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1. Introduction

The numeral systems of New Guinea are of considerable interest both to linguists and to scholars of other disciplines, such as (cognitive) anthropology.¹ Since New Guinea communities readily borrow number systems², both from other communities in the area and from lingua francas and national languages, traditional numeral systems have often been described by linguists at a time when these systems no longer (fully) functioned and had been superseded by borrowed Tok Pisin or Malay numerals.

The purpose of this article is to present material on the number systems of Kombai, Korowai, Wambon, Mandobo, Aghu, Sjiagha-Yenimu, and Pisa, seven Papuan languages of the Awyu family (Voorhoeve 1975; Wurm 1982) spoken in southern Irian Jaya, Indonesia (see map). Since several languages belonging to the Awyu family (e.g., Tsakwambo and Awyu) are completely unknown, this article does not pretend to generalize about the Awyu family as a whole. The data presented in it are taken partly from unpublished sources (e.g., for Korowai), and partly from rather rare Dutch-language sources (e.g., Drabbe 1957). They were recorded at a time when

¹ I would like to thank the Rev. Gert van Enk and the referees of this article for their very helpful comments.

² In comparative linguistics, numerals (especially those for low numbers) are sometimes regarded as part of the basic vocabulary, i.e., vocabulary that is not readily borrowed (see, e.g., Blust 1993:40). In the New Guinea area, however, number systems are so easily borrowed (cf. Laycock 1975) that these systems can best be viewed as 'cultural' features that lend themselves to borrowing, just like, for example, magic formulas. Bruce (1984:102) observes with regard to the Alamlak Papuan language of Papua New Guinea, for example, that 'three numeral systems coexist in Alamlak: a borrowed tally system, the borrowed New Guinea Pidgin system, and a mixed binary/quinary/vigesimal system (primitive numbers of one, two, five, and twenty)'.

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Map of the Awyu language area. (The names of the Awyu languages are printed in capitals and underlined.) (Reproduced from map no. IX in Silzer and Heikkinen 1991.)

the numeral systems were still fully functioning and could be observed in daily use in natural contexts.³

The northern Awyu groups live in extreme isolation in the swampy rain forests. The traditional numeral systems are still widely used by them. For most Korowai clans, the traditional system – a body-part system used in conjunction with a binary system – is the only system they know, except perhaps for the Citak system of counting with the aid of the hands and feet which they may observe when trading with Citak people during the sago grub festivals.

The numeral systems of the Awyu languages discussed in this article can be classified into three groups: the group formed by the Kombai, Korowai and Wambon systems, which are pure body-part tally systems; the Mandobo system, which is a mixed body-part tally system; and the group formed by the Aghu, Sjiagha-Yenimu and Pisa systems, which involve counting using the hands and feet.

In the Kombai, Korowai and Wambon pure body-part tally systems, used in conjunction with a binary system⁴, counting starts from the little finger of the left hand to the thumb, thence up the arm to the highest point on the head – the turning-point – after which it proceeds down the other arm again, to the little finger of the right hand, the end-point. Mandobo also has a body-part tally system, like Kombai, Korowai and Wambon, but here it is a blend of a binary and a tally system, whereas Kombai, Korowai and Wambon have pure tally systems used in conjunction with a binary system.

This method of counting by moving up and down the arms in Kombai, Korowai, Wambon and Mandobo contrasts with that using the hands and feet as employed in Citak (described by Kruidhof s.a.), the neighbour of Kombai and Korowai in the western Asmat family (see map). In spite of intensive contacts between the Citak and the Kombai and Korowai clans, the northern Awyu languages spoken in the foothills of the central mountain range seem to link up with the languages of the mountain tribes as far

³ The data derive from Drabbe (1950, 1957, 1959), Boelaars (1970) and my own research in the area in the period 1982-1991, which I carried out as a linguist with the ZGK (Mission of the Reformed Churches).

⁴ Binary systems are systems with primitive numerals for 1 and 2; quinary systems comprise a primitive numeral for 5; vigesimal systems have a primitive numeral for 20. Where the qualifications 'binary', 'quinary', and 'vigesimal' are used with reference to Awyu numeral systems, it is not implied that these systems necessarily form the numerals for higher numbers by combining the primitive numerals. For example, Korowai is binary in the sense that it has primitive numerals for 1 and 2, though it does not use these as a basis for forming numerals for the higher numbers, whereas Kombai is binary in having both primitive numerals for 1 and 2 and numerals for higher numbers that are derivatives of these, formed in accordance with the binary principle (for example, the Kombai numeral for 4, *molumo-molumo*, is a reduplication of the primitive numeral for 2).

as the system of counting (proceeding up and down the arms) is concerned, whereas the Awyu languages in the south (Aghu and Sjiagha-Yenimu) and south-west (Pisa) seem to have affinities with the Asmat family, in which a system of counting using the hands and feet is the norm.

The more isolated Kombai and Korowai in the north came into regular contact with the outside world in the 1980s. Their counting system then came to be used in wholly new contexts, for example to denote the seven days of the week and the twelve months of the year introduced by missionaries and government personnel. In the process, compound nouns developed in which the body-part numerals came to have ordinal instead of cardinal meanings, which they could not have before.

2. Pure body-part tally systems: Kombai, Korowai and Wambon

Kombai, Korowai and Wambon have a pure form of the body-part tally system that is found all over New Guinea (Laycock 1975). In this system, counting starts from the little finger of the left hand (number 1), which the speaker touches or bends with the middle or index finger of the right hand. Via the ring finger (2), middle finger (3) and index finger (4), the speaker proceeds to the thumb (5), thence to move up the left arm, starting with the wrist (6), proceeding to the lower arm (7), the elbow (the inside of which is touched) (8), the upper arm (9), and the shoulder (10). After the five points on the hand and the five points on the arm, five points on the head (neck, ear, eye, nose and crown of the head) are used.

Whereas Kombai, Korowai and Wambon correspond to this as far as the first and second sets of five points are concerned, they differ with regard to the five points on the head. Kombai uses just two points on the head, proceeding after the shoulder (10) to the left ear (11), to reach the turning-point on the crown of the head (12), after which the ear on the other side (13) is touched, followed by the shoulder on the other side (14), and so on, until the little finger of the right hand is reached (23). Korowai uses three points on the head, namely the neck (11), ear (12) and crown of the head (13), and accordingly ends at the number 25 when the little finger of the right hand is reached. Wambon uses four points on the head – the neck (11), ear (12), eye (13) and nose (14) – and ends at the number 27.

