except Bow used spoken English and Hebrew as the primary means of communication.

Bow communicated pointing at printed lexigrams in the standard orthography of the human languages he knew. There was no expectation at this point in the experiment that Bow could understand the phonetic principle. He was to select the written words that corresponded to spoken words he knew based on association alone. Bow had a holistic gestalt of what each lexigram looked like, and he knew which lexigram corresponded to which spoken word in which language. For the time being, English and Hebrew lexigrams were treated no differently from Chinese characters in terms of understanding their subcomponents.

Bow occasionally used three word sentences in SVO patterns, such as "MARY CHASE BOW", or two word combinations such as "MORE BANANA", but the vast majority of his utterances were still on the one word level. Most of Bow's utterances involved requests: for particular foods, for games he wished to play, and for particular toys. He also answered "YES" and "NO" to questions, and much of the communication with him was elicited in this way. As yet, Bow did not ask questions, issue complaints, discuss his feelings, or initiate conversations about long range goals or desires. He expressed preferences only with regard to very concrete options. Bow's performance in this regard was comparable to that

[1] The author wishes to thank Eden Michaelov, without whose help in working with Bow, processing the data, and constructing tables and diagrams, this paper would not have been possible.

[2] Since July of 2007, when the presentation upon which this article is based was given at Eastern Kentucky University, Bow has made tremendous progress, which will be detailed in future publications. The use of past tense in reference to Bow's accomplishments as described in this paper is due to this fact.

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WATER	מים
GRAPES	ענבים
BANANA	בננה

Figure 1. *Examples of lexigrams in English and Hebrew.*

of other chimpanzees in language experiments. (Segerdahl, Fields & Savage-Rumbaugh 2005; Savage-Rumbaugh *et al.* 1985; Savage-Rumbaugh *et al*. 1993.)

The difficulty in eliciting more elaborate conversational language use from Bow was being addressed by a modified form of DIR/Floortime, a play therapy developed by Dr. Stanley Greenspan. (Greenspan & Wieder 2006). This paper will show how this modified version of floortime expanded Bow's language use by allowing him to find a way to secure the joint attention of his interlocutors.

1. LEXIGRAMS AND MENUS. The lexigrams that Bow was exposed to consisted of printed words in the standard orthography of the language in question (see **Figure 1**). Bow was not instructed in how the printed words were composed of letters, nor was he given any instruction in how the letters were to be pronounced. The lexigrams were treated as indivisible wholes, to be learned holistically, in much the same way children learn to recognize spoken words without explicit instruction in the phonology of their native language. Sometimes the lexigrams appeared separately, and sometimes they were arranged in menus, where several lexigrams appeared together.

Even when the lexigrams were arranged in menus, Bow had to learn to recognize the individual lexigram, not its position in the menu. Several different arrangements of the same menu were available on hand, and Bow was not allowed to rely on the position of a lexigram relative to other lexigrams in order to identify the lexigram he wished to use.

By July of 2007, Bow had a vocabulary of 137 lexigrams, corresponding to 137 spoken words, in Hebrew. **In Figure 2**, the words are arranged by semantic category.

Bow's vocabulary in English by the summer of 2007 was considerably larger, coming in at 238 words (see **Figure 3**, overleaf). Despite the greater size of the English vocabulary, Bow more readily expressed himself with Hebrew. In selecting vocabulary, he was more willing to deploy lexigrams in Hebrew than in English.

At first glance, Bow's greater willingness to use Hebrew lexigrams could not be teased apart from his unwillingness to speak with strangers, since all English speakers he knew were not household members, and almost all Hebrew speakers he knew were household members. However, once Eden Michaelov, who was bilingual in Hebrew and English, entered the picture in June of 2007, she was able to report that Bow preferred to communicate with her in Hebrew. This was due to his own fluency, not Eden's. She was more fluent in English.

