

Races of *Homo sapiens*: if not in the southwest Pacific, then nowhere

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Abstract

The physical anthropology literature reveals considerable disagreement on whether discrete biological races, or subspecies, exist within *Homo sapiens*, and which races to recognize if they do exist. The authoritative work on zoological taxonomy by Mayr and Ashlock defines a subspecies as 'an aggregate of phenotypically similar populations...inhabiting a geographical subdivision of the [species'] range and differing taxonomically from other populations of that species' (1991: 43). Our analysis of cranial average measurements, in combination with other biological data, indicated that the autochthonous populations of the southwest Pacific would be more likely to satisfy Mayr and Ashlock's definition than any other division of humanity. Five tests (using individual cranial measurements) were then performed to confirm (or falsify) the hypothesis that the southwest Pacific indigenes would qualify as a distinct race. In all cases, the test results tended in the direction of confirmation of the hypothesis, but it was not always clear that the results were sufficiently strong to qualify as full confirmation. One positive result however clearly emerged: Australian crania dated to approximately 10,000 years ago cannot be considered specifically Australian, based on their measurements, but they can be regarded as distinctly southwest Pacific.

Keywords

Human races; southwest Pacific populations; Indo-Malaysian populations; craniometrics.

The concept of race in history and biology

From early historical times, people of widely diverse origins were brought together through trade and conquest. As a result, scholars of Ancient Egypt and other Mediterranean empires developed various schemes to classify humans based on physical looks. Skin colour was the most important criterion in these early schemes, as it was when European scholars, inspired by the Linnean model of zoological nomenclature, began to develop formal taxonomies of human races (Jurmain and Nelson 1994: 115–17).

During the twentieth century, as physical anthropology grew into a recognized discipline, several main themes emerged to address the burgeoning knowledge of human phenotypic variation and the expanding human fossil record. These themes, to be discussed below, can be summarized under the headings of (1) integration of a wide range of biological indicators, (2) approaches to the clinal pattern of human variation, (3) packaging indigenous human variation into geographically continuous blocs and (4) searching for the races' fossil ancestry.

Charles Hooton's research ably represents the early twentieth-century transition towards a rational theory of human variation. In a famous article in *Science*, Hooton (1926) stressed that races in the biological sense of the term should not be confused with linguistic or ethnic groups, and that the delineation of races depended on evidence from the entire phenotype. Hooton's approach however was avowedly typological, prompting him to recognize pure races, and to explain gradations between types as due to mixing between the races. In his major treatise on the topic, Hooton (1947: 575–643) recognized three primary races and eight composite races (as an example of the latter, American Indians were described as predominantly Mongoloid, with Iranian Plateau, Australian and Negrito admixture). He further split his three primary races into seventeen sub-races, and his eight composite races into eighteen secondary sub-races-cum-morphological types. His three primary races – White, Negroid and Mongoloid – obviously echo skin-colour divisions, though not entirely, as shown by his classification of 'Indo-Dravidians' and mainland Australian Aborigines as predominantly White. A simplified map of Hooton's divisions (Fig. 1) reveals a complex interdigitation of White, Negroid and Mongoloid groups between North Japan, Southeast Asia and Tasmania, though elsewhere his divisions fall into extensive blocs. Finally, after a detailed review of the available fossil record, Hooton (1947: 412–14) placed Piltdown Man at the base of the main stem of human evolution leading up (of course) to Whites! By the 1950s, Hooton's views were so dated that Ashley Montagu (1957), in his famous assault on the concept of race, mentioned Hooton only in passing, and his follow-up edited volume (Montagu 1964) includes no reference to Hooton at all.

A younger generation of scholars, armed with a more sophisticated knowledge of human variation, genetics and the fossil record, had however taken up the cause to partition humanity into races. Stanley Garn (1961) explicitly enunciated the concept of geographical races separated from each other by geographic barriers to gene flow. Focusing on the distribution patterns of genetic markers known at the time, Garn recognized nine discrete races, all labelled geographically (Fig. 1). Carleton Coon's scheme reduced the number of races to five, and also explicitly related human differentiation to wide-scale patterns in zoogeography. However, Coon also departed from a geographical paradigm in such respects as his recognition of two races in Sub-Saharan Africa, and his belief in 'Australoid' relics – cousins of the major southwest Pacific bloc – in India and Southeast Asia (Fig. 1). Coon's major motivation for these complications was his attempt to trace his five races back to the times of *Homo erectus*, leading him to reconstruct the former existence of one race where another race later held sway (Coon 1962, 1966). Yet, in spite of the comprehensive schema developed by Coon, Garn and other scholars of their ilk (see Coon et al. 1950), a growing number of physical anthropologists directly opposed the notion of human races. These critics argued that the clinal pattern of human variation obviated any need to recognize races, or that human variation simply does not fall into

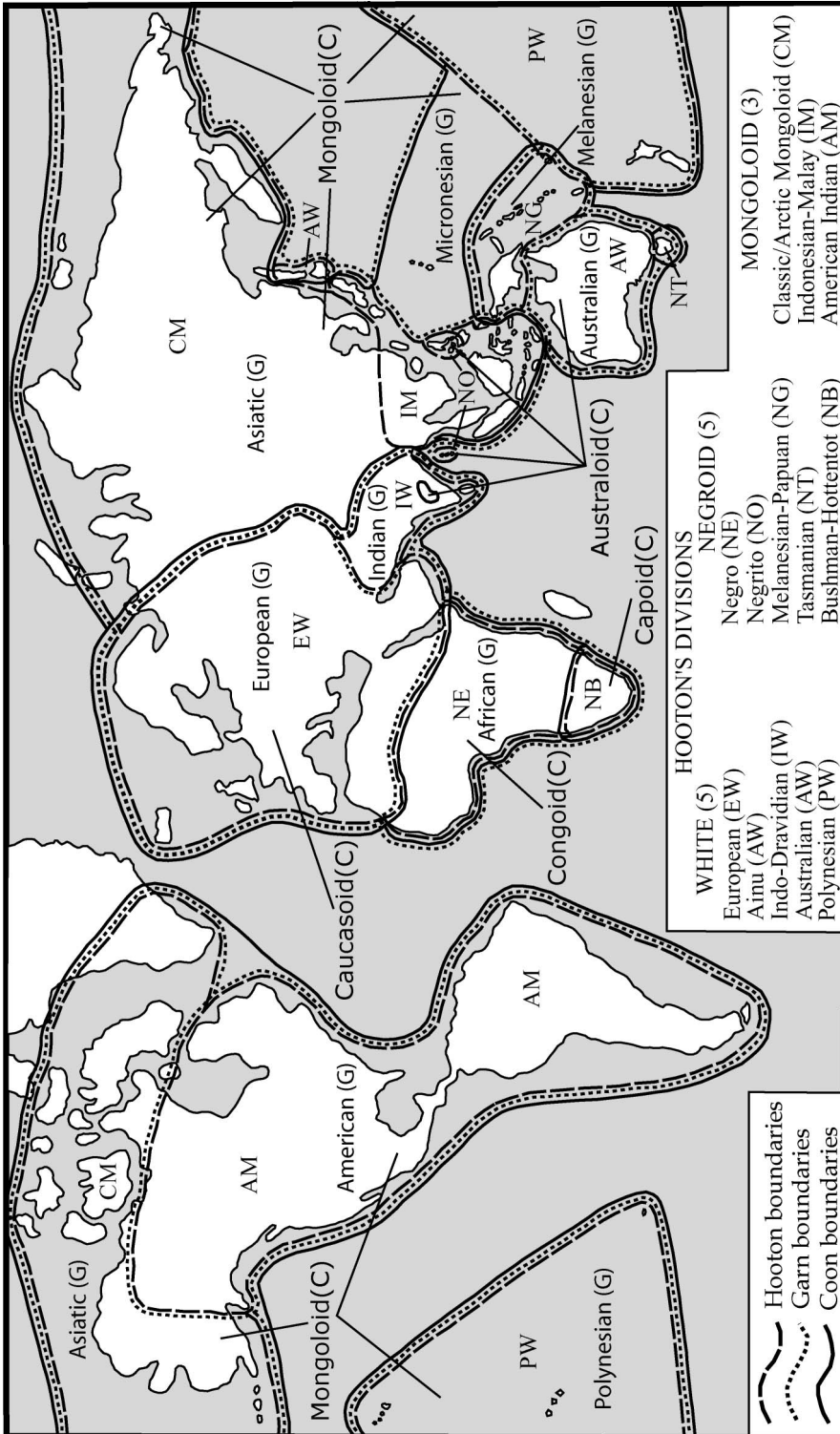


Figure 1 Geographical distribution of the races of humanity recognized by Hooton (1947), Garn (1961) and Coon (1962).