When, after the turning-point, counting continues on the right side of the body, Kombai, Korowai and Wambon all add a prefix meaning 'other side' to the words for the relevant body parts, like many other New Guinea languages. Although these languages make a distinction between 'left' and 'right', they do not use this distinction in their system of counting. The Kombai words for 'left' (*wa*) and 'right' (*uu*) are usually found as modifiers of the noun *i* 'hand' (e.g., *i uu* 'right hand', *i wa* 'left hand'). These expressions may be used in a locative sense (e.g., 'he sat at my right hand'). In the system of counting, however, the distinction between 'right' and 'left' is irrelevant, for the system works equally well if one

starts from the right side. This is nevertheless unusual, since most people are right-handed and the right hand is the active hand in the bending and touching gestures.

2.1 The Kombai numeral system

The Kombai language area (De Vries 1987, 1993) is surrounded by other Awyu languages, namely Awyu, Yair, Mandobo (= Kaeti), Wambon, Tsakwambo, and Korowai, except in the west, where it adjoins the area where Citak, a language of the Asmat family, is spoken. It was opened to the outside world in 1980, when the Mission of the Reformed Churches constructed an airstrip in Wanggemalo, in the centre of the Kombai area. The speakers of Kombai total about 4,000.

The Kombai numeral system is a pure body-part system that is used in conjunction with a binary system comprising the 'genuine' numerals *mofenadi* 'one' and *(mo)lumo* 'two'. The tally system, firstly, is as follows:

<i>Kombai numeral</i>	<i>Corresponding body part</i>
1 raga	little finger
2 ragaragu	ring finger
3 wororagu	middle finger
4 woro	index finger
5 abalo	thumb
6 go	wrist
7 khani	lower arm
8 igabu	(inside of the) elbow
9 rafe	upper arm
10 dodou	shoulder
11 ruro	ear
12 khabiya	(top of the) head

The head is the turning-point after which counting proceeds downward again on the right-hand side of the body. This is indicated by adding the word *imofo* 'other side' to the relevant numerals:

<i>Kombai numeral</i>	<i>Corresponding body part</i>
13 imofo ruro	ear on the other side
14 imofo dodou	shoulder on the other side
15 imofo rafe	upper arm on the other side
16 imofo igabu	elbow on the other side
17 imofo khani	lower arm on the other side
18 imofo go	wrist on the other side
19 imofo abalo	thumb on the other side
20 imofo woro	index finger on the other side
21 imofo wororagu	middle finger on the other side
22 imofo ragaragu	ring finger on the other side
23 imofo raga	little finger on the other side

When numerals are used attributively in noun phrases, they take the attributive suffix *-khu*, as in:

- (i) *Kho abalo-khu*
 man five-ATTR
 'five men'

The suffix *-khu* basically means 'also', 'added', as, for example, in:

- (ii) *Nu-khu bomede*
 I-also DUR.come 1SG.NF
 'I am also coming.'

The body-part numerals from the little finger / 1 to the index finger / 4 cannot be used to qualify nouns. They only function, firstly, in the direct counting of objects ('one', 'two', 'three', 'four' ...), and secondly, in compound nouns denoting the days of the week and months of the year (see section 2.4 below). For the first four numbers (1-4), Kombai has the following primitive numerals, this 'genuine' binary numeral system being used to qualify nouns in noun phrases but never in direct counting (a fact for which we do not so far have an explanation):

- (iii) *Kho mofenadi*
 man one
 'one man'

Kho (mo)lumo
 man two
 'two men'

Kho molumonefe
 man three
 'three men'

Kho (mo)lumo-(mo)lumo
 man four (two-two)
 'four men'

For attributive 'one', some speakers use the word *mokhaliyo*.

The internal structure of the binary numerals from 1 to 4 is as follows⁵:

⁵ For this, as well as several other points in the analysis and presentation of the Kombai, Korowai and Wambon data, I am indebted to suggestions by the referees of my article.

1 = <i>mo-e-fe-n-adi</i>	(<i>mo</i> +1+transitional nasal+'just')
2 = <i>mo-lumo</i>	(<i>mo</i> +2)
3 = <i>mo-lumo-n-e-fe</i>	(<i>mo</i> +2+transitional nasal+1)
4 = <i>mo-lumo-mo-lumo</i>	(<i>mo</i> +2+ <i>mo</i> +2)

The transitional nasal /n/ always occurs when two vowels come to be adjacent in morpheme sequencing (cf. De Vries 1989). The use of an adverbial element meaning 'just', 'only' in combination with the numeral for 1 has also been reported for other Papuan languages (e.g., in Siroi in Papua New Guinea; see Wells 1979:22).

The attributive form *mofenadi* 'one' is occasionally used with indefinite-specific noun phrases, as in:

- (iv) *Kho mofenadi bome*
 man a DUR.come 3SG.NF
 'A man came.'

The use of *mofenadi* implies several things: firstly, that the noun phrase is indefinite; secondly, that the noun phrase has a specific, unique referent; and thirdly, that the referent of the noun phrase will be referred to again in the subsequent discourse (cataphoric topicality).

2.2 The Korowai numeral system

Korowai (De Vries and Van Enk 1993a and 1993b) is spoken in the area between the upper Becking and Eilanden rivers.⁶ The dialect described here is that of the clans living on the western banks of the Becking River, in the proximity of Yaniruma. Yaniruma, a village with a mixed Kombai and Korowai population, was opened up in 1980 by the first missionary in this area, Johannes Veldhuizen, who built an airstrip here.

The Korowai number system is a pure body-part system used in conjunction with a binary system. The Korowai tally system is as follows:

<i>Korowai numeral</i>	<i>Corresponding body part</i>
1 senan	little finger
2 senanafül	ring finger
3 pinggu(lu)p	middle finger
4 wayafül	index finger
5 wayo	thumb
6 gédun	wrist
7 lafol	lower arm
8 bonggup	elbow

⁶ I would like to thank the Rev. G.J. van Enk for sharing his information on Korowai numerals with me and for supplying the photograph of a *saündal* reproduced with the present article.

