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Sound Symbolism, Onomatopoeia, and New Guinea Frog Names

Brent Berlin has recently proposed the use of r *sounds as a* substantive universal *in the names given to frogs and toads, a tendency that he attributes to onomatopoeia. A data set from over 200 New Guinea languages is analyzed. Berlin's proposal regarding* r *sounds receives strong support, but an even more significant pattern is found with respect to* g *sounds. Onomatopoeia is a possible motivation for both of these patterns.*

The diverse research directions manifest within American anthropology in recent decades have raised to prominence the long-standing tension between our hopes to reach valid general conclusions about the human condition and our appreciation of the nuances of its particular realizations in different societies. Among those striving for balance between these goals have been the practitioners of *ethnoscience*, conducting detailed and systematic studies since the early 1960s of the ways in which people classify and name the animals and plants of their environments. It is surely ironic that this "new ethnography," assailed by some early critics as being particularistic in the extreme with its emphasis on *emic* descriptions, has led to the postulation of worldwide regularities in folk systems of ethnobiological classification and nomenclature that profoundly challenge anthropology's long-standing stress on the diversity and, as some would have it, the noncomparability of cultures. Impressive bodies of evidence have been marshaled, as in Brent Berlin's recent book, *Ethnobi-*

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ological Classification (1992), to support a further claim: that these regularities, at least with respect to classification, correspond to the *inherent order* of at least some domains of experience, such as living organisms. It would seem that we have come a very long way from a Whorfian view of reality as a "kaleidoscopic flux" upon which each language and culture freely imposes its unique signature.

Although some critics doubtless will continue to challenge and qualify Berlin's position that there are "universal" or "general principles" that characterize all folk systems of biological classification, the opposite view of complete arbitrariness or "relativity" of conceptual groupings of organisms would now seem indefensible. But if the evidence appears undeniable that there are constraints of *some* kind with respect to *classification* (and several kinds have been proposed in addition to Berlin's [see, e.g., Atran 1990; Brown 1984]), until recently the *naming* of plants and animals has been largely accepted as more variable, if not actually arbitrary.

In his most recent synthetic work, Berlin (1992) takes up the matter of ethnobiological nomenclature and boldly proposes that, for some organisms at least, naming universally follows identifiable patterns and that *sound symbolism* and onomatopoeia are basic influences on the *non*arbitrariness of ethnobiological nomenclature. Such a claim, he realizes, "does not square well at all with modern linguistics textbook ideology on the arbitrariness of the association of sound and meaning in languages generally" (1992:235), and is thus bound to invite close scrutiny. Indeed, while Berlin repeatedly uses terms such as *universals* and *general principles*, it is clear from the general tone of his discussion that the generalizations that he proposes are to be regarded as *hypotheses* to be tested against his own, as well as new, data. Accordingly, my purpose in this article is to offer a critique of Berlin's treatment of this topic with respect to frog names and also to introduce a fresh body of data that both support and extend his proposals.

Berlin's *Sound Symbolism* Hypotheses

As in his earlier theoretical works, Berlin's proposed "general principles" regarding ethnobiological nomenclature (1992:26–31) refer mainly to the lexical structure of plant and animal names and the relationship of those names to the folk taxonomic ranks of the organisms involved, e.g., the tendency for categories of subgeneric ranks to be labeled with secondary lexemes and higher-order taxa with primary lexemes. But, in "Principle 5," which "codifies a growing body of empirical observations on the non-arbitrariness or iconicity of plant and animal names," he addresses the phonological and semantic content of the names. As a "general principle" he merely states that "names for plants and animals commonly allude metaphorically to some typical morphological, behavioral, ecological, or qualitative characteristic feature of their referents" (Berlin 1992:31), but later, in a groundbreaking chapter on "the nonarbitrariness of ethnobiological nomenclature" (1992:232–259), he goes much further. Adducing impressive evidence (1992:235–250) that Huambisa Jivaro names for birds

and fish fairly consistently follow particular phonological patterns (e.g., with high front vowels occurring disproportionately more often in bird than in fish names), Berlin suggests that "universal sound symbolic processes" may be at work (1992:249), with the result that "the Huambisa, and perhaps other peoples like them who maintain close ties with the natural universe, are unconsciously motivated to develop systems of zoological nomenclature whose sound-meaning associations take full advantage of the frequency code innate to many living species" (1992:250).

Berlin reports that his sound symbolism data prompted the Romance philologist Yakov Malkiel to suggest "that a profitable area of research would be to explore the phonetic makeup of words for 'frog' in the world's languages. Based on his experience with Indo-European languages, Malkiel had the distinct impression that an exceptionally high number of names for 'frog' contained the sound [r], a phonetic segment known technically as a flapped or trilled alveolar liquid" (1992:250). Following Malkiel's lead, Berlin cites a number of Indo-European language names for frogs and toads (1992:251) but also presents "a list of names for toads and frogs in thirty-three non-Indo-European languages" as support for a broader conclusion:

> While the data are clearly scanty at the present time, it appears that Malkiel's intuitive observations on Indo-European may have wide application in languages of traditional societies as well. *The alveolar trill [r], and the phonetically closely related lateral liquid [l]*, seem to be unconsciously drawn upon as *the most appropriate sounds* from the human speech inventory to serve as segments for the names of anurans (both frogs and toads), so that the names of these creatures are formed in this fashion in *an extraordinary proportion of the languages examined*. These data allow one to speak of *substantive universal features of onomatopoeia* comparable to universal size-sound symbolism. [1992:250, emphasis added]

He restates this last point by contending that "it seems undebatable that *the use of [r] and [l] in names of frogs and toads is fundamentally onomatopoeic*" (1992:250–251, emphasis added).

The main concern of this article is to test Berlin's proposals that names for anurans disproportionately employ *r* sounds (used hereafter to designate the retroflex [r], the "flap" [ř], and the dental/alveolar lateral [l] phones) and that the principal motivation for this tendency is onomatopoeic. First I will argue that the data Berlin adduces and his method of analysis—simple tabulation of the frequency of these sounds in "frog names"—yield suggestive, but inconclusive, results. Second, drawing upon a database from New Guinea languages,[1] I calculate not only the frequency of *r* sounds in frog names but also their *expected* frequency given general sound patterns in those languages. The results indicate considerable support for Berlin's basic hypothesis, but even more for a tendency for frog names to display what I shall refer to as *g* sounds (see below). Third, I explore Berlin's hypothesis that onomatopoeia is the most likely basis for either of these patterns, concluding that, while a straightforward assessment of that proposal is problematic, again the results are sufficiently suggestive to warrant further research using worldwide samples.