the neat spatial blocs that would justify the construction of races, or (especially with regard to Coon's work) that efforts to trace racial ancestries amounted to unfounded speculation (see the contributors to Montagu 1964).

In the late twentieth-century literature, supporters of the existence of human races were little more than apologists for the concept. Hulse (1971), Brues (1977), and to some degree Bennett (1979) and Molnar (1998), are examples of textbooks that made reference to large groupings of physically relatively homogeneous people in their global descriptions of human physical variation. However, the confident, definitive classifications of earlier race advocates were now replaced with discursive surveys which, to be sure, often availed themselves of terms from the race literature (such as 'Mongoloid'), but were primarily interested in adaptive explanations for physical diversity. More recently, worldwide surveys of human physical variation have fallen into disfavour, as studies in human genetics have become increasingly adept at grouping related lineages into race-neutral haplotypes (e.g. Merriwether et al. 2005). Opponents of the human race concept have risen to such prominence that racial terminology is effectively banished from the flagship journals of physical anthropology. The increasingly defensive attitude of race advocates is epitomized by Sarich and Miele (2004: 170–3) who appear to equate de-recognition of human races with the (untenable) view that human groups do not show major phenotypic differences. On the question of how many human races, their answer is: as many as you like, depending on your scale of investigation (Sarich and Miele 2004: 210–11; see also Brues 1977: 2; Bennett 1979: 362).

The highly flexible definition of race endorsed by writers like Bennett, Brues, and Sarich and Miele begs the question: why use this term instead of the neutral term population? The popular and indeed the legal meaning of 'race' (as in racial vilification) essentially equates to ethnic group. Attempts to discuss human races scientifically are guaranteed to raise offence in many quarters. The only possible justification, which we shall investigate in this paper, would be that there are (or at least were, at around 1492 CE) human races in the sense used in biological taxonomy, where the term race is a synonym for subspecies. To understand what taxonomists mean by subspecies (races), we may turn to Mayr and Ashlock: '*A subspecies is an aggregate of phenotypically similar populations of a species inhabiting a geographical subdivision of the range of that species and differing taxonomically from other populations of that species*' (1991: 43, italics in the original). Mayr and Ashlock (1991: 43–4) then point out that subspecies often comprise many slightly different populations, that subspecies should be distinguished only if they are taxonomically distinct on a number of diagnostic attributes, and that, as subspecies phenotypically overlap with each other, not every individual can be correctly assigned. They also discuss how taxonomists have become more cautious about recognizing subspecies but there is still no hard and fast methodology for determining when a species' variation should be classified into subspecies. Further, while distinct subspecies can be sharply delimited along a border of limited interbreeding or hybridization, it is usually unwise to recognize subspecies when they appear to be connected by a chain of intermediate populations displaying gradual change (Mayr and Ashlock 1991: 44, 96–100).

Are there any divisions of humanity that would meet these taxonomic criteria, and qualify as races in the strict sense of Garn and Coon rather than the loose sense of later writers? In this paper, we shall argue that the indigenous people of the southwest Pacific,

and perhaps they alone, largely meet these criteria. Whether the existence of one valid human race would justify the division of humanity in general into races, or whether this result would indeed validate application of the loaded term 'race' to southwest Pacific people, are not questions that we would answer in the affirmative. However, we emphasize that the explanation for this southwest Pacific bloc is a shared genetic ancestry of Pleistocene antiquity, and this finding could well be of political benefit to southwest Pacific indigenes as they struggle with the complexities of the modern world.

A global view on the validity of human races

If we entertain the hypothesis that human race advocates had developed reasonable taxonomies of human races, then we would expect these taxonomies to be confirmed by more recent studies of global human variation. Let us test this expectation against the human genetic clusters of Cavalli-Sforza et al. (1988: 6003), the major dental morphology regions reported by Scott and Turner (1997: 318–20) and the craniometric clusters published by Wright (2002: 6). The results are presented in Table 1.

The first point to note is that the schema of Garn and Coon outperform Hooton's in their overall agreement with modern research. For instance, Hooton's distinction between mainly White, mainland Australian Aborigines and Negroid Tasmanians is not supported by dental morphology or craniometrics. The single instance where Hooton's scheme might be preferred is his division between 'Malay-Mongoloids' and other East Asians to the north, which is supported by genetics as well as dental morphology. However, the evident failings in Garn's and Coon's schema should also be observed. Garn's erection of Melanesian and Micronesian races does not stand up to recent research nor is Coon's division between Capoids and Congoids substantiated in Table 1. In short, not only is there disagreement between schema of human races, but also no single published schema would appear to be the best.

The shortcomings of racial classifications may, however, reflect the unruly nature of indigenous human variation rather than scholarly lapse. It is not clear that the genetic, dental and craniometric groupings agree with each other better than they agree with the racial classifications (or than the latter agree with each other). The precise affinities of South Asians, Eskimos and Polynesians, for instance, would appear to be legitimate points of dissension (Table 1). If there are distinct groupings that emerge from recent research, they would appear to be restricted to Europe-Mediterranean (indeed, in accord with the three racial schema considered here), Sub-Saharan Africa and the southwest Pacific.

Finally, the relict isolates recognized by Coon are not confirmed by recent research. The Ainu appear to be East Asian, not Caucasoid; 'Capoids' and 'Congoids' should both be sunk into sub-Saharan Africans; and Coon's Australoid remnants in India and Indo-Malaysia find no echo in Table 1. Garn's emphasis on geographical blocs would appear to be headed in the right direction, even if some of the specific blocs he proposed are not supported.