9	labul	upper arm
10	main	shoulder
11	khomofekholol	neck
12	khotokhal	ear
13	khabeán	head

When *khabeán* ‘head’/‘thirteen’ is reached, counting proceeds on the right-hand side of the body. To indicate this, the word *mén* ‘other side’ is added, as follows:

14	mén-khotokhal	ear on the other side
15	mén-khomofekholol	neck on the other side
16	mé-main	the other shoulder
17	mén-tabul	the other upper arm
18	mé-mbonggup	the other elbow
19	mén-tafof	the other lower arm
20	mé-nggédun	the other wrist
21	mé-wayo	the other thumb
22	mé-wayafül	the other index finger
23	mén-pinggu(lu)p	the other middle finger
24	mén-senanaful	the other ring finger
25	mén-senan	the other little finger

Twenty-five is the logical end-point of this system. However, one may start all over again for the numbers from 26 to 38 by adding the word *laifu*, which (probably) means ‘produce’, as follows:

26	laifu-senan	produce-little finger
27	laifu-senanaful	produce-ring finger
38	laifu-khabeán	produce-head

When these numerals are used as modifiers in noun phrases, the relational noun⁷ *anop* ‘amount’ must be suffixed to the numerals as a clitic to indicate that they are used attributively (ATTR), as follows:

- (v) *pinggup*
middle finger
‘three’

⁷ The term relational noun is used for nouns that function as markers of grammatical relations; in this case the noun *anop* ‘amount’ is used to indicate the attributive grammatical relation.

gol *pinggu-anop*
 pig middle finger-ATTR
 'three pigs'

gol *wayafül-anop*
 pig index finger-ATTR
 'four pigs'

The relational noun *anop* also occurs in the following interrogative word:

- (vi) *mbakha-mo-n-anop*
 what-SUPP-INF-amount
 'how much / how many?'

This element *anop* cannot be added to *senan* 'little finger / one' and *senanafül* 'ring finger / two' to form modifying numerals, as in:

- (vii) **gol senan-anop*
 pig one-ATTR
 'one pig'

Instead, *lidop* 'one' and *pol* 'two' are used as modifiers in noun phrases, as in:

- (viii) *gol lidop*
 pig one
 'one pig'

gol pol
 pig two
 'two pigs'

Lidop and *pol* are the two members of the binary numeral system of Korowai. The word *pol* 'a pair / two' is also used in combination with a word meaning 'just' to denote the concept of 'few', as in:

- (ix) *gol pol-tanukh*
 pig pair-just
 '(a) few pigs'

There is variation in the use of these body parts in counting. Some speakers skip the ear, for instance, in which case *khabeán* 'head' represents the number 'twelve'.

Lidop 'one' is used in combination with *fekha* 'a certain' in indefinite-specific noun phrases, as follows:

- (x) *lido-fekha* *abül*
 one-a certain man
 'a certain man'

However, *fekha* 'a certain' usually occurs without *lido*, as in:

- (xi) *uma-té-do* *abül-fekha* *khomilo-bo*
 tell-3PL.NF-DS man-a certain die 3SG.NF-PERF
 '... they said that a certain man had died ...'

There are metaphorical expressions derived from *lido* 'one' and *pol* 'two' through reduplication. Compare:

- (xii) *mahüon* *lido-lido*
 story one-one
 'a straightforward story'
- (xiii) *ye* *fimelon* *po-po-telo*
 he innermost part two-two-COP.3SG.NF
 'He is in doubt.'

2.3 The Wambon numeral system

Wambon is spoken by about 3,000 people in the Upper Digul area, north of the Murup River and close to the border with Papua New Guinea. It has two main dialects, Yonggom (Drabbe 1959) and Digul-Wambon (De Vries 1989; De Vries and Wiersma 1992). It is the Digul-Wambon numeral system that is described here. Digul-Wambon speakers came under the influence of the Protestant Mission in the early 1970s, whereas the Yonggom Wambon first came into contact with the Roman Catholic Mission in the 1950s.

The Wambon number system is a pure body-part system used in conjunction with a binary system. The body-part system, firstly, is as follows:

<i>Wambon numeral</i>	<i>Corresponding body part</i>
1 <i>sanop</i>	little finger
2 <i>sanopkunip</i>	ring finger
3 <i>takhem</i>	middle finger
4 <i>hitulop</i>	index finger
5 <i>ambalop</i>	thumb
6 <i>kumuk</i>	wrist
7 <i>mben</i>	lower arm
8 <i>muyop</i>	elbow
9 <i>javet</i>	upper arm
10 <i>malin</i>	shoulder
11 <i>nggokmit</i>	neck

12	silutop	ear
13	kelop	eye
14	kalit	nose

The nose here is the turning-point, after which counting descends again along the right-hand side of the body. This is indicated by prefixing *em-* 'the other side' to the body-part numerals, as follows:

15	emkelop	eye of the other side
16	emsilutop	ear of the other side
17	emnggokmit	neck of the other side
18	emalin	shoulder of the other side
19	emjavet	upper arm of the other side
20	emuyop	elbow of the other side
21	emben	lower arm of the other side
22	emkumuk	wrist of the other side
23	emambalop	thumb of the other side
24	emhitulop	index finger of the other side
25	emtakhem	middle finger of the other side
26	emsanopkunip	ring finger of the other side
27	emsanop	little finger of the other side

According to one informant, one may continue on reaching the number 27 by prefixing the word *nggisikhivo* 'return'/'again' to the relevant body-part numerals and starting all over again from the little finger of the left hand, as follows:

28	nggisikhivo-sanop	return little finger
29	nggisikhivo-sanopkunip	return ring finger
30	nggisikhivo-takhem	return middle finger
31	nggisikhivo-hitulop	return index finger
32	nggisikhivo-ambalop	return thumb
33	nggisikhivo-kumuk	return wrist
34	nggisikhivo-mben	return lower arm
35	nggisikhivo-muyop	return elbow
36	nggisikhivo-javet	return upper arm
37	nggisikhivo-malin	return shoulder
38	nggisikhivo-nggokmit	return neck
39	nggisikhivo-silutop	return ear
40	nggisikhivo-kelop	return eye
41	nggisikhivo-kalit	return nose

The body-part numerals can be integrated into noun phrases by adding the attributive suffix *-kup*, which derives from the adverbial clitic *-kup* 'also', as in:

- (xiv) *ap hitulop-kup*
 house index finger / four-ATTR
 'four houses'

The numerals *sanop* 'little finger / 1', *sanopkunip* 'ring finger / 2' and *takhem* 'middle finger / 3' cannot be used as numeral modifiers in noun phrases. For example:

- (xv) **ap sanop-kup*
 house little finger / one-ATTR
 'one house'

Instead, three 'genuine' numeral modifiers are used, reflecting a binary system, as follows:

- (xvi) *ap ndominuk*
 house one
 'one house'

- (xvii) *ap ilumo*
 house two
 'two houses'

- (xviii) *ap ilumtakhemo*
 house three
 'three houses'

The form *ilumtakhemo* consists of the words *ilumo* 'two' and *takhem* 'middle finger / 3'. Often in binary systems the word for 'three' is a compound of the words for 2 and 1 ('two plus one'). The Wambon word for 3 begins with the genuine numeral 2 but ends with the body-part numeral for 3.

