

6-21-2011

Racial Identification in the Skull and Teeth

Jodi Blumenfeld

The University of Western Ontario

Follow this and additional works at: <http://ir.lib.uwo.ca/totem>



Part of the [Biological and Physical Anthropology Commons](#)

Recommended Citation

Blumenfeld, Jodi (2000) "Racial Identification in the Skull and Teeth," *Totem: The University of Western Ontario Journal of Anthropology*: Vol. 8: Iss. 1, Article 4.

Available at: <http://ir.lib.uwo.ca/totem/vol8/iss1/4>

This Article is brought to you for free and open access by Scholarship@Western. It has been accepted for inclusion in Totem: The University of Western Ontario Journal of Anthropology by an authorized administrator of Scholarship@Western. For more information, please contact kmarshal@uwo.ca.

Racial Identification in the Skull and Teeth

Keywords

racial identification, skull, teeth, forensic anthropology

Creative Commons License



This work is licensed under a [Creative Commons Attribution-Noncommercial-No Derivative Works 3.0 License](https://creativecommons.org/licenses/by-nc-nd/3.0/).

RACIAL IDENTIFICATION IN THE SKULL AND TEETH

Jodi Blumenfeld

INTRODUCTION

There is one major problem in the determination of race and that is the extreme difficulty encountered when attempting to define the term "race". According to Skinner and Lazenby (1983:48-49), in the field of forensic anthropology, the term "race" is used very broadly. Racial affinity is identified for the lone purpose of identifying human skeletal remains. Shipman *et al.* (1985:250-251) define race as "...a morphologically recognisable subset of a species". According to Dyer (1974:1), the term "race" describes populations, not individuals, and it "...implies that a population, or group of populations, is sufficiently different from all others in the species to be separately recognized".

Dyer (1974:8) discusses early racial classifications such as the earliest classification of Linnaeus, who recognized four human racial subspecies: *Homo sapiens europaeus*, *Homo sapiens asiaticus*, *Homo sapiens afer*, and *Homo sapiens americanus*. Dyer (1974:8) also mentions the six classifications proposed by W.C. Boyd in 1950. Based on blood group studies, these classifications include: Early European, European (Caucasoid), African (Negroid), Asiatic (Mongoloid), Amerindian, and Australoid.

One major problem in these racial classifications is that they do not take into account the occurrence of racial hybridity. As Shipman *et al.* (1985:251) state, "...many skeletons possess features "typical" of two or more racial groups". Shipman *et al.* (1985:251) use the example of "American blacks" who are "...an admixture of several different racial stocks and are skeletally

difficult to differentiate". Skeletons that are hybrids of several different racial groups, and exhibit characteristics typical of one or more race are difficult to categorise into one specific racial group.

According to C. Loring Brace (1995), prior to the Renaissance era of trans-oceanic voyaging, there was no such thing as a concept of race. Brace (1995:174) refers to the travels of Marco Polo and Ibn Batuta, who were fully aware of the wide range of human biological variation that existed. Neither explorer used such a concept as "race" because their voyages were broken up into day-long segments and they "...perceived the spectrum of human variation as an unbroken continuum" (Brace 1995:174). After the European discovery of the western hemisphere, when navigational capabilities allowed one to board a boat in England and get off in the New World without seeing anything in between, concepts of human variation became categorical. Today, airplanes and the television camera have further reinforced categorical notions of human biological variation (Brace 1995:174).

In 1940, Franz Boas pronounced that "...homogenous populations do not exist anywhere in the world" (Boas 1940:38). In his anthropometric experiments on the characteristics of European immigrants to the United States, Boas stressed the important influence of social and geographic environments on body form, and stated that "...head forms may undergo certain changes in course of time, without change of descent" (Boas 1940:74). Boas refers to the plasticity of the form of the human cranium as the "instability or plasticity of types" (Boas 1940:72).

More than 50 years after Boas' experiments, the American Association of Physical Anthropology published a statement on the biological aspects of race (1996:569-570). In this statement, the AAPA declared that all living humans belong to a single species (*Homo sapiens*), and all share a common descent. The AAPA stated that there is a great deal of genetic diversity and variation within all human populations, and "...pure races, in the sense of genetically homogenous populations, do not exist in the human species today, nor is there any evidence that they have ever existed in the past" (AAPA 1996:569).