Bow's human adoptive mother and sister spoke Hebrew in the home. However, the wider community in which the household was embedded was English speaking. Although Bow had been exposed to more words in English than in Hebrew, he was more familiar

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People		Foods		Colors	Misc.	
איה	לפתוח	פה		אדום	1	שגפן
אלי	לצאת	רגל		אדומים	2	שורות
אמא	לקום			אפור	3	שיט
אמי	לקרוא	אפנה		אפוד	אביב	שש
גיל	לקרוץ	אפדסק		ורוד	אחד כך	שתי
דני	לשחק	אדוחה		חום	את	אין
חרב	לשתות	בננה		ירוק	בבית	איפה
יוני	לתת	בשר		ירוקים	בבדכה	אני
נץ	רוצה	גכינה		כחול	בסדר	את
סבתא	תן	גזר		כחולים	די	אתה
עדן	Toys	גלידה		כתום	הקידות	ב
קיץ	גרב	דג		לבן	ועוד	הוא
קשת	דב	דובדבנים		סגול	חיב	היא
שרה	דגדוג	חלב		צבע אחר	ילדות	הנה
Verbs	כדור	יוגובט		צהוב	ישן	יש
אכלו	מחבואים	לחם		צהוב	ישרות	ל
בוא	מכונית	מים		שחור	כל	לה
בואי	ספר	מיץ		Potty	כן	לול
לאכול	תופסת	עוגה		סיר	כסתה	לי
להכנס	Body Parts	ענבים		פיפי	לא	לך
לטפס	אף	שתיה		עדיך	מדלנה	על
לישון	אצבע	תפוח		ככי	משהו אחר	עם
לנוח	יד	אדמה מתוק			עוד	ש
לסגור	ידים	תפוח			ריח	שקט
	עין	תרנגולת				

Figure 2. *Bow's Hebrew vocabulary of 137 words arranged by semantic category.*

with his core Hebrew vocabulary than with his core English vocabulary. Much like children brought up bilingually in a home where the parents speak a different language from the people in the surrounding community, Bow had a better command of simple domestic vocabulary in Hebrew, although he had been exposed to many more speakers of English, each of whom introduced him to new words and new concepts.

2. METHOD OF SELECTING LEXIGRAMS. Bow selected which lexigram he wished to use by pointing to it. Over the course of the experiment, the following methods of pointing emerged:

1. **Open-handed Point (OHP)** – Bow used his own hand to point at the lexigram. The hand was in an open palm configuration, rather than pointing with an index finger, which is the human method of pointing in the cultures to which Bow was exposed.

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People
ALLIE
AYA
BOW
BOW'S
CARRIE
DAGON
DANAY
DELIGHT
EDEN
ELIZA-BETH
JESSICA
JUNE
KARYN
MARY
MOMMY
NETS
PHILLIP
PHILLIP'S
SAMINA
SARA
SWORD
TEYMAN

Verbs
BITE
BLOW
CHASE
CLAP
CLIMB
CLOSE
DO YOU WANT TO DRING
EAT
FIND
GROOM
HIDE
HIT
HUG
HURT
I WANT
I WANT TO
KISS
KNOW
LIFT
MASSAGE
OPEN
PLAY
POINT
PRETEND
PUSH
READ
RELAX
ROLL
SCRATCH
SEE
SHARE
SHOW
SWING
THROW
TICKLE
WANT
WANTS
WIGGLE
WRESTLE
WRITE

Toys
ALBUM
BALL
BEAR
BIN
BLANKET
BLOCK
BOOK
BOX
CRAYON
DINO-SAUR
DRUM
DRUMS
GORILLA
HARMON-ICA
HAT
JUG
KAZOO
LID
MAGA-ZINE
MASK
MUSIC
NEW TOY
OLD TOY
OTHER TOY
PANTS
PAPER
PENCIL
ROPE
SHEET
SHIRT
SHOE
SOCK
STRING
TOY
TOY BOX
TOY CAR
WAGON
XYLO-PHONE

Body Parts
ARM
BACK
BOTTOM
CHIN
EARS
EYES
FACE
FACES
FEET
FINGER
FOOT
HAND
HEAD
LEG
LEGS
LIPS
MOUTH
NOSE
SHOUL-DER
TOES
TONGUE
TOOTH
TUMMY