2.4 Days of the week and months of the year in Kombai, Korowai and Wambon

In the course of the 1970s the Gregorian calendar and related concepts were introduced into the Wambon area by missionaries, traders and government officials. The same happened in the Kombai and Korowai area in the 1980s.

In pre-contact times the key units of time were the days and months, with the word for 'sun' also denoting the temporal concept of a day, and the word for 'moon' that of a month; for example, Kombai *rei* 'sun/day', *amaga* 'moon/month'. Journeys through the jungle were measured in terms of the number of days such a journey took. Sago grub festivals were planned ahead in terms of months ('in three months we shall have our sago

grub feast'). Since there are no clear-cut dry and wet seasons in the foothills of Kombai, Korowai and Wambon, where it rains throughout the year, there is no unambiguous pre-contact word to denote the concept of 'year'. There is a compound word *khefe-refe* 'wind-drizzle' which is sometimes used to denote 'year' but, given the irregularity of these annual rains (somewhere between May and July), this is at best a marginal temporal concept in Kombai culture (for example, people's ages are not counted in years).

When airstrips began to be built in the area by the missionaries, Kombai, Korowai and Wambon labourers were hired for the work. They worked from Mondays to Saturdays. On Sundays the missionaries held church services. The missionaries used the Indonesian words for 'week' (*minggu*) and for the seven days of the week (*Senin* 'Monday', and so on). The opposition between days of work and days of worship was crucial in the teachings of the mission. Furthermore, the use of the names 'Monday', 'Tuesday', and so on, implies a particular *order* in the sequence of the days: Monday comes first, Tuesday second, and so on. Both concepts (the order of the days – Monday = day number 1, and so on – and the distinction between workdays and days of worship) are reflected in the names for the days of the week that the Awyu languages evolved.

Kombai, Korowai and Wambon adopted the same strategy of adapting their system of counting to the new methods of measuring time. They formed compounds consisting of the noun for 'day' as modified noun and a body-part numeral for any number from 1 to 7 as modifying noun. Thus Monday = little-finger day, Tuesday = ring-finger day, and so on.

To indicate the distinction between workdays and days of worship, all three languages may take the Indonesian word for 'worship', *sembahyang*, adapt it phonologically, and form a compound noun with it in combination with the word for 'day' to indicate the latter (e.g., Kombai *sembayana-rei* 'worship day').

The Kombai system for enumerating the days of the week is as follows:

raga-n-e-rei
first-TR-CONN-day
'Monday' ('little-finger day')

raga-ragu-n-e-rei
second-TR-CONN-day
'Tuesday' ('ring-finger day')

woro-ragu-n-e-rei
third-TR-CONN-day
'Wednesday' ('middle-finger day')

woro-n-e-rei
fourth-TR-CONN-day
'Thursday' ('index-finger day')

abalof-e-rei
fifth-CONN-day
'Friday' ('thumb day')

go-n-e-rei
sixth-TR-CONN-day
'Saturday' ('wrist day')

sembaya-n-a-rei
worship-TR-CONN-day
'Sunday'

In Korowai, there are no connective clitics between the modified and the modifying noun as in Kombai. Furthermore, whereas the Kombai prefer the compound with the Indonesian word for 'worship' for designating Sunday, the Korowai seem to prefer the expression 'lower-arm day'. The Korowai days of the week are:

<i>senan-tefül</i> little finger-day	'Monday'
<i>senanafü-tefül</i> ring finger-day	'Tuesday'
<i>pinggu-lefül</i> middle finger-day	'Wednesday'
<i>wayafü-tefül</i> index finger-day	'Thursday'
<i>wayo-lefül</i> thumb-day	'Friday'
<i>gédun-tefül</i> wrist-day	'Saturday'
<i>lafo-tefül</i> lower arm-day	'Sunday'

Wambon uses the connective *-o* to link the body-part modifier to the word modified in the compound noun. The Wambon days of the week are:

<i>sanov-o-sat</i> little finger-CONN-day	'Monday'
<i>sanopkuniv-o-sat</i> ring finger-CONN-day	'Tuesday'
<i>takhem-o-sat</i> middle finger-CONN-day	'Wednesday'
<i>hitulov-o-sat</i> index finger-CONN-day	'Thursday'
<i>ambalov-o-sat</i> thumb-CONN-day	'Friday'
<i>kumukh-o-sat</i> wrist-CONN-day	'Saturday'
<i>mben-o-sat</i> lower arm-CONN-day	'Sunday'

It should be noted that the innovation of using numerals in compounds denoting the days of the week necessitates differentiation between the expressions for 'one day', 'two days', and so on, and the expressions for 'day no. one', 'day no. two', and so on, as in:

- (xix) *sat ambalop-kup*
day thumb-ATTR
'five days'
- (xx) *ambalop-kuv-o sat*
thumb-ATTR-CONN day
'five days'
- (xxi) *ambalov-o-sat*
thumb-CONN-day
'Friday / day no. five'

I have not been able to discover any clear semantic difference in connection with the difference in word order between examples (xix) and (xx), although further research might very well reveal a semantic or pragmatic difference between them (for the use of the connective *-o* with pre-nominal modifiers, see De Vries 1989). The formal differences between (xix) and (xx) on the one hand and (xxi) on the other have to do with the fact that (xxi) is a compound noun and that (xix) and (xx) are noun

phrases. Correlating with this difference in syntactic status is the absence of the attributive suffix *-kup* in (xxi) and its presence in (xix) and (xx).