At this stage it is appropriate to describe the results of a simple test that readers can replicate for themselves. The test involves entering the means of the twenty-eight male samples of skulls published by Howells (1989: 122–38; see Fig. 2) into the *FORDISC* 2.0 computer program, and having the program calculate the typicality probabilities with

Table 1 The racial classifications of Hooton, Garn and Coon, compared to major clusters based on nuclear genes (Cavalli-Sforza et al. 1988: 6003), Scott and Turner's (1997: 318–20) dental morphology (DM) major regions, and the craniometric clusters of Wright (2002: 6)

<i>Classificatory bloc</i>	<i>Hooton (1947)</i>	<i>Garn (1961)</i>	<i>Coon (1962, 1966)</i>	<i>Genetic cluster</i>	<i>DM major region</i>	<i>Wright cluster</i>
Mainland Australians	Australian (White)	Australian	Australoid	New Guinea-Australia	Sahul-Pacific	Australia/Melanesia
Tasmanians	Negroid	Australian	Australoid	?	Sahul-Pacific	Australia/Melanesia
Melanesians	Negroid	Melanesian	Australoid	New Guinea-Australia	Sahul-Pacific	Australia/Melanesia
Indo-Malaysian Negritos	Negrito (Negroid)	Unassigned	Australoid	Southeast Asian*	Sunda-Pacific	India (for Andaman Islanders)
Sub-continental Indians	Indo-Dravidian (White)	Indian	Australoid +Caucasoid	Caucasoid	Western Eurasia	India
Mediterranean	Mediterranean (White)	Europe	Caucasoid	Caucasoid	Western Eurasia	Europe-Mediterranean
Alpine	Alpine (White)	Europe	Caucasoid	Caucasoid	Western Eurasia	Europe-Mediterranean
Nordic	Nordic (White)	Europe	Caucasoid	Caucasoid	Western Eurasia	Europe-Mediterranean
Ainu	Ainu (White)	Unassigned	Caucasoid	Northeast Asia	Sino-Americas	East Asia
Northeast Asians	Classic Mongoloid	Asiatic	Mongoloid	NE Asia/Arctic	Sino-Americas	East Asia (/Americas)
East Arctic	Arctic Mongoloids	Asiatic	Mongoloid	Arctic	Sino-Americas	Pacific
Amerindians	American Indians (Mongoloid)	American	Mongoloid	America	Sino-Americas	Americas
Southeast Asians	Malay-Mongoloid	Asiatic	Mongoloid	Southeast Asian	Sunda-Pacific	East Asia
Micronesians	Unassigned	Micronesian	Mongoloid	Southeast Asian	Sunda-Pacific	East Asia
Polynesians	Polynesian (White)	Polynesian	Mongoloid	Southeast Asian	Sunda-Pacific	Pacific
Southern Nile	Nilotic Negro	African	Congoid	Africa	Sub-Saharan Africa	Sub-Saharan Africa
Africa	African Negro	African	Congoid	Africa	Sub-Saharan Africa	Sub-Saharan Africa
Khoisan	Bushman-Hottentot (Negroid)	African	Capoid	Africa	Sub-Saharan Africa	Sub-Saharan Africa

Note

*The 'Negrito' question is specifically addressed by Cavalli-Sforza et al. (1994: 234, 237), and their finding is here included in Table 1.

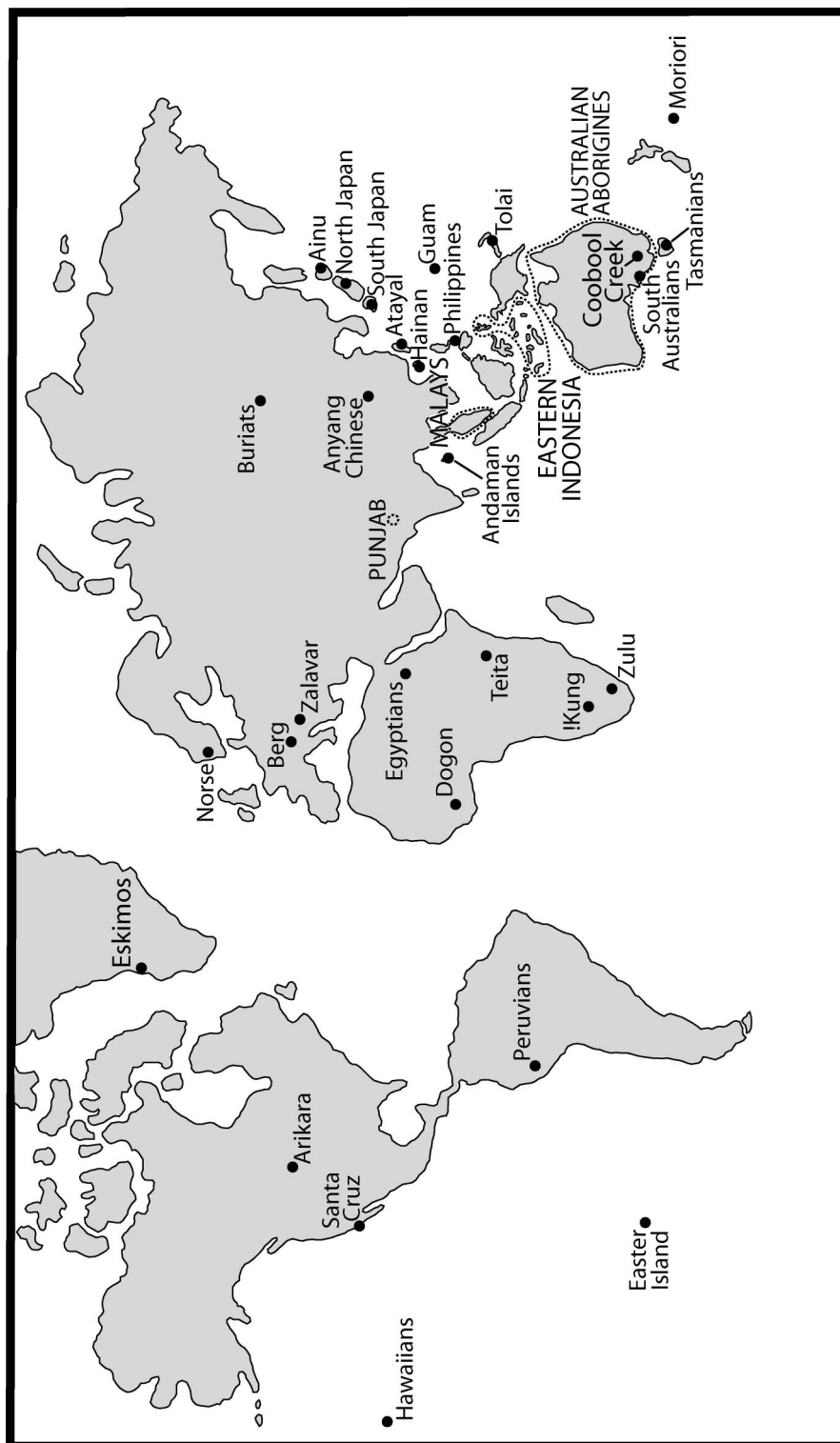


Figure 2 Location of four recent test samples (in capital letters), Coobool Creek and Howells's populations.

respect to Howells's populations. The procedural details and rationale will be described later in our article, and at this stage it is enough for a reader to realize that all of these populations would register a 1.000 typicality probability with themselves – in effect, 1.000 registers statistical identity, decreasing to a lowest possible figure of 0.000 for two populations whose craniometrics are totally unlike each other's. There is of course no point to including the typicality probability of a population with itself; thus, where typicality probabilities of 1.000 are included in the results (Table 2), this means that the mean measurements of the compared populations are so close as to be statistically indistinguishable. All the measurements are Howells's, so inter-observer measurement differences are not an issue, and all the compared data are averages, so variation within a population is not at stake either. Under these ideal circumstances, we would expect valid racial groups – if they exist – to jump out at us from the results, in the sense that all the typicality probabilities between populations within the same racial group should be higher than any typicality probability between a population of that racial group and a population not of that racial group.

The results are not very encouraging for advocates of discrete human races (Table 2). Populations within a 'racial group' do tend to resemble each other (i.e. display higher typicality probabilities) than populations from different racial groups, but the overlap is extensive. For example, the lowest threshold typicality probability between Europe-Mediterranean populations (0.817) would fail to exclusively distinguish them from sub-Saharan Africans (Coon's Congoids), Andaman Islanders, southwest Pacific populations, north-east Asians, Sunda-Pacific people or Amerindians. Indeed, if we take the Zalavár (Hungary) averages and enter them into FORDISC, they emerge as statistically identical (typicality probability of 1.000) with the North Japanese averages. As another example, the Ainu could be classified as Europe-Mediterranean, sub-Saharan African, Sunda-Pacific or north-east Asian, on the basis that they are craniometrically more similar to at least one population in all of these groups than the least similar populations within these groups are to each other. Numerous other examples from Table 2 could be cited to establish the overriding point: craniometrics do not appear to be very useful in segmenting humanity into discrete racial groups, even when we remove intra-population variation from the equation by using only population means.

