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ORIGINAL PAPER

Variations in an African Grey parrot's speech patterns following ignored and denied requests

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Abstract Communicative competence is one measure of an individual's ability to navigate conversations with social partners. The current study explored the possibility of basic communicative competence in a non-mammal speaker, a speech-using African Grey parrot. Spontaneous conversations between one Grey named Cosmo and her caregiver were recorded, from which three corpora (i.e., bodies of text) of Cosmo's vocalizations were developed: (1) Baseline: Vocalizations containing no requests, (2) Ignored Requests: Vocalizations immediately following Cosmo's caregiver ignoring Cosmo's requests, and (3) Denied Requests: Vocalizations immediately following Cosmo's caregiver denying Cosmo's requests. The distributions of social (e.g., "I love you," kiss sounds) and nonsocial (e.g., answering machine beeps, "That's squirrel") vocalizations, as well as speech and nonword vocalizations, were statistically different across the three corpora. Additionally, qualitative analysis of the datasets indicated Cosmo was persistent in repeating vocalizations when denied and ignored, and interrupted her caregiver more often when requests were denied compared to ignored. Neither repetition nor interruption occurred during the Baseline conversations. The data indicate that despite the outcome being the same (i.e., request was unmet), Cosmo treated an ignored request differently than a denied request, modifying her vocalizations in accord with the specific context. Such modification is evidence of basic communicative competence.

Keywords Communicative competence · African Grey parrot · *Psittacus erithacus* · Speech · Requesting behavior · Communicative persistence

Introduction

The extent to which an individual knows what to say and how to say it appropriately in a given social context is a reflection of that individual's *communicative competence* (Hymes 1972; Paltridge 2006). Communicative competence does not refer simply to knowledge of language, but also includes the dynamics accompanying interactions with social partners. For humans, this ability takes into account the social and cultural settings in which an interaction takes place, the nature of the conversation, the relationship between speakers, and societal norms and expectations—thus extending beyond the grammatical rules of language (Paltridge 2006).

Like the grammatical features of language, communicative competence is cultivated through frequent social interaction with others (Axia 1996; Harbaugh et al. 2007). However, development moderates this learning process, especially with respect to higher-order cognitive abilities such as perspective taking (Axia 1996; Clark and Delia 1976; Pellegrini et al. 1984). Perspective taking is argued by some to require theory of mind—or the ability to understand that another's thoughts, feelings, and desires are different from one's own (Premack and Woodruff 1978). Early work by Clark and Delia (1976) established a link

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between perspective taking and persuasion—one feature of communicative competence. These authors tested 7- to 14-year-old children and found that as children aged, their use of higher-order persuasive strategies (e.g., supplying advantage to addressee, "If you let me have a party, I'll wash your car for you") increased, while use of lower-order strategies (e.g., no support or demonstration of need for request, "I would enjoy a party") decreased. Very recently, Slaughter et al. (2013) assessed the relationship of age, persuasive argument generation, and scores on a theory of mind task (a false belief test). As expected, as age increased, so did the number of persuasive arguments. When age was controlled for, there was a positive correlation between number of persuasive arguments and scores on the theory of mind assessment, further illustrating the link between cognitive development and communicative competence.

Along with persuasive strategies, requesting behavior is one of many social strategies under the umbrella of communicative competence. Requesting behavior can be classified as an interactive *control act* where the purpose is to attract the attention of a social partner and make a case that convinces the partner to satisfy a need, while still maintaining the social relationship (Ervin-Tripp 1982; Stein and Albro 2001). Age-moderated qualities of the request (e.g., politeness), the persuasiveness of the request, the relationship between the requester and hearer, as well as the effect on the hearer of granting the request (Brown and Levinson 1987) are just some of the factors which contribute to whether requests are denied or accepted.

In humans, the earliest requesting strategies involve gesturing. Pre-linguistic infants between one and 2 years incorporate pointing, vocalizing, and visual checking with the social partner. In response to either being ignored or failing to elicit a response from a caregiver, children as young as 1.5 years strategically respond by (re)establishing mutual attention, employing repetition, and/or modifying requests (Keel 2015; Marcos and Bernicot 1994, 1997). As children develop, perspective taking and additional social and cognitive skills such as persuasion are incorporated into the management of unmet requests (Stein and Albro 2001).

Speech acts associated with forming an argument/request and responding to denied or ignored requests are much different in children who have not yet developed perspective taking compared to older children and adults (Clark and Delia 1976; Ervin-Tripp et al. 1990; Wootton 1981). While children under age three modify request form (e.g., politeness) based on the identity of the addressee (Ervin-Tripp et al. 1990), their request tactics are basic and offer little support for why those requests should be granted (Clark and Delia 1976). Further, these youngest children respond to unmet requests more often with "insistence strategies" as Stein and Albro (2001) call them: repetition, repetition with aggravation, threatening, or pleading (Clark and Delia 1976; Ervin-Tripp et al. 1990; Garvey 1975).

