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KAPAUKU NUMERATION: RECKONING, RACISM, SCHOLARSHIP, AND MELANESIAN COUNTING SYSTEMS⁽¹⁾

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While it is understandable that Pospisil and Price⁽²⁾ might be unhappy at our dismissal of their suggestion that Kapauku numeration may derive from ancient Babylonia, and that they might bristle at the term "racism" applied to their idea, it is clear that they did not read our article carefully. "Racist implications" does not mean a deliberate racist view. And it is unfortunate that, rather than responding to the issues involved in interpretation of Melanesian counting systems, they have merely resorted to charges about our "ignorance of the pertinent literature" and "faulty logic".

Because their original paper was published in a source not readily available to many readers of the Journal of the Polynesian Society, I will first summarise their argument and review their scholarship. I will then go on to analyse reckoning systems of the Kapauku (also known as Ekagi or Ekari) and their neighbours, and finally comment on the real issues.

THE CASE FOR BABYLONIAN DERIVATION OF KAPAUKU RECKONING

Price and Pospisil's proposition⁽³⁾ is as follows. The "isolated" Kapauku mountain Papuans use a 60-base system of numeration (see Table 1). This system, according to the authors, "is a perfectly ordinary sexagesimal arithmetic of the Babylonian variety, counting to base sixty, and even considering it natural that half and thirty are denoted by the same word." Terms for numerals 1-5 seem indigenous while 6-9 have an Austronesian source.

Peculiarities of Kapauku numerals behind Price and Pospisil's view of Babylonian derivation are:

- terms for 60 (*muto* or *bado* meaning 'thigh' *muta* or 'foot, base')
- terms for 30 (*amonaato* 'half' or *jokagaati* 'child of ten')
- terms for 20 and 40 (*mepi* × one, *mepi* × two; possible survivals of reckoning in thirds)

To appreciate the condescending air of these authors towards Kapauku folk science, the reader must refer to the original paper. This tone is, however, not apparent in Pospisil's monographs.⁽⁴⁾

1. Because Mr Lepi has returned to Papua New Guinea, I shall respond to Pospisil and Price's 1976 note. I thank Ralph Bulmer, Susan Bulmer, Ross Clark, Carolyn Hide, Robin Hide and Andrew Pawley for advice on specific points. Responsibility for interpretation of the literature is mine alone.
2. Pospisil and Price 1976.
3. Price and Pospisil 1966.
4. Pospisil 1958, 1963.

The authors continue: the Kapauku can readily halve and double, add and subtract in sets of 60, but no other aspects of Kapauku folk science such as astronomy show Mesopotamian connections. "All that we have is the clear evidence for sexagesimal arithmetic, otherwise unknown in modern or historic times outside the regions of direct Babylonian influence."⁽⁵⁾

Seeking some connection, Price and Pospisil cite early nineteenth century (A.D.) material from South India, "which is sufficiently near the known trade routes to New Guinea for such a relation to be due to migration and trade contacts,"⁽⁶⁾ including a non-literate method of eclipse prediction from Pondicherry. They conclude:

Do we now have therefore a second instance in which Babylonian sexagesimal methods seem to have survived for some two thousand years at least by transmissions and cultures unknown, in what seems to be an oral tradition in South India and in New Guinea?⁽⁷⁾

I repeat Price and Pospisil's main points:

1. Kapauku numeration is 60-based.
2. The Kapauku conceive of halves and thirds of 60.
3. The Kapauku were isolated from the rest of the world.
4. There is an example of a South Indian oral tradition in mathematical astronomy which harks back to Near Eastern/Mediterranean origins.

Pundia Lepi and I disputed only the third and fifth of these statements. Our comment on the Price and Pospisil hypothesis reflected our view that none of these points in themselves demonstrates a Babylonian connection, and our distress that by these authors' refusal to analyse Kapauku reckoning in terms of known characteristics of Melanesian numeration systems, the Kapauku and all Melanesians have been sold short.