The single instance in Table 2 of a 'racial group' which is craniometrically discrete is the southwest Pacific group. All three populations share typicality probabilities with each other of at least 0.960, higher than the typicality probability between any one of them and a non-southwest Pacific population. (As previously noted, Europe-Mediterranean populations would not be exclusively distinguished from southwest Pacific populations, as neither would sub-Saharan Africans, but this relationship is not symmetric – that is, southwest Pacific populations, being more tightly defined craniometrically, can still be exclusively distinguished from the other two groups.) Further, this craniometric homogeneity of southwest Pacific populations is not an artefact of Howells's particular choice of which three populations to measure. We have tested all eleven Melanesian populations published in Pietrusewsky (1984: Table 9), by entering the male craniometric means into FORDISC, and in every instance the three closest populations are Howells's southwest Pacific populations (<http://arts.anu.edu.au/bullda/interobserver.html>). We would not be prepared to claim that every southwest Pacific population would have

Table 2 Typicality probability results from entering the means of the populations represented in the rows into FORDISC. CAUC includes Norse, Zalavár, Berg and Egyptians. CONG includes Teita, Dogon and Zulu. SWP includes South Australians, Tasmanians and New Britain Tolai. SNP includes Atayal, Philippines, Guam, Hawaiians, Moriori and Easter Islanders. NEA includes North and South Japanese, Anyang and Hainan Chinese, and Buriats. AMER includes Arikara, Santa Cruz and Peruvians

	CAUC	CONG	!Kung	Andamans	SWP	Ainu	SNP	NEA	Eskimo	AMER
CAUC	0.817-1.000	0.221-0.887	0.144-0.355	0.486-0.825	0.010-0.846	0.660-0.994	0.030-0.993	0.063-0.999	0.034-0.660	0.445-0.991
CONG	0.241-0.914	0.905-1.000	0.550-0.660	0.649-0.986	0.590-0.957	0.798-0.912	0.180-0.964	0.003-0.918	0.012-0.165	0.099-0.625
!Kung	0.243-0.344	0.610-0.710	—	0.657	0.044-0.478	0.132	0.000-0.364	0.000-0.040	0.000	0.004-0.048
Andamans	0.360-0.674	0.492-0.904	0.368	—	0.054-0.243	0.145	0.015-0.838	0.002-0.686	0.005	0.074-0.614
SWP	0.008-0.602	0.285-0.850	0.031-0.257	0.043-0.186	0.960-0.988	0.680-0.825	0.072-0.646	0.000-0.580	0.045-0.345	0.047-0.360
Ainu	0.585-0.944	0.572-0.814	0.044	0.198	0.689-0.952	—	0.581-0.978	0.146-0.908	0.388	0.329-0.585
SNP	0.023-0.965	0.081-0.970	0.000-0.276	0.029-0.967	0.094-0.865	0.770-0.961	0.338-1.000	0.001-1.000	0.045-0.756	0.027-0.972
NEA	0.086-1.000	0.003-0.892	0.000-0.033	0.010-0.901	0.001-0.756	0.340-0.997	0.003-1.000	0.175-1.000	0.004-0.723	0.142-0.994
Eskimo	0.039-0.536	0.008-0.234	0.000	0.013	0.129-0.416	0.716	0.101-0.842	0.004-0.701	—	0.334-0.622
AMER	0.408-0.946	0.152-0.640	0.006-0.036	0.203-0.813	0.123-0.618	0.615-0.843	0.063-0.998	0.171-0.998	0.371-0.550	0.856-0.998

exclusively southwest Pacific craniometrics – indeed, our website reference includes one minor counter-example – but we can conclude, based on tests with means, that southwest Pacific people appear to be craniometrically homogeneous to an extent unparalleled elsewhere in the world.

The remainder of the paper will therefore test whether Mayr and Ashlock's criteria for a race can be validated, from craniometrics, for southwest Pacific populations, given that these alone would appear to be a possible candidate.

Materials and methods

Craniometrics offer a number of advantages for our empirical test of the validity of the human race concept. A huge body of craniometric data has been collected over the decades, on both ancient and recent members of *Homo sapiens*; crania show abundant metrical variation both within and between populations; and craniometric data have frequently been used in diagnosing population affinity. In particular, computer programs are now available which take craniometric data as input, and return information on the affinity of the measured specimen in relation to populations across the world. The particular program we use is FORDISC 2.0 (Ousley and Jantz 1996), which allows the user to select up to twenty-eight male and twenty-six female populations measured by Howells (1989: Appendix B) for comparison with the entered measurements. The standard practice is to enter the measurements specimen by specimen, and this allows us to monitor variation within a population in terms of the consistency or otherwise of their population affinities as suggested by FORDISC.

Five representative series of crania are included in this study (Fig. 2). As detailed in Table 3, they include recent Australian Aborigines from across the continent ($n = 447$), terminal Pleistocene Australian Aborigines from Coobool Creek in New South Wales ($n = 31$), recent eastern Indonesians ($n = 222$), recent Malays ($n = 92$) and recent Punjabis ($n = 185$). The recent series are analysed to investigate the metrical distinctiveness of

Table 3 Main characteristics of studied samples. For more details see text and acknowledgments

<i>Location</i>	<i>No. males</i>	<i>No. females</i>	<i>Measurer</i>	<i>Sexing</i>
Recent Mainland Australia	303	144	Milicerowa 1955; Brown n.d.; Hanihara unpublished	Brown's sexing; otherwise FORDISC
Coobool Creek, Pleistocene Australia	22	9	Brown n.d.	Brown's sexing
Recent eastern Indonesians	151	71	Pietrusewsky unpublished; Hanihara unpublished; Bulbeck unpublished	Recorder's sexing
Recent Malays	54	38	Rayner unpublished; Bulbeck unpublished	Bulbeck's sexing
Recent Punjabis	114	71	Raghavan unpublished	Raghavan's sexing

southwest Pacific crania. The Coobool Creek series allows a test on the time depth of any southwest Pacific race suggested by the analysis of recent crania. The availability of a substantial palaeoanthropological record in mainland Australia, compared to the meagre fossil records from Tasmania and Melanesia, justifies our decision to treat mainland Australian crania as the critical representative of southwest Pacific people.

We would not expect every recent Australian skull to be classified as Australian or even as southwest Pacific. As explained by Mayr and Ashlock, this expectation would be excessive for a subspecies. However, we would expect the unmistakable signal of a southwest Pacific craniometric profile. Turning to eastern Indonesia, we observe its universal recognition (by race advocates) as a sharp boundary between 'Mongoloid' populations to the north-west and southwest Pacific populations to the south and east (Fig. 1; Hulse 1971: 369). Our expectation would be that eastern Indonesian crania mostly classify either as southwest Pacific or as 'Mongoloid', along with a proportion whose mixed ancestry would make their classification unpredictable. Further, this complex signal should be equally strongly expressed throughout eastern Indonesia, rather than exhibiting gradual change from a southwest Pacific profile in the east to an Indo-Malaysian profile in the west. However, an Indo-Malaysian profile should be clearly apparent with the Malays, among whom any southwest Pacific resonances should be virtually non-existent. This effective absence of southwest Pacific tendencies should be equally apparent for the Punjabis, even though their craniometric affinities should be very different from those of Malays (see Table 1).