By around 4 years of age, children still rely heavily upon repetition of requests (Wootton 1981), but can provide more justification (Clark and Delia 1976; Ervin-Tripp et al. 1990), suppress frustration after refusals (Ervin-Tripp et al. 1990), employ greater repetition of the addressee's name before retrying an ignored request (Garvey 1975), and modify their argument strategies in response to the social partner's identity (Stein and Albro 2001).

By age 5 or 6 years, depending upon the task presented, children will consider the desires of others in their requesting behavior. This reflects the clear presence of perspective taking (Axia 1996; Clark and Delia 1976). Around this age, requests incorporate compromise and bargaining (Weiss and Sachs 1991). For example, Weiss and Sachs refused three- to 6-year-old children's persuasive attempts during a role play task. Weiss and Sachs noted that bargaining behavior was observed in the oldest children who used phrases such as "I'll give you a million dollars if…" (see Bartsch et al. 2010, for evidence of bargaining in everyday conversation by younger children). It is not until adolescence that the greatest attunement of the individual to social partners' psychological states occurs (Clark and Delia 1976). Thus, while much of requesting and denied/ignored request behavior is learned, predictable patterns do surface as socio-cognitive abilities develop.

Like humans, other social species must maintain positive relationships during interactions with conspecifics. It is not surprising, then, that features of communicative competence appear in the nonhuman literature. For example, "politeness" in requesting behavior has been documented in apes' usage of artificial and species-normal communication systems. In a laboratory setting, Lana the chimpanzee, *Pan troglodytes*, was documented using the Yerkish symbol for "please" prior to requesting objects like music or water (Rumbaugh 1977). It is important to note, however, that the "please" symbol started the keyboard, and so was necessary to begin communicative interaction. One of Fouts' (1997) chimpanzees, Washoe, was trained to use "please" in the form of a manual gesture. Fouts describes one signed conversation between Washoe and a volunteer who had just had a miscarriage. The volunteer signed to Washoe MY BABY DIED. In response, Washoe held the volunteer, and signed PLEASE PERSON HUG. At the surface, this use of "please" more closely approximates humans' use of the word than Lana's required use of the "please" symbol to begin requests. Finally, as part of their natural communication system, chimpanzees will often present an up-turned palm during begging (van Lawick-Goodall 1968). Some have described this behavior as a symbol of "politeness" (e.g., Corballis 2003).

Evidence for strategic use of persistence, repetition, and elaboration by captive and/or wild apes has also been observed (Roberts et al. 2013; Greenfield and Savage-Rumbaugh 1993; Leavens et al. 2005). Roberts et al. (2013) reported that when one chimpanzee's response partially matched the sender's goal, the sender repeated the gesture. However, when the receiver's action did not match the intended behavior at all, the sender elaborated on it by providing a different gesture with a similar function. In human–chimpanzee interactions, Greenfield and Savage-Rumbaugh (1993) observed repetition being used as a communicative tool to signal request and excitement, among other functions.

Despite examples of nonhumans displaying communication strategies which would be indicative of communicative competence in humans, the phrase itself is rarely used. Pepperberg (1988) and Luef and Liebal (2012) used *communicative competence* to describe avian and ape communication, respectively. However, whether these authors meant the more pragmatic, linguistics definition (Hymes 1972; Paltridge 2006) is not completely clear. Therefore, the current study explored one speech-using African Grey parrot's (*Psittacus erithacus*) requesting behavior within the linguistics framework of communicative competence.

Our predictions were grounded in the view that, like other aspects of communication, requesting behavior (gestural or vocal), regardless of species, is associative in nature and refined in accord with the overall context of learning to manage interactions with others (Owings and Morton 1998). This approach supports a phylogenetically wider examination of communicative competence, whether with humans via speech or among conspecifics via species-typical communicative pathways. From an associative perspective, individuals learn through interaction with familiar and new social partners what "works" and what does not work to achieve one's goals. With respect to requesting behavior, Pepperberg's (1988) observation that the African Grey parrot she studied refused a grape then repeated his request for banana when his request was unmet can be interpreted as evidence of communicative competence in the form of repetition of an unmet request.

We hypothesized that the parrot we worked with, Cosmo, as a result of extended conversational practice with her owner, BJ, would have developed additional strategies for managing unmet requests. Specifically, we predicted Cosmo would treat the context of having a request ignored as distinct from having a request denied—resulting in qualitatively and quantitatively different vocal behaviors. Finally, research suggests that African Grey parrots may engage in perceptual perspective taking (Péron et al. 2011). Thus, in addition to these pre-specified analyses, we used detailed discourse analysis to reveal any requesting behaviors that reflected more advanced communicative competence, such as bargaining.