A knowledge of the days of the week is of immediate practical importance to the Kombai, Korowai and Wambon people, since their work on roads, airstrips and the like is regulated by these concepts. The concept of the twelve months of the year did not initially have the same immediate daily impact on their lives, although with the introduction of schools (with holiday months), national elections, the Indonesian Independence Day celebrations in August, and so on, a familiarity with the twelve months of the calendar year has become increasingly relevant for them. These concepts were first introduced in the Wambon area, where the following compound nouns for 'January' (little-finger moon), 'February' (ring-finger moon), and so on, are used alongside the relevant Indonesian loan-words:

- (xxii) *sanov-o-wakhot* 'January'
 little finger-CONN-moon
- sanopkuniv-o-wakhot* 'February'
 ring finger-CONN-moon

At the mention of any particular day of the week, Kombai, Korowai and Wambon speakers, in a kind of automatic gestural reflex, touch the relevant body part. For example, when Kombai speakers say *gone rei* 'Saturday', they touch their wrist.

3. The Mandobo numeral system

The Mandobo number system has been described by Drabbe (1959:100) and Boelaars (1970). The Roman Catholic Mission started its activities in the Mandobo area in 1951.

The Mandobo (or Kaeti) number system is a mixture of a binary system and a body-part tally system. It has basic numerals for 'one' (*ome*) and 'two' (*rumo*). The status of the numeral *ititmo* 'three' is rather ambiguous. Drabbe (1959:100) suggests two possible analyses, one whereby *ititmo* is a 'genuine' (i.e., not body-part-based) numeral and one whereby it is a body-part numeral consisting of the word *it* 'hand' and a hypothetical element *tit* 'middle finger'.

For numbers higher than three, Mandobo uses body-part terms. The 'genuine' numerals are integrated into the series of body-part numerals (see, for example, the expressions for 22 and 23, where the term for 'other side (of the body)' is used in combination with the non-body-part numerals for 1 and 2).

<i>Mandobo numeral</i>	<i>Corresponding body part</i>
1 ome	—
2 rumo	—
3 ititmo	—
4 kurugutköp	index finger
5 onggugup	thumb
6 komogöp	wrist
7 mbenköp	lower arm
8 nggambunköp	(the inside of the) elbow
9 taetköp	upper arm
10 magöp	shoulder-blade
11 keretopköp	ear
12 nggumitköp	top of the head
nggunopköp	head
13 ei(ga) ne keretop	ear of the other side
14 ei(ga) ne mak	shoulder of the other side
15 ei(ga) ne taet	upper arm of the other side
16 ei(ga) ne nggambun	elbow of the other side
17 ei(ga) ne mben	lower arm of the other side
18 ei(ga) ne komok	wrist of the other side
19 ei(ga) neonggu	thumb of the other side
20 ei(ga) ne gurugut	index finger of the other side
21 ei(ga) n'ititmo(göp)	the other side 'three'
22 ei(ga) ne rumo(göp)	the other side 'two'
23 ei(ga) ne ome	the other side 'one'

For the numbers from 13 to 20 one may also use expressions in which the noun *ei(ga)* follows the body-part noun and is in turn followed by the word *göp* 'also, added', as in:

(xxiii) *keretow ei(ga)göp* 'ear other side / 13'

The word *köp* 'also, added' also occurs in the numerals for 4 to 12, and optionally in those for 21 and 22.

4. Counting with the aid of the hands and feet: Aghu, Sjiagha-Yenimu and Pisa

4.1 The Aghu numeral system

Aghu is spoken by about 2,000 persons living in the area between the Digul and Mappi rivers (see map). The Aghu language has been described by Drabbe (1957). It is closely related to the Yair (or Jair) language (see map); in fact, so closely that Aghu and Yair might be dialects of one language. The Yair have many affinal ties with the Kombai. Below I shall

follow the account of the Aghu number system given by Drabbe (1957:28).

The Aghu number system is a curious mixture of a body-part and a binary/quinary/vigesimal system. It is as follows:

<i>Aghu numeral</i>	<i>Corresponding body part</i>
1 fasike	—
2 okuomu/okuoma	—
3 okuomasike	—
4 sigiane/sigianému	little finger
5 bidikimu/bidikuma bifidikimu/bifidikima	hand
6 bidikuma-fasike	hand (plus) one
7 bidikuman-okuoma	hand (plus) two
8 bidikuman-okuomasike	hand (plus) three
9 bidikuma-sigiane	hand (plus) little finger
10 bidikuma-bidikuma	hand (plus) hand
11 kito wodo	big toe
12 kito wodo womu	toe next to big toe
13 kito efe womu	middle toe
14 kito sigia womu	toe next to little toe
15 kito sigia	little toe
kitikumu/kitikuma	foot
kitifikumu/kitifikuma	one foot
16 afi-kito wodo	the other big toe
17 afi-kito wodo womu	the other toe next to big toe
18 afi-kito efe womu	the other middle toe
19 afi-kito sigia womu	the other toe next to little toe
20 aghù-bigi	person-bone
21 aghù-bigi fasike	person-bone (plus) one
22 aghù-bigi okuomu	person-bone (plus) two
<i>and so on</i>	
30 aghù-bigi bidikuma-bidikuma	person-bone hand hand

The highest number in the Aghu system is 30. When counting from 1 upwards, the Aghu bend the fingers of the left hand first, starting with the thumb. When the ring finger is bent, they say *sigiane* 'little finger', because that is the only finger that then still remains straight. Thus the little finger corresponds to 4. Counting then proceeds to the fingers of the right hand and, when these are bent, to the two hands (thus making 'ten'). Interestingly, the Aghu then continue with the big toe of the left foot

(‘eleven’), counting to ‘fifteen’ on the toes of this foot. Then they proceed to the foot on the other side, using a word for ‘side, other side’ to indicate this switch, just like so many body-part systems in New Guinea. The word *kito* means ‘foot’; it is used before the names of the fingers to denote the corresponding toes, for example, *wodo* ‘thumb’, *kito wodo* ‘big toe (thumb of the foot) / eleven’. Thus after 10 (‘hand-hand’, a quinary number), Aghu switches to a body-part system for 11–19.