Berlin's Data

Berlin (1992:251) cites a number of Indo-European languages whose names for frogs and toads follow the proposed *r* pattern. Examples such as Old English *frogga*, Modern German *frosch*, and Spanish *rana* would seem unarguable. On the other hand, among Indo-European terms not mentioned by Berlin, the Dutch "generic"[2] term *kikker* seems only marginally to fit his proposal, and the apparently alternative Old English form *tosca* (Jember 1975:33) is surely one exception. Neither are Berlin's examples numerous, nor are they claimed to constitute a representative sample of Indo-European terms; in any case, it is clear that he considers most persuasive the evidence that he finds in non-Indo-European languages.

As an exploration of Malkiel's proposal, Berlin

> compiled a list of names for frogs and toads in thirty-three non-Indo-European languages, . . . In my inventory, I listed all of the terms found in the source and then selected those languages that showed one or more names comprised of [r] or [l]. Of the thirty-three languages examined, thirty, or 91 percent of them, showed the suspected pattern for [r], [l] or both. [Berlin 1992:251]

On the surface this appears to be an impressive body of evidence, but a closer examination raises serious questions as to its significance. First, to produce a sample confined to Central and South American languages (the vast majority of his examples), I reduce the database he presents (1992:252–254) from 30 languages to 27. Then, given Berlin's view that the proposed pattern is based on *onomatopoeia*, I also exclude Wahibo and Yukpa, since only terms for 'tadpole' are provided for those languages (1992:252, 254) and it is unlikely that whatever sounds tadpoles might produce are salient to, or ever heard by, would-be frog-namers. Thus we are left with a list of 25 Central and South American languages that include at least one "frog name" that contains *r*.

Among the shortcomings of this database, Berlin admits that "the inventories are incomplete, good scientific determinations for the large majority of the animals are missing, and one could always cite problems with investigators' various renderings of the sounds [r] and [l]" (1992:251). To these I would add the observation that the inventories are not only "incomplete" but that they are highly diverse, with some languages represented only by names for types of frogs, while generic terms or some combination of the two are provided for others.

Berlin anticipates another possible criticism by saying that

> since most of the languages are from South America, it might be claimed that their similarity is due to either genetic relationship or lexical borrowing. While this factor is relevant to a small number of languages in the sample . . . an examination of the several different language families represented should convince the reader that genetic affiliation is highly unlikely as a primary factor leading to the presence of [r] and [l] in the terms cited (unless one is talking in terms of time depths so remote as to be virtually impossible to document).

> Likewise, the massive geographic area covered makes historical contact and linguistic borrowing even more unlikely. [Berlin 1992:251]

In fact, the question of genetic relationship applies to a larger number of the languages than is implied. Berlin concedes that "Ashéninka and Asháninka (Maipurean), on the one hand, and Huambisa . . . and Shuar (Jivaroan), on the other [might be treated] as single cases due to their close genetic relationship," but he claims that "the proportion [of *r* names] changes insignificantly" (1992:251). According to Berlin's data, the Takanan family of languages is also represented by two cases, Maipurean by seven rather than two, Kawapanan by two, and Jivaroan by another pair. Thus, if one truly wanted to control for genetic affiliation, the sample of 25 languages would be reduced to 16, allowing only one language per family. Berlin's final point, that "the presence of terms with [r] and [l] in languages of different continents of the world should be decisive in ruling out genetic or historical factors as the fundamental reasons for the patterns observed" (1992:251), is of course crucial, but his citation of three cases and several Indo-European examples cannot be considered an adequate sample of the world's languages.

We are left, then, with frog names (of varying degrees of specificity) from 16 language families in Central and South America (and three additional cases) that contain *r* sounds. What we are *not* told are two vitally important bits of information. First, Berlin says that he "examined" 33 languages, of which 30 "showed one or more names comprised of [r] or [l]" (1992:251). Does this group of 30 constitute a sizeable, let alone representative, sample of the potential universe of cases in Central and South America? Second, for the languages examined, how many frog names that are not listed do *not* include [r] or [l]? Without answers to these questions, it is not possible to conclude that the proposed "universal" applies even to Central and South American languages.

Additionally, and especially with respect to the hypothesized onomatopoeic basis for these names, Berlin acknowledges that "of course, *a full test* of the apparent specific association of [r] and [l] segments with words for 'frog' requires one to show that *these sounds do not occur with a similar distribution in the names for other common creatures* that might equally well be so characterized because of their calls, for example, the names for crows or parrots in the languages of the world" (1992:251, 255, emphasis added). For a variety of reasons, then, the data that Berlin deploys cannot be considered a definitive demonstration of the validity of his claims. Their suggestive nature and heuristic value, however, seem clear, and Berlin invites further explorations: "when more data are compiled from additional sources, I am quite convinced that Professor Malkiel will be shown to be correct. If the essence of any animal can be captured by the ways humans have chosen to refer to it, the frog confidently croaks its way to first place in line" (1992:255). I shall now turn to data from New Guinea to see whether Berlin, and Malkiel, are indeed correct.

Frogs in New Guinea

Of the three orders of amphibians as classified by Western science, Urodela (salamanders) and Apoda (the limbless caecilians) are absent in the New Guinea region. The remaining order, Anura ("tailless"), is by contrast well represented, with probably at least 200 different species found on the mainland (Menzies 1975; Zweifel 1972), and it appears that "New Guinea has been a major centre of frog evolution" (Tyler 1970:246). The New Guinea frogs so far discovered and described by zoologists represent six families, some of which correspond little to Western images of frogs. For example, "about half of the species of frogs known from New Guinea belong to eleven genera of the family Microhylidae," which do not lay their eggs directly in water, and hatch into fully formed frogs with no tadpole stage (Zweifel 1972:468). Another 40 percent of the species are tree frogs of the family Hylidae, which do have a tadpole stage but, as their name implies, spend most of their time in trees (sometimes high in the canopy) rather than on streambanks (Zweifel 1972). The families Leptodactylidae and Ranidae are represented by only a few genera and species, and Rhacophoridae are known only from a couple of questionable specimens (Menzies 1975). The remaining family, Bufonidae, is a recent arrival to New Guinea in the form of *Bufo marinus*, the "marine toad" or "cane toad," which was deliberately introduced to New Britain in 1937 to control a sweet-potato pest, and then to the mainland for use in human pregnancy tests. It subsequently has spread widely, although it is largely confined to elevations of 300 meters or less (Zug et al. 1975). As Menzies points out, the distinction between "frogs" and "toads" in terms of appearance (especially leg length, color, and dryness of skin) may seem clear to Americans and Europeans, but such definitions