The twenty-eight populations measured by Howells (1989) are cited in Table 1 and Figure 2. Here it can be seen that most of the world, with the significant exception of South Asia, has been sampled. This worldwide coverage is important in testing the expectation that Australian crania are distinctive from those of any other part of the world, not just those in regions close to Australia. The procedures for using FORDISC to compare crania with populations around the world are detailed elsewhere (cf. <http://arts.anu.edu.au/bullda/interobserver.html>; http://arts.anu.edu.au/bullda/oz_cranioetrics.html), and here we shall merely summarize the main points. Up to twenty-one measurements from the face and braincase can be entered for any skull. The full twenty-one are available for Malays and Punjabis, but a slightly smaller number, between eighteen and twenty, for the other series. Many crania however are incomplete, and this raises the question of when a skull has enough measurements to be employed in the analysis. This decision is facilitated by a feature of FORDISC, whereby the user is advised of the proportion of the skulls measured by Howells that would be correctly classified with the available measurements. When all twenty-one variables are entered, approximately 70 per cent of Howells's reference skulls are correctly classified (70.6 per cent of females, 69.1 per cent of males). This may not sound very promising, but of course many 'misclassifications' would occur between closely related populations. In this study, the only results used are those where at least 50 per cent of the Howells specimens are correctly classified (in practice, ten or more variables, depending on how useful the variables are). This is a simple heuristic to exclude crania with an inadequate battery of available measurements.

The FORDISC program then calculates variance-covariance matrices which allow it to estimate the 'typicality probability', between 0.000 and 1.000, that a specimen with the entered measurements would belong to a given Howells population. Our analysis of

craniometric means (Table 2) employed these typicality probabilities to register the level of distinctiveness between the populations measured by Howells. Typicality probabilities would also be of interest to our analysis that follows, but are not wholly necessary, and so are omitted to simplify the discussion. (Readers interested in these data, and indeed the full presentation of our results, can consult this article's companion web page at http://arts.anu.edu.au/bullda/oz_cranioetrics.html.) Here we shall focus on the 'posterior probabilities' which FORDISC calculates through linear discriminant analysis. Based on the menu of entered measurements, the program transforms the Howells measurements to obtain the maximum possible correct classification of the skulls measured by Howells, and then gauges how the cranium whose measurements are entered would be classified through that analysis. This cranium can have a posterior probability anywhere between 0.000 and 1.000 of being classified with any Howells population, and the sum of its posterior probabilities is one. In non-technical terms, when the chips are down, which is the closest Howells population to the cranium of interest, and how much more probable is its classification with Howells's population X rather than Howells's population Y?

The usual treatment of the FORDISC results is to focus on the Howells population with which the cranium of interest is classified. In our terms, for instance, a cranium would be classified as 'southwest Pacific' if its closest population were Howells's South Australian, Tasmanian or New Britain Tolai sample. However, this level of analysis would sacrifice the information from FORDISC on the probabilistic strength of the classification. For example, a skull might register strong posterior probabilities with all of Australians, Tasmanians and Tolai, yet a slightly higher posterior probability with Zulu might waste the information that it has strong southwest Pacific tendencies. Accordingly, we also summarize the posterior probability results obtained for our five test populations. These results will be summarized in terms of their tenth and fortieth percentile values, for the reasons explained elsewhere (http://arts.anu.edu.au/bullda/oz_cranioetrics.html).

First test: closest population classifications

Based on Mayr and Ashlock's specifications, we predict a distinct southwest Pacific pattern for Australian crania, a virtual absence of that pattern west of eastern Indonesia, and a mixed southwest Pacific/Indo-Malaysian pattern in eastern Indonesia. These predictions appear to hold when we consider the simple statistic of classification in terms of the closest Howells population (Table 4). Nearly three-quarters of Australian crania would be classified as southwest Pacific, but that proportion drops to around 10 per cent among Malays and Punjabis. Moreover, three-quarters of Malays would be classified as 'Mongoloid' (i.e. SNP, NEA, AMER or Eskimo in Table 2 terms), much higher than the corresponding figure of 7.6 per cent of Australians. Additionally, eastern Indonesians have similar proportions of around 40 per cent classified as southwest Pacific and 40 per cent as 'Mongoloid', in accord with their location in a transitional zone. It can also be noted that 'SNP' populations (Filipinos, Hawaiians, Guam and Atayal) account for the majority of 'Mongoloid' classifications for both Malays and eastern Indonesians.

One interesting similarity of Australians, eastern Indonesians and Malays is the proportion of approximately 20 per cent that would be neither southwest Pacific nor

Table 4 Summary of closest Howells populations to recent cranial series

	<i>Australians</i>	<i>Eastern Indonesians</i>	<i>Malays</i>	<i>Punjabis</i>
Australian	223	11	0	7
Tolai	67	18	1	8
Tasmanian	39	51	5	6
Total south-west Pacific	329/447 (73.6%)	80/222 (36%)	6/92 (6.5%)	21/185 (11.4%)
Total	34/447	94/222	69/92	45/185
'Mongoloid'	(7.6%)	(42.3%)	(75%)	(24.6%)

'Mongoloid' (Table 4). The implication, already noted previously (see Table 2), is that populations of very different ancestry overlap extensively with each other in their cranial measurements. In the case of the Punjab crania, around 65 per cent would be classified neither as southwest Pacific nor as 'Mongoloid'. This makes perfect sense, given that they are neither, and if anything it is the *c.* 35 per cent of southwest Pacific and 'Mongoloid' classifications that might be considered a less than satisfactory result.

Second test: classificatory diversity

Our second test investigates the diversity of classifications that are obtained when individual crania belonging to our four recent samples (Table 2) have their measurements entered into FORDISC. The hypothesized distinctiveness of southwest Pacific would entail a smaller range of closest Howells populations for Australians than for Malays. Eastern Indonesians should have a greater diversity of classifications than either Australians or Malays, on account of individuals of mixed ancestry for whom FORDISC classification should be problematical. Finally, the fact that Punjab represents a part of the world (South Asia) not covered by Howells's database would also suggest a diverse range of classifications for Punjabis, because FORDISC would have to thrash around to find a population with which to classify these Punjab skulls.

For this test, we need to take into account the sample size of the entered specimens. For instance, if one sample is four times as large as another (as is more or less the case comparing Australian Aborigines with Malays), and if the larger sample has four cases of only one specimen being classified with one of the Howells populations, then this would be equivalent to merely one specimen in the smaller sample being classified with one of the Howells populations. Thus, to bring Australian Aborigines and Malays into parity (the case just described), we accept only one quarter of the Australian Aborigines' single classifications, half of their dual classifications and three-quarters of their triple classifications. To bring Eastern Indonesians and Punjabis (whose sample sizes approximately double those of Malays) into parity with Malays, we halve their number of single classifications, but otherwise do not correct the raw diversity of classifications. After these corrections, the effective diversity is obtained, being an estimate of how many populations would be identified as the closest Howells population, under the circumstances where 100 specimens are tested with FORDISC (Table 5).

The results bear out our expectations. Taking a sample of 100 crania from each population, there would be fewer populations that are the closest Howells population for Australians than for Malays and especially for eastern Indonesians or Punjabis. However, while our results follow the expected trend, it is less obvious that the trend is strong enough to characterize southwest Pacific crania as particularly homogeneous. To draw this inference with confidence, we might require an effective diversity for Australian Aborigines closer to 3 than to 15.

Third test: Eastern Indonesia – sharp or gradual transition zone?