It is illuminating to compare the Aghu body-part numeral for 11 (‘big toe’) with the way the numeral for 11 is formed in Alamlak, a Papuan language of Papua New Guinea (Bruce 1984). Alamlak has three number systems – a tally system, a binary/quinary/vigesimal system, and the New Guinea Pidgin system – existing side by side. The Alamlak tally system (by now most probably no longer in use) was unusual because it had a masculine tally system and a feminine tally system in which the female breasts were incorporated. The masculine system was of the usual type, starting with the little finger and moving up the arm via the shoulder (10), neck muscle (11), side of the neck (12), ear (13) and eye (14) to the nose, the highest point (15), after which it moved down again, with a qualifier meaning ‘other side’ being added to the relevant words (for example, other side eye = 16). In the Alamlak binary/quinary/vigesimal system, the numeral for 11 comprises a co-ordinate numeral phrase ‘hands two and foot one’ in which the word for ‘one’ is the primitive numeral *rpa*. The Citak (Asmat) system described by Kruidhof (s.a.) uses similar co-ordinate numeral phrases (e.g., 11 = *mban amnik tazota mbai taka* = hand two finished foot one).

Aghu, like Alamlak, has primitive numerals for 1, 2, 5 and 20. However, whereas in Alamlak the tally system and the binary/quinary/vigesimal system are kept mutually separate, in Aghu they are mixed up together. The numeral for 10 here is formed in a quinary fashion (‘hand-hand’), but for 11 the primitive numeral for ‘one’ (*fasike*) is not used in combination with ‘hand-hand (10)’ as in Alamlak and Citak. Instead, the word for ‘big toe’ is used as a tally. The numeral for 15 is the word *kito sigia*, ‘little toe, the little finger of the foot’. It should be noted that the *sigia*, or little finger, of the hand is the symbol for 4 in Aghu(!).

For the numbers from 1 to 10 Aghu follows a binary/quinary system, though integrated into the gestural system of counting with the aid of parts of the body. For example, when the primitive numeral *fasike* is used, the thumb is bent. The little finger is the symbol for 4, as that is the only finger that is not bent on reaching 4, before the quinary numeral for 5 (‘hand’).

In the numeral for 20, *aghù-bigi*, the word *aghù* means ‘man, person’. The word *bigi* ‘bone’, which is often used to denote something in its full length (e.g., *kesaghe bigi* ‘tree, stem of tree’), in combination with *aghù* here means ‘the whole man’, i.e., ‘fingers and toes’, i.e., ‘20’.

Several of the Aghu numerals listed above end in *mu* or *ma*. These are

medial forms of the verbalizing support verb *me-* (such support verbs meaning 'to do' or 'to be' being used in all Awyu languages to make verbs of words belonging to other grammatical categories; cf. De Vries and Wiersma 1992:14). Such verbs derived from numerals are used in two different contexts in Aghu, namely to indicate the number of nights (*womi*; the Aghu reckon time by nights rather than days), months (*bidi*, 'moon'), or hours (*jam*, Indonesian loan) an event or process lasts; and, in combination with the word *gonggo* 'times', to indicate the number of times an event has occurred. Examples are:

(xxiv) *gho-dok womi okuo-mo-ghena*
 go-NOM night two-SUPP-3PL.NF
 'They have been walking for two days'

(xxv) *büsjü si-dik bidi bidikumo-dkoa*
 house build-NOM moon five-SUPP-1PL.PAST
 'It took us five months to build the house'

(xxvi) *dafi gonggo sigiane-me-de*
 come NOM time four-SUPP-1SG.NF
 'I came (here) four times'

The numerals can also be used predicatively with the predicate marker *ogho*, which is used with adjectives and numerals but never with nouns, as in:

(xxvii) *kesaghe okuoman ogho*
 tree two PRED
 'There are two trees' (literally, 'the trees are two')

The verbalized form of the numeral for 'one', *fasikemu*, 'to be one', is used metaphorically in its medial SS form with the meanings 'straight', 'true', 'really', 'for good', as, for example, in:

(xxviii) *fasikem o-ghe*
 one-SUPP.SS speak-3SG.NF
 'He spoke truthfully/the truth'

4.2 Some data on Sjiagha-Yenimu and Pisa numbers

Drabbe (1950) gives a very sketchy account of the numbers used in the Sjiagha and Yenimu dialects of Sjiagha-Yenimu and Pisa. Sjiagha-Yenimu is the name given by Drabbe to the language spoken by Awyu clans living along the Sjiagha and Yenimu rivers. Drabbe only gives the words for 1 to 5 and for 10, viz.:

Number	<i>Sjiagha dialect</i>	<i>Yenimu dialect</i>
1	ésjà	isjò
2	okòmo	okum
3	okom-ésjà	okum-isjo
4	okom-okòmo	okum-okum
5	béd-afi-bumo	bed-afi-kome
10	se	se

These data indicate primitive numerals for 1, 2, 5, and 10. In the word for 5, *béd-afi* means 'the one hand'.

For Pisa, an Awyu language spoken along tributaries of the Kampong and Wildeman rivers, Drabbe (1950) gives the numerals for the numbers from 1 to 11 and for 20, as follows:

1	sikirè/tisijé
2	kuruma
3	kumandima
4	sòghondéma
5	bédaghafima
6	bédo-sikirè
7	bédo-kuruma
8	bédo-kumandima
9	bédo-sòghondéma
10	bìdi-bidima
11	bìdi-bidima-sikirè
20	ghobigifè

The Pisa data point to a binary/quinary/vigesimal system, with the numerals for 3 and 4 being body-part numerals, *kumandi* meaning 'middle finger / 3' and *sòghondéma* 'ring finger / 4'. As is often the case in New Guinea systems, the Pisa word for 5 incorporates the word for 'hand' (the expression *bédaghafima* meaning 'the one hand'). The word for 20 incorporates the words for 'man' (*gho*) and 'bone' (*bagi*), just as in Aghu.

Apart from the words for 1, 6, and 20, the Pisa numerals end in a suffix *-ma*. Drabbe (1950:104) observes that the meaning of this suffix is hard to determine. Most probably, it is the support verb *mV-* 'to do', which is used as a verbalizer in all Awyu languages (also in Pisa, see Drabbe 1950:109). In Aghu this same support verb is used to verbalize the numerals (see above) and thus integrate them morpho-syntactically. Thus the Aghu and Pisa number systems resemble each other both in type (non-body-part, with primitive numerals for 1, 2, 5, and 20) and in morpho-syntactic integration.

A Korowai *saiindal*. (Photograph by courtesy of the Rev. G.J. van Enk.)