Method

Subject and housing

Cosmo was 6 years old at the beginning of data collection. Cosmo was purchased by BJ from a pet store in 2002 at 5 months old. Although Cosmo had some experience hearing other human speakers, BJ was her sole caregiver. BJ established a simplified grammar with limited vocabulary by labeling new objects for Cosmo and correcting Cosmo's misuse and mispronunciation of words. Social interaction with BJ was the primary means by which Cosmo acquired melodies, English speech, and some nonword sounds like kiss noises. Additional nonword sounds such as microwave beeps were acquired naturally. Two female dogs also resided with BJ and Cosmo at the time of data collection.

All video-taping was conducted at BJ's home with Cosmo in her primary cage (55.9 × 61.0 × 83.8 cm, with perch extending 40.6 cm from top) which was located in a sunroom. Food and water were provided ad libitum throughout testing. All procedures were performed in accordance with institutional guidelines for the care and use of animal subjects.

Recording and transcriptions

The recordings and transcriptions came from a larger, original dataset (Colbert-White et al. 2011). We present here an overview of procedures with relevant additional details included. Three weeks prior to testing, Cosmo was habituated to a Sony DCR-TRV39 mini-DV video camera on a tripod 1.5 m from the cage. Cosmo's cage was the only object in the camera frame. The camera's built-in microphone (32 kHz, 16-bit audio) recorded all audio. After the habituation phase, BJ recorded five, hour-long events at her leisure in each of two locations during times when she thought Cosmo would be particularly talkative. These locations were BJ's reading chair in the sunroom and BJ's desk in the office out of sight (see Fig. 1). BJ was asked to ignore and deny Cosmo's requests at will across the sessions. That is to say, each hour-long session contained both ignored and denied requests. In order to mimic normal social interactions, BJ was not given explicit instructions for how long to wait before responding to ignored requests or giving into denied requests. However, we did ask that BJ never give into Cosmo's requests to be let out of her cage. This was done for video-taping and audio-recording purposes.

Videos were transcribed using the code "ID" (i.e., indistinguishable) whenever vocalizations were not clear. Syllables and fragments were transcribed as they were heard (e.g., "tele" and "showe" as in "telephone" and

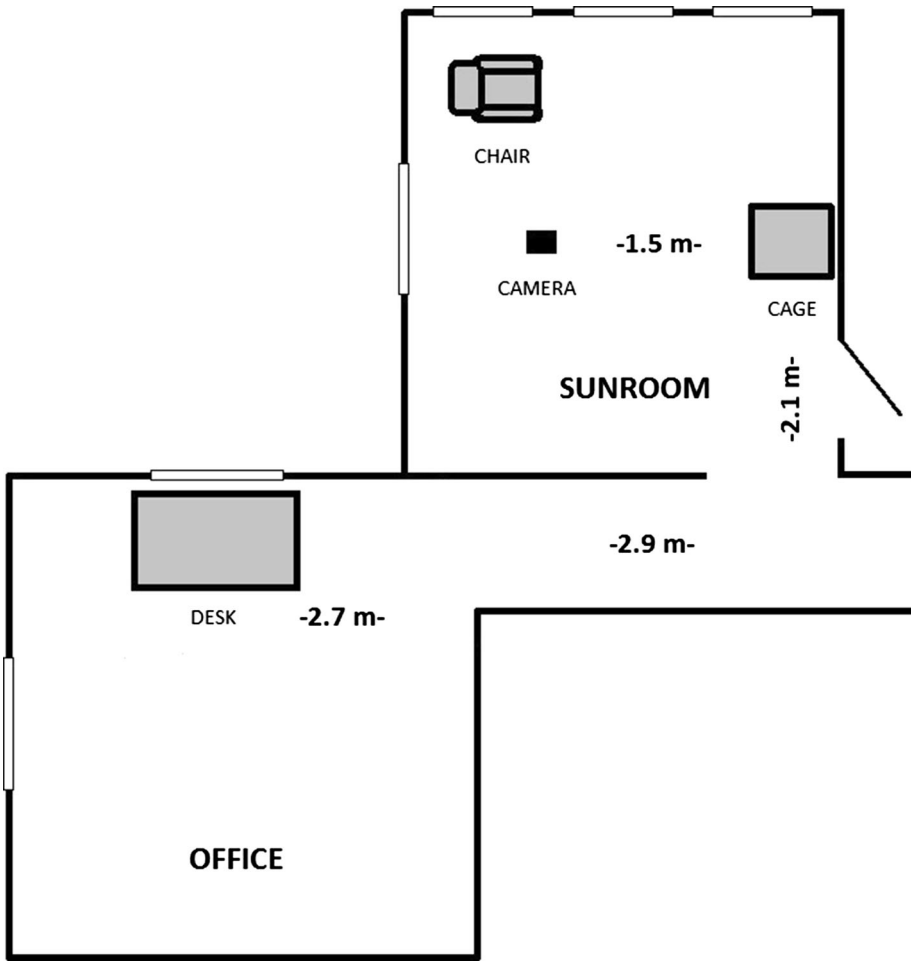

Fig. 1 Floor plan of the testing space, including relevant dimensions and furniture for reference