Foods
APPLE
APPLES
BANANA
BANANAS
BREAD
CAKE
CARROTS
CEREAL
CHEESE
CHERRIES
CHICKEN
COOKIES
FISH
FOOD
GRAPES
GREEN APPLE
JUICE
MCDON-ALD
MEAL
MEAT
MILK
PEACH
PEAS
POTATOES
PURPLE GRAPES
RAISINS
RED APPLE
RICE
STUFFING
SWEET POTATO
WATER
YOGURT

Colors
BLACK
BLUE
GREEN
NOT BLUE
NOT RED
ORANGE
PURPLE
RED
YELLOW

Potty
DON'T NEED TO
PEE
POOP
POTTY

Places
BIG POTTY
BOW'S POTTY
COM-PUTER ROOM
DOOR
KITCHEN
LIVING ROOM
PHILLIP'S ROOM
PLAY ROOM
TUNNEL
WINDOW

Misc.
AND
ANIMALS
ARE
BAD
BED
BIRTHDAY
CAT
DON'T
DOWN
ENOUGH
FAST
FRUS-TRATED
FUNNY
GENTLE
GET U
GOOD JOB
HAPPY
HARD
HI
HOW MANY
IN
IS
LATER
MAD
MEAN
MIN
NAUGHTY
NEVER
NICE
NO
NOT
NUMBERS
OFF
OKAY
ON
OR
OUT
PLEASE
READY
SHAPES
SLOW
SMELLY
SOME-THING ELSE
START
STOP
THE COLOR IS
TIRED
TV
UP
WHAT COLOR?
WHEELS
WHERE
WHO
WHY
WORDS
YES
YOURS

Figure 3. *Bow's English vocabulary of 238 words arranged by semantic category.*

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2. **Assisted Finger (AF) –** Bow pointed with his index finger, like the humans around him, but he had to help the index finger by supporting it with his other hand. (Pointing with the index finger is an unnatural gesture for a chimpanzee. Bow couldn't do it with one hand.)
3. **Researcher's Hand (RH) –** Bow took the researcher's hand and used it as a pointing device. Bow's hand was the moving force behind the gesture, and the researcher's hand was like an inanimate object that Bow was manipulating.
4. **Prompted (PR) –** In a prompted point, the researcher took Bow's hand and made it point. In a prompted point, Bow is not the real speaker. The researcher is suggesting a lexigram to Bow.

The best evidence for Bow's autonomous language use would have been either an OHP or an AF. However, as the experiment progressed, Bow showed a marked prefernce for RH. We will explain why in the following sections.

3. THE ROLE OF FLOORTIME. Children who are developmentally delayed, whether diagnosed with classical autism, Asperger's syndrome, hyperlexia, PDD-NOS, or some other autistic spectrum disorder, have been found to make remarkable progress when their caretakers engage with them according to the specifications of the floortime model of play therapy. (Greenspan & Wieder 2006.) The two major goals of floortime are to follow the child's interest and to bring the child into a shared world. By engaging in play on the child's level of development, caretakers encourage and facilitate communication in context that is directed to the child's areas of interest. The emphasis is not on any particular formal linguistic skill, so much as on the child's ability to engage with others. Caretakers encourage the child to open and close as many circles of communication as possible, to engage in turn taking in communication, whether verbal or non-verbal, in order to elaborate upon the child's expressed desires and preferences.

Bow was given a modified form of floortime for two years, from age three to age five, before he began to make his linguistic breakthroughs in the summer of 2007. The lack of progress during the first two years of floortime was due primarily to a mismatch between the researchers and Bow in terms of their relative metabolic speeds and the ability to process information at a standard rate. Bow was not autistic and had normal social impulses, but the rate of communication used by the researchers was not well matched to Bow's natural tempo.