According to Gill (1998:293), skeletal race attribution is important to the process of records screening and personal identification. The AAPA may state that pure races do not exist, but society still perceives human genetic diversity in terms of discrete racial groups. This poses a dilemma for many forensic anthropologists. While most contemporary anthropologists have abandoned the traditional Western concept of race as bounded, identifiable biological populations (Sauer 1992:107), the race concept continues to persist in government census data and mass media sources. Because of this, the forensic anthropologist must be equipped to provide results of analysis in those terms, and thus, perpetuates the myth that races exists within our species (Kennedy 1995:798). This practice is not a vindication of the traditional race concept but a prediction, based upon skeletal morphology, that a certain label would have been assigned to a person when that person was alive (Sauer 1992:110). Brace (1995:172) warns that skeletal analysis can provide an accurate estimate of

ancestry, or original geographical origins, but no straight assessment of skin colour. "Africa of course entails "black", but "black" does not entail African" (Brace 1995:172). Jim Chatters, the anthropologist who first described Kennewick Man, was misunderstood and misquoted when he used the term "Caucasoid" to describe the ancient remains (Shanklin 2000:102). Caucasoid does not mean "white", but only that the remains exhibit Caucasoid-like features. Brace (1995:172) warns that forensic anthropologists must be fully aware of the many biological inaccuracies contained in the socially-expected practice of assigning race to a skeleton.

In this paper, I will attempt to describe the many different morphological variations in the skull and teeth that occur among different "racial" groups. I will also attempt to describe the different methods, both past and present, anthroposcopic and anthropometric, which are used within the field of forensic anthropology for determining race from the skull and teeth. For the sake of simplicity, I have chosen to use the three primary racial classifications used in modern race identification studies in forensic anthropology: Caucasoid, Negroid and Mongoloid (including American Indians) (Sauer 1992:109).

MORPHOLOGICAL/ANATOMICAL VARIATION IN THE SKULL AND TEETH

Table 1. outlines the essential craniofacial trait variations, which are common to these three racial categories.

	<i>Mongoloid</i>	<i>Caucasoid</i>	<i>Negroid</i>
<i>Cranial form</i>	broad	medium	Long
<i>Sagittal outline</i>	high, globular	high, rounded	highly variable, post-bregmatic depression
<i>Nose form</i>	medium	narrow	Broad
<i>Nasal bone size</i>	small	large	medium/small
<i>Nasal profile</i>	concave	straight	straight/ concave
<i>Nasal spine</i>	medium	prominent, straight	Reduced
<i>Nasal sill</i>	medium	sharp	dull/absent
<i>Incisor form</i>	shoveled	blade	Blade
<i>Facial prognathism</i>	moderate	reduced	Extreme
<i>Alveolar prognathism</i>	moderate	reduced	Extreme
<i>Malar form</i>	projecting	reduced	Reduced
<i>Palatal form</i>	parabolic/elliptic	parabolic	Hyperbolic
<i>Orbital form</i>	round	rhomboid	Round
<i>Mandible</i>	robust	medium	gracile, oblique gonial angle
<i>Chin projection</i>	moderate	prominent	Reduced
<i>Chin form</i>	median	bilateral	Median

Table 1. Craniofacial trait variations.
(modified from Gill 1986, Table 1.)

Cranium

Caucasoid

A Caucasoid cranium is long in length, narrow in breadth and high in height. The sagittal contour is round, and it exhibits a somewhat sloping forehead in comparison to Negroid or Mongoloid crania. The occipital profile is rounded and it exhibits strong nuchal muscle markings (Skinner & Lazenby 1983:50).

Bass (1979) has referred to a study by Adeloye *et al.*, which was conducted in 1975 that measured the thickness of the cranium at four different

points on the sagittal plane. This study was done on the skulls of black and white males, and it concluded that the frontal bones of white males were thicker than those of black males (Bass 1979:558).

Negroid

A Negroid cranium is long in length, narrow in breadth, and low in height. The sagittal contour is flat and the occipital profile is quite rounded (Skinner & Lazenby 1983:50). The flatness of the sagittal contour is due to a post-bregmatic depression, a trait that

occurs frequently in the Negroid cranium (Eckert 1997:356). Skinner and Lazenby (1983:50) describe the Negroid forehead as steep, but El-Najjar and McWilliams (1978:74) describe the Negroid forehead as rounded. According to Bass (1979:558), again referring to the 1975 Adeloys *et al.* study, the Negroid cranium exhibits thicker parieto-occipital areas than Caucasoid crania.

