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Are Conversations Between Dolphins and Humans Possible?

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Scientific speculations concerning the sophistication of dolphin communication systems have contributed to the notion that meaningful two-way communication between dolphins and humans is possible. This notion has garnered considerable support in the media and popular literature, resulting in an enduring myth that dolphins and humans can communicate in ways that rival, and perhaps even surpass, human-human communication. The truth, however, is quite different from the myth. Although humans and dolphins can certainly communicate with one another, communication between dolphins and humans has been quite limited to date. In fact, there is no compelling scientific evidence that humans and dolphins have engaged in meaningful conversations that involved mutual exchanges of information. In this paper, I consider the reasons why communication between humans and dolphins has been much more limited than many media reports suggest.

Scientists and laymen have long been interested in the possibility that dolphins and humans could engage in meaningful conversations of some sort. In general, scientists have been cautious in their interpretation of data relevant to this possibility (e.g., see Gregg, in press; Tyack, 1999). However, Lilly's (1962a, 1962b, 1967, 1978) early studies of dolphin communication and subsequent speculations concerning human-dolphin communication contributed to the notion that dolphins have sophisticated communication systems and to the belief that dolphins could converse with humans in much the same way that humans converse with one another if we could discover a common ground. These ideas have garnered considerable support in the media and popular literature, resulting in the prevailing myth that dolphins and humans can communicate in ways that rival, if not surpass, human-human communication.

The truth, however, is quite different from the myth. Although humans and dolphins can certainly communicate with one another, communication between dolphins and humans has been quite limited to date. We know precious little about the actual functions and content of dolphin communication systems, but we do know that humans can communicate a wide range of information to one another during conversational exchanges. Although it is possible that dolphins also exchange a variety of forms of information with one another, such communication among dolphins has yet to be demonstrated. More importantly for the topic of this paper, communication between dolphins and humans has not proven to be particularly meaningful (Gregg, 2012, in press; Kuczaj, 2012). At present, the safest conclusion concerning dolphin-human communication is that meaningful exchanges of information between humans and dolphins are qualitatively different from those that occur when humans converse. In fact, there is no compelling scientific evidence that humans and dolphins have or even can engage in meaningful conversations that involve mutual exchanges of information. Moreover, there is not a single convincing anecdote to suggest that a true conversation between a human and a dolphin has ever taken place.

Why the Distinction Between Communication and Conversation is Important

Conversations involve communication, but not all communication is conversational. Communication may be defined as the use of signals to convey information from a sender to a receiver (Bradbury & Vehrencamp, 2011). The transmission of information by the sender may be

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intentional but can also be unintentional. Thus, the intent of the signaler is not an essential component of communication – as long as the receiver receives the information, communication has occurred. Using this definition, there is no doubt that dolphins communicate in a variety of ways, including the use of sound, touch, posture, and movements (Dudzinski, Thomas, & Gregg, 2008; Herman & Tavolga, 1980; Tyack, 1999, 2000). However, many species exchange information and so such communication is common among non-human animals (Bradbury & Vehrencamp, 2011). The existence of communication systems in a species does not entail the ability to communicate with other species, let alone engage in conversations with them.

Dolphins' use of sound has received far more attention than the other modalities (Dudzinski et al., 2008; Herman & Tavolga, 1980; Kuczaj, in press; Tyack, 1999, 2000), perhaps because we associate acoustic signals with spoken language and so are more likely to look for parallels between dolphins' use of sound and our use of spoken communicative signals and symbols. For example, dolphins appear to use some whistles as contact calls and to facilitate reunions between separated animals (Janik, Sayigh, & Wells, 2006; Smolker, Mann, & Smuts, 1993). It is possible that dolphins use sounds and body postures to signal the intent to play (Blomqvist, Mello, & Amundin, 2005; Kuczaj & Makecha, 2008), and that some of the clicks produced by dolphins signal a dolphin's mood and/or the intent to "say" something (Blomqvist & Amundin, 2004). Although these are all intriguing possibilities, more data are needed to determine their accuracy since it is not clear what these calls actually mean to the signaler and to the receivers. We also know relatively little about the precise functions of dolphin signals. For example, it is likely that dolphins experience emotions. Given that they are social animals, it is also likely that dolphins possess the ability to interpret another dolphin's emotion state (Kuczaj, Highfill, Makecha, & Byerly, 2013). However, the manner in which they do so is unknown, as is the extent to which dolphins use sounds to express emotions.