> are useless when applied to a tropical country such as New Guinea where there are hundreds of different species differing in body form, some toadlike, some frog-like and some like neither. To make matters worse, many of the toad-like species are microhylids, which are more closely related to the ranid frogs than to the toads. In these circumstances, it is probably better to refer to all native New Guinea amphibians as "frogs" and restrict "toad" to the single introduced species, *Bufo marinus*. [1975:4–5]

It is not possible to follow Menzies's suggestion here since, when names to be discussed below are glossed as 'frogs and toads' or 'toad' by ethnographers and linguists, it is seldom determinable whether they in fact refer to *Bufo marinus* or to some misleadingly "toadlike" frog that has fooled the ethnocentric Western observer. For present purposes and given available data, this issue will not be pursued further, with expressions such as "frogs" or "frogs and toads" used uncritically and interchangeably, and "frog names" to be construed inclusively.

While frogs appear to be eaten nearly everywhere in New Guinea, the ethnographic literature consistently reports them as a minor food item, hunted opportunistically and usually by women and children, who also tend to be the main consumers.[3] Yet, whatever their economic significance

may be, frogs are classified by at least some New Guinea peoples in considerable detail. Only one such folk system, that of the Karam, has been studied intensively and systematically (Bulmer and Tyler 1968), and they are said to distinguish among at least 34 named kinds of frogs. Other especially large inventories are reported for the Bimin-Kuskusmin, with 37 named types (Poole 1976); Wopkaimin, with 35 (Hyndman 1982, 1984); Telefolmin, 25 (Healey and Healey 1977); Waffa, 23 (Stringer and Hotz 1979); and the Kâte (Keysser 1925) and Baruya (Lloyd 1992), each with 20. In all, I have so far collated 304 such specific frog names, to be considered along with 256 generic names as I now turn to the linguistic evidence for my tests of Berlin's hypotheses.

The New Guinea Frog Name Database

Paralleling the diversity of New Guinea's frog fauna is remarkable linguistic diversity, with at least 850 different languages spoken in the area considered here (Wurm and Hattori 1981). Ideally one should proceed with a systematic analysis of their frog names by drawing a random sample of these languages, but this would presume the availability of comprehensive relevant data. Only scanty lexical materials are available at all for a sizable number of languages, and this is especially true regarding frog names. 'Frog' is usually not included in the standard word lists used in linguistic surveys; so my coverage is incomplete and geographically uneven. Nevertheless, by surveying a large number of published comparative word lists, dictionaries, and ethnographies, I have compiled a list of generic terms for frogs in 216 languages, a quarter (25.3 percent) of the potential universe (including 29.7 percent of the languages of mainland Papua New Guinea and 11.7 percent of those of Irian Jaya), if one uses figures deriveable from Wurm and Hattori 1981.[4] Much of New Guinea's linguistic diversity is incorporated, with these languages representing both Austronesian and non-Austronesian ("Papuan") languages, five of New Guinea's six language phyla (plus two phylum-level families and two phylum-level isolates), 28 language stocks (plus eight stock-level families and four stock-level isolates), and 75 (or 48.7 percent) of New Guinea's language families and subgroups, the latter with respect to Austronesian languages (plus 10 family-level isolates). For some languages, more than one generic term was discovered; in most cases these correspond to dialectal differences, but in some there appear to be alternative terms involved. Thus for the total of 216 languages 256 generic frog names are reported, and for 30 languages 304 specific frog names have also been obtained. The database to be used here, then, consists of a total of 560 New Guinea frog names.

Is *r* for Frog?

Berlin titled his discussion of frog names " '-*r*-' is for FROG" (1992:250), which would seem to imply that his claim of "universality" applies only to *medial* [r] or [l], but it is clear from his examples that either of these *r* sounds occurring initially, medially, or terminally in a frog name constitutes a confirmatory case. By this guideline, out of 216 New Guinea *languages*, 90

(41.7 percent) possess at least one generic frog name that includes *r*.[5] As noted above, for some languages more than one generic term is reported, yielding a total of 256 frog *names*, of which 102 (39.8 percent) include *r*. These frequencies are sizable, but they do not represent a majority of either languages or total generic names.

In his listing of cases (Berlin 1992:252–254), Berlin combined generic and specific frog names (as well as 'tadpole' terms, which I ignore). For my New Guinea database, specific terms have been analyzed separately. Of the 30 *languages* for which data are currently available, 26 (86.7 percent), an overwhelming majority of the cases, include at least one specific frog name that contains *r*. However, when the 304 *names* are tabulated, the frequency of *r* drops to 120/304, or 39.5 percent, a proportion very close to that for generic frog names. Similarly, when generic and specific terms are combined, as in Berlin's sample, the frequency of *r* in total frog *names* is 222/560, or 39.6 percent of the cases.

As earlier discussed, Berlin largely dismissed the question of the influence of genetic relationships among languages, and claimed that "the proportion [of confirmatory cases] changes insignificantly" (1992:251) when controlled for that factor. But for some New Guinea language families at least (e.g., Eleman, with three of five languages in the database having virtually identical terms), genetic affiliation as well as borrowing (often suggested by very similar frog names in adjacent languages that are not members of the same family) inflate the frequency of *r* occurrences. Accordingly, from the generic frog name database for each language family or subgroup with more than one member, I randomly selected one case, resulting in a stratified random sample of 91 *languages* (one each from 75 families or subgroups plus 16 isolates), which are represented by 103 generic *names*.

Of the 91 *languages* in my sample (see appendix), 31 (34.1 percent) possess at least one term containing *r*, which is virtually the same proportion as the 35 (34.0 percent) of the 103 generic frog *names* recorded for those languages. In both instances, the proportion of *r* drops (from 41.7 to 34.1 percent, and 39.8 to 34.0 percent) when one controls for genetic relationships.