PRICE AND POSPISIL'S SCHOLARSHIP

1. Trade.

In regard to "known trade routes to New Guinea," Price and Pospisil cited no sources. Modern views of early to fifteenth century Old World trade emphasise regional centres influencing one another rather than the late nineteenth century ethnocentric picture of a one-way influence from some one seminal centre. The focus of scholarly interest has long since shifted from an assumption of Near Eastern impetus everywhere — the extreme diffusionist position — to a focus on regions, e.g., East and South-east Asia as realms. By 1966, there was enough known about the extensive relations between Melanesian and insular South-east Asia to enable Price and Pospisil to make some concrete statements. Much material had been collected about Indonesian, Chinese and European trade with New Guinea.

I will ignore Price and Pospisil's undocumented speculations about Mesopotamian relations with Melanesia and instead briefly summarise what has been established about New Guinea's prehistoric and protohistoric relations. In Melanesia itself, early trade between coast and interior eastern New Guinea may be inferred from the presence of marine shells (cowries) at the Kafivana site, perhaps 9,000 years ago.⁽⁸⁾ Agriculture had begun more than 5,000 years ago. Potsherds at the Wañlek site, at a level not less than 3,000 years B.P. have been

5. Price and Pospisil 1966:32.
6. Price and Pospisil 1966:32.
7. Price and Pospisil 1966:32.
8. White 1972.

attributed to trade with Austronesian speakers.⁽⁹⁾

One Melanesian domesticate, sugar cane, had reached India by the middle of the first millennium B.C.,⁽¹⁰⁾ a fact not directly attributable to Babylonian influence. Undated stone copies of bronze axes and spearheads have been found in several montane New Guinea localities, including the Grand Valley of Irian Jaya⁽¹¹⁾ — which is within the extended orbit of present-day trade links involving the Kapauku. Actual bronze objects have been unearthed at Lake Sentani.⁽¹²⁾ By the close of the first millennium A.D., New Guinea may have been firmly within the Indonesian trading realm; by the sixteenth century eastern Indonesian traders were established in coastal areas of what is now Irian Jaya.⁽¹³⁾

The traders who it seems had the most contact with western Melanesians were from eastern Indonesia, especially Ceram. "Kapaoko" — a general term for the interior mountain peoples — were well known on the Mimika coast.⁽¹⁴⁾ Pospisil himself has recorded contemporary Kapauku trade contacts with Mimika on the one hand and other mountain peoples such as the Moni, Uhunduni and Dani on the other.⁽¹⁵⁾ Expedition leaders of the 1920s and 1930s were impressed by the wide range of contacts of some of the mountain Papuans.⁽¹⁶⁾ The Kapauku were certainly not isolated.

A serious attempt to account for Kapauku numeration by diffusions from Babylonia should have included some reference to Kapauku relations with non-Kapauku peoples and to the historical context of mountain-coastal and other relations further afield.

2. Kapauku numeration.

The reader, unfamiliar with Melanesian arithmetic, might think that Pospisil alone had discovered Kapauku counting, that no other Melanesians possess interesting and relevant numeration systems, and that no previous writers had dealt with Melanesian reckoning. Price and Pospisil cited no references and seem still to be unaware of the vast literature on Melanesian reckoning.⁽¹⁷⁾

Although Pospisil seems to know of the existence of Le Roux's three-volume work⁽¹⁸⁾ on the montane peoples of Irian Jaya — for he lists it in the bibliography of his *Kapauku Papuan Economy*, there is no indication that he is familiar with its contents, that he knows of Galis' and others' surveys of Irian Jaya numerals, or that he has any acquaintance with the characteristics of Melanesian reckoning systems.⁽¹⁹⁾