According to the criteria of Mayr and Ashlock, a subspecies should not be recognized if the zone of transition between it and its neighbour(s) is gradual rather than sharp. To test this expectation we subtend a line between the westernmost tips of tropical Australia (i.e. the Northwest Cape) and New Guinea (see Fig. 2). Island groups to the east of this line (Aru, Kei, Tanimbar, Babar, Leti) are assigned to an eastern division, islands cut by this line (Seram and Timor) are assigned to a central division, and islands to the west (Halmahera, Tidore, Ambon, Buru, Wetar, Roti, Alor, Solor, Flores, Sumba and Sumbawa) are assigned to a western division. In terms of southwest Pacific, ‘Mongoloid’ and other aggregations, crania from all three divisions appear to show similar classification rates (Table 6). The chi-square value for these frequencies does not nearly approach a level of statistical significance (chi-square=3.06, 4 degrees of freedom), dispelling any grounds for treating the eastern Indonesians in these three regions as

Table 5 Summary of FORDISC classifications for four populations. Effective diversity is the expected diversity per ~100 specimens (see text)

	<i>Diversity of classifications</i>	<i>Single classifications</i>	<i>Dual classifications</i>	<i>Triple classifications</i>	<i>Effective diversity</i>
Australian Aborigines	22	7	2	1	15
Malays	20	4	3	4	20
Eastern Indonesians	26	2	3	2	25
Punjabis	25	2	6	2	24

Table 6 Aggregate classifications of eastern Indonesian crania assigned to eastern, central and western divisions (see text)

	<i>South-west Pacific</i>	<i>‘Mongoloid’</i>	<i>Other</i>	<i>Total</i>
Eastern division	14	15	4	33
Central division	35	38	25	98
Western division	31	41	19	91
Total	80	94	48	222

different populations. In summary, eastern Indonesia acts as a sharp boundary between the southwest Pacific and Indo-Malaysian regions, and so satisfies this criterion for assigning southwest Pacific people to a distinct race.

Fourth test: posterior probabilities

As explained in ‘Materials and methods’ above, when a cranium’s measurements are entered into FORDISC, it displays the posterior (as well as the typicality) probability for every Howells population, producing useful data that are lost when only the closest population is considered. To illustrate the uses of these probability data, we present them (in terms of their tenth and fortieth percentile values) for the seven Howells populations that are closest to each of our four test populations. Seven populations provide an appropriate depth to the comparisons to illustrate the main results (for full details of the analysis, see http://arts.anu.edu.au/bullda/oz_cranioetrics.html). Here we define the closest populations as those having the highest posterior probability at the tenth percentile. This leads to some loss of information concerning the number of ‘hits’ – for instance, Eskimos and Easter Islanders are slightly more often the closest Howells population to Australian Aborigines than are the Teita, Ainu or Dogon included in our analysis – but a major rationale for focusing on the posterior probability profile is that it excludes Howells populations with sporadic similarities that might be considered ‘flukes’. The results are presented in Tables 7 and 8.

When we consider the tenth percentile values (Table 7) there is little difference, statistically speaking, between our four tested populations. In all cases the posterior probabilities range between approximately 0.7 and 0.1. There are striking differences, of course, in the particular Howells populations that emerge as the seven closest. In the case of Australians, Howells’s Australian population is closest (as expected), followed by southwest Pacific and sub-Saharan African populations (along with the Ainu of Japan). In the case of Malays, the seven closest populations are all ‘Mongoloid’, but from remote locations like North America and Mongolia, as well as from Southeast Asia, Micronesia and Polynesia. In the case of eastern Indonesians and Punjabis, the seven closest populations are best described as those within reasonable geographical proximity. These

Table 7 Posterior probabilities, tenth percentile values, for the seven closest Howells populations

	<i>Australians</i>	<i>E. Indonesians</i>	<i>Malays</i>	<i>Punjab</i>
Closest	Australia 0.673	Tasmania 0.750	Filipinos 0.687	Andamans 0.740
2nd closest	Tolai 0.497	Filipinos 0.254	Hawaii 0.623	Egyptians 0.314
3rd closest	Zulu 0.433	Tolai 0.242	Buriats 0.516	!Kung 0.273
4th closest	Tasmania 0.402	Hawaii 0.212	Guam 0.202	Norse 0.232
5th closest	Teita 0.334	Guam 0.193	Hainan 0.176	Zalavár 0.181
6th closest	Ainu 0.132	Andamans 0.182	Arikara 0.119	Teita 0.171
7th closest	Dogon 0.127	Australia 0.151	Atayal 0.069	Atayal 0.136

Table 8 Posterior probabilities, fortieth percentile values, for the seven closest Howells populations

	<i>Australians</i>	<i>E. Indonesians</i>	<i>Malays</i>	<i>Punjab</i>
Closest	Australia 0.561	Tasmania 0.040	Filipinos 0.278	Andamans 0.009
2nd closest	Tolai 0.075	Filipinos 0.011	Hawaii 0.036	Egyptians 0.035
3rd closest	Zulu 0.033	Tolai 0.011	Buriats 0.002	!Kung 0.003
4th closest	Tasmania 0.034	Hawaii 0.006	Guam 0.028	Norse 0.014
5th closest	Teita 0.012	Guam 0.010	Hainan 0.034	Zalavár 0.029
6th closest	Ainu 0.009	Andamans 0.004	Arikara 0.003	Teita 0.011
7th closest	Dogon 0.008	Australia 0.003	Atayal 0.005	Atayal 0.009

seven populations respectively ring eastern Indonesia (including all three southwest Pacific populations) and India (Andaman Islands, Europe and Africa).

It is important to note that eastern Indonesians are metrically close (in this analysis) to populations to which they are geographically close, but that the same does not apply to our test populations either side of the eastern Indonesian divide. Australians do not show ‘Mongoloid’ similarities and Malays do not show southwest Pacific affinities. This observation highlights the efficacy of eastern Indonesia as a barrier to gene flow between Indo-Malaysia and the southwest Pacific.

With the posterior probabilities at the fortieth percentile (Table 8), two values stand out. The posterior probability of Australians with Howells’s Australian population lies above 0.5, and the posterior probability of Filipinos for Malays is also high (0.278). All other posterior probabilities in Table 8 are less than 0.1. The implication here is that there is a profound depth of metrically Australian crania in our Australian sample and a similar depth of metrically Filipino crania among the Malays. For all other comparisons, for instance Tasmanians with eastern Indonesians, the resemblances clearly affect only a minority of our test population, as revealed by the low posterior probabilities (at the fortieth percentile).

Our enthusiasm for the craniometric distinctiveness of southwest Pacific populations is tempered by one result revealed in Tables 7 and 8. The Zulu would appear to be craniometrically more similar to mainland Australians than Tasmanians are, as also confirmed by the number of FORDISC ‘hits’ (fifty-four for Zulu, compared to thirty-nine for Tasmanians). The secondary craniometric similarity between sub-Saharan Africans and Australians is not in itself a challenge to the hypothesis of craniometric homogeneity among southwest Pacific people, but the elevation of the Zulu above Tasmanians is.

Fifth test: longevity of southwest Pacific craniometrics

Brown (n.d.) publishes original measurements for thirty-one Coobool Creek crania, located in the Murray Valley and dated to around 10,000 years ago, in a form suitable for FORDISC analysis (for details see http://arts.anu.edu.au/bullda/oz_cranioetrics.html). Twenty-one (67.7 per cent) of the crania would be classified as southwest Pacific, although only two would be designated as specifically Australian (Table 9). At least as many

Table 9 Coobool Creek main FORDISC statistics

<i>Population</i>	<i>No. classifications</i>	<i>Posterior probability 10th percentile</i>	<i>Posterior probability 40th percentile</i>
Tasmanians	11 (35.5%)	0.717	0.241
Tolai	8 (25.8%)	0.793	0.220
Easter Island	3 (9.7%)	0.328	0
Australians	2 (6.5%)	0.430	0.071
Guam	2 (6.5%)	0.254	0.008
Zulu	2 (6.5%)	0.251	0.026
Eskimos	1 (3.2%)	0.201	0
Ainu	1 (3.2%)	0.062	0.001
Santa Cruz	1 (3.2%)	0.012	0

Coobool Creek crania would be classified as Easter Island, Guam or Zulu as would receive an Australian classification. The posterior probabilities correct this impression to an extent, as they would promote Howells's Australians to the status of third closest population to Coobool Creek, but they would also confirm the status of Tasmanians and Tolai as the two closest Howells populations. Thus, it would be incorrect to describe the Coobool Creek people as Australian in their craniometrics, but they can be characterized as southwest Pacific in this regard.