When all of these results are viewed collectively, as in the second column of Table 1, we can see that in none of the six tests does the proportion of *r* occurrences in frog names reach 50 percent. Whether or not frequencies of 34.0 to 41.7 percent are "extraordinary" proportions (to use Berlin's phrase) is a matter of judgment, but I do not consider the New Guinea data reviewed so far to provide the kind of support for Berlin's first hypothesis that was suggested by his (problematic) Central and South American database. I have, however, found a more compelling pattern than Berlin has proposed, to which I shall return after a preliminary consideration of his onomatopoeia hypothesis.

"Croaks" and "Whistles"

While an English speaker might typically characterize the sound of a frog as a "croak" ([krok]) and even mimic its call as "ribbet" ([rɪbət]), the

Table 1
Summary of tests of Berlin's first hypothesis

Test	*r*		*g*	
	n	%	*n*	%
Generic names				
216 languages	90	41.7	141	65.3
256 names	102	39.8	157	61.3
91 sample languages	31	34.1	57	62.6
103 sample names	35	34.0	61	59.2
Specific names				
304 names	120	39.5	163	53.6
Total names				
560 names	222	39.6	320	57.1

inference of an onomatopoeic basis for frog names that contain *r* segments does not take into account the remarkable diversity to be found in the sounds that frogs (and toads) in fact make. Just as New Guinea frogs might confuse or surprise a Western observer by their appearance or behavior, at least the calls of South American frogs often depart from the stereotype. According to Donaldson, "Doris M. Cochran of the Smithsonian Institution spent many nights deep in the steaming jungles of southeastern Brazil, listening to and describing the sounds of frogs" (Donaldson 1980:98–99), producing a list including, among many others: "Like a cricket—pip-pip-pip-pip"; "Cry as in ah, ah, ah, grunting like a pig slowly"; "A booming metallic sound, with regular clanging, like that of a blacksmith beating an anvil"; "Frequently repeated tit-tit-tit-tit"; "A whispering voice, a note like tschw, tschw, tschw, often repeated"; "Cry of wah, wah, wah, wah, wah"; "Musical high-pitched metallic coo-coo-twice repeated"; and "A plaintive whimpering."

The Karam people, whose frog folk biology is certainly the most thoroughly studied system in New Guinea (and perhaps the world), clearly recognize comparable diversity in the sounds made by the frogs in their environment. As Bulmer and Tyler report:

> According to Majnep [one of Bulmer's main informants], Karam distinguish between the *mnm* ("speech", "call" or "natural sound") of a frog, which it makes spontaneously, and the *wal* ("cry"), which it makes in fright or pain, as when being taken by a snake or a human captor. Majnep says he does not think the "cries" of frogs vary greatly from kind to kind, whereas the "call" is generally different for each kind. Further, he says, some frogs make different sounds when they are just beginning to call in early evening, from those which they make when they are in full voice. Others have more than one standard call. Some frogs' calls (e.g. those of *kwlek* or *gwnm*) may be described as *gwglak* ("croaks"): others, e.g. one of the calls of *wyt*, as *sabok* ("whistle"): most, however, can only be described verbally as *mnm*, though informants distinguish them according to taxon, and can imitate many of them. [Bulmer and Tyler 1968:356]

With such a wide range of potential models, should we expect the Karam or anyone else to privilege any particular sound upon which to base their names for the creatures that make them?

It is true that some New Guinea peoples claim that *some* of their frog names are onomatopoeic. Thus, among the BEAMI (Etoro),[6] "a frog was named *ego* after its call" (Dwyer 1990:121), and the KEWA specific frog name *tutu-wapi-ruru* is said to be "an (alternative) name for the *wapi-ruru* frog [so named because it cries *tutu*]" (Franklin and Franklin 1978:235). In seeking etymologies for Karam frog names, Bulmer found that five specific names were claimed to be onomatopoeic: *akok*, *gttek* or *gwttek*, *kwyos*, *lk*, and *wyt* or *wytwyt* (Bulmer and Tyler 1968:362, 363, 368, 369). While some of the sounds reportedly made by these frogs are somewhat ambiguously described, only two of the seven reportedly "onomatopoeic" names, *lk* and *tutu-wapi-ruru*, contain Berlin's [r] (or [l]).

On the other hand, Berlin's proposal is that [r] and [l] "seem to be *unconsciously* drawn upon as the most appropriate sounds from the human speech inventory to serve as segments for the names of anurans" (1992:250, emphasis added). Thus he might argue that the issue turns on whether or not the sounds that frogs make typically include *r* regardless of informants' *conscious* recognition of the fact in their naming practices. Given the paucity of reliably determined referents of New Guinea frog names (available for only 6 out of the 30 languages in the database for specific names) and the concomitant incompleteness of our field knowledge of the frogs themselves, the data we have to work with are few. For AWA speakers, *kíukíuq* is reported as the "noise made by [a] frog" (Loving and Loving 1975:61), the BRAT term *kanit* is glossed as 'croak' (Elmberg 1968:290), and according to KEWA speakers, the "cry" of the *kenome* frog "sounds like *geao geao*" (Franklin and Franklin 1978:153). Again, the most numerous data come from Bulmer's research among the Karam, but not all of them are unambiguous. Bulmer glosses the Karam term *gwglak* as 'croaks' and *sabok* as 'whistle' (Bulmer and Tyler 1968:356), the most common general characterizations of frog sounds, although these are not necessarily mutually exclusive. Thus, with regard to the frog given the specific name *mabas* (or, alternately, *monas*), "informants disagree as to call, some saying it is a croak . . . , others that it is a very loud whistle" (Bulmer and Tyler 1968:364). For another 11 Karam specific frog taxa, the information is more straightforward:

akpt or *aymeneb*, "Call 'tytyty' ('chichichi')" (p.369)
cebs "Call said to be *tytyty* (as *akpt*)" (p.369)
danbon "Call a high-pitched 'pok-pok-pok' " (p.361)
gepgep "Call said to be same as that of *kwyos*" (p.364)
gojmay, *byn-pk*, or *byn-pok* "Call variously rendered as 'k-k-k' or a high-pitched throaty 'la-la-la' (each squeak preposed by a glottal-stop)" (p.364)
kabanm— "Call is a piping whistle" (p.367)
kawag "Call a high-pitched 'kuk-kuk-kuk-kuk' (p.360)
kogop—"Informants disagreed as to its call, but some said, similar to *kwyos*" (p.361)
kosaj or *kosoj* "Gi says that although the female . . . is silent, the male's call is a

high-pitched 'tok-tok-tok' " (p.361)
kwlek or *cgep* "Call said to be a croak . . . 'k-k-k' (as also call of *gojmay*), or 'tch-tch-tch' " (p.365)
kwyos "Call said to be a squeak, as of air being drawn in between tightly pursed lips" (p.363)

While the number of examples is small, in only one case, the KALAM (Karam) specific frog name *gojmay* (whose alternate name is *byn-pk*), does the call reportedly made by it—"a high-pitched throaty 'la-la-la' "—include either [l] or [r].