9. Bulmer, in press.
10. Warner 1962. Also see Artschwager and Brandes 1958.
11. Heider 1969; Bulmer and Tomasetti 1970; Bulmer and Clarke 1970.
12. de Bruyn 1959, 1962.
13. Papuans as slaves have been reported in Java as early as the tenth century A.D. These persons may actually have been native to such present-day eastern Indonesian islands as Timor or Halmahera. A fully comprehensive study of New Guinea's protohistoric and historic relations with Indonesia remains to be written. For surveys emphasising the period after A.D. 1500, one may refer to Elmberg 1968, Hughes 1971, and Pouver 1955.
14. Pouver 1955.
15. Pospisil 1958, 1963 (esp. 1963:331-9).
16. Roux 1948:326-7.
17. Pospisil and Price's accusation of our "ignorance of the literature" is ludicrous. There are 16 citations just on Melanesian counting systems in our 1975 paper. Lepi and I were also aware that Kapauku terms for numerals 6-9 are of Austronesian origin (not "apparently borrowings from Malay" as in Price and Pospisil 1966:31).
18. Roux 1948, 1950 vols. 2 and 3.
19. Galis 1960; Boelaars 1950; Wolfers 1971.

KAPAUKU AND RELATED NUMERATION SYSTEMS

While there are many references to local numbers of the West Irian mountain peoples, from scattered comments in monographs and number words in dictionaries to Boelaars' analysis of Father Drabbe's linguistic materials and Le Roux's collection of numerals obtained from his own and others' pre-Second World War expeditions, all the material must be approached with some caution. Coverage is uneven, there is little information on local rules for use of numerals and less on how numeration systems are used in intertribal trade; some translations are obviously in error. Because the best collection — that of Le Roux — is in Dutch and the material is not well known outside of Galis' surveys, also in Dutch, an examination in some detail of numerals in these montane languages may be worth while.⁽²⁰⁾

Le Roux listed five pages of numerals from five different locations. He included some analytical and comparative discussion. In Table 1, I present two long Kapauku and Moni number lists from Le Roux, together with Pospisil's Kapauku numerals, so that the reader may follow my comparison of Ekagi (Kapauku), Moni, and other reckoning systems. The full listing published by Le Roux includes:

Goliath language family: one body count
 Dani languages (various): three number lists
 Dem: one number list and one body count
 Uhunduni: three number lists
 Ekagi (Kapauku) dialects: four number lists
 Moni: two number lists

There is an additional short list in Moni, probably a digital count, which does not agree in its low numbers with the longer Moni tables.

First, it is important to note the affiliations of languages represented by these lists (see Figure 1). All are probably to be included in the Trans-New Guinea phylum. The Goliath family lies far to the east of the area inhabited by the Kapauku. The Greater Dani family has been linked with Uhunduni, Dem, and the Ekagi (Kapauku)-Moni-Wodani family on a microphylum level. Below this level, Dem remains a stock-level isolate while Uhunduni may be linked with Ekagi-Moni-Wodani on the stock level. From a Kapauku-centred view, one would expect to find closest relationships in number terms with Moni and

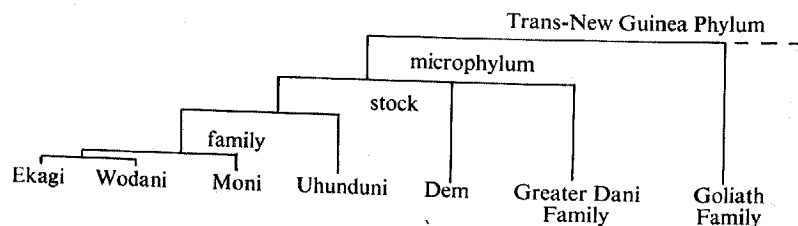


FIGURE 1

Linguistic relations of the mountain Papuans, from an Ekagi-centred view. Some of these languages (of the Greater Dani and Goliath families) have closer genetic relationships with languages outside the area than with those of these other montane peoples. I have also left out the Ok family.

20. Where no other source is specifically cited, the following material is taken from Roux 1950 vol. 2:528-42. Originals of other investigators' number lists printed in that volume are not available to me.

Wodani who share over 40 percent cognates with Ekagi. Ekagi and Wodani are more closely related than either is to Moni.⁽²¹⁾

Although one would not expect to find obvious cognates for Kapauku terms beyond Moni, even further east manners of thinking about quantities may be common, owing both to a basic linguistic inheritance and to influences generated among the montane peoples and from coastal areas during the thousands of years since these languages became separate.