5. The place of counting in Awyu societies

The number systems in Awyu societies are used particularly in the following two contexts: in institutionalized payments in shell currency and in kind (bridal payments, compensation payments); and at sago grub and pig festivals, which also have an economic function (cf. Venema 1990; Schoorl 1957; Boelaars 1970). Boelaars (1970:185) gives the following list of prices, in Mandobo *tagèt*⁸ (small cowrie shells), in transactions involving pigs at a pig festival:

<i>it</i>	= right foreleg	2 <i>tagèt</i>
<i>it</i>	= left foreleg	2 <i>tagèt</i>
<i>ngébén tirambon</i>	= neck + head + upper half of back	2 <i>tagèt</i>
<i>kikemambuman</i>	= lower half of back	4 <i>tagèt</i>
<i>kondok</i>	= left hind leg	2 <i>tagèt</i>
<i>kondok</i>	= right hind leg ⁹	2 <i>tagèt</i>
<i>wobogan</i>	= neck + breast	1 <i>tagèt</i>
<i>mènggop</i>	= belly	2 <i>tagèt</i>
<i>omunop</i>	= intestines	2 <i>tagèt</i>
one whole pig =		19 <i>tagèt</i>

Of course, at these festivals anything of value may be obtained by barter or payment in cowrie shells. Since people from different Awyu tribes meet each other at these festivals, magic formulas may often be bought here from other tribes in the area. The prices of stone axes, magic formulas, nose and ear decorations, birds of paradise, and so on, are easy to state within the limits of body-part counting systems.

Bridal payments and compensation payments for deaths constitute a subject for heated and prolonged negotiation between representatives of the various patriclans or patrilineages. Boelaars (1970:157) gives the following list of items that made up the original Mandobo bridal payment (*amot* or *rankandün*):

⁸ Cognates of Mandobo *tagèt* 'cowrie shell' in Kombai (*rakhe*) and Wambon (*takhet*) constitute the basis of the verb for 'to buy / to sell', which is formed in Awyu languages by verbalization of the noun denoting a cowrie shell with the aid of support verbs, as, for example, Wambon *takhimo*- 'to buy / to sell' and Kombai *rakhimo*- 'to buy / to sell'.

⁹ Awyu languages do have words for 'right' and 'left', but these are only used when it is really important to specify that a given thing is on the right or left of the relevant object. In this list of prices of parts of a pig, the fact that there are *two* forelegs and *two* hindlegs of which the price needs to be specified is the only important thing. Similarly, in the tally system the fact of a switch to the *other* side is what is important, not the fact that the switch is to the *right* side, so that accordingly the words for 'left' and 'right' do not play a role in Awyu tally systems.

- 30 *tagèt* (cowrie shells), 5 or 6 *mbotnon* (string of small beads)
- 2 *tenggat* (stone nose decorations)
- 2 *warok* (nose decorations made of bird's claws)
- 1 *janop* (the part of a white shell that is tied to a string of cowrie shells which, as a symbol for the female genitals, is demanded as first payment)
- 1 *mbandit* (bow)
- 1 *enop* (big string bag)
- 1 *jang* (small string bag)
- 5 *kurèn* (stone axes)
- 1 *irik* (string of dog's teeth)
- 1 *aomban* (string of pig's teeth)

In the 1950s, Mandobo bridal payments had fallen to 24 *tagèt*. Nowadays, bridal payments are made in Indonesian *rupiah*; they range in value between Rp 200,000 and Rp 2,000,000.

Counting of cowrie shells, pig's teeth, dog's teeth and valued objects such as stone axes in the context of festivals and bridal and compensation payments takes place with the objects to be counted placed in between the parties involved. The objects are picked up one by one and carefully inspected. Counting proceeds by matching these visible objects with the relevant body parts used as tallies. Drabbe (1959) has observed that the Mandobo, who have the reputation of being great traders, are able to count very rapidly with the aid of their body-part tally system.

According to Boelaars (1970:70), the Mandobo also used a system based on the number 6 for counting cowrie money, on the basis of the fact that one string of shells comprised 6 shells, hence one string = 6, 2 strings = 12, 10 strings = 60.¹⁰ The number 60 (10 strings) could also be designated by clapping the hands once. By clapping twice, the number 120 was designated, and by clapping four times, the number 240.

Units of time (days, nights, months) constitute a more abstract subject for counting. The Korowai use a simple device, the *saündal*, to assist them in these more abstract arithmetic operations. It consists of the rib of a leaf of the sago palm tree, into which a number of pegs or bits of wood have been inserted. When somebody invites someone else to a feast, for example, he will hand over *saündal* together with the invitation; the person invited will take one peg out of the *saündal* every day, and when he has reached the last peg, which is twice as long as the others, the day of the feast will have arrived. The *saündal* depicted in the photograph accompanying this article is a 'modern' one, since it indicates a time span of

¹⁰ A similar use of strings of cowrie shells is reported by Drabbe (1959: 123) for the Yonggom dialect of Wambon. In this dialect the word *tik* 'rattan, string' is used in the context of counting to denote 10, since one *tik* of shells comprises 10 shells. By combining their mixed binary / body-part tally system with words denoting 10, the Yonggom are able to count up to a hundred.

two seven-day weeks. The opposition between workdays and Sundays (see also section 2.4 above) is reflected in this *saündal* by the distinction between the long pegs representing Sundays and the short pegs representing workdays.

Two points become clear from the consideration of the place of counting in Awyu societies. Firstly, the prices of goods and services stated in shell currency rarely exceed 30 shells. According to my Kombai, Korowai and Wambon informants, bridal payments (in Mandobo comprising 24 to 30 shells) and payments for pigs (in Mandobo comprising 19 shells) are the two most expensive transactions in a man's life. Hence the highest numbers that can be designated in the body-part numeral systems of the Awyu area are high enough to satisfy the basic counting needs in these societies. Secondly, counting in the great majority of cases involves concrete, visible objects, which are touched and matched with the relevant body parts, which are also touched.

As soon as Indonesian money enters the Awyu communities, numerals for the numbers 100, 1,500, 1,000, 10,000, 100,000 and 1,000,000 are required. The Indonesian numeral system appears to be easy to adopt and to integrate into traditional systems, however, as the following passage from the Kombai translation of the Gospel of Mark (chapter 8, verse 19) testifies:

- (xxix) *Nu* *roti* *ambalo-khu* *mofena* *lefa*
 I bread five-ATTR that take SS
- famo* *lima ribu* *khof-o* *ri* ...
 cut SS five thousand man-CONN for
 '... I took the five loaves of bread and cut them for five thousand
 men ...'

