A CLOSER LOOK AT A SUPPOSEDLY ANUMERIC LANGUAGE[1]

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Languages without cardinal numbers are exceedingly rare, with only a few clearly documented cases. One such case is putatively Jarawara, an Arawá language that has been claimed to lack native number terms. Recently collected evidence demonstrating the existence of such native terms is described here. The terms in question were corroborated independently by seven Jarawara speakers. Additional evidence for these native numbers is provided via the description of an associated tally mark system traditionally employed by the Jarawara. Combined with previous published claims on other Arawá languages, the data presented here suggest that number terms existed in Jarawara and other Arawá languages prior to contact with non-indigenes.

[KEYWORDS: number, Jarawara, Arawá, typology, Amazonian]

1. Introduction. Languages with extremely modest number systems are typological rarities. Such cases are of interest to many linguists and other researchers, particularly those attempting to better document the interaction between numeric language and cognition (Gordon 2004 and De Cruz and Pica 2008, inter alia). One oft-cited Amazonian case, Pirahã (ISO code: myp), has been claimed to lack number terms altogether (Everett 2005), and this claim has been corroborated experimentally (Frank et al. 2008). Jarawara (ISO code: jap) is another language that has been considered a clear exemplar of anumericity in Amazonia (Epps 2006:260). According to the comprehensive survey of number system types in Hammarström (2010:17), it is one of the few languages in the world to have no number bases. This assessment, like Epps's, is based in large part on some claims from Dixon (2004*a*:559), who first suggested that the language lacks native number terms altogether:

It is likely that before contact with Branco culture, the Jarawara did not indulge in counting and did not use lexical numbers. A modern-day conversation such as 'How many fish did you catch?' 'Two (or three or seven or eleven)' simply did not occur.

The language did have the following intransitive verbs: (1) *-ohari*(*ha*)- 'be alone', (2) *-fama-* 'be a pair, be a couple (with)'.

[1] I would like to thank the Jarawara who made this work possible. I am also grateful to several *IJAL* reviewers for helpful comments, as well as the following people for sharing some of their knowledge of Arawá languages: Alan Vogel, Shirley Chapman, Marcia Suzuki, and Vladmir Cunha.

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However, on exposure to counting in Branco culture, the Jarawara began to count in their own language. Quite naturally, the meaning of *-ohari*(*ha*)- has been extended to also serve as a number 'be one', and *-fama-* has taken on the additional sense 'be two'. Other numbers are loans from Portuguese, for example, *terei -na-* (or *trei -na-*) 'be three', *kowato -na-* 'be four', *siko -na-* 'be five', *tee -na-* 'be ten' (from *três*, *quatro*, *cinco*, and *dez*, respectively). In short, while many of the Jarawara now employ Portuguese loanwords for numbers beyond two, the evidence suggests to Dixon that the people lack native terms for such concepts, and also that they did not count prior to their exposure to Portuguese.

There is much discussion in the cognitive sciences today on the role of number terms in numerical cognition (see, e.g., Condry and Spelke 2008). Recent work among other Amazonian tribes (Pica et al. 2004 and Gordon 2004) suggests that number words play a crucial role in numerical cognition, allowing for the creation of ligatures between two innate neurophysiological substrates—one devoted to the exact representation of numerosities of three or less and the other devoted to the approximate representation of greater numerosities (Condry and Spelke 2008). My own recent work with a colleague, among a number-less society, further supports this suggestion (Everett and Madora [in press]). Given the paucity of anumeric languages, of which there are only a handful of clearly documented cases among the world's extant languages (see Hammarström 2010:17–22),[2] each language of this type potentially represents an important test case for this issue, so that conflating cultural variables can be reduced to the extent possible in the formulation of hypotheses regarding linguistic effects on numerical cognition.

With the aim of contributing to the literature on the interaction between numerical cognition and lexical numbers, I recently conducted a pilot study among native Jarawara speakers. During the course of preliminary work for this pilot study, however, incontrovertible evidence was found for a relatively robust native number system in the language. This evidence may interest those concerned with the numerical cognition–language nexus, as well as typologists and Amazonianists more specifically. Next I present the evidence, describe the number system in question, and suggest some plausible reasons that it has been overlooked in the literature.