However, before abandoning the search for an onomatopoeic basis for frog names, one might note a tendency that *does* clearly appear in this set of names, and that is for the velar stop [g] or its unvoiced version [k] to occur in the reputed sounds made by at least some Karam specific taxa—in perhaps 7 out of 11 cases, with the nature of a 'squeak' (another three possible cases) being unclear. Might Berlin have been on the right track, but focusing on the wrong sound classes?

Is *g* for Frog?

In considering Indo-European frog names, Malkiel (and Berlin) might have noticed the frequency of *g* segments (here taken to represent the closely related velar fricatives [k] and [g], velar stops [x] and [g], and the glottal stop [ʔ]) as easily as that of *r*. Old English *frogga* and *tosca;* Middle English *frogge, vrogge,* and *frugge;* Anglo-Saxon *frogga;* modern English *frog;* Dutch *kikker* and *kikvors;* French *grenouille;* and Icelandic *froskr* could be cited as examples of *g* as well as of *r*. (Yet there are a few clear exceptions, such as Italian *rani* and Spanish *rana*.) It can also be noted that, among the Central and South American languages listed by Berlin (1992:252–254), 14 (56.0 percent) of the 25 (excluding those with only 'tadpole' terms listed) have at least one frog name that includes *g*. Thus, these non-systematically-drawn samples of world languages could suggest an alternative hypothesis to Berlin's, namely, that names for anurans disproportionately employ *g* sounds. As with the *r* hypothesis, my New Guinea database can be used as a larger and more representative sample than either of Berlin's; accordingly, the six tests earlier conducted were repeated for *g*.

With respect to generic frog names, 141 (65.3 percent) of the 216 *languages* possess at least one term that includes *g*. When the 256 *names* are examined, 157 (61.3 percent) are found to contain *g*. In both instances the proportion is substantially higher than that for *r:* 41.7 and 39.8 percent, respectively, as discussed above. Using the stratified random sample, again we find considerable increases from *r* proportions, with *g* showing a frequency of 57 (62.2 percent) out of 91 *languages* (compared to 34.1 percent for *r*), and 61 (59.24 percent) of 103 *names* (contrasted with *r* frequencies of 34.0 percent). Turning to specific names, 25 (83.3 percent) of the *languages* for which data are available have at least one *g* term, which is similar to the 86.7 percent frequency for *r*, and 163 (53.6 percent) of the total of 304 *names* contain a *g* segment, compared to *r* segments in 39.5 percent. Finally, when all 560 New

Guinea frog names are combined, 320, or 57.1 percent, contain *g*, as compared to 39.6 percent for *r*. For ease of comparison, the results of all 12 tests for both the *r* and *g* hypotheses are shown in Table 1. If one had to choose between the two, surely the *g* hypothesis appears to receive more support so far as New Guinea languages are concerned. But what about the proposed onomatopoeic basis for these names?

"Croaks" and "Whistles" Again

As with *r*, our data are few and no straightforward test of onomatopoeia is possible. However, out of the seven *reportedly* onomatopoeic frog names discussed above, only two (*lk* and *tutu-wapi-ruru*), or 28.6 percent, were judged to contain *r*, whereas *five* (*akok, ego, gttek, kwyos,* and *lk*), or 71.4 percent, include *g*. Also, when we examine the *sounds* reportedly made by the 11 Karam frog taxa discussed above, five (those of *danbon, gojmay, kawag, kosaj,* and *kwlek*), or 45.5 percent, unambiguously contain *g*; two more (*akpt* and *cebs*) include [č], which might be considered similar to [k]; and judgments regarding the remaining three (*gepgep, kogop,* and *kwyos*) depend on what is meant by a 'squeak.' Only *one* of the 11 calls (that of *kabanm*, with its 'piping whistle') could probably not reasonably be considered as an example of *g*.

Onomatopoeia or Language Preferences?

Without more complete information regarding the sounds actually made by all of the New Guinea frogs referred to by the names considered here, no adequate test can be made of the onomatopoeia hypothesis. However, we can conduct a kind of test of the null hypothesis by asking whether the frequency of inclusion of *g* (or *r*) segments in frog names is simply a reflection of the commonality of those sounds in the languages' lexicons *in general*. If these are in fact very common sound classes, then high proportions of them in frog names would not necessarily indicate anything unusual, such as the constraints Berlin has proposed.

Ideally, of course, one should conduct frequency counts for entire lexicons (and for all sound classes), but this is not possible with available data and resources. As an alternative, I selected four *control terms*—'smoke,' 'stone,' 'sugar cane,' and 'tooth'—usually included in standard word lists, arguably representing "basic" vocabulary items (at least in New Guinea), and unlikely to be influenced by onomatopoeia. Using my stratified random sample of 91 languages, I coded the four control terms with respect to inclusion of *g* and *r* sounds.[7] Tabulations of my codings, along with those for generic frog names from the same languages, are summarized in the second and third columns of Table 2.