Although dolphins clearly communicate with one another (and sometimes with us), there is no conclusive evidence that wild dolphins communicate with the *intent* to share information or change another's perspective. It is possible (perhaps even likely) that they do so, but it is also possible that much or even all of dolphin communication occurs unintentionally. Even if some dolphin communication is intentional, conversations require more than one-way intentional communication events. Bradbury and Vehrencamp's (2011) definition of communication requires the transmission of information from one being to another and a decision by the receiver about how to act on this information. Conversation requires much more than this.

Conversations are intentional and require cooperation among those involved in the conversation. In contrast, communication can occur in the absence of cooperation. A signaler may communicate something to a receiver without one or both parties intending to engage in a communicative act. This is not the case for conversations. Grice (1975, 1989) argued that meaningful conversations only occur when all members involved in a conversation are cooperating. Grice also noted that human conversations are implicitly governed by a number of rules, or conversational principles. If these rules are followed, participants in a conversation are truthful, efficient, stay on topic, and communicate in a way that the other participants can comprehend. We are not always aware of these conversational principles, and we may not always follow them. However, we certainly notice when someone violates one or more of these principles.

Conversations, then, are rule-governed. Without some sort of conversational principles, conversation is impossible. It is not surprising, then, that Stivers et al. (2009) found evidence that the rules that govern turn-taking in human conversations may be universal across human languages. Their study of ten diverse human languages revealed remarkable consistency in turn-

taking behavior. Regardless of the language being spoken, speakers who were engaged in conversations tended to avoid speaking at the same time but also avoided long bouts of silence between turns. Moreover, when silences occurred between turns, it tended to be for the same reasons across different cultures. Silences were more likely to precede indefinite answers to questions than definite answers. Silences also occurred more often when a speaker provided a negative answer to a question compared to a positive answer. The authors suggested that these turn-taking rules may be universal aspects of social interaction. This may be the case for humans, and it would be interesting to know the extent to which such rules are found in the natural communication systems of non-human species. Unfortunately, we know very little about the extent to which dolphins engage in turn-taking behavior while communicating with other dolphins (let alone with humans).

In a very real sense, successful conversations require that participants take into account others' perspectives, expectations, knowledge, and emotional states. These abilities are commonly referred to as "theory of mind" (Leslie, 1987; Wimmer & Perner, 1983). Although data suggesting that dolphins are able to consider others' mental states are sprinkled throughout the literature (Kuczaj, Tranel, Trone, & Hill, 2001; Tschudin, 2001, 2006; Xitco, Gory, & Kuczaj, 2004), the question of whether dolphins' theory of mind is sufficient for them to participate in conversations has not been answered.

Advances in Dolphin-Human Communication will Require a Better Understanding of Dolphin-Dolphin Communication

It is possible that dolphin-human communication has been limited by the fact that we have much to learn about dolphin communication systems (see Gregg, in press, for a more detailed consideration of this possibility). We know that dolphins produce a variety of sounds that may be communicatively significant. Some of these sounds are inaudible to humans, and so require specialized equipment for scientists interested in the communicative functions of such sounds. To further complicate the problem of studying natural dolphin communication, humans have evolved to localize sounds in air (Gibson, 1966) and so find it difficult to precisely localize sounds underwater. This means that even when we do perceive a dolphin sound underwater, we often experience difficulty in determining which dolphin produced the sound. Given that dolphins are social animals, it is not unusual for multiple dolphins to be producing sounds simultaneously or in rapid succession, and the inability to apprehend which dolphin is producing what sound has hindered our understanding of dolphin communication.