2. New findings. Over the course of three days, I conducted individual interviews and elicitation sessions with seven adult Jarawara speakers in Porto Velho, Rondônia, a city some Jarawara occasionally visit from their reservation in the Brazilian state of Amazonas. Prior to the individual sessions, I established friendships with the participants over the course of

[2] There are of course many more languages that have modest number systems, as evident in Hammarström (2010) or other surveys such as the one by Green (1997).

several weeks. During the sessions I was informed that lexical numbers do exist in their language. Initially I assumed that the terms in question were those described by Dixon (2004*a*), i.e., a few Portuguese borrowings produced consistently with Jarawara phonology. This assumption proved incorrect, however. I subsequently elicited number words in Jarawara by simply presenting arrays of stimuli (e.g., spools of thread) to speakers individually, in non-sequential/random order, and asking them to describe the quantity of arrays. These elicitations were carried out primarily in Portuguese, though also with some basic Jarawara phrases that were taught to me by a participant beforehand. In a few cases, elicitation was carried out merely by pointing at a specific array, after it became clear that I was interested in eliciting terms for quantities rather than other possibilities such as ordinal terms. While there are inherent limitations to elicited data in linguistic fieldwork, they have a potentially crucial role to play in cases like this one. Given that native number terms frequently fall into disuse once indigenous cultures come into contact with a hegemonic culture, they may not be readily discernible in texts or discourse transcriptions. Therefore, elicitation techniques were warranted, and in fact essential, in this case.

Contra my expectations, four participants independently produced non-borrowed cardinal numbers for the arrays. In fact, two participants produced cardinal numbers as high as 20. Since these words were elicited in isolation, it is not the case that the subjects merely adopted terms utilized by their fellow participants. Furthermore, the three remaining participants recognized the number words once I produced them, and they claimed that such words are in fact Jarawara terms, albeit ones that are rarely used contemporarily. These three participants evinced difficulty when attempting to independently recall the terms for some numerosities, however, a point returned to below.

Table 1 contains the Jarawara numbers for 1–20, based on these elicitation sessions. As can be gleaned from table 1, the language employs a binary/quinary-based system, with the words for 2 (*fama* 'pair') and 5 (*yehe* 'hand') serving as bases in the sense of Hammarström (2010). These bases are not among the most common corporeally motivated types evident cross-linguistically (given the preponderance of decimal and vigesimal types—see, e.g., Heine 1997), but they can hardly be considered typological rarities either. I should stress that, while numbers for 11–20 are presented, these have only been corroborated independently with two speakers and await further verification. The numbers are transcribed via the Jarawara orthography.[3]

As shown in table 1, two other morphemes play a prominent role in Jarawara numbers. One of these is *ka-*, which is a prefix with comitative connotations (among others; see Vogel 2006:20). A number such as 10, *yehe kafama*,

[3] The *f* denotes a bilabial fricative while *y* denotes a lamino-palatal semi-vowel (see Dixon 2004*a*:17).

TABLE 1
CARDINAL NUMBER TERMS IN JARAWARA

Numeral	Jarawara Term	Numeral	Jarawara Term
1	*ohari*	11	(*yehe*) *kafama ohari*
2	*fama*	12	(*yehe*) *kafama fama*
3	*fama oharimake*	13	(*yehe*) *kafama fama oharimake*
4	*famafama*	14	(*yehe*) *kafama famafama*
5	(*yehe*) *kahari*	15	(*yehe*) *kafama kahari*
6	(*yehe*) *kahari oharimake*	16	(*yehe*) *kafama kahari oharimake*
7	(*yehe*) *kahari famamake*	17	(*yehe*) *kafama kahari famamake*
8	(*yehe*) *kahari fama oharimake*	18	(*yehe*) *kafama kahari fama oharimake*
9	(*yehe*) *kahari fama famamake*	19	(*yehe*) *kafama kahari fama famamake*
10	(*yehe*) *kafama*	20	(*yehe*) *kafama kafama*

could be interpreted then as ‘with two hands’, though the ‘hand’ portion is omissible for 10, and 5–10 more generally, according to the speakers providing these terms. Such omissibility suggests that these terms are not simply a creative combination of more basic lexical numbers but instead are more appropriately considered lexical numbers themselves. The other morpheme common to these numbers is the suffix *-make*, used with 3 and 6–9 (and, as a result, 13 and 16–19 as well). This morpheme is a motion suffix roughly equivalent to ‘following’ (Vogel 2006:17).