"shower," respectively). To decrease experimenter bias, contextual information in the videos was not used to construct the transcriptions. Nonword sounds were transcribed with two- or three-letter codes (refer to the Online Resource for full nonword sound coding scheme). While the original Colbert-White et al. (2011) dataset excluded units which were uttered only once, all units from the original dataset were included in the current study's analyses. Fragments (e.g., "Mary is a doggie has") were excluded from analysis.

An independent observer had transcribed 13 % of the original dataset, and the range of Cohen's kappa coefficients for matching individual words/nonword sounds was .65–.97 ($Mdn = .80$). A previous study defined Cosmo's full repertoire as 278 units, where a *unit* was defined as 1–8 words and/or nonword sounds (see Colbert-White et al. 2011). These units were dichotomously categorized by ECW as either social or nonsocial. Social vocalizations included those related to physical or vocal interaction, requests, greetings, farewells, and generic conversation utterances (see Table 1 for examples). The full list of social and nonsocial vocalizations is provided in the Online Resource. Co-author HH independently categorized the 278 units. The percent agreement between ECW and HH was 91 %.

Table 1 Social vocalization examples

Category	Vocalization
Physical interaction	Wanna cuddle
	Come here
Vocal interaction	Wanna whistle
	DUW interaction
Miscellaneous	Wanna …
	Cosmo wanna …
Greetings	Hello
	Hi cos
Farewells	Good-bye love you
Generic conversation utterances	Fine thanks
	How are you

The SAE Phrase Frequency Tool (Strategic Analysis Enterprises, Inc., Williamsburg, VA) computer program searched for recurrent phrases, and not only single words.

This program is used by linguists to find recurrent phrases in text. The program tabulated the number of occurrences of all words and phrases ranging from one to nine words long that occurred at least once. Nonword sounds were considered words in this tabulation. To aid with qualitative analysis of the conversations, utterances that only occurred once were included, despite the inability to make comparisons across conditions. If a phrase only occurred as part of a larger phrase (e.g., "in a car" was only uttered as "go in a car"), then the program tabulated the larger of the two phrases.

Corpora preparation

One-hundred eighty minutes of footage were used to develop three corpora (bodies of text). This was accomplished using AntConc (v. 3.2.1w) freeware text analysis program. Keyword searches identified all of Cosmo's requests, from which the four most frequently requested items (cuddles, approaching Cosmo's cage, being let out of cage, and peanuts) were included in all analyses. The four types of requests were first divided into whether the request was denied or ignored. A denied request was considered one where BJ gave direct refusal. An ignored request was one in which there was no response from BJ within 30 s, or BJ's response came within 30 s but was meant to redirect the conversation away from the request rather than directly refuse (e.g., "Let's play telephone"). Cosmo's vocalizations during the 2 min following refused and ignored requests were extracted to create two different corpora. A third corpus without any requests from 8 different recording sessions (7 while BJ was in the room) served as the Baseline condition for comparison.

Data analysis

Comparisons among Ignored Requests, Denied Requests, and Baseline vocalizations were made first using a series of three Spearman's correlations (Baseline-Ignored, Baseline-Denied, Ignored-Denied) for evidence of differential use of individual vocalizations. Additionally, comparisons of distributions of word and nonword units and social and nonsocial units were made among the three corpora using Chi-square tests. All statistical analyses were evaluated at $\alpha = .05$ level.

Results

Preliminary findings

After combining vocalizations using the SAE phrase frequency table and AntConc, the Ignored Request corpus contained 54 unit types and 111 tokens. A *unit type* is a distinct repertoire unit, and a *token* is an occurrence of a unit type. For example, in the sentence "*The dog ate the bone*," there are four unit types and five tokens. The corpus consisted of 38 speech units, 11 nonword sounds, and 5 speech-nonword sound combinations. Sixty-eight vocalizations were social; 43 were nonsocial. The five most frequently uttered vocalizations were DUW, KS, "No," NWM, and "I'm here" (see Table 2 for nonword sounds appearing in this article). Nonword sounds comprised 40 % of the tokens. Vocalizations were predominantly requests for physical and vocal interaction, repeated requests and statements about getting out of the cage, as well as miscellaneous requests beginning with "wanna" (see Table 3 for examples).