Chimpanzees operate at a higher speed than humans. They respond more quickly to physical stimuli, social events, and even linguistic input. When Bow responded to our questions, we often didn't see the answer because he moved so fast. It was not until we watched the video footage of our exchanges several times, over and over again, utterance by utterance, gesture by gesture, that we began to pick up on the fact that Bow had indeed used lexigrams to communicate with us spontaneously.

It has been theorized that chimpanzees either lack a theory of mind, or alternatively, have a less developed theory of mind than humans. (Povinelli 2004). The presence or absence of a theory of mind is not an all or nothing proposition. Humans are not born with

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a theory of mind. They develop their knowledge about the states of mind of others slowly, over time. Even in the case of normal adults, it is arguable that many continue to develop their theory of mind over a lifetime of interacting with others. More mature adults tend to understand more subtle issues of state of mind than less mature adults.

In any communicative encounter, one can take a normative view, suggesting that the better theory of mind is that which would give a correct understanding of the majority of interlocutors. Alternatively, one might take a transactional view, rating as the better theory of mind that which explains the behavior of one's current interlocutor, no matter how atypical his or her state of mind might be. The importance of this distinction is often lost in human to human communication. When an autistic child fails to understand an interlocutor's point of view, often it is assumed that this is because the child does not realize that the other party has a mind. The possibility that the child assumes the other party has a mind *just like his own* is often discounted.

When we began floortime with Bow, both Bow and the researchers had an essentially normative view of each other's states of mind. The norms of each party were largely based on introspection. Bow assumed we knew what he had said, when he answered our questions at a rate of speed which would have been sufficiently slow for him to understand the utterance. The researchers, on the other hand, assumed that Bow's lexigram pointing would proceed at a rate of speed that we could follow. Each side ignored the point of view of the other.

This communicative impasse was resolved by Bow when he chose to use our hands as pointing devices in order to gain our joint attention.

It turned out that in our case, floortime helped us, not because it allowed us to view things from Bow's perspective, but rather because, little by little, in the course of play, Bow learned what he had to do in order to reach us. It may be that many children who are considered to be behind in their development are facing similar problems of learning how to interact with adults who are much slower than they are.

4. JOINT ATTENTION. In the following transcriptions of video clips[3], we will see how Bow attempted to communicate using an OHP, but was not observed until he resorted to RH:

(1) 07021603-3 Feb. 16, 2007
Bow (RH): CHASE
Aya: Who? MOMMY BOW PHILLIP CARRIE (shrugging) Who?
Bow (simultaneously): (OHP) MOMMY (Aya doesn't see.)
Carrie: He just kind of hit "MOMMY" with the back of his hand.
Bow (PR): MOMMY CHASE BOW

In Clip No. 07021603-3, Bow and Aya Katz were on one side of a glass partition, while Carrie Stengel and Phillip Jones were on the other side. There were four lexigrams for names

[3] Thanks are due to Danay Downing, Mary Dunham, Phillip Jones, Eden Michaelov and Carrie Stengel for their work with Bow, and the camera work, editing and transcriptions upon which this section is based.

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posted on the glass: MOMMY (referring to Aya), BOW, CARRIE, and PHILLIP. There were three lexigrams for actions on the glass: CHASE, BLOW and KISS. Bow could ask for each of the participants to perform the transitive action on each of the other participants. If the two selected participants were on the same side of the glass, the action was performed with actual touching. If the two participants selected were on different sides of the glass, the action was performed through the glass, in a ritualistic fashion, without real touching.[4]

Bow used the researcher's hand to select the lexigram CHASE. Aya asked him orally "Who" and then pointed at each of the possible answers, then repeated "Who", shrugging. While Aya was engaged in naming the possible participants for the CHASE action, and before she had shrugged, Bow selected MOMMY. However, Aya was so busy talking and pointing, that she did not see him do this. By the time it was pointed out to her that Bow had made his selection, Bow was not willing to say anything more, and Aya prompted him to say MOMMY CHASE BOW, before she began chasing him around the room to his great delight.