The consistency of the number terms for number words beyond 2, which I should stress were elicited independently from the study participants, suggests that there is a standard syntax internal to the Jarawara numeral system. As Hurford (1987:82) notes, “there can be an early stage in the development of any numeral system when it has a small lexicon but no syntax internal to the numeral system—no way of putting number words together to form expressions for further numbers.” Clearly, Jarawara numerals have such a syntax given the cross-speaker consistency of the strategy employed in the creation of higher numerals.

One might propose that the mere synchronic presence of the number words in table 1 does not imply that they are in fact NATIVE number terms. After all, it is possible that these are very recently innovated neologisms (perhaps even innovated since Dixon’s research) and are modeled on the Portuguese number system. There are three reasons, however, that the data are not amenable to

such an account. The first is that Alan Vogel (personal communication), who has over 20 years of experience working on and speaking the Jarawara language (see, e.g., Vogel 2003; 2009), has confirmed the existence of number terms. Numbers greater than 3 are not evident in his extensive and detailed dictionary of the language (Vogel 2006) and are not contained, for instance, in its illustrative sentences. This may be due to the fact that in choosing such sentences he "avoided the use of elicited data" (2006:7). Regardless, when asked about the existence of numbers in the language, Vogel (personal communication, 2010) provided the following observations:

> There is no doubt in my mind that the Jarawaras have always counted, and that *ohari, fama,* and *e na*, in addition to their other meanings, have also always meant 'be one', 'be two', and 'how many'. Furthermore, the Jarawaras have always also had a method of counting numbers beyond two. The method involves various combinations of *ohari, fama,* and *yehe* 'hand' for five. I have never thoroughly investigated the system, because the Jarawaras hardly use it, since the Portuguese numbers are much easier to use.

Vogel's assessment on Jarawara counting, based on decades of work among the people, is consistent with the claims offered here vis-à-vis quantifying. He notes as well that, in examining numerous Jarawara texts, he has in fact uncovered several instances of native number term usage, including at least one case in which *yehe kafama* ('ten') is employed in discourse.

A second reason we can be confident that the terms in table 1 are native number terms is that two of the older Jarawara participants, who appeared to be in their late forties to early fifties, maintain that their grandparents regularly employed such words before systematic contact with Brazilians. (For a history of this contact, see Dixon 2004*a*:2–7.) In a related vein, these participants also described a tally mark system that was once regularly employed in the culture, and this tally mark system apparently relied on the number system described by table 1. The system consisted of etchings on the side of a single narrow strip of wood. These etchings were triangular marks that varied in number. One of the Jarawara participants illustrated this tally mark system by carving such a series of etchings on a narrow piece of wood of a type traditionally used for this purpose. A picture of these etchings is provided in figure 1. The man who produced the tally marks described the way in which speakers traditionally referred to numbers when quantifying, for instance, the estimated number of days of an upcoming trip. As can be seen in figure 1, the tally mark system consists of groups of one, two, three, four, five, and ten carved wedges. There are two groups of five and four groups of ten. According to the artist, speakers could employ the tally mark system for larger numbers by pointing iteratively at combinations of certain groups of etchings. When employing numbers not specifically carved into the wood, a speaker could point to the components of the number, e.g., to the section with two notches and one of the sections with five notches to refer to (*yehe*) *kahari famamake*

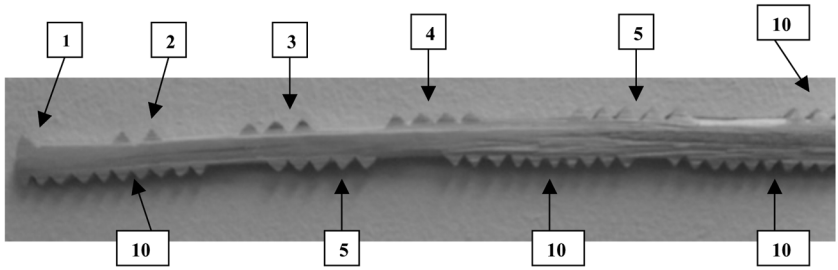

FIG. 1.—An exemplar of the tally mark system of the Jarawara culture, carved by a Jarawara man. The number of "triangles" for each segment corresponds to the numeral in the adjacent box.

'seven'. An anonymous reviewer questions why, if this tally mark system is based on the number system, there is not greater evidence for a binary system, i.e., why there is no clear indication that 'four' is made up of 'two two'. This is an interesting point, however the Jarawara speaker who made the stick in question said the four notches did in fact denote *fama fama* or 'two two'. These claims are based on native assessments. Also, it is worth noting that simply because a number term such as *fama fama* evinces a binary base, it still denotes the number 'four' and the fact that it is represented via four notches is not inconsistent with its binary internal structure.