The presence of body counts in areas that would come within the Kapauku sphere of trade contact — especially Dem — should be noted. One common characteristic of Melanesian body counts, and especially odd-numbered counts, is that body parts are indicated starting with the thumb — or more often, little finger — along the hand and up to some central point such as the nose; their counterparts along the other side of the body are named with a suffix or free form indicating other side, or other half. This is clearly shown in the Goliath list, where, for example, number 10, *taung-gé*, is reached at 'shoulder' (*taung*), while number 18, at the opposite shoulder, is *ton taung-gé* (the total in this system is 27). Here can be seen one possibility of a prototype for the feature in which the Kapauku recognise 30 as an important unit in their 60-base system.

Several ways of counting have been reported for various Dani groups. The Dugum Dani and the Pesechem have numerals for one, two, and three. The Dugum Dani also practise a type of counting by two's, sometimes to indicate "many". Heider also reported a more complex system given by one informant but used seldom if at all in the Dugum area.⁽²²⁾ An interesting set of Dani numbers is reported for the Saeoweri-Hablifoeri region, where numerals 1-4 follow the "Australian system"—that is, 1, 2, 2+1, 2+2. An alternative term for 3 (*hingiam*), however, may be cognate with the Dugum form, *henaken*. Moreover, at 5 a body part enters the system: *isia*, 'thumb'. Meanings for 6 and 7 are not indicated in Le Roux. Wirz's list from the Swart Valley Dani is also reprinted in this volume. This could be a 20-based digital system (5=one fist, 15=2 fists and 1 foot) but how much it is used in handling large numbers is questionable, for 'many' (*torab* or *gorop*) is specifically stated to refer to "more than 5". And Le Roux suggested that some Grand Valley Dani may use a body count, as the Archbold Expedition noted people counting shells (30!) by reference to parts of the body.

It is clear only that there is no standardised Dani-wide counting system—not surprising in view of the large population speaking Greater Dani languages — some 200,000 persons—and the vast area involved. Each Dani region seems to have a separate network of trade relationships — see reports of Bromley, Heider, Peters, and Ploeg.⁽²³⁾ Few Dani seem to participate directly in trade coming through Kapauku country or in the less extensive contacts from the Goliath region. Bromley in fact states: "In mid-Grand Valley, where trade is carried on often by small colonies or groups of bilinguals, the majority of the population is linguistically and culturally homogeneous and is untraveled."⁽²⁴⁾ Counting methods recorded specifically from such specialists might reveal more elaborate arithmetics. Data available so far, even from the Swart Valley, do not indicate that the digital count has developed into a true 20-base system.

The Dem number list represents a digital count going up to 20. Like the Swart Valley count, it begins in a 1, 2, 2+1, 2+2 fashion (the Dem also count

21. Larson and Larson 1972. For other recent studies of relationships among these languages of highland Irian Jaya, see Bromley 1967, 1973 and Voorhoeve 1975.

22. Heider 1970:170-1.

23. Bromley 1973; Heider 1970; Peters 1975; Ploeg 1969.

24. Bromley 1973:5.

by two's), and since a special word (*kalòsa*) is glossed as 'many' the system may not, in practice, function as a 20-base, even though Le Roux reports its use in counting shell money. Le Roux also collected a Dem body count with a 25-total in the same locality.