The Denied Request corpus contained 139 unit types and 334 tokens. The corpus consisted of 112 speech units, 15 nonword sounds, and 12 speech-nonword sound combinations. One-hundred and fifty-two vocalizations were social; 182 were nonsocial. The five most frequently uttered vocalizations were DUW, NWM, "No", KS, and OOO. Nonword sounds comprised 34 % of the tokens. No clear patterns emerged in the content of the vocalizations, with the exception of a presence of utterances relevant to BJ's dogs (e.g., Hello Kerri, Mary, Mary has feathers MWH, Mary's a dog), which was not in the Ignored and Baseline corpora. Requests and statements relevant to BJ kissing, whistling, or approaching Cosmo's cage, and repetition of requests and statements relevant to being let out of the cage were also present.

The Baseline corpus contained 91 unit types (i.e., distinct utterance units) and 272 tokens (i.e., total utterances). The corpus consisted of 69 speech unit types, 16 nonword sounds, and 6 speech-nonword sound combinations (e.g., "DUW I'm here"). One-hundred and four vocalizations were social; 168 were nonsocial. The five most frequently uttered vocalizations were NWM, DUW, WBI, PH, and WW. Nonword sounds comprised 51 % of the tokens. Vocalizations were predominantly statements beginning with "Cosmo," greetings and farewells, and labels (see Table 4 for examples).

Table 2 Coding scheme for nonword sounds appearing in this article

Code	Description
DUW	Duet whistle
KS	Kiss sound
NWM	Other nonwhistle sound (i.e., miscellaneous)
WW	Wolf whistle
OOO	"Oooh" (ōō sound as in "yoo")
WBI	Wild songbird vocalization
PH	Telephone dialing beep

Table 3 Ignored corpus vocalization examples

Category	Vocalization
Interaction	Betty I wanna kiss on the beak KS KS Betty wanna kiss feathers MWH
	Come here
	Come here Cosmo wanna cuddle
	Wanna come here
Getting out of enclosure	Okay go up
	Wanna go up
	Cosmo go up
Miscellaneous requests	Wanna be a good bird
	Wanna go bed
	Wanna stay here

Table 4 Baseline corpus vocalization examples

Category	Vocalization
Cosmo statements	Cosmo poop
	Cosmo has feathers MWH
	Cosmo's a bird
	Cosmo's a girl
Greetings and farewells	Hello
	Hi Cos
	Good-bye love you
Labels	That's bark
	That's Betty kiss
	That's birdie
	That's tele

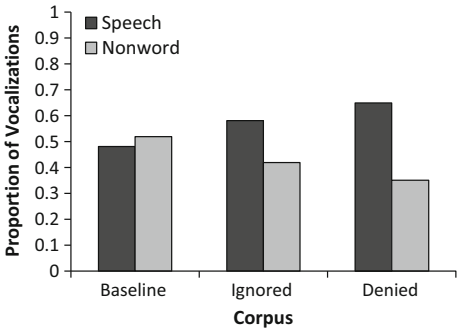

Fig. 2 Nonrandom ($p = .00024$) distributions of speech and nonword vocalizations during non-requesting conversation (*baseline*), immediately following ignored requests, and immediately following denied requests

Quantitative comparisons

The 20 most frequently uttered vocalizations for each of the three corpora appear in the Online Resource. Three Spearman's correlations determined there was no significant relationship among the rankings of the 20 most frequently uttered vocalizations for the three corpora pairs: Baseline-Denied, $r_s = 0.35$, Denied-Ignored, $r_s = -0.056$, Baseline-Ignored, $r_s = 0.039$, all $P_s > .05$. The series of correlations supported qualitative observations described later that the content of Cosmo's vocalizations was significantly different in the 2 min immediately following being ignored or denied compared to baseline.

To assess whether the distribution of speech and nonword vocalizations was nonrandom for the three corpora, and to account for the variability in size of the three corpora, a Chi-square test was conducted. The analysis showed that the rates with which Cosmo uttered speech and nonword vocalizations was significantly different across the three corpora $X^2(2, N = 690) = 16.71$, $p = .00024$. That is, Cosmo uttered speech and nonword vocalizations with differing rates following an ignored request (61 speech, 44 nonword), immediately following a denied request (207 speech, 112 nonword), and when she was not requesting anything of BJ (128 speech, 138 nonword). These data are summarized as proportions in Fig. 2.

A second Chi-square test assessed whether the distribution of social and nonsocial vocalizations was nonrandom for the three corpora. The analysis revealed that the rates with which Cosmo uttered social and nonsocial vocalizations was different across the three corpora, $X^2(2, N = 718) = 16.91$, $p = .00021$. That is to say, Cosmo uttered social and nonsocial vocalizations with differing rates immediately following an ignored request (68 social, 43 nonsocial), immediately following a denied request (153 social, 182 nonsocial), and when she was not requesting anything of BJ (104 social, 168 nonsocial). These data are summarized as proportions in Fig. 3.