A third and final reason for concluding that table 1 represents a previously undocumented native Jarawara number system is that there is strong evidence for cardinal number systems in Arawá languages more generally. While no studies specifically addressing number systems in other Arawá languages have been produced, the dictionaries of these languages produced by missionary linguists over the past several decades include number terms in all cases.

According to Dienst (2008), Arawá languages can best be internally classified in the manner depicted in figure 2. The Madihá varieties are largely mutually intelligible, as are the Madi varieties. Dixon (2004*a*; 2004*b*) refers to Madi as one language with the three dialects listed in figure 2. This assessment is supported by his claim that Jamamadi (ISO code: jaa), Banawá (ISO code: bnh), and Jarawara speakers can maintain conversations. Dixon goes so far as to claim that these dialects are analogous to the British, Australian, and American varieties of English in terms of overall similarity, with lexical similarity rates of about 95% for each intra-linguistic dialect pair. Percentages of lexical similarity for the three possible pairings of the three dialects are much lower according to Anonby and Anonby (2007), all hovering around 70% for a list of 200 basic words. Anonby and Anonby (2007) conducted a series of cloze tests to investigate the levels of mutual intelligibility and found that Madi speakers' performance on the tests was relatively poor across dialects. Nevertheless, based on the relatively high conversational mutual

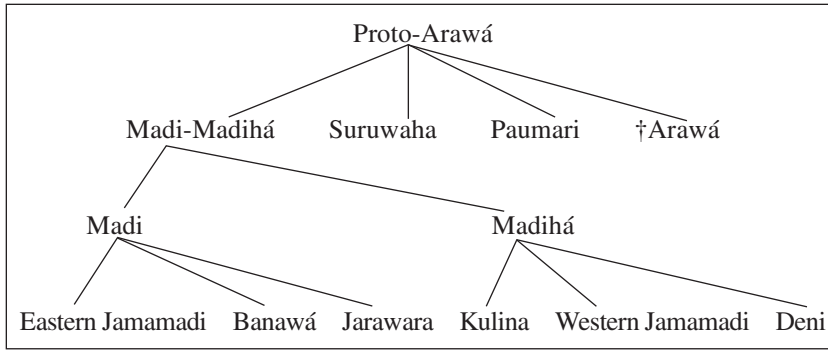

FIG. 2.—Affiliations of Arawá languages (based on Dienst 2008).

intelligibility of the three branches of Madi, which many outsiders have observed firsthand, it seems clear that Madi is one language with three dialects, as Dixon (2004*a*) notes.

Given the dialectal status of Jarawara, Banawá, and Jamamadi, one might assume that neither of the other two dialects has native number terms beyond 2, provided Dixon's (2004*a*) claims regarding the absence of numbers in Jarawara are correct. In fact, this is not the case. Anonby and Anonby (2007:25) document non-borrowed words for 1, 2, and 3 in all Madi dialects and also provide words for 5 and 10 in Jamamadi and 4–10 in Banawá. I recently elicited the same number words for 4–10 from a Banawá speaker; they are presented in table 2. Anonby and Anonby (2007:25) note that "loans" are used by Jarawara speakers for numbers greater than 3, a point that is accurate since by all accounts Portuguese words are now typically employed by Jarawara speakers. In short, my own recently collected data, taken in concert with previously published data on Banawá and Jamamadi, imply that all Madi dialects have native number words that are similar though not identical, as evident in table 2.

The word lists in table 2 suggest strongly that speakers of Madi have for some time employed native number terms for numerosities at least as high as 10. To judge from the data provided by two of the speakers, the number terms may have reached 20 or greater. Native number terms exist in other Arawá languages as well, and clear correspondences between these native numbers and those in Madi can be established for numbers such as 5 and 10. This is also evident in table 2, in which number terms are transcribed per the sources' orthographies.[4] The only literature on Arawá (ISO code:

[4] The phonemes associated with particular symbols in table 2 are generally transparent. There are two notable exceptions: the *z* in Deni denotes a voiced alveolar affricate while *'b* in Paumari denotes a voiced bilabial implosive.