There is a sound explanation for the southwest Pacific, rather than specifically Australian, craniometrics of the Coobool Creek people (and other Pleistocene Sahulland human skulls, see http://arts.anu.edu.au/bullda/oz_craniometrics.html). During most of the Pleistocene Australia was connected with Tasmania and New Britain/New Guinea into the single continent of Sahulland. Gene flow across Sahulland could explain why the Coobool Creek find their closest affinities with Sahulland descendants now located across the seas from mainland Australia. Indeed, the very reason why we find suggestions of a southwest Pacific cranial form is the shared Pleistocene ancestry of these Sahulland descendants.

One unexpected result of the FORDISC analysis is the substantial minority (seven out of thirty-one, or 22.6 per cent, even excluding the Ainu) that would be classified as 'Mongoloid' (Table 9). None of these classifications would lie outside the recent range of Australian variation, but the proportion is greater than expected. The Coobool Creek sample is significantly different from recent Australians in this regard, as can be shown with a chi-square test comparing Coobool Creek and recent Australians for southwest Pacific, 'Mongoloid' and other classifications (chi-square=8.8, 2 degrees of freedom, $p < 0.025$). This result might be declared an anomalous curiosity, except that it is paralleled to the north west of eastern Indonesia. If we look at middle Holocene and earlier crania from Indo-Malaysia and Ryukyu that have been tested with FORDISC (Bulbeck 2004: 248, 2005: 279; Bulbeck and Adi 2005: 319), and take only those classifications for which at least 50 per cent of the Howells crania were correctly classified, we find a similar situation in that a substantial minority would be classified as southwest Pacific (Table 10); that is, a region where recent crania (as represented by Malays) show

Table 10 FORDISC closest populations for early (sub)tropical East Asians

<i>Howells population</i>	<i>(Sub)tropical East Asian specimens</i>
Easter Island	Gua Peraling 4 (Malaysia), Leang Buidane (North Sulawesi)
Tasmanian	Gua Cha As.33.6.11 (Malaysia), Minatagowa 1 (Ryukyus)
Ainu	Wajak 1 (Java)

minimal southwest Pacific affinities possibly contained a stronger southwest Pacific element in the past.

We hesitate before interpreting the results in Table 10 as support for the claim by Coon (1962), Jacob (1967), Bellwood (1997) and others that Southeast Asia had formerly hosted an ‘Australoid’ or ‘Australo-Melanesian’ race. We need merely point out that any such characterization would apply *a fortiori* to the Ryukyus, and that our evidence for a ‘Mongoloid’ element at Coobool Creek would be statistically sounder than a counterpart claim for Southeast Asian ‘Australoids’. Instead, we suggest from the craniometric evidence that the distinctiveness of the populations on the two sides of eastern Indonesia has become more pronounced during the middle and late Holocene. It would be premature at this stage to attribute this observation to specific changes in gene flow patterns during the Holocene, or else to a single process of gradually increasing phenotypic distinctiveness, over time, of Indo-Malaysian and southwest Pacific people following the colonization of Sahulland. Whatever the explanation, it would appear that, at around 10,000 years ago, the populations of Indo-Malaysia and the southwest Pacific were less distinct than they have been in recent times.

The long shadow of skin colour

As noted towards the start of this paper, Coon’s (1962) proposal of ‘Australoid’ relics in Southeast Asia is not supported by modern studies in physical anthropology. In addition, studies in craniometry have consistently found that Philippine ‘Negritos’ cannot be distinguished from other East Asian populations (e.g. von Bonin 1931; Hanihara 1993; Bulbeck and Adi 2005; and see below). Yet the belief that the Negritos of Island Southeast Asia represent an Australoid population that held sway before a mid to late Holocene Mongoloid immigration is widespread, and not infrequently cited as straightforward fact (e.g. Diamond 1997: 332–8). We suggest that this view is a retention of the hoary belief that human races can be classified by skin colour, given that a dark skin (along with a different hair form) sets the so-called Negritos apart from other Southeast Asians.

The belief in Holocene population replacement in Southeast Asia is not necessarily coupled to a belief in human races. As one of the contributors to Montagu’s (1964) ‘farewell to races’, Brace (1964) depicted indigenous variation by mapping the large-scale distribution of phenotypic traits graded into three to five categories. On this basis he argued that the dark skin and crinkled hair of certain tribal groups of southern India and

Southeast Asia are adaptive for these regions, and so would once have been ubiquitous among the general populace. Carefully avoiding any racial terminology, he concluded that the populations with these features must be relics of the ancient inhabitants, prior to the immigration of farming people whose origins lay elsewhere. In a later paper on craniometrics, Brace et al. (1991) were less wary of racial terminology, and explicitly referred to Australo-Melanesians. Their purpose here was to demonstrate that Negritos indeed cluster craniometrically with Australo-Melanesians, although their paper also volunteered other evidence to the contrary.

The craniometric analysis that supposedly aligned Negritos with Australo-Melanesians merits some discussion. Brace et al. (1991: 251, 259) took twenty-four measurements but decided to remove nine of them after converting them to indices (see Fig. 3). Four of their indices are the same as or similar to commonly employed indices – three that relate the length, breadth and width of the cranial vault to each other (16/17, 16/18, 17/18) and one that expresses the sagittal projection of the uppermost nasal saddle (nasion) as a proportion of the breadth between the orbits (22/23). Two of their indices, however, are idiosyncratic. One such index expresses the forward projection of the upper jaw as a ratio of the forward projection of the point at the top of the nasal aperture (6/19). The purpose of this index might be to gauge the relationship between the nasal bones and upper jaw in terms of their anterior projection, but the measurements are likely to be highly auto-correlated owing to the proximity of the utilized landmarks, and the probable effect would be to remove both measurements from analysis. The second unusual index expresses the forward projection of the top of the nasal aperture (with respect to the upper lateral orbits) as a proportion of the breadth between the orbits at their lateral midpoints (13/21). No explanation is given as to why these two particular measurements are chosen for representation as an index.

The analysis by Brace et al. thus employed six indices, of which two are highly unusual, along with fifteen measurements not involved in the six indices. No attempt was made to justify including indices and direct measurements (chords and subtenses) in the same analysis. The only conceivable justification is that the analysis yielded the result that Brace et al. (1991: 259–60) wanted, in that Andaman Islanders and Philippine Negritos formed a distinct cluster with Australo-Melanesians, relatively distinct from their South Asian sample and well removed from their Jomon-‘Mongoloid’ cluster. This is the result they favoured, even though direct analysis of their original measurements aligned Andaman Islanders with South Asians (as confirmed by Wright 2002: 6) and found that Philippine Negritos could not be distinguished from Mainland East Asians (Brace et al. 1991: 254, 260–1). It is also the result that several commentators have chosen to emphasize, without noting the dubious aspects of this particular analysis or the other conflicting results obtained by Brace et al. Matsumura and Hudson, who believe that the original inhabitants of Indo-Malaysia were closely related to Australo-Melanesians, report that Brace et al. ‘advocated that Philippine Negritos are closely related to Australo-Melanesians’ (Matsumura and Hudson 2005: 204). Bellwood (1997), who believes that the original inhabitants of Indo-Malaysia belonged to the Australo-Melanesian race, went considerably further. ‘Brace et al. (1991) offer no doubt from craniofacial evidence that the Southeast Asian Negritos are most closely related to Australians and Melanesians’ (Bellwood 1997: 72).