Qualitative observations

Differences in rates of vocalization repetition were observed across the three corpora. There was no evidence of repetition of vocalizations in the baseline corpus—despite its longer length. However, Cosmo did repeat her requests when she was ignored or denied. This occurred both when BJ was in the sunroom with Cosmo and in her office. As shown in transcription excerpts in Table 5,

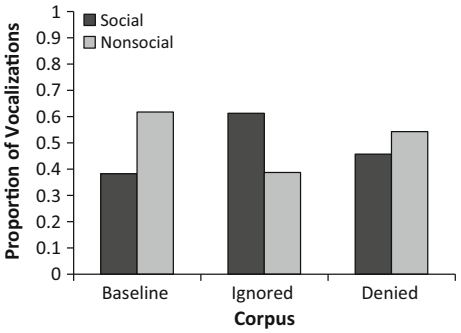

Fig. 3 Nonrandom ($p = .00021$) distributions of social and nonsocial vocalizations during non-requesting conversation (baseline), immediately following ignored requests, and immediately following denied requests

Table 5 Conversation excerpts containing repetition and redirection

Excerpt A
Cosmo: Wanna come here?
BJ: No i'm busy
Cosmo: Wanna come here
KS
Wanna come here
BJ: No Cosmo I'm busy
Cosmo: We're gonna go to kiss
KS
BJ: KS KS
Cosmo: Wanna come here?
Excerpt B
Cosmo: Cosmo wanna go up?
BJ: No Cosmo stay in cage okay?
Cosmo: Cosmo go up?
Cosmo be a good bird
Okay go up
Here step up
Hi
BJ: How are you
Cosmo: Wanna be a
Cosmo wanna come here
Okay cosmo wanna go up

Question marks were added post hoc to illustrate instances of upward tonal inflection. Original transcriptions contained no punctuation

repetition following unmet requests was sometimes accompanied by solicitations for interaction or possible redirection. For example, in Excerpt A, following three identically repeated and refused requests to be let out of her cage, Cosmo solicited interaction from BJ, then returned to asking to be let out. Excerpt B presents a different type of repetition from Excerpt A—alternative form repetition—in which Cosmo vocalized multiple utterances synonymous with the theme of being let out of her cage. Similar to

Table 6 Conversation excerpts containing interruption

Excerpt A
Cosmo: Wanna go up here?
BJ: Cosmo stay in cage okay?
Cosmo: Okay
BJ: Cosmo stay in cage
Cosmo: Cos don't bite okay
BJ: Okay cosmo stay in cage please
Cosmo: Wanna go up here
No
ID be a good bird
Don't bite okay
BJ: Be a good—
Cosmo: Cosmo wanna go up
be a good bird Cosmo
Excerpt B
Cosmo: Wanna be a good bird?
Cosmo go up
Cosmo go up
Be a good bird?
Okay
Cosmo wanna go up?
BJ: Cosmo stay in cage okay?
Cosmo: Cosmo wanna go up?
BJ: No Cosmo
Cosmo stay in cage
Cosmo: Be a good bird?
BJ: Cosmo's a good good bird—
Cosmo: Okay
Cosmo go up

Question marks were added post hoc to illustrate instances of upward tonal inflection. Original transcriptions contained no punctuation

Excerpt A, Cosmo responded to one minute of being ignored by BJ by saying "hi" (which elicited a response from BJ), then repeating her request after BJ replied.

There were differences between the Baseline and the Denied and Ignored request corpora regarding turn-taking and interruption. In particular, the Baseline contained four instances of simultaneous speech, where BJ and Cosmo both tried to take up the turn at the same time. Usually this occurred following a silence or during sessions when BJ was out of the room. For example, Cosmo asked "What that?" then proceeded to say "What" at the same time as BJ laughed. There were also two instances of interruption by BJ while Cosmo was vocalizing. In one case, Cosmo was vocalizing a long wild bird imitation, and BJ interrupted with "Cosmo." In the other interruption, BJ said "Wow" over a long nonwhistle nonword sound that Cosmo made. There was no evidence of Cosmo interrupting BJ in the Baseline; however, there were two instances of Cosmo interrupting BJ during unmet requests. As shown in Table 6, following a

Table 7 Conversation excerpt containing a denied then met request

Cosmo: Cosmo go up
BJ: No Cosmo stay in cage okay
Cosmo: Wanna be a bird?
BJ: Cosmo be a good bird
Cosmo go
Cosmo: Wanna
Okay
BJ: Okay be a good bird
Be a good bird
Wanna come here?
Here step up
Now be a good bird stay up here okay?
Please thank you
Cosmo: Wanna kiss?
KS
BJ: Stay up Cosmo
Cosmo: Wanna come kiss?
BJ: KS KS KS
I love you
Cosmo: Come here
BJ: Here I am
Cosmo: Please
KS KS
BJ: Okay
Okay Betty Jean wanna kiss
KS KS KS