TABLE 2
NATIVE NUMBER TERMS IN OTHER DOCUMENTED ARAWÁ LANGUAGES

Numeral	Banawá	Eastern Jamamadi
1	*damara, owaria*	*ohari*
2	*fama*	*fama*
3	*famabisa one owaria*	*fama oharimaki*
4	*famabisa*	n.a.
5	*eye kadamara*	*yehe ohari nima*
6	*eye kadamara one owaria*	n.a.
7	*eye kadamara eye one famama*	n.a.
8	*eye kadamara eye one famama one owarima*	n.a.
9	*eye kadamara bone atina eye damara hasina*	n.a.
10	*eye kafama*	*yehe kafama nima*

Numeral	Deni	Paumari
1	*uhariari/uhariaru (masc/fem)*	*hoarana*
2	*pamari/pamaru*	*'afo'bamakhama* (*bama* = 'both')
3	*pamaha uhariha/pamihi uharihi*	*ahoarabakosiki*
4	*pamaha pamaha/pamihi pamihi*	*ako'bamahakhamaki*
5	*izepe kahariari/izepe kahariaru*	*sa'ai kahoarani (sa'ai* = 'hand')
6	*izepe kahariari uharimitari*	n.a.
7	*izepe kahariari pamamitari*	n.a.
10	*izepe kapamari/izepe kapamaru*	*sa'ai ko'bamiki*

Numeral	Arawá	Suruwaha
1	*warihí*	*wanzy, wenji*
2	*famihí*	*uhama/uhamazy*[1]
3	*arisafahá*[2]	*wanaha udaru/wanaha udari* (fem/masc)[3]
4	n.a.	*uhamaru bujini/uhuamary bujini*
5	n.a.	*ibihi wanaharu/ibini wanaharu*
10	n.a.	*ibihi tumini*

[1] According to Marcia Suzuki (personal communication), the *-zy* suffix serves as a nominalizer when using the number referentially.

[2] As a reviewer astutely points out, this form for 3 may be a combination of 1 and 2 due to its similarity with *wari*(*hi*) + *fami*(*hi*).

[3] This form for 3 differs from that evident in Suzuki (2002), but Marcia Suzuki (p.c.) claims this form to be correct and notes that it can also be used to denote the middle finger.

ara) is a 52-word list transcribed by a nineteenth-century explorer (Chandless 1869:311). Interestingly, this list does contain words for 1, 2 AND 3, as shown in table 2. According to an extensive lexicon of Deni (ISO code: dan) (Koop and Koop 1985), there are native number words for at least 1–7 and

10 in Madihá. Vladmir Cunha, a Brazilian missionary with two decades of experience among the Deni, suggests via personal communication that native Deni number terms are still employed, though Portuguese loan words adapted to Deni phonology are typically employed for numbers greater than 5. Salzer and Chapman (1997), a very extensive Portuguese–Paumari (ISO code: pad) and Paumari–Portuguese dictionary, offers native Paumari number words for 1–5, 7, and 10. These words are also provided in table 2. Chapman (personal communication) suggests that the Paumari continue to use their native cardinal numeral system on a daily basis for a variety of functions, though Portuguese numbers are typically employed for economic transactions.[5]

Madi, Madihá, Paumari, and Arawá all have native number terms, then. As is evident in Table 2, for several numbers there are clear correspondences across the languages. For instance, in all documented cases the word for 2 is cognate: *famihí* (Arawá), *fama* (Madi), *bama* (Paumari root for 'both' evident in the word for 2), *uhama* (Suruwaha), and *pama* (Madihá), suggesting a proto-form of **pama*.[6] The word for 5 in all documented cases involves the word for 'hand'. Words for 6–10, where documented, are quinary-based, also involving the word for 'hand'. The word for 10 in all but one case—Suruwaha (ISO code: swx)—includes the words for 2 and 5. The absence of documented number terms greater than 3 in Arawá says little, since Chandless's (1869) word list is so short.

As is shown in Suzuki (2002), native number words exist in Suruwaha also. These are employed synchronically by the speakers (Marcia Suzuki, personal communication). Crucially, the Suruwaha number system evinces some binary orientation as in the other Arawá languages, since the word for 4, *uhamaru bujini*, is best translated as 'two pairs'. Furthermore, the number for 5 includes the word for 'hand' *ibihi* as well as 'other' *wanaharu*. The number for 10 includes reference to 'hands', though in this case the word is best translated as 'all the hands'. While numbers are not heard frequently in discourse (M. Suzuki, p.c.), they do exist and are oriented according to the binary–quinary pattern evident in Paumari, Madi, and Madihá.