Mongoloid

The Mongoloid cranium is long in length (Skinner & Lazenby 1983:50), but can frequently appear round instead of long (El-Najjar & McWilliams 1978:74). The Mongoloid cranium is broad in breadth and average in height, categorised between the high Caucasoid cranium and the low Negroid cranium. The occipital profile is angular and the nuchal muscle markings are moderate (Skinner & Lazenby 1983:50). The sagittal contour is arched due to a "keeling" of the skull vault (Eckert 1997:356).

Birkby (1966:25) notes that archaeological American Indian skulls sometimes exhibit posterior occipital cranial deformation, or occipital flattening, which is the result of the use of cradleboards during infancy.

Face

Caucasoid

El-Najjar and McWilliams (1978:74) describe the Caucasoid face as a "hatchet face" due to the fact that the face aligns vertically in the sagittal plane. There is little or no prognathism exhibited, because Caucasoids have an orthognathic face with little protrusion in

the dental region of the skull (Bass 1995:88).

The malar bones (zygomatic bones) retreat in the Caucasoid skull which can make the skull appear somewhat "pointed" (Ubelaker 1989:119). In the nasal region, Caucasoids possess a rather large and sharp nasal sill (Bass 1995:88). El-Najjar and McWilliams (1978:74) describe the Caucasoid nasal root depression as well-marked, and mention that the "...superior ends of the nasal bones often seem to disappear beneath an overhanging projection at glabella". Gill (1986:148-149) refers to the Caucasoid nose as narrow with a long, straight nasal spine and large nasal bones.

Ubelaker (1989:119) describes the Caucasoid palate as narrow and triangular, as does Gill (1986:150) who also mentions that the palatine suture has sharp angles close to, but not on, the midline. El-Najjar and McWilliams (1978:74) and Gill (1986:149) both describe the Caucasoid orbital form as rounded.

Gill (1986:151) discusses the mastoid form and its use in identifying race from a skull, and states that the Caucasoid mastoid process is narrower, and more pointed than Negroid or Mongoloid mastoid processes.

According to Lahr (1996:47), *metopism* "...is by definition the abnormal persistence of the medio-frontal suture into adulthood", and Lahr states that metopism can occur in Caucasoid, Negroid and Mongoloid skulls, but it is most commonly found in Caucasoid skulls.

Negroid

According to Bass (1995:92), Negroid faces are renowned for

exhibiting *alveolar prognathism*, the anterior protrusion of the alveolar process. Alveolar prognathism produces facial prognathism, which is pronounced in Negroid skulls (Gill 1986:149).

Ubelaker (1989:119) notes that the Negroid face possesses rectangular shaped orbits and little projection of the malars. The most diagnostic feature of the Negroid face, according to El-Najjar and McWilliams (1978:74), is the *guttered nasal sill*. The base of the nose lacks the sharp sill seen in Caucasoid faces, it is round in shape and "...a gutter or trough is often found running laterally about 5mm inside the nostril" (El-Najjar & McWilliams 1978:74). The nasal form is broad, the nasal bones are medium/small and heavy, the nasal profile is straight or concave and the nasal spine is somewhat reduced (Gill 1986:148-149).

Ubelaker (1989:119) describes the Negroid palate as wide, and rectangular in shape, but Gill (1986:150) describes it as hyperbolic with long, parallel sides, and mentions that there tends to be a definite curve in the palatine suture close to the midline.

When discussing the use of the mastoid form in determining race from a skull, Gill (1986:150-151) states that "...the very oblique angle of the Negroid mastoid with its characteristically small tubercle along the inferior border constitutes the most distinctive of the mastoid forms".

Post (1969) conducted a study comparing the size of the external opening of the tear duct, or nasolachrymal canal, between American Negroids and Caucasoids. Post (1969:85) concluded that American Negroids possessed shorter nasolachrymal canals which are straighter,

and larger in diameter than American Caucasoids.

Mongoloid

Bass (1995:92) describes the Mongoloid face as flat, due to the extreme projection of the malar bones. Bass mentions that not only do the zygomatic bones protrude forward, but they also project inferiorly, below the inferior border of the maxilla.

Mongoloid faces exhibit medium alveolar prognathism, but it is not as extreme as it is in Negroid skulls (El-Najjar & McWilliams 1978:75). El-Najjar and McWilliams (1978:75) describe the Mongoloid orbital form as triangular, but Ubelaker (1989:119) and Gill (1986:149) both describe Mongoloid orbits as round and circular.

Mongoloid nose form is medium, with small nasal bones and a concave nasal profile. The nasal spine