However, as daunting as the problems of hearing and localizing sounds are, it is even more difficult to determine what these sounds *mean*. A famous (among those who study dolphin communication) Far Side cartoon by Gary Larson pokes fun at English speaking scientists for failing to recognize Spanish phrases that the dolphins produced, one scientist exclaiming "we're getting another one of those strange 'aw blah es pan yol' sounds." In addition to tweaking the noses of monolingual scientists, Larson also highlighted the problem of segmenting the acoustic stream into meaningful units. Keeping with Larson's spelling, is "awblahespanyol" one word, two words, or the five words his cartoon scientists hear? Of course, units need not be words, for human languages can be segmented into phonemes, morphemes, words, or sentences. Nonetheless, Larson's example illustrates the problem of determining the units used in dolphin communication systems, a problem that has also been recognized in the scientific literature on dolphin communication (Gregg, in press; Hauser, 1996; Kuczaj & Kirkpatrick, 1993). The inability to identify units makes it very difficult to ascertain the meanings of the sounds one

hears. Unfortunately, we have yet to determine the communication units used by dolphins. Are the whistles used as contact calls a single unit or some combination of smaller units? If dolphins use some clicks to signal emotional state and/or intent to communicate, is such information contained in a single click or a series of clicks? If a series of clicks, how many clicks are necessary? How do these clicks differ from those used in echolocation? Answers to questions such as these are integral to a more complete understanding of dolphin communication.

As a consequence of our lack of understanding of the units used in dolphin communication, we do not know the extent to which these units are categorically perceived (Kuczaj & Kirkpatrick, 1993). Categorical perception of communicative signals is an inherent component of human speech processing, and young human infants use categorical perception to process human speech sounds (Werker & Desjardins, 1995). This means that humans process speech sounds in terms of categories. Decisions about speech sounds rest on whether a sound falls into a category of similar sounds rather than simply on whether or not a sound is identical to another sound. Categorical perception has been found in a number of species (Baugh, Akre, & Ryan, 2008; Harnad, 1987), but we have no evidence at this time that dolphins do so. One of the issues in the signature whistle controversy involves the extent to which a whistle can vary from a supposed signature whistle and still be considered an exemplar of that whistle (Caldwell, Caldwell, & Tyack, 1990; Harley, 2008; Janik et al., 2006; McCowan & Reiss, 1995). Although dolphins appear to use information about whistle shapes rather than specific acoustic parameters to categorize whistles (Harley, 2008), additional information about how much variation is tolerated before a sound pattern ceases to be perceived as an exemplar of a particular category, such as a signature whistle, is integral to understanding the nature of dolphin communication systems.

For anyone who has traveled to a country in which they did not understand the language, it should not be surprising that determining the units of a communication system is only part of the problem. What do these units mean? We are not very good at deciphering units and meanings for human languages that we find strange (i.e., outside our normal experience). This point was strongly made by Quine (1960), who provided an interesting thought experiment. To paraphrase Quine (and replace his rabbit with a dolphin), imagine yourself at a location where you understand nothing of the native language. You are walking on the beach with a local and she is pointing out stationary objects to you and producing sounds that you believe are individual names for each object. But then a dolphin chases a fish up onto the beach, grabs the fish with its mouth, and then wiggles its way back into the sea. The local exclaims "vigivia!" and points toward the location where the dolphin had herded and caught the fish. What does "vigivia!" mean? Does it mean "dolphin" Or "fish" Or "the dolphin caught a fish" Or "did you see that?" Or "that was the coolest thing I've ever seen" Or "that usually happens further down the beach" The possibilities are enormous. Given that you do not know if vigivia is one word, two words, three words or even more, it is very difficult to assign a precise meaning to the sound sequence you heard (the problem of determining units raises its head again). But even if you somehow knew that vigivia was one word (or two words, etc), there are still many possible meanings for that word (or word). Deciding on the correct one(s) is no easy task.

Quine's (1960) notion of the "indeterminacy of translation" emphasizes that decisions regarding the meaning(s) of symbols are rarely straightforward (see also Brown, 1973). This means that the use of context to interpret a signal's meaning is rarely sufficient to yield a definitive decision, particularly in cases where there is not a simple one-to-one correspondence between a sound pattern and a particular context. Flexible communication systems, such as those used by humans, consist of myriad relations between symbols and meanings, which often makes

the use of simple one-to-one correspondences between contexts and symbols inadequate to accurately identify meanings even if we know what the units of the communicative system are. When we do not know the units, the problem is magnified a thousand-fold.