In order to sustain a conversation, interlocutors must be open to unexpected communication from the other party. Part of the reason that Bow's progress under floortime was stalled was that we were unable to respond in real time to Bow's unexpected comments. An example of this, where Bow's OHPs were completely missed and ignored is set forth below:

(2) 07030908-1 March 9, 2007

Carrie: Okay, all right, ready to play the new toy game? All right, let's play, let's play. Okay, Bow, you have to watch. You have to watch where I put it, okay?

Carrie: Okay, you watch where I put it.

(Carrie holds the green bowl and the blue toy up for Bow to see. Then she hides the blue toy beneath the green bowl. Bow makes raspberry sounds.)

Bow (OHP): TOY BLUE (Carrie doesn't notice.) BLUE TOY. (Carrie still doesn't notice.)

Carrie: Okay, okay, Phillip, Bow's ready to tell you. He saw where it went.

Phillip: (approaching the glass): Where is it?

Carrie: Hey, Bow, can you tell Phillip where it is so that you guys can play with it? Can you tell him? He doesn't know.

(Bow runs off to the far corner of the room and stays there for a while.)

Phillip: Bow, come here. Bow, come help me.

Carrie: Can you help him?

Phillip: Bow, help me.

Carrie: Come help Phillip find the toy.

(Bow approaches the glass, then walks away.)

[4] The glass partition was where the words were posted. Words had to be posted on the other side of the glass from Bow in order to conserve resources, otherwise he would destroy them. Only one person went in with Bow each time, while the rest participated on the other side of the glass to avoid power struggles.

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(2) **Carrie**: Aw, you guys aren't going to get to play with it then.
Phillip: Bow, where is it? Do you know?
Carrie: You know where it is. Don't you want to play with it? Do you want to play with the new toy?
Phillip: (Reaching out with his arm and offering Bow his hand) Help me.
(Bow comes back and takes Phillip's hand.)
Carrie: Show him where it is.
Bow (RH): GREEN
Phillip: Green.
Carrie: Yay! It was under the green one, wasn't it? Okay, you guys can play with it now.

In Clip No. 07030908-1, Bow and Phillip Jones were on one side of the glass, while Carrie Stengel was on the other. As part of a game that targeted issues of theory of mind, Phillip was to close his eyes, while Carrie hid a toy under one of three colored bowls: green, blue and yellow. The object of the game was for Bow to tell Phillip under which bowl the toy was hidden. If Phillip guessed correctly, then Bow would get to play with the hidden toy. However, while Carrie was busy hiding the toy, Bow pointed at the lexigram TOY followed by the lexigram BLUE. When Carrie ignored this, Bow pointed again to the lexigram BLUE, followed by the lexigram TOY. Carrie again did not see. By the time Carrie was ready to pay attention to what Bow had to say, Bow did not want to say anything anymore. Eventually, after much cajoling, Bow took Phillip's hand and used it to point at the lexigram GREEN, to identify under which bowl the toy was hidden.

Carrie Stengel reported that after she watched the video footage in Clip No. 07030908-1 for the first time, she did not yet see that Bow had said "BLUE TOY." Even when she began to cut the unedited footage into small clips, she still did not see what Bow had said. It was not until after she began to transcribe the dialogue, slowing the footage down and observing each segment of the exchange separately, one utterance at a time, that she noticed that Bow had said "BLUE TOY." By then, it was entirely too late to reply to Bow's spontaneous utterance. Since Bow could not make the researchers pay attention to anything unexpected that he had to say, he was trapped in a game of multiple choice communication. He could answer Carrie's question about where the new toy was hidden, or he could refuse to answer, but he had no ability to change the course of the conversation. Bow must have experienced many such moments of frustration at being ignored during the first two years of play therapy before the problem came to our attention.

The method of transcription changed considerably during the fall of 2007. From September of 2005 to September of 2007, handwritten notes and video clips were two separate methods used to log exchanges with Bow. When video footage was shot, it was never transcribed, since it was believed that a single viewing would suffice to see the contents of a conversation with Bow. On other occasions, no footage was shot, but a volunteer kept handwritten notes of the exchanges. The handwritten notes were later transcribed into dialogue form. As a result, when we had written documentation of conversations, there was no video footage to review. When we had video footage, there was no written transcript.