It is evident from these tabulations that generic frog names employ *r* sounds with a substantially higher frequency than is true for any of the four control terms, with 34.1 percent of the languages possessing at least one frog name employing *r* while only 16.9 to 24.4 percent of them include *r* in the control terms taken individually, and 19.6 percent when they are

Table 2
Comparison of control terms and generic frog names (Stratified random sample)

Item	*r*		*g*		*r* or *g*		*r* and *g*	
	n	%	*n*	%	*n*	%	*n*	%
'Smoke'								
90 languages[a]	17	18.9	38	42.2	50	55.6	4	4.4
'Stone'								
89 languages[a]	16	18.0	39	43.8	49	55.1	6	6.7
'Sugar cane'								
83 languages[a]	14	16.9	32	38.6	42	50.6	4	4.8
'Tooth'								
90 languages[a]	22	24.4	41	45.6	50	55.6	13	14.4
All control terms								
352 cases[a]	69	19.6	150	42.6	191	54.3	27	7.7
'Frog'								
91 languages	31	34.1	57	62.6	66	72.5	22	24.2

[a]Missing data result in fewer than 91 (or 364) langauges.

aggregated. This pattern is even more striking with respect to *g* sounds, found in at least one generic frog name for 62.6 percent of the languages, contrasted with a range of 38.6 to 45.6 percent for individual control terms and 42.6 percent when the four are combined.

Simple frequencies in themselves, however, can be misleading; so the *significance* of these differences was determined by using Z-tests, with the normal curve used as an approximation for the binomial expansion. With respect to *r* sounds, their frequency in the aggregated control terms (69 out of 352 cases) would lead us to *expect r* sounds in the generic frog names of only 17.8 languages, whereas the actual incidence is 31. This difference is highly significant ($Z = 3.47$, $p < .0003$). Even more significant is the difference between expected and actual occurrences of *g* sounds in generic frog names, with 57 cases instead of the expected 38.8 ($Z = 3.86$, $p < .0001$). These results indicate that *both r* and *g* sounds occur in generic frog names for the randomized sample languages with significantly higher frequencies than would be predicted on the basis of their general occurrences.

Is It Either/Or, or Even Both?

Since the results with respect to both Berlin's choice of *r* and mine of *g* are significant, we might combine the two and hypothesize that *either r or g* sounds, or even *both* of them, will be incorporated with disproportionate frequencies in frog names.

Turning again to Table 2, the fourth column includes the frequencies of *either r or g* in at least one generic frog name and in the control terms for the languages in the stratified random sample. Of those languages, 66 (72.5 percent) possess at least one such frog name, while frequencies of *either r*

or g in the four control terms range from 50.6 to 55.6 percent, and 54.3 percent in the aggregated terms. Again, the difference between the latter frequency and that for generic frog names is highly significant, with 66 cases rather than the expected 49.4 ($Z = 3.49$, $p < .0003$).

Finally, as shown in the fifth column of Table 2, the frequency with which *both r and g* are found in at least one generic frog name in the randomized sample languages is 24.2 percent, as contrasted with a range of 4.4 to 14.4 percent for the control terms taken individually and 7.7 percent when they are aggregated. The pattern for the control terms would lead us to expect *both r and g* sounds in generic frog names for only 7.0 languages, while the actual number of cases is 22, resulting in an extremely significant difference, with the largest Z-score of all four columns ($Z = 5.90$, $p < .0001$).

Conclusions

The New Guinea data presented here constitute strongly supportive evidence for the claim that the naming of frogs (and toads) is neither arbitrary nor a simple manifestation of common patterns in word formation. Berlin's hypothesis regarding *r* and related sounds receives considerable support, but even more is found for *g* and similar sounds. While Berlin gave insufficient acknowledgment to the range of sounds frogs (and toads) actually make, if we accept the proposal that *r* and *g* sounds are commonly, if not always, made by anurans, the possibility of onomatopoeia as a motivating factor for the patterns discovered clearly appears credible. Obviously, with respect to both issues, worldwide samples of languages need to be examined before any "substantive universal" can be claimed (Berlin 1992:250). While this is a somewhat hackneyed cautionary statement, in this case my analysis indicates that there is good reason to conduct such investigations. Although frequencies of *r* and *g* sounds in *specific* frog names are impressively high, as discussed earlier, such names are often structured in terms of physical features of the creatures (e.g., color) or habitat (Bulmer and Tyler 1968), factors that conceivably might override other considerations. Thus, future research might usefully and sufficiently focus on *generic* frog names, for which the data are likely to be more abundant in any case. This should be a manageable task with respect to Amerindian, African, and other languages, and the prospects are exciting.

Whether sound patterns are likely to be so compelling with respect to other organisms is questionable, especially for plants, but Berlin's Huambisa Jivaro data (1992:235–250) regarding bird and fish names suggest that we may be dealing with a family of templates for ethnobiological nomenclature that are not limited to anurans. Thus Berlin's preliminary findings and those presented here underscore not only the need for more field studies of folk biology, especially urgent as many of these knowledge systems face imminent extinction in the context of worldwide economic and social change, but also the unanticipated payoffs of what can seem rather arcane topics for research. Whether indeed "universal" or not, the patterns described here pose explanatory challenges, with templates based on sound symbolism plausible contenders.

Notes

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1. For present purposes the name "New Guinea" refers to the Indonesian province of Irian Jaya and the independent nation of Papua New Guinea, excepting the islands of Bougainville, Buka, and the Bismarck Archipelago.

2. In this article I do not use the terms *generic* and *specific* in the technical sense employed in Berlin's schema. Instead, the former refers merely to "general" or "cover" terms for 'frogs' or 'frogs and toads,' with the latter referring to those used to designate "types" or "kinds" of these creatures.

3. Exceptional in this regard are the Etoro, for whom frogs are said to be "quantitatively important in the diet" (Kelly 1977:40). Also, writing of the Gadio Enga, Dornstreich suggests that "[f]rom a nutritional point of view, *regular* eating of such small sources of high quality protein [as frogs] is definitely preferable to a pattern of more substantial, but less frequent consumption" of larger game animals (1973:266, emphasis in original). I hope to explore frogs' salience, both nutritional and otherwise, in a separate publication.

4. Given space considerations, data sets are not included here, but they may be obtained, with references, from the author.

5. In New Guinea languages, Berlin's [r] sound class is realized as the "flap" [ɾ], with the dental/alveolar lateral [l] being a very common allophone.

6. For purposes of this article, language names will be indicated with all uppercase letters, following those used by Wurm and Hattori (1981). These names are not always the names by which groups are known in the ethnographic literature, just as their language classifications, which I also use in this article, are not universally adopted. Nevertheless, for consistency and unambiguous reference I employ the naming and grouping conventions of Wurm and Hattori.

7. Insofar as possible, I drew these terms from the same sources, or at least the same researchers, that provided the generic frog names for the database. Additional references, as well as the control-term data, can be obtained from the author.