Dolphin communication may be flexible (Kuczaj & Makecha, 2008; Tyack, 1999), and so the translation of dolphin signals will require both the determination of the units that dolphins use when communicating and a comparison of the use of individual units in isolation and with other units in a variety of contexts. These sorts of comparisons do not completely avoid Quine's (1960) "indeterminacy of translation," but they will facilitate more accurate hypotheses about the structure and function of dolphin communication systems.

Two-Way Communication Between Dolphins and Humans

There have been a number of attempts to provide contexts in which dolphins and humans could communicate with one another. These include the far-fetched dolphin-human translation device supposedly developed by Batteau and Markey (1967) that would provide "a basis for the development of a language between man and dolphin" (p. 84). Given the wide-spread interest in establishing dolphin-human communication, the lack of progress in the 46 years since this report demonstrates that the authors were at best somewhat premature in their claims. Lilly's (1965, 1967, 1978) attempts to teach dolphins English and to unravel the complexities of dolphin communication received considerable public attention, but provided little in terms of scientific accolplishments. The failure and scientific shortcomings of these and similar efforts have been described by Tyack (1999) and Gregg (in press), and so I will simply note here that efforts to teach dolphins human or human-like languages have not been successful.

The acoustic system of dolphins is not designed to produce sounds that correspond to human speech, and so attempts to speak with dolphins are doomed to failure if the criteria for two-way communication are conversations in English, Polish, or any other human language. Lou Herman and his colleagues (Herman, Richards, & Wolz, 1984) designed a gestural communication system that allowed humans to successfully request a variety of behaviors from dolphins. Although an effective means to study dolphin comprehension of gestural signals and an invaluable means to gain insight into dolphin cognitive abilities and processes (Herman, Kuczaj, & Holder, 1993; Kuczaj & Walker, 2012), this system was uni-directional in that it did not provide dolphins any means to communicate with humans (other than with either natural dolphin behaviors or behaviors in various testing situations).

Xitco, Gory, and Kuczaj (1999) created an underwater "keyboard" (see Figure 1) in which both dolphins and humans could activate keys to denote specific objects, locations, and activities. Humans modeled use of the keyboard by activating keys and than swimming to the object or location that had been designated, or performing the activity that had been signaled. Dolphins were not trained to use the keyboard but instead were provided opportunities to observe humans do so. Dolphins were curious about the human's behavior with this strange object, and began to use the keyboard themselves by using their rostrums to activate keys (see supplemental video on IJCP website). Although this study did reveal that dolphins and humans could use a keyboard to communicate with one another, the communication was limited. To be fair, this may have reflected issues with the communication system that was being used rather than a lack of ability on the dolphins' part to engage in more complex communication. The keyboard was too large to facilitate timely activation of successive keys, especially for slow-swimming humans. Attempts to model syntactic key use by human divers resulted in unfortunate delays between key presses, and so it is not clear that the dolphins understood that multiple keys were being used to

create a more complex message in these cases. Regardless, the dolphins mainly used the keyboard by activating single keys at a time to signal the need for human assistance to obtain things the dolphins desired (e.g., food, toys, tools).

Figure 1. A dolphin watches as a human activates a key on the underwater keyboard.

The instrumental nature of the dolphins' communication with humans was also evident in their pointing behavior (Xitco, Gory, & Kuczaj, 2001). The dolphins began to spontaneously point at objects they wanted but could not acquire without human assistance. Although the dolphins' pointing behavior demonstrated an awareness of a human's perspective (the dolphins were much more likely to point to an object if the human was facing the dolphin than if the human was turned away from the dolphin, Xitco, Gory, & Kuczaj, 2004), the dolphins only pointed when they needed help from a human. Unlike human children (Franco & Butterworth, 1996; Tomasello, Carpenter, & Liszkowski, 2007), the dolphins never pointed to simply direct attention to an object or to initiate a conversation about an object.