TABLE I
Kapauku and Moni numerals.¹

No. Kapauku ²	Ekari (Kapauku)	Moni (Dzjonggoenaoe clan) ³
1 ena	enà	hàró
2 wija	wijà	hijà, hizà
3 wido	wido	helò
4 wii	wi	wi
5 idibi	idibi	ili
6 benumi	benomi	àmónàró, amonègaro
7 pituwo	pitoewo	àmóne hija
8 waguwo	wároewo	àmóne helò
9 ijee	ijé	àmóne wi
10 gaati	gati	àmóne ili, hànàgi
11 ena ma gaati	enàmà (gáti)	bàló hàró
12 wija ma gaati	wijamà (gáti)	bàló hijà
13 wido ma gaati	widómà (gáti)	bàló helò
14	wimà (gáti)	bàló wi
15	ibidimà (gáti) [sic]	bàló ili
16	benoma (gáti)	àmó bàló hàró
17	pitoewomà (gáti)	àmó bàló hija
18	wároewomà (gáti)	àmó bàló helò
19	ijémà (gáti)	àmó bàló wi
20 mepiina (mepi one)	gátimà (gáti) or mèpinà	àmó bàló ili, mendó hàró
21	enà mèpinà	hàróne mendó hàróne
22	wijà mèpinà	hijàne mendó hàróne
25	idibi mèpinà	iloné mendó hàróne
26	benomi mèpinà	àmóne hàróne mendó hàróne
27 pituwo ma mepiina		
30 jokagaati (child of ten) or àmonaato (a half)	dzjogà gáti	mendó hàró àginé
31	enà dzjogàgáti	hàróne mendó hàró àginé
35	idibi dzogàgáti	iliné mendó haró àginé
36	benomi dzogàgáti	àmóne hàróne mendó hàró àginé
40 mepijja (mepi two)	mèpijja	mendó hijà
41	ena mèpijja	hàróne mendó hijàne
45	idibi mèpijja	iliné mendó hijàne
46	benomi mèpijja	àmónéhàró mendó hijàne
50 gaatibeu (ten without)	gátibéw	àgitàwàdánó
51	enà gátibéw	hàróne àgitàwàdánó
55	idibi gátibéw	iliné àgitàwàdánó
60 muto or bado (foot, base)	bádó	mendó helò
70	bádówádógati	mendó helò àpantó àgi
80	bádo wádó mèpinà	mendó wi
90	bádo wádó dzjogàgati	mendó wi àpantó àginé
98		àmónéhelóné mendó wi àpantó àginé
100	moeto	mendó ili

Notes:

¹ I have retained the orthographies of Price and Pospisil and of Le Roux respectively, and the accents of Le Roux despite some apparent inconsistencies in the latter.
² Price and Pospisil 1966:31.
³ Both the Ekari and Moni lists are from Le Roux 1950 vol. 2:531-2, and both were originally recorded by van Eechoud.

From Uhunduni speakers three number lists collected by other investigators are reprinted by Le Roux. Two are short counts going up to 5 — Le Roux believed these were finger counts. The third count — its low numbers are cognate with the first two lists — goes beyond 22 and is more interesting. It appears to be a digital count built up by 5's, perhaps shifting from limb to limb and side to side. As Le Roux pointed out, there is some internal structural inconsistency: 7 would factor out to 6+2; 8 to 6+3. There are probably no good grounds to view 6 as an important unit, however. And although this lack could be an artefact of recording, the Uhunduni list is the first non-body count so far encountered in this survey from west to east where numbers above 20 appear. Clearly, this system can handle higher numbers.

In the region of the Moni and Kapauku speakers, more elaborate reckoning systems have been recorded (see Table 1).

Moni numbers 1-5 (*hàró*, *hijà* or *hizà*, *helò*, *wi*, and *ili* — note Kapauku cognates) are basic to the system. From 6 through 10 the numbers are formed with the addition of *àmóne* to the lower numbers, thus 9 is *àmóne wi*. The term *àmoe* is said to mean 'nose' but Le Roux said that it is also used to mean 'on the other hand'. I will be referring to the term *àmo* when I come to analyse Kapauku counting. To return to Moni, it proceeds through sets of fives, using the low numbers listed above, to 15, with *bàló* 'foot' being used as the initial term for number 11-15 (e.g., *bàló wi=14*), then adds *àmo* again to express the next five numbers (note 19 *àmo bàló wi*). The term *bàló* is not encountered in numbers other than 11-20; it may be inferred that these numbers factor out to 1-5 on the foot and 1-5 on the other foot.