In short, the binary–quinary pattern has been documented for the four Arawá branches that have received significant attention from linguists. Given that Suruwaha and Paumari are not closely related to Madi-Madihá, and given that a number of languages that share this pattern are geographically distant, this finding suggests that number words with a binary–quinary foundation have existed for some time in Arawá languages. While this pattern is not a

[5] While there are over 600 members of the Paumari tribe, only about a third of them still speak the Paumari language. In contrast, the members of Madi tribes still speak their native dialects of Jarawara (about 200 speakers), Jamamadi (250), and Banawá (120).

[6] This proto-form and a Proto-Arawá form for 1 (**ohari*) appear in Dixon (2004*b*:66). Dixon (2004*b*) does not present any other numbers for Proto-Arawá.

typological rarity, it is also far from common to the world's languages. The odds of each of these related but geographically non-proximate languages independently innovating such similar systems is remote. The cross-linguistic findings also help us rule out the possibility that the Jarawara numbers in table 1 are simply the result of some sort of self-evident numeral strategy utilized by the participants of the present study, though this possibility is also ruled out by the consistency of the terms employed by four participants tested separately. After all, the chances of four speakers choosing to employ the same non-conventionalized strategy independently, of their own accord, are quite remote. There is a possibility, however unlikely, that the numbers for 11–20 in table 1, which were only provided by two speakers and do not have analogues in the literature on other Arawá languages, were simply innovated during the course of the tasks.

While the shared numeral strategies evident in Arawá languages are likely due to common inheritance, there is a chance that the similarities of lexical numbers across this language family are the result of diffusion or calquing (discussed in **3** below) some time in the very distant past. Either way, it seems clear that number words greater than 2 have existed in Arawá languages for some time. Furthermore, proto-forms for 1 and 2 can clearly be established in the family. The purpose of the present endeavor is not to reconstruct numbers terms in Proto-Arawá, however, it is to establish that native number terms do in fact exist in Jarawara and that the existence of such terms is consistent with the data from related languages. At this point, the claim that Jarawara can be considered one of the few exemplars of anumericity among the world's languages is untenable. For us to maintain that no native number terms exist in Jarawara, we would have to ignore (*a*) the elicited data presented here, collected systematically and independently from four native speakers and corroborated by three others; (*b*) the metalinguistic assessments of the Jarawara interviewed; (*c*) the relationship between the documented numbers and the documented tally mark system suggested by the Jarawara; and, just as crucially, (*d*) the fact that number terms of a similar type are evident in all the documented Arawá languages. Apparently, as contact with a hegemonic culture increased, Jarawara number terms began to fall into disuse. Nevertheless, they are still used in some instances today, as evidenced by the fact that Alan Vogel has heard the terms used in natural discourse.

3. Recent diffusion? A reviewer notes insightfully that perhaps the number terminologies reported here for these languages could all have arisen by areal diffusion in post-contact times and suggests that the situation here may be analogous to that of another small Amazonian language family, Nadahup (see Epps 2006). This is an interesting suggestion that merits attention. The first point to make in addressing it is that, even in

the case of Nadahup, the diffusion of number systems did not likely occur in post-contact times. As Epps (2006:277–80) notes, the diffusion of Tukanoan number subsystems into Nadahup likely resulted from the movement of Tukanoan peoples into the Vaupés region, a process that occurred in pre-contact times, since a wealth of evidence suggests this region has been characterized by linguistic and cultural exchange since that era (Aikhenvald 2002:24). Furthermore, the Arawá situation differs crucially in important respects from that described in Epps's (2006) fascinating work on Nadahup numbers. Some discussion of number terms in that language family is in order here.