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In the fall of 2007, the method of transcription was overhauled, and now each play therapy session with Bow was cut into small clips of approximately three minutes each, and then each clip was transcribed into dialogue form. The intent was to provide a streamlined method of storing data. The unexpected bonus was that we suddenly began to see things that Bow had said, and we began to realize how much faster he was at using lexigrams than we were.

During the two year period, from 36 months to 60 months of age, Bow had many opportunities to answer questions and make requests, but he was seldom observed to use more than one lexigram at a time. His progress was characterized by rapid sprints forward with the arrival of each new volunteer, followed by periods when he refused to deploy his lexigrams except with his adoptive mother during mealtime. Even then, with the passage of time, he increasingly preferred to use RH over OHP.

In time it became clear that using RH was the only method Bow could devise to ensure the joint attention of his interlocutor. While this state of events was unfortunate because it created difficulties for third party onlookers to observe that Bow was indeed speaking for himself, it did allow Bow to move forward, and it paved the way for the breakthroughs to come.

5. BOW'S LINGUISTIC BREAKTHROUGHS EARLY IN THE SUMMER OF 2007. In July of 2007, Bow began to make progress in employing his lexigrams to talk about topics of interest to him, rather than necessarily answering the questions posed to him by others. His use of RH ensured that researchers attended to his unexpected comments.

(3) 07070201-1 July 2, 2007
Aya asks and points: Okay. Which bowl, the YELLOW, the GREEN or the BLUE, should I turn over? Which toy do you want — the one under the YELLOW, GREEN or BLUE bowl?
Danay: Which toy do you want?
Bow (RH): SHOE
Aya: Well, I don't know where the shoe is. Is there a shoe?
Danay: Oh, he's untied my shoe.
Aya: I guess Bow wants to play with Danay's shoe.

In Clip No. 07070201-1 Bow selected his own topic. Bow has always been fascinated by shoes, and while he does not like wearing them, they rank high in his list of favorite playthings. When researchers tried to entice him with a different toy, playing the colored bowl game, he preferred to untie the shoelace of his current playmate, Danay Downing, while pointing at the lexigram SHOE. While this was only a one word utterance, it represented a leap in Bow's communicative range. He chose the topic, and he was talking about his own focus of interest. This is the beginning of the spontaneous use of language in context.

(4) 07070504-4 July 5, 2007
Aya: ? מה אתה רוצה עכשו 'What do you want now?'
? אתה רוצה משהו אחר 'You want anything else?'
Bow, RH: לאכול 'TO EAT'.

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(4) **Aya:** ? לאכול מה 'To eat what?'
Bow, RH: אדום 'RED'
Aya: ? אתה רוצה אדום 'You want red?'
? איזה דבר אדום אתה רוצה 'What red thing do you want?'
? אתה רוצה תפוח ? כן או לא 'Do you want an apple? Yes or no?'
Bow, RH: לא 'NO.'
Aya, while pointing: ? אתה רוצה... מה עוד יש לנו אדום 'You want... what else do we have red?'
? אתה רוצה ענבים אדומים ? כן או לא 'Do you want red grapes? Yes or no?'
Bow, RH: לא 'NO.'
Bow, RH: משהו אחר 'SOMETHING ELSE.'
Aya: משהו אחר אדום 'Something else red.'
Aya gets the watermelon and asks: ? האם זה מה שאתה רוצה ? כן או לא
'Is this what you want? Yes or no?'
Bow, RH: כן 'YES.'
Aya: .זה אדום. זה אבטיח 'This is red. This is a watermelon.'

In the July of 2007 Bow found creative ways of using his limited store of lexigrams to talk about whatever subject matter presented itself. In the past, Bow had used the lexigram SOMETHING ELSE to ask for anything he did not have a word for. Now he was using the color of foods for which he had no lexigram to identify which food he wanted. In the course of the discussion in Clip No. 07070504-4 Bow closed 5 circles of communication in helping to select what he wanted. Here are the circles numbered

1. Q :What do you want? A :To eat.
2. Q : To eat what? A :Red.
3. Q : An apple? A : No.
4. Q : Grapes? A : No. Something else.
5. Q : Is this what you want? A :Yes.