An important Moni unit is *mendó* (20). Le Roux suggested that it stems from *mè* 'person' and would thus cover one hand of five fingers, the other hand, a foot of five toes, and the other foot. Moni counting proceeds in this same way past 20 in units of five — five on one side, five on the other, to at least 100. For example, 21 is *hàróne mendó hàróne* or '1+20×1' and 26 is *àmóne hàróne mendó hàróne*. Another interesting Moni feature is the term for 50, *àgitàwàdánó* ('not ten' — cf. *gaatibeu* in Ekagi which Pospisil translates as 'ten without') — showing that the unit of 60 is not totally unrecognized in Moni. There is no internal evidence in the Moni list to suggest that *àgi* carries any meaning of 30. Moni, it seems, is essentially a 20-base system, highly developed but of similar nature to the hands-and-feet counts already noted in Swart Valley Dani, Dem, and Uhunduni and found widely in Melanesia.

Kapauku or Ekagi numeration is constructed along lines more familiar to Western readers. "The numbers 11-19 and 21-29, 31-39, etc., are formed in the normal way by the addition of the first nine numerals to the words for ten, twenty, etc."⁽²⁵⁾

Numerals 2-5 are related to Moni terms, but 6-9 in Wodani,⁽²⁶⁾ as well as Kapauku, have Austronesian prototypes. Le Roux found convincingly close cognates from Ambon and Ceram languages for 7, 8 and 9; cognates as well from mainland and offshore island New Guinea for 8 and 9. For Kapauku and Wodani 6 — *binimi*, *benumi*, *benomi*, *menuomi*, *bainowa*, *benowi*, *beniwe* — the presence of the initial bilabial is difficult to account for (cf. proto-Austronesian **enem*). The problem is to find a donor language with an initial bilabial in the term for 6 and suitable cognates as well (without the extra bilabial) for numerals 7-9. In Gah of Ceram 6 is *wonem*,⁽²⁷⁾ the best fit I have found, but Gah terms for 7-9 would require more changes into Kapauku than would some other

25. Price and Pospisil 1966:31 (emphasis mine).

26. Wodani (= Wolani) numbers 1-11 may be found in Galis 1960.

27. Wallace 1869:490-1.

eastern Indonesian number words. It may eventually be possible to pinpoint the exact source for these Ekagi and Wodani loans.

Having incorporated these Austronesian introductions for numerals 6-9, Kapauku does not build its units in fives, shifting from side to side, as does Moni. Kapauku 10 is *gaati* (*rati*, *lati*, *wati*, *dati* in various Wodani and Ekagi dialects) which may be of local origin.⁽²⁸⁾ Kapauku 20 *mepiina* is constructed in the same way as Moni *mendó* from the cognate *me* 'person'.

Unlike Moni, Kapauku gives special recognition to the unit 30 — *jokagaati* 'child of 10' or *amonaato*, which Pospisil glosses as 'a half'. The reader will be reminded of the Moni term *amo*, used in Moni numeration as an initial term for the five numbers "on-the-other-side" and although *amoe* does not mean "nose" in Kapauku, *amo* does have the meaning of 'side' or 'off to the side'. There is actually no entry for *amonaato* as collected by Pospisil in either the Doble or Steltenpool dictionaries,⁽²⁹⁾ nor does it appear in Eechoud's list printed in the Le Roux volume, but two other number lists in the latter source include *amonato*, *emonaato*, etc.

Most Ekagi dialects express 40 as '*mepi* × 2' i.e., '2 persons' but in the Kuik number listed printed in Le Roux, 40 appears as *mèpisa béoe* or '20 without' — again pointing to the importance of 60 as a basic Kapauku unit. All lists except one from the Mapia region where 50 is *datibi* ('10 × 5') show a form for 50 with the meaning of '10 without' — e.g., *gaatibeu*, *lahtibéoe*. And the reader will recall Moni *àgitawà dano*.

Kapauku 60 is *bado* 'foot' (note that its Moni cognate, *bàlò*, is used only to express numbers between 10 and 20) or *muto*, which Pospisil implies is related to *muta*, 'thigh bone'. In Eechoud's Ekari list, as reprinted in the Le Roux volume, *moeto* (which would be *muto* in a standard linguistic orthography) appears as 100. This may be an error in recording or reprinting; alternatively, it could indicate that Kapauku numeration is not fully standardised.