I refer the reader to Epps (2006) for a complete treatment of the Nadahup data, but the most relevant points are as follows. There are four Nadahup languages: Hup (ISO code: jup), Yuhup (ISO code: yab), Dâw (ISO code: kwa), and Nadëb (ISO code: mbj). The latter language is located furthest from the Vaupés linguistic area and exhibits one very modest number system with number words for 1–3. Dâw, on the other hand, utilizes two distinct numeral strategies, only one of which corresponds to the Nadëb system. Hup and Yuhup, however, utilize three strategies, one of which corresponds to the strategy for 1–3 common to the other two languages. They also utilize a "fraternal" strategy for 4 (also evident in Dâw for 4–10), as well as a quinary strategy for 5–20. For reasons that are clearly delineated in Epps (2006), these patterns across Nadahup suggest that there were three stages in the growth of the Nadahup number system. First, a system was developed in all of these languages and remains common to all of them today. Second, a somewhat limited fraternal-based strategy was borrowed from Tukanoan, and is present in Dâw, Hup, and Yuhup today. Finally, a more robust quinary system diffused from Tukanoan into Yuhup and Hup, both of which are located in the Vaupés, as interactions with speakers of these languages increased. As Epps notes, "the number of numeral strategies that occurs in each language corresponds to the language's geographic proximity to the Vaupés region, a fact which can be attributed in part to areal diffusion and supports the characterization of this region as a linguistic area."

Crucially, in the interesting case of the various numeral strategies employed in Nadahup, there is clear evidence for diffusion. There are different numeral strategies or "growth rings" (Hurford 1987), and two of these strategies have a clear source of diffusion (Tukanoan). Furthermore, there is a clear correlation between the implementation of particular strategies and degree of interaction with Tukanoan speakers. Put differently, there is a correlation between certain numeral strategies and proximity to a particular linguistic area, the well-documented Vaupés region. In the case of Arawá languages, there is no analogous correlation between proximity to a particular linguistic area and the number of numeral strategies employed. Unlike Nadahup languages, in Arawá

languages there are no discernible growth rings reflecting a gradual accrual of a number system consisting of diachronically distinct numeral strategies.

The Vaupés is a clear linguistic area due to the interaction of the Tukanoan, Arawak, and Nadahup cultures, and it has drawn significant attention from linguists and anthropologists. Various aspects of the languages of these people have been borrowed due to inter-linguistic contact, and so the potential for grammatical diffusion is great. According to Aikhenvald (2002), there is significant evidence suggesting that the Vaupés has been an area of multilingual diffusion for hundreds of years, and that this diffusion pre-dates European contact. The area between the Juruá and Purus occupied by Arawá speakers does not exhibit the same cultural patterns of multilateral linguistic diffusion, nor any other significant documented diffusion for that matter. In fact, no other major indigenous language family is represented in the relevant, enormous portion of this interfluvial region. It is an area dominated by one language family only, Arawá. Not surprisingly, there is no clear potential non-Arawá indigenous source for the diffusion of numeral strategies across this family, as in Nadahup. While I admit that the numeral strategies of some of these languages require further exploration given that they have not been explored in great depth, it is clear from table 2 that there is a consistency to the number systems of the Arawá languages.

While there is no clear non-Arawá indigenous origin for the shared numeral strategies of these languages, there are other languages that could potentially be known (or have been known) by all speakers of Arawá languages and could theoretically serve as the common source for the number words in these languages. The most obvious potential source would be Portuguese, but this source can be ruled out easily since Portuguese employs a decimal system without any traces of binary or quinary strategies. Another potential source is Língua Geral/Nheengatu (ISO code: yrl), but the number system of that language, which was once employed across much of Amazonia, is also decimal-based. In short, the number systems of these two other potential sources for numeral diffusion do not resemble those documented here for Arawá languages. Among indigenous number systems, there are no clear family-external candidates for sources of diffusion as there are in the case of Nadahup. For example, the indigenous language that is most geographically proximate to an Arawá language today is Apurinã, an Arawákan language whose main village is less than six kilometers from the main Paumari village, on the eastern side of the Purus. Interestingly, Apurinã has a number system that is not quinary-based and is limited to 1–5 (Facundes 2000:359). Given the absence of a clear, family-external source that could explain the similarity of the strategies employed over such a large geographic region represented by Arawá languages, we can safely rule out the possibility of any RECENT diffusion accounting for the patterns in question for numbers beyond 2.

The Nadahup and Arawá situations differ in these very significant ways. If diffusion or calquing were the source of number terms in Jarawara, and we cannot rule out the possibility that calquing or diffusion WITHIN Arawá occurred at some point, this diffusion would have taken place well before contact times. Madi has been spoken along the Purus since consistent contact with outsiders in the late nineteenth century, and we know that other Arawá languages have been spoken at a great distance, along the Juruá, since before that time (see Chandless 1869). This suggests that the languages have been dispersed over a wide geographic area, which cannot be traversed via direct river travel,[7] since contact with Westerners began and before the rubber-boom era of the late nineteenth century. Given that the elderly Jarawara language resource personnel claimed their grandparents used the numeral system described here, we can directly trace its usage along the Purus to the early part of the twentieth century at least. Given the distances between the Arawá groups in question, even if a particular family-internal source for the numerals could be identified, it would be, at the least, extremely implausible that diffusion or calquing could have occurred across all the languages in table 2 after systematic contact with outsiders began in the late 19th century. Tellingly, one of the tribes in question, the Suruwaha, avoids most contact with outsiders to this day, and yet still the language has number terms that resemble (in the ways mentioned above) those in the other Arawá languages.

4. Potential explanations for previous findings. We are left to wonder how previous research yielded such disparate results, specifically how Dixon's (2004*a*) claims vis-à-vis Jarawara number terms differ so markedly from those offered here. Two plausible explanations for the discrepancy are available.

There are six Jarawara villages on the reservation demarcated for them by FUNAI (*Fundação Nacional do Índio*), all of which are located within a few dozen miles of the town of Lábrea, Amazonas (7°15′S, 64°47′W), a municipality with approximately 38,000 inhabitants. These villages are located west-northwest of the city. There are approximately 200 Jarawara scattered throughout these villages, some of which are inhabited by only one family. The two largest villages, each with about 40 residents, are Casa Nova and Água Branca. The coordinates to these villages are 7°18′S, 65°15′W and 7°16′S, 65°11′W, respectively. Both villages are located only a few miles from the western bank of the Purus River. Four of the participants in

[7] Contrast this with the Nadahup languages that, while also being located over a large geographic area, are all located along the Rio Negro river system, generally along an east–west axis. Even in that case, however, the evidence suggests that the diffusion of number systems occurred during pre-contact times.

this study are residents of the Água Branca village, and three are residents of the Casa Nova village. Interestingly, the four residents of Água Branca recalled the native numbers with ease. Those of the Casa Nova village did not recall number words beyond 2 until being prompted. This suggests that recall of number terms may vary according to village residence, or at least that this variable merits consideration. While both villages maintain contact with outsiders, there has been a more consistent foreign presence in the past several decades in the Casa Nova village (Dixon 2004*a*:13). This fact could potentially have motivated a lessened retention of native number terms in that village, leading to poorer recall abilities when contrasted with the residents of Água Branca. It is worth noting that the research for Dixon (2004*a*) was undertaken primarily in Casa Nova (2004*a*:13). Given the high caliber of Dixon's grammar (winner of the Linguistic Society of America's Leonard Bloomfield Award in 2006), which was based on months of residence in Casa Nova over the course of a decade of research on the Jarawara language, there is little doubt that his claims on such a typologically remarkable feature of the language were based on extensive contact and interviews with the people. This suggests that Dixon's claims regarding Jarawara anumericity may be due to the pool of speakers he worked with most frequently.[8]

Another possible factor motivating the divergent findings is methodological. As Dixon (2004*a*:13) notes, he utilized elicitation sparingly during the course of his fieldwork, and only as a means to test generalizations based on the analysis of a corpus of texts. An alternate possibility for the discrepancy, then, is that because Dixon avoided reliance on elicited texts out of methodological rigor, and because Portuguese numbers have in fact become the norm in Jarawara, absence of evidence for native lexical numbers was taken as evidence for their absence in the language.

5. Conclusion. We are left to conclude that the claim that Jarawara is or was an anumeric language is simply not buttressed by the data. Dixon (2004*a*) is one of the most comprehensive and detailed descriptions of any indigenous language. Nevertheless, it is important to delineate these divergent findings on Jarawara numbers and to draw attention to number words in Arawá languages more generally. After all, given the rarity of anumeric languages (and they are rare, as detailed surveys such as Hammarström 2010 suggest), and given the importance of claims on anumericity to typologists and cognitive scientists alike, we need to ensure that such claims are clearly supported.

Of course, we cannot rule out the possibility that at some point in the very distant past Jarawara did not have native numbers. There simply is no clear

[8] Though not exclusively: an anonymous reviewer notes that speakers from Água Branca often visited Casa Nova while Dixon undertook his research.

evidence to support this suggestion. Such terms are not used synchronically with much frequency among the people, but this is true in many cultures in which native number words have been replaced by an outside (often more robust) system. Native number terms, including those with binary and quinary bases, do exist in Jarawara and in the Arawá family more generally.

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