More recently, Herzing, Delfour, and Pack (2012) have attempted to communicate with wild dolphins via a portable underwater keyboard system that used visual and acoustic signals to denote objects that could be used in play. Female juvenile dolphins seemed the most intrigued by human activity with the keyboard, but actual two-way communication involving the keyboard did not occur. This is a longitudinal project, and one in which redesigns of the human/dolphin interface may eventually result in a much more dolphin friendly system. However, even if further

efforts with a system such as this yielded evidence that dolphins could learn to use a human/dolphin interface to request play objects, it seems most likely that in such cases the dolphins would use the system in an instrumental fashion, much as the dolphins studied by Xitco, Gory, and Kuczaj (1999) did. Advances in attempts to communicate with dolphins require both a dolphin-friendly system and communicative topics that go beyond that of providing dolphins with objects they desire. Otherwise, the communication that occurs will be quite limited.

Can we Converse with Dolphins?

The title of this article asked whether it is possible for dolphins and humans to engage in conversations. Although we cannot say for certain that dolphin and humans will never converse, the cross-species communication that has been documented to date falls far short of conversations. At the very least, the lack of success in this area suggests that we are a long way from achieving anything like human-human discourse when we communicate with dolphins. And it may very well be the case that conversations between dolphins and humans are impossible. This does not mean that dolphins and humans cannot communicate, for they certainly can and do communicate, but such communication is qualitatively different from human-human communication. Dolphin-dolphin communication may also be limited in comparison to human-human communication. As Herman (2009) recently noted, there is no evidence for human-like language in the communication systems of wild dolphins (see also Gregg, in press; Janik, 2009; Kuczaj, in press). It is certainly the case that dolphins have never been reported to discuss among themselves the possibility of communicating with humans. And if this seems like a ridiculous thing to mention, keep in mind that even young humans often discuss possibilities and hypothetical events (Kuczaj, 1981; Kuczaj & Daly, 1979). The fact that dolphins do not appear to do so is simply another indication of the vast gulf that exists between human communication and dolphin communication.

Even if it proves to be impossible to converse with dolphins, it is essential that we continue to unravel the manner in which dolphins communicate with one another. This is obviously important for scientific reasons, but it is also the case that any attempt to improve our ability to communicate with dolphins will require a better understanding of the ontogeny and functions of natural dolphin communication. In turn, this entails that we learn more about what dolphins like and dislike, as well as what motivates their behavior. It is impossible to understand a communication system without appreciating the users' predilections, drives, and concerns.

As Cheney and Seyfarth (1990; Seyfarth & Cheney, 2003) have emphasized in their studies of primate communication, it is important to consider the perspectives of both listener and signaler when investigating a communication system. From the primate listener's perspective, vocalizations function to inform others about aspects of the environment and the signaler's emotions and intentions. Such calls are clearly communicative, no matter what definition of communication one uses. However, Cheney and Seyfarth point out that the signaler may not intend to share any of this information. Thus, the communication is unidirectional. The receiver obtains information, regardless of whether or not the signaler intended to share the information. This distinction is important for the study of dolphin communication as well, for if it turns out that dolphin communication is only unidirectional, then conversations between dolphins do not exist, and it is unlikely that conversations between humans and dolphins will ever occur. However, if dolphin communication is bidirectional, then it is possible that dolphins have conversations. Understanding such dolphin "conversations," if they exist, will enable us to better design dolphin-friendly communication systems rather than the human-friendly ones that have

been tried to date. Using a system that is closer to the one that dolphins use naturally should significantly improve our ability to communicate with dolphins, especially if we can discover topics that are intrinsically interesting to dolphins.

At the present time, however, dolphin-human conversations are largely in the minds of the humans who believe that they can converse with dolphins. I noted the one-sided nature of such "conversations" in an interview with the New York Times (Olsen, 2011), and if one substitutes "dolphin" for "dog" in my statement "It depends on what you mean by communicate. I can communicate with my dog. But do I have conversations with my dog? Well, if I do, they're very one-sided," one has a succinct and apt summary of the current state of affairs insofar as dolphin-human conversations are concerned. Communication between dolphins and humans is possible (albeit in a very limited way). Conversations are not.

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