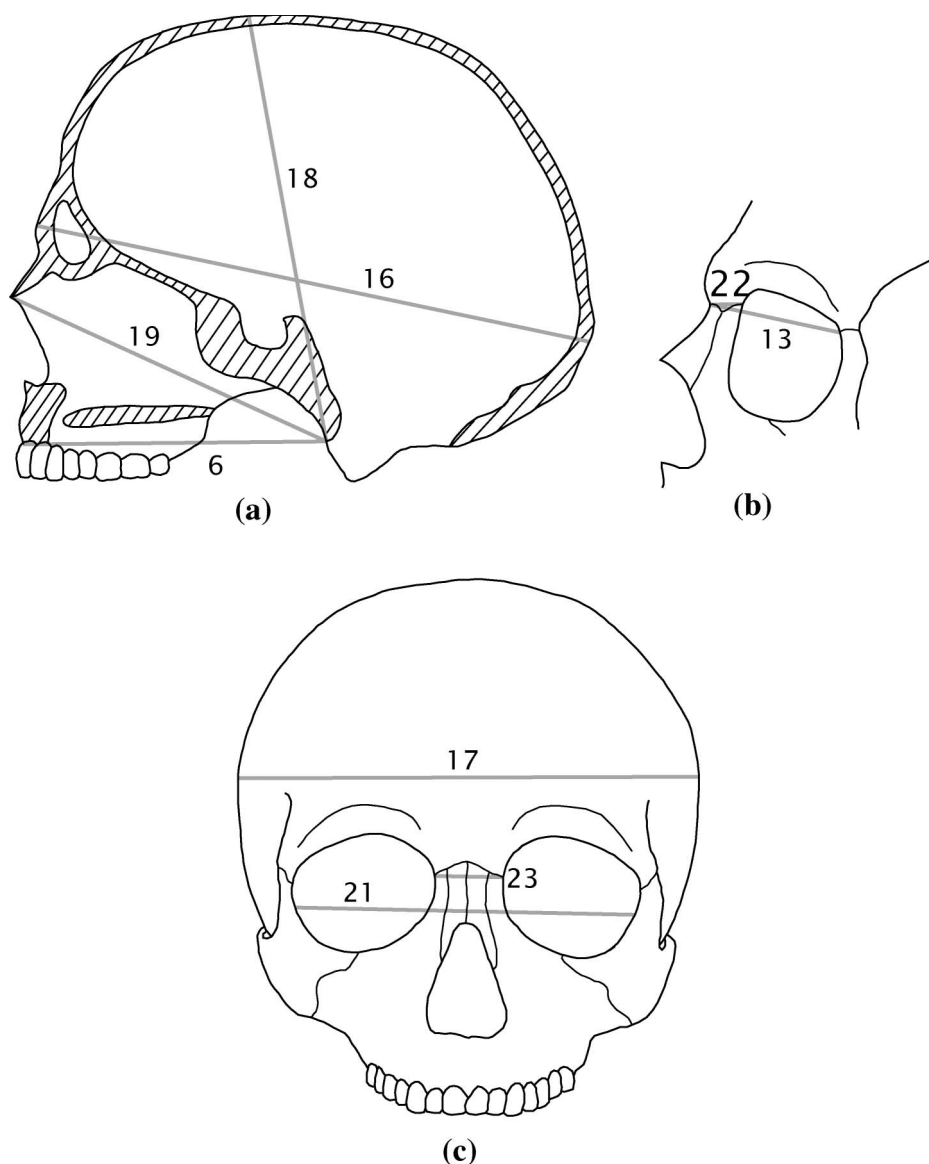


Figure 3 Cranial measurements converted by Brace et al. (1991) into indices. Note that the measurements depicted in (b) are not chords, but are subtenses measured between the projections of the indicated anatomical points onto the median sagittal plane.

We are not advocates of the notion that Indo-Malaysia has been free from immigration from northerly sources. Our own research strongly suggests some level of immigration over the last two thousand years (e.g. Bulbeck 2000: 33, 2004: 252; Rayner and Bulbeck 2001: 37–8), just as historical sources indicate some level of Chinese immigration into Indo-Malaysia throughout that period. The point we emphasize is that the supposed evidence relating Southeast Asia's 'Negritos', or earlier inhabitants of Indo-Malaysia, specifically to southwest Pacific populations is meagre and contradictory

(<http://arts.anu.edu.au/bullda/roonka.html>). As reflected in the minority 'Mongoloid' component among the Coobool Creek crania, we suggest that the distinctiveness of Indo-Malaysian and southwest Pacific populations is predominantly the effect of cumulative differentiation following the colonization of Sahulland, a process that has continued throughout the Holocene.

Conclusion

Racial classification schemes posed by twentieth-century scholars do not agree particularly well with each other, and often clash with the statistically generated divisions of humanity suggested by modern research. However, these latter divisions also differ from each other, in support of critics who argue that racial classifications fail to recognize the complexity, and ambiguity, of indigenous human variation. Study of craniometric averages further supports the paradigm of extensive overlap between geographical divisions. However, southwest Pacific populations do emerge as a quite distinctive bloc of humanity on all the above counts. Mayr and Ashlock (1991) propose criteria for when to accept a subspecific (racial) classification for a division within a species. Detailed craniometric analysis shows that southwest Pacific populations satisfy, to varying degrees, all the criteria expected of a racial group. In particular, eastern Indonesia is a sharp boundary between southwest Pacific populations and their 'Mongoloid' neighbours in Indo-Malaysia, and the distinctiveness of southwest Pacific craniometrics can be traced back to approximately 10,000 years ago.

Supporters of the concept of human races will presumably take heart from these results, at least as regards southwest Pacific populations, whereas opponents of that concept will probably not find these results sufficient reason to change their view. It is not our intention to sway opinion on this debate but instead to point out that, in terms of craniometrics, southwest Pacific people can be shown to be distinct from other world populations. In particular, we need a broader category than 'Australians' to deal with the Pleistocene ancestry of Australian Aborigines, because 10,000 years ago the inhabitants of Australia do not appear to have been distinctly Australian, although they were clearly of southwest Pacific status. The shared Pleistocene ancestry of the indigenous people of Australia (including Tasmania) and Melanesia is an important point that deserves far wider recognition, among the general public, than it currently has.

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Pathmanathan Raghavan received his MSc (Hons) and, in 1988, his PhD from Panjab University in Chandigarh, India. He specialized in the comparative vertebrate palaeontology (micro- and megafauna) and palaeohistology of fossil and living primates of the sub-Himalayan terrestrial deposits, and was selected as an outstanding scientist by the University Grants' Commission program for the period 1993–8. Most recently he has worked as a Visiting Researcher at the School of Archaeology and Anthropology, the Australian National University, with the Australian Research Council-funded project 'The Contribution of South Asia to the Peopling of Australasia'. As part of this work he has studied more than 1500 human crania (Mesolithic to recent) from 12 states of India covering more than 100 tribes and ethnic Indians. Currently he is also serving as a visiting faculty member to many medical institutions in India, and is visiting India on behalf of the Archaeological Survey of India – Chennai Circle, to study the skeletal morphology of the prehistoric people of Adichanallur (3800–800 years BP). Dr Raghavan has been granted Australian citizenship on the basis of his offshore academic research contributions. His current interests and specializations include human skeletal anatomy and CT, SEM and EDAX applications.

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