Note. Question marks were added post hoc to illustrate instances of upward tonal inflection. Original transcriptions contained no punctuation

Table 8 Conversation excerpts containing persistence and refocusing

Excerpt A
Cosmo: Cosmo wanna go up?
BJ: No Cosmo stay in cage okay?
Cosmo wanna play telephone?
Telephone
Cosmo: You have reached
BJ: You have reached Cosmo
Cosmo: LA
BJ: LA
Cosmo: OOO
Wanna be a good bird
BJ: Yes Cos
Cosmo: ID
BJ: Be a good bird
Cosmo: Wanna be a bird
ID
BJ: Wanna be a bird
Cosmo: Cosmo go up
Excerpt B
Cosmo: Wanna peanut okay
Be a good bird okay go up
Wanna be a good bird
BJ: Yes be a good bird stay in cage okay
Cosmo: Wanna peanut okay

Question marks were added post hoc to illustrate instances of upward tonal inflection. Original transcriptions contained no punctuation

series of refusals, Cosmo interrupted BJ, causing BJ to stop vocalizing, in order to repeat her requests to be let out of her cage.

During three of the recording sessions, BJ did let Cosmo out. This went against the instruction we gave BJ to refuse Cosmo's requests to be let out; however, it did provide an opportunity to observe Cosmo's vocal patterns during initially unmet requests which were later met. For all three cases, once Cosmo was let out of her cage, she stopped requesting to be let out. The example in Table 7 shows Cosmo was very persistent in her requests, despite being ignored and refused. Once she was out, she stopped all cage requests in favor of kiss requests. Along a similar vein, Cosmo also maintained her requests in a goal-oriented fashion. The examples in Table 8 demonstrate how BJ's attempts to redirect Cosmo were rarely effective at making Cosmo stop repeating requests (Excerpt A), and even when Cosmo redirected herself via a new request, she still returned to the original request (Excerpt B).

To investigate strategic use of vocalizations during requesting, we recorded patterns in Cosmo's use of two phrases, "Wanna be a good bird" and "Cosmo don't bite okay." These frequently accompanied Cosmo's requests to be let out of her cage (see Table 9). These phrases were most likely said by BJ during times when Cosmo asked to be let out of her cage. Neither of these phrases appeared during the baseline, which confirmed they were specific and appropriate to the context of letting Cosmo out of her cage and to requests. Despite the phrases being associated with being let out of the cage, they were not uttered when BJ met Cosmo's request and let her out of her cage, even though BJ most likely would utter the phrases to Cosmo once she was let out (see Table 7 for example).

Discussion

The current investigation examined conversations between an African Grey parrot and her caregiver for evidence of communicative competence as defined in the linguistics literature (Hymes 1972; Paltridge 2006). The recorded conversations included spontaneous instances of both denied and ignored requests to establish how the parrot modified her vocalizations in response. We approached the

Table 9 Conversation excerpt containing "Be a Good Bird" and "Cosmo Don't Bite Okay"

Cosmo: Hi
BJ: Hi
Cosmo: MWH
BJ: Fine thank you
How are you?
Cosmo: Wanna be a good bird?
Cosmo go up
Cosmo go up
Be a good bird?
Okay
Cosmo wanna go up?
BJ: Cosmo stay in cage okay?
Cosmo: Cosmo wanna go up?
BJ: No Cosmo
Cosmo stay in cage
Cosmo: Be a good bird?
BJ: Cosmo's a good good bird—
Cosmo: Okay
Cosmo go up
Cosmo be a good bird?
Cosmo don't bite okay?
BJ: Okay
Cosmo: Cosmo wanna go up?
Cosmo go up
Cosmo wanna go up?
Okay
Come here
Here you are
I'm here

Question marks were added post hoc to illustrate instances of upward tonal inflection. Original transcriptions contained no punctuation

analyses from an associative perspective. Just as young children learn through experience what "works" and does not work when making requests and responding to unmet requests, we hypothesized that an African Grey parrot might also demonstrate these skills.

The results with Cosmo mirror that of young children's conversations. By as early as 1–1.5 years, preverbal children treat an ignored request as a failed attempt, and repair by employing strategies such as repeating the social partner's name before repeating the request (Golinkoff 1986). On the other hand, directly refused requests are treated differently from ignored requests (Ervin-Tripp et al. 1990; Garvey 1975; Wootton 1981; see Marcos and Bernicot 1994, 1997 for evidence of differential response to being ignored and refused in children under 2 years). Cosmo, too, treated being ignored differently than being denied. Previous work with Cosmo showed that during times when BJ ignored Cosmo in favor of talking to ECW, Cosmo's vocalization rate decreased substantially to only a few utterances per hour-long session (Colbert-White et al. 2011). Additionally, being vocally ignored was associated with a proportional increase in requests for physical interaction, a finding that Colbert-White et al. interpreted as Cosmo modifying her requests in response to BJ's refusal to interact vocally. This previous study and current results both support the notion that Cosmo not only noticed when she was being ignored, but vocalized differently to achieve her requesting goals depending on whether she was ignored or denied.