In example (xxix) both the Kombai body-part numeral 'thumb/five' and the Indonesian numeral *lima* 'five' are used. When multiples of the numbers designated by the borrowed Indonesian numerals *ratus* 'a hundred', *ribu* 'a thousand' and *juta* 'a million' need to be indicated in Kombai, the entire numeral phrase will consist of Indonesian numerals. Thus example (xxx.a), in which a Kombai numeral modifies an Indonesian loan-word, is unacceptable, while (xxx.b) is correct:

- (xxx.a) **ribu* *ambalo-khu*
 thousand five-ATTR
 'five thousand'
- (xxx.b) *lima* *ribu*
 five thousand
 'five thousand'

The extent of the influence of the borrowed Indonesian numeral system is dependent of course on the degree to which the various Awyu communities have been exposed to external influences. In the Mandobo and Aghu communities, the Indonesian system is widely used, whereas in most parts of the Korowai area, the traditional system is the only one that is known to people. The Kombai and Wambon are somewhere in between these two opposites.

6. Concluding remarks

In the Awyu language family, Kombai, Korowai and Wambon have pure body-part systems, used in conjunction with a binary system; Mandobo has a mixture of a body-part system and a binary system; Aghu has a mixture of a binary/quinary/vigesimal and a body-part system of sorts using the toes; while Pisa has the purest binary/quinary/vigesimal system of the languages surveyed. The diversity within the Awyu family confirms Laycock's observation (1975) that genetically related languages in New Guinea have widely varying number systems.

In Awyu communities, counting takes place either with the aid of parts of the hand, arm and head (as in Kombai, Korowai, Wambon and Mandobo), or using the hands and feet (as in Aghu, Sjiagha-Yenimu and Pisa). The numeral systems of the latter languages have affinities in this respect with the methods of counting with the aid of the hands and feet of the Asmat family to the west, and those of the former languages, spoken in the foothills, with the tally systems of the mountain tribes.

Below I list the various Awyu body-part tally systems according to highest number and turning-point. The languages mentioned here differ especially as regards the parts of the head used, Kombai and Mandobo using two points (the ear (11) and the crown of the head (12)), Korowai three points (the neck (11), ear (12), and crown of the head (13)), and Wambon four points (the neck (11), ear (12), eye (13) and nose (14)).

<i>Language</i>	<i>Highest number</i>	<i>Turning-point</i>
Kombai	23 (imofo raga)	head (12)
Mandobo	23 (eine ome)	head (12)
Korowai	38 (laifu-khabéan)	head (13)
Wambon	41 (nggisikhivo-kalit)	nose (14)

Wambon, with 41 as the highest number, remains well below the highest number reported for New Guinea body-part systems in general, namely 47 in Kewa (Franklin and Franklin 1961; Laycock 1975).

The starting-point of the Awyu body-part systems, the little finger of the

left hand, is the usual starting-point in these languages.¹¹ Since the end point of the Awyu systems also is the little finger, they are symmetrical systems.

The central point (turning-point) in the tally systems of Mandobo, Kombai and Korowai is the (top of the) head, and in Wambon the nose. Laycock (1975:220) mentions the nose and the breastbone as the usual central points.

When counting, after reaching the central point, continues down the other side of the body, the relevant body-part names are preceded by a word meaning 'the other side' in all of the Awyu languages investigated, including Aghu, which after 10 uses the toes as tallies in a body-part system, starting with the left big toe, and switching from the left to the right foot, when it adds the word *afi* 'the other side' to the numerals. Words for 'right' and 'left' do exist in Awyu languages, but do not play a role in numerical expressions.

The Awyu languages differ among themselves in the morpho-syntactic integration of the numeral systems. Aghu (and very likely also Pisa) uses the device of verbalization to integrate the numerals morpho-syntactically. Verbalization with the aid of support verbs is a widespread phenomenon in Awyu languages, and is a device used for all kinds of purposes (cf. De Vries 1993:14-8; De Vries and Wiersma 1992:13-7 for Wambon; De Vries and Van Enk 1993 for Korowai). Aghu employs it for the clausal morpho-syntactic integration of numerals. In nominal phrases, Mandobo simply uses the numerals without any formal changes, while Kombai, Korowai and Wambon employ an attributive suffix to indicate that the relevant body-part word is used as a numeral modifier.

Healy (1965:28) also reports the formation of attributive numeral forms in Telefol, a member of the Ok family, the eastern neighbour of the Awyu family. In Telefol the suffix *-kal* is added when body-part numerals are used to qualify nouns. This *-kal*, which functions primarily as a locative suffix meaning 'at', is added to the numerals for 'five' ('at left thumb') to 'fourteen' ('at nose') when they are used attributively. The numerals for numbers higher than 'fourteen' ('at nose', the turning-point in the Telefol system) do not take *-kal* when used attributively, but add an expression meaning 'the other side' (comparable to Kombai *imofo* 'the other side').

Here the variation in the sources of the grammaticalized attributive suffixes should be noted. They are: a locative suffix (Telefol), an adverbial clitic meaning 'also' (Kombai, Wambon), and a relational noun 'amount' (Korowai).

In the direct counting of objects, body parts are always involved in Awyu languages, both when numerals based on words for parts of the body and when 'genuine' numerals are used, as in Aghu, where counting

¹¹ Galis (1960) and Kirschbaum (1938) have noted starting-points on the right side; but see Laycock's comments (1975) on the dubious status of these exceptions.

starts from the thumb of the left hand. The association between numerical concepts and body parts is so strong here that most speakers automatically make the gesture of touching or bending the relevant body part whenever a numerical concept is expressed, also in contexts other than that of direct counting, for example, when a numeral modifier is used in a noun phrase or as part of a temporal phrase designating a particular month or day.

ABBREVIATIONS

1	first person
3	third person
ATTR	attributive
CONN	connective
COP	copula
DS	different subject (for switch-reference verbal suffixes indicating that the subject in the next clause is different)
DUR	durative
INF	infinitive
NF	non-future
NOM	nominal(izer)
PERF	perfect
PL	plural
PRED	predicative
SG	singular
SS	same subject (for verbal forms indicating that the subject in the next clause is the same)
SUPP	support verb (used as verbalizer)
TR	transitional sound

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