While the researcher in this clip was leading the conversation by following up every answer with a question, Bow was making linguistic choices at every turn to help zero in on what he wanted.

In time, Bow began to use the color of a food in order to identify even foods that he did not wish to eat. He began to call the cereal that he saw his mother and sister eat at breakfast BROWN, using the Hebrew lexigram for that color. He did this even if he did not wish to eat cereal. Sometimes he would merely comment on the cereal-eating event and then refuse to eat the cereal when it was offered.

What happened next, as it appears in Clip No. 07071701-1 was that Bow used the lexigram BROWN, in English, to comment on an event he had not personally witnessed.

(5) 07071701-1 July 17, 2007
Eden enters and locks door.

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(5) **Eden:** Hi, Bow. (He turns to her.) What? What's up?
Bow (RH): BROWN.
Eden: Brown? What?
Bow (RH): MOUTH.
Eden: Mouth? *This* is your mouth. This *is* your mouth.
(Bow smells Eden's mouth.)
Eden: Are you telling me I just ate cereal? I just ate cereal. I know you call cereal brown sometimes. Is that what I ate? Is that what Eden ate?

Bow had referred to cereal as "brown." In those other instances, he was either requesting cereal for himself or commenting on the fact that others were currently eating cereal. Here, he used the lexigram BROWN to comment on what someone had eaten outside his presence. He could smell cereal on Eden Michaelov's breath. He chose to communicate this to Eden. It is even possible that he inferred from this that Eden had eaten cereal, although we cannot be sure of the inference.

6. CONCLUSION. The events narrated in this paper marked only the beginning of a series of breakthroughs that Bow underwent in the summer of 2007. The remaining breakthroughs, which occurred at the end of July and in the month of August, are outside the scope of the presentation on which this article is based, as they occurred after the LACUS conference at Eastern Kentucky University. They will be documented in future publications.

For the time being, it is sufficient to note that by resolving the problem of joint attention, Bow was able, in July of 2007, to initiate spontaneous comments on a topic of his own choice and to express his own preferences by closing as many as five circles of communication. He was also able to comment on the sensory evidence of past events that occurred outside his presence. While Bow's utterances still tended to be composed of single words, the conversations he engaged in were coherent and involved coordinated turn-taking.

In this paper we have seen how the problem of synchronizing the relatively slow processing rates of humans with the relatively fast rate of chimpanzees was resolved by Bow through the use of RH as a prop to gain the joint attention of his interlocutors. When two parties are communicating at a mismatched speed, it seems inevitable that the faster party will have to slow down, as it is unlikely that the slower party can significantly alter the optimal speed of processing that is dictated by anatomy and metabolism. In human-chimp communication, the slower party is the human.

REFERENCES

GREENSPAN, STANLEY & SERENA WIEDER. 2006. *Engaging autism*. Cambridge MA: Da Capo.

SAVAGE-RUMBAUGH, E. SUE, ROSE A. SEVCIK, D.M. RUMBAUGH & ELIZABETH RUBERT. 1985. Animal intelligence. *Philosophical transactions of the Royal Society of London. Series B, biological sciences* 308(1135):177–85.

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Savage-Rumbaugh, E. Sue, Jeannine Murphy, Rose A. Sevcik, Karen E. Brakke, Shelly L. Williams & D. M. Rumbaugh. 1993. *Language comprehension in ape and child*. Monographs of the Society for Research in Child Devlopment 233. Chicago: University of Chicago Press.

Povinelli, Daniel J. 2004. Behind the ape's appearance: Escaping anthropocentrism in the study of other minds. *Daedalus* 133(1):29–41.

Segerdahl, Par, William Fields & Sue Savage-Rumbaugh. 2005. *Kanzi's primal language: The cultural initiation of primates into language.* New York: Palgrave Macmillan.

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