In comparison, both Kapauku and Moni⁽³⁰⁾ reckoning systems show traces of an original digital count (5-based and 20-based), both proceed to 10, 20, 30, 60, and above — Ekagi by 10s using its incorporated Austronesian numbers, Moni through the 5-on-one-side, 5-on-the-other-side method. Despite the difference in bases (60 and 20), some conceptual principles are alike: a cognate or borrowed term *amo* is used to express the idea of half or side of a unit. The terms for 'foot' — *bado* and *bàlò* respectively — are undoubtedly cognates although today they refer to different quantities.

In short, there is nothing exotic or non-Melanesian, save perhaps the Austronesian loan words, about Kapauku reckoning. Several other NAN languages of Irian Jaya have borrowed Austronesian number terms,⁽³¹⁾ although none, except the related Wodani, in the same manner as has Kapauku. Too much store need not be placed on the 60-base of Kapauku numeration; body-count totals, sometimes functioning as bases, have been recorded for 19, 23, 25, 27, 33, 37, 44, 47, 68, etc., in NAN languages.⁽³²⁾ The sexagismal system is really not all that unique. Duke of York Islanders who "usually count in tens but

count coconuts, taro and yams by fours" have "a special set of terms for counting *diwara* ('shell money') in quantities of sixty."⁽³³⁾

Pospisil deserves credit for his setting out the Kapauku 60-base system as a type. It is only too easy to allow the rules for one's own cultural phenomena to distort material in another culture. Boelaars, for example (probably using Father Drabbe's notes), translates Ekari (Kapauku) *joka ghaati* as "three ten" rather than the appropriate 'offspring of 10' and worse, *ghaati béu* as "ten five" rather than 'less 10'.⁽³⁴⁾ According to Boelaars, Drabbe had suggested that the Ekari system was essentially senary with the decimal aspects resulting from Indonesian influence; it has already been seen that there is no basis for positing an original 6-base in highland Irian Jaya counting systems. Despite the range of counting materials available to Le Roux, he never recognised sexagismal numeration as a type. And Galis' 1960 survey, since the numbers dealt with did not go above 40, perforce did not allow for consideration of 60-base systems.

Pospisil and Price pessimistically claim, "It has been shown in anthropological literature that an item introduced into a foreign culture may indeed soon become deeply interrelated with its new cultural milieu so that studying 'the context' will shed little light on the cultural history." I have noted above, however, that "the context" as can be gleaned by a non-specialist in Irian Jaya ethnography has shown that (1) some principles of Melanesian counting systems are shared by the Kapauku and their neighbours; and (2) the Kapauku and other montane Irian Jaya peoples are and were keen traders, a stone copy of a bronze item having been found even in the remote Grand Valley Dani country far to the north-east of the trade route that seems to begin in the Kapauku region. The picture of the Kapauku as isolated has been demolished.

Further information which can help to clarify the development of Kapauku numeration and lay to rest the alleged Babylonian connection may be obtained in the following categories:

1. Prehistory and ethnohistory. Shells and Indonesian-inspired items discovered in dated contexts, and analyses of Indonesian, Chinese, etc. materials.
2. Linguistics. Research may spot the precise source of Kapauku numerals 6-9
3. Ethnography.

a. The provenience of counting systems in highland Irian Jaya is still not known. Material should be obtained from those persons and groups most prominent in trade, as suggested by Bromley's data.

b. What are the rules for counting in various montane areas of Irian Jaya? As for elsewhere in Melanesia, most material on counting systems consists mainly in lists of terms arranged according to English, German, or Dutch categories.⁽³⁵⁾ There is some indication that Kapauku numerals may be less absolute than their European counterparts. For example, Steltenpool's dictionary lists *bado* (= *muto*) as "sixty (sometimes 40, 50)" and *mege badoona* as "a string of 60 (sometimes 40 or 50) shells".⁽³⁶⁾ Kapauku numeration may not be sexagismal in the generally accepted sense. The Kapauku may count days, people, and other entities, as well as shells, but it is clear that research attention should be paid to customary prices in intertribal trade, the numeration system used therein, and the manner in which shells are to be paid, either strung or loose. For example, it is not hard to see that a belt or string consisting of a "standard" unit of cowries could be readily halved and spoken of in terms of halves or sides.