As we predicted, Cosmo's word choice following being denied and ignored was significantly different not only from the no-request baseline, but also from each other. Further, qualitative observations showed differential patterns in repetition, interruption, and placement of utterances within conversation. Thus, Cosmo modified her vocalizations to BJ based on context provided by the speech environment, which is Hymes' (1972) definition of communicative competence, and supports Pepperberg's (1988) suggestion that social interaction leads to development of communicative competence by vocal learning avian species, as for humans.

In the current study, following denied requests to get out of her cage, Cosmo uttered more vocalizations associated with the social context of being let out of her cage. This included mimicry of BJ telling Cosmo to be good and not to bite. Uttering these vocalizations during the context of Cosmo asking to be let out of her cage could represent a reflexive, contextually bound vocal behavior. That is to say, while requesting to be let out of the cage, Cosmo could be uttering all vocalizations surrounding that setting. This, however, does not explain the finding that Cosmo produced a different repertoire of vocalizations when such requests were ignored compared to denied. The word "bite," for example, was uttered 1 time when ignored compared to 16 times when denied (a frequency distribution which would be predicted by chance only 7 % of the time). Once Cosmo was let out, she stopped using words like "bite," though BJ would often remind her not to bite once she was let out. Rather than reflexively mimicking vocalizations surrounding a static social context, the results indicate that Cosmo instead first proposed a request, and then modified subsequent vocalizations in accordance with each new social circumstance introduced by BJ. That is to say, she used vocalizations strategically, in accord with her social partner's actions, not in accord with a particular event (e.g., getting out of the cage).

Considering that both ignored and denied requests have the same outcome (i.e., her request was unmet), Cosmo's differential responding reflects how finely she monitored and responded to BJ. Péron et al.'s (2010) work with African Greys corroborated these findings from a

behavioral perspective, reporting that Greys behaved differently when a social partner was unable versus unwilling to provide treats. These authors, like others (e.g., Premack and Woodruff 1978), explored theory of mind as a possible explanation for an understanding of what a social partner can and cannot do. However, we avoid framing the results of our study with respect to intention and theory of mind in parrots because in our view Cosmo's vocal behavior is not sufficient to discriminate between these two alternatives. The predictions about behavior that could be developed to conclude that Cosmo's behavior suggests theory of mind are the same as those that support interpreting the same behavior as the outcome of associative learning. Current methods do not allow us to tease apart intention or theory of mind from associative learning. In any case, Cosmo's communicative competence denotes strategic and sophisticated use of a learned vocal repertoire.

Probabilistic models of Cosmo's conversations with BJ may allow for more objective measures of intentionality. It may be possible, for example, to compare the probabilities of a particular vocalization occurring following a particular response from BJ. For example, Ervin-Tripp et al. (1990) noted that mitigating words like *please* after refusals appear in greater frequencies in the requesting events of 3.5-year-olds. This suggests strategic placement in response to the new speech context of refusal. Developing such a model would strengthen claims about Cosmo's use of her repertoire. In particular, intentionality, manipulation, and perhaps behavioral indicators of frustration (e.g., interruption in humans, Gallagher and Craig 1982) could be assessed in more detail.

The current study showed through a variety of measures that one captive African Grey has learned to use an artificial communication system in a goal-oriented manner during instances of relationship conflict brought about by denied or ignored requests. These results provide evidence for strategic requesting behavior by a Grey parrot which is qualitatively similar to communication data reported for children (e.g., Golinkoff 1986) and great apes (e.g., Cartmill and Byrne 2007; Roberts et al. 2013)—all of which conclude that intentionality drove requesting behavior. Like with the results of studies with captive apes, results with Cosmo are of particular interest because the communication system Cosmo uses to interact with BJ is not species-typical. Rather, as a highly social vocal learner, Cosmo acquired and effectively uses BJ's communication system. Whether or not wild African Greys monitor and modify species-typical vocalizations to achieve social goals, as has been demonstrated with wild chimpanzees' gestures (Roberts et al. 2013), has yet to be determined. However, Cosmo's ability to modify her species-atypical communication system to cope with variable social situations with her human caregiver suggests that wild Greys may modify their vocalizations with conspecifics to achieve social goals. This interesting possibility merits attention from researchers able to study African Grey parrots in species-normal environments.

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