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Appendix

Generic Frog Terms

Languages n = 216; names n = 256. (* denotes language included in stratified random sample.)

	Language	*Genetic Affiliation*	*Term(s)*
	ABASAKUR	Omosan Family	isto
	ABELAM	Ndu Family	maak
*	AGÖB	Pahoturi River Family	palugo
*	ALAMBLAK	Alamblak Family	kʰo′ kʷatʰ
	〃	〃	khukhar
*	ALFENDIO	Arafundi Family	magay
	AMA	Arai Family	sɛlloᵘ
*	AMAIMON	ISOLATE	su:t
	AMELE	Gum Family	awɔ:k
	AMTO	Amto-Musian Family	huno
*	ANGAUA	Atan Family	ogʌs
*	ANGORAM	Pondo Family	′kʰəřem, ′khəřɛm
	ARAMO	Waibuk Family	sau
*	ARAPESH, MT.	Arapesh Family	maki
	ARAWUM	Kabenau Family	ñam
*	ASAS	Evapia Family	hamɛnɛ
	ATEMPLE	Atan Family	aŋgramʌm
	〃	〃	u:kis
*	AUTU	Ram Family	yowkey
*	AUYANA	Eastern Family	awaima
	〃	〃	táoma
	AWA	Eastern Family	iô, iyo
*	AWIN	Awin-Pa Family	crawe
	BAGUPI	Hanseman Family	awɔgo
*	BAHINEMO	Bahinemo Family	wabi
*	BAIMAK	Baibai Family	ok
*	BANARO	ISOLATE	pʰʌ′kʰɛ
	BARUYA	Angan Family	nyaabula
	BAU	Gum Family	awɔk

*	BEAMI	Bosavi Family	sai
	BEMAL	Kokon Family	bʌl
	BENABENA	East-Central Family	soló('i)
	BEPOUR	Kumilan Family	iti
*	BERIK	Tor Family	sádjak
	BIAK	Geelvink Bay Sub-Group	mankran
	"	"	robebré
	BIKARU	Sanio Family	kadi
*	BIKSI	ISOLATE	bidu
	BILAKURA	Numagenan Family	maiban
	BIMIN	Ok Family	koor
	"	"	kyn koor
	"	"	ok koor
	BIYOM	Brahman Family	mbusu
	BO	Arai Family	nʌmel
	"	"	nau
*	BOAZI	Boazi Family	taka
*	BOIKEN	Ndu Family	magi
*	BOM	Mindjim Family	balumdu
	"	"	ŋorŋor
	BONGU	Mindjim Family	krongroŋ
*	BRAT	Central Bird's Head Family	ach
	BUNABUN	Mabuan Family	kukaŋgat
	"	"	mamur
	BURUM	Western Huon Family	kaŋ
*	BUSAN	ISOLATE	ʌi
	CHIMBU	Central Family	dú
*	DADIBI	Teberan Family	gereli
*	DANARU	Peka Family	kamɛn
*	DANI, WEST	Great Dani Family	kuri
*	DEM	ISOLATE	oenja
*	DIMIR	ISOLATE	imbɛlɛŋot
	DUDUELA	Nuru Family	fɛligu
	"	"	kamɛna
	DUMPU	Evapia Family	awaw
*	EKAGI	Ekagi-Wodani-Moni Family	dogé
	ENGA	West-Central Family	mónge, moŋgi, mɔwge
	"	"	godi, koti, xodi
	ERIMA	Nuru Family	pelɛŋgu
	FAITA	Brahman Family	pure
	FAIWOL	Ok Family	fagâp
	"	"	kul
*	FASU	West Katubu Family	kuti
*	FOE	East Katubu Family	auwage
*	FORE	East-Central Family	táko', táro'
	GADSUP	Eastern Family	kabani
	"	"	watoya
	GAHUKU	East-Central Family	gízalá', gízele'

	GAL	Hanseman Family	awɔ:g
	GANGLAU	Yaganon Family	kwɛŋkwɛŋ
	"	"	pr̃ik
	GARUH	Hanseman Family	bir̃oy
	"	"	kir
	"	"	lɛkay
	"	"	wawɔ:k
	GARUS	Hanseman Family	sisul
	GENDE	East-Central Family	tumua
	GIMI	East-Central Family	huba
	"	"	kua'
	"	"	uka
*	GIRAWA	Kokon Family	$p^h\wedge 1$
	GUMALU	Gum Family	ok
*	HEWA	Sanio Family	uwal
	HINIHON	Tiboran Family	so:pu
	IKUNDUN	Pomoikan Family	g*u*r*u*pa
	IRESIM	Geelvink Bay Sub-Group	koewaroe
	ISABI	Brahman Family	kuna
	ISEBE	Gum Family	awɔ:g
	ITERI	Arai Family	nau
	JILIM	Nuru Family	imɛm
*	KAETI	Awyu-Dumut Family	aò
	KALAM	Kalam Family	as
	KAMANO	East-Central Family	éso(na), hésó(na)
	"	"	hoga', hoga(na)
	"	"	olúsapa(na)
*	KAMBA	Hanseman Family	kɔ:g
*	KAMBOT	Porapora Family	uk^hðr̃ðmphð
	KAPRIMAN	Bahinemo Family	k∧k∧l∧
*	KARE	ISOLATE	yaira
	KÂTE	Eastern Huon Family	qaqec
	KATI, SOUTH	Ok Family	kòt
	KATIATI	Sikan Family	kukasa
	KESAWAI	Evapia Family	k∧mne
	KEURU	Eleman Family	paripara, poripara
	KEWA	West-Central Family	kuri, uri
*	KIWAI, SOUTH	Kiwaian Family	keon
*	KOBON	Kalam Family	as
	"	"	baŋ
*	KOGUMAN	Omosan Family	piŋ
*	KOIARI	Koiarian Family	mavo
*	KOLOM	Kabenau Family	par̃ŋgau
*	KOPAR	Nor Family	'gr̃ongr̃ok^h
	KORAK	Kowan Family	gul∧k
	KOSORONG	Eastern Huon Family	taŋak
	KOWAKI	Tiboran Family	horina
	KWATO	Nuru Family	kamɛna

	〃	〃	paliko
*	LABU	Siassi Family	sôkôla
*	LEMBENA	West-Central Family	monge, 'moŋge, mɔŋk
	LEMIO	Kabenau Family	krogro
*	MALAS	Mabuan Family	inzi
	MALE	Mindjim Family	kʰriŋ
	MANDER	Tor Family	soeger
*	MAPE	Eastern Huon Family	pakpek
*	MARIND	Marind Family	adolo, ghadolo
	〃	〃	gargur, garguru, gulgul
*	MARING	Central Family	kamp
	MATEPI	Hanseman Family	ogo
	MAWAK	Tiboran Family	sopuʌ
	MAWAN	Hanseman Family	ogo
	MIANMIN	Ok Family	map
*	MIYAK	Yuat Family	'ȼamu, samokʰ
*	MOERE	Kumilan Family	iti
	MOI	West Bird's Head Family	kedák
	MORESADA	Pomoikan Family	gɨrɘp
	MOSIMO	Hanseman Family	magala
	〃	〃	wahe
*	MUGIL	ISOLATE	kutɛr
	MUNIT	Kokon Family	kõlɛ
	MURIK	Nor Family	'kʰokʰřaikʰ, pʰopʰřakʰ
	MURUPI	Hanseman Family	ogo
	〃	〃	suhuřu
*	MUSAK	Emuan Family	ŋʌŋʌm
*	MUSAR	Tiboran Family	hali:nʌ
*	MUSIAN	Amto-Musian Family	sɛkɛ
*	NAGATMAN	ISOLATE	giˀ
	NAKE	Hanseman Family	ˀo:g
	NDUGA	Great Dani Family	manggè
	MGALUM	Ok Family	kol
	NIMO	Arai Family	yɔ:melk
	NINGIRUM	Ok Family	bumbia
*	NOMAD	East-Strickland Family	gwamo
	OPAO	Eleman Family	paripara
	OROKOLO	Eleman Family	pariala, pariara
*	OSUM	ISOLATE	okasa-
	OWINIGA	Arai Family	nekwa
*	PANIM	Gum Family	og
*	PAPI	Papi Family	siyauɓo
	PARAWEN	Numagenan Family	maiwan
*	PAWAIAN	ISOLATE	sio
	PAY	Kaukombaran Family	kurɛŋkurɛŋ
*	PAYNAMAR	ISOLATE	kwasa
	PIAME	Sanio Family	kɔdi

	"	"	se'yala
	PILA	Kaukombaran Family	kruboas
*	PINAI	Waibuk Family	'sau, sa'u
	PONDOMA	Pomoikan Family	ansaŋ
	PULABU	Kabenau Family	kʌge
*	PYU	ISOLATE	pʌlʲʌsuˀ
*	RAO	ISOLATE	baŋ
	"	"	zungwa
	RAPTING	Hanseman Family	biloˀ
	"	"	sunar
	REMPI	Hanseman Family	bi:r̃ok
	RERAU	Nuru Family	imɛm
*	ROCKY PEAK	Arai Family	naᵘ
*	SAEP	Yagnon Family	tʰʌkʰo
	SAKI	Kaukombaran Family	koʌra
	SAMOSA	Hanseman Family	sɛsɛr
	SANIO	Sanio Family	so
	SARUGA	Hanseman Family	ogo:, oyay
	SAUSI	Evapia Family	kʌ:mɛnɛ
*	SELEPET	Western Huon Family	kesuŋ
*	SENTANI	Sentani Family	hikè
	SIANE	East-Central Family	hanu
	"	"	hera, kélá
	SIHAN	Gum Family	o:k
*	SILEIBI	Sikan Family	kanza
	"	"	ma:murɛ
	SILOPI	Hanseman Family	ogo:
	SINSAURU	Evapia Family	hamana
	SIROI	Kabenau Family	gir̃po
*	SOBEI	Sarmi Sub-Group	wéhtrow
	SONGUM	Mindjim Family	koŋgʌŋ
	SUMAU	Peka Family	itʌ
*	TAIKAT	Taikat Family	goewèh, gwèh
	TAIRORA	Eastern Family	eqaboka
	"	"	fe'ana
	"	"	taa'vasa
*	TANI	Kaukombaran Family	dʌgʌ
*	TARUNGGARE	East Geelvin Bay Family	ikè
*	TAUYA	Brahman Family	ununu
*	TEHIT	West Bird's Head Family	qaqo
*	TELEFOL	Ok Family	kol
	TIFAL	Ok Family	kool, kul
*	TOARIPI	Eleman Family	horahora
	"	"	malele
	"	"	pakeke
	UARIPI	Eleman Family	karakara
	UKURIGUMA	Numagenan Family	mamur

	ULINGAN	Kumilan Family	ikia
*	URIA	ISOLATE	bli, blɪk
	URIGINA	Peka Family	kamin
	USINO	Peka Family	itʌ
	USU	Nuru Family	tɛmul
	UTU	Hanseman Family	oga
*	WADAGINAM	ISOLATE	uŋgi:gᵊnʌmp
	WAFFA	Eastern Family	yéekaana
	WAHGI	Central Family	'ndók
	WAIBUK	Waibuk Family	hambʷu'mʌ1
	"	"	hau
	WALIO	Walio Family	sosikaɬʌ
	WAMAS	Hanseman Family	kukunai
	WANAMBRE	Tiboran Family	mʌkɛl
	WANDAMEN	Geelvink Bay Sub-Group	ròswai
	"	"	wagɛ̆rini, wangirïni
*	WANTOAT	Wantoat Family	ngwak
	WANUMA	Numagenan Family	mʌmur
*	WARIS	Waris Family	kɨl
	"	"	kuke
*	WAROPEN	Geelvink Bay Sub-Group	koidoanino
*	WASKIA	Kowan Family	kari
	YABEN	Numagenan Family	maibʌn
*	YABIO	Walio Family	ʌroma
	"	"	emene
	YABIYUFA	East-Central Family	osulepa
	YABONG	Yaganon Family	dɔku
*	YAGWOIA	Angan Family	nable
*	YANGULAM	Nuru Family	anma
*	YAQAY	Yaqay Family	qarò
*	YARAWATA	Numagenan Family	maiban
*	YIMAS	Pomoikan Family	kʰʌlayŋ
	"	"	kʰukʰʌlak
	YOIDIK	Hanseman Family	gadan
	YONGGOM	Ok Family	kot
*	YOTAFA	Yotafa Sub-Group	oem
	ZIMAKANI	Boazi Family	wewe