33. Boelaars 1950:103.

34. Wolfers 1971:79.

35. Bowers and Lepi 1975:309.

36. Steltenpool 1969:25-6.

28. Le Roux makes a very weak case for "10" (*gaati*, etc.) as an Austronesian loan.

29. Doble 1960, Steltenpool 1969.

30. The apparent complexity of Moni and its similarity to Ekagi numeration (including Moni *àgitawà dano* — "not 10") may be due to the provenience of this list. Eechoud obtained it from the Kugapa region and thus from Moni-speakers who live especially close to the Kapauku, having trade and other friendly and hostile relations with them — but not marital relations (Nunen 1973:40; Pospisil 1958:167).

31. See Galis 1960 for examples.

32. Bowers and Lepi 1975; Laycock 1975.

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Careful consideration of highland Irian Jaya counting systems has shown that much more can be determined from material already available than one might think from Pospisil and Price's assertions. No evidence of a Babylonian connection has been found. It has been possible to cast doubt upon the unique character of the Kapauku 60-base system and even to challenge its sexagismal nature. It is also worth while noting that Neugebauer, whom Price admires, did not see a 60-base system in itself as spectacular:

No historical theory of the origin of the sexagismal system is acceptable if it does not account also for this extraordinary feature, namely the use of the same small number of symbols for different values, depending on the arrangement. A variety of 'bases' is well known from number words and number writing all over the world. The place of notation, however, is the most striking feature of the Babylonian system.⁽³⁷⁾

Pospisil and Price, however, state:

What is at stake is the altogether remarkable role of a sexagismal base, otherwise unattested in any culture, ancient or modern, other than those in direct line with the Babylonian, and the uncommon prowess in numeration that stems, not from the numeration, but from the facility offered by such devices as the identification of the number 30 with one half of the base.⁽³⁸⁾

Most of the properties of numbers so dear to the historian of science, and their practical applications to Near Eastern-Mediterranean peoples and their cultural descendants, are of no interest to the Kapauku, who did not have to sail the open seas or predict seasonal waterflows.

By definition, the history of science deals mainly with documentary materials. The historian of science who laboriously and lovingly disentangles the complexities of ancient time-keeping devices or computational methods should, if he intends to dabble in the folk sciences of peoples with unwritten languages, accord them a similar respect if he hopes to earn the regard of scholars outside his own field. Melanesian folk sciences, just as those from other areas of the world, must be studied first on their own terms before convincing comparisons can be made. A spurious, one-sided alliance with the historical school of American anthropology adds no weight to Price and Pospisil's postulated Babylonian connection. The first prerequisite of Boas, Kroeber, and their colleagues was controlled comparison.

The implications of Price and Pospisil's 1966 paper are only too clear to Melanesian specialists — and to Melanesians. I accept that there was no such deliberate intention on the part of these authors.

What is really at stake is the extraordinarily open, fluid, diverse, and yet Melanesian manner in which people deal with quantification. Perhaps an over-emphasis on classification of counting systems — an interest which began with the Cambridge Expeditions and has continued to the present — has impeded the analysis of Melanesian numeration methods. Many systems, such as the 24-base in use among the upper Kaugel people and the 60-base of the Kapauku, cannot be handled in the categories that have been set up, yet similar principles underlie them all. A particularly Melanesian way of thinking seems to be involved. I hope that other scholars, including Leopold Pospisil — who has made very detailed studies indeed (the 1966 article is not typical of his work) — will take up some of the suggestions made above and contribute further to the understanding of the history and nature of highland Irian Jaya reckoning systems.

37. Neugebauer 1969:18.

38. Pospisil and Price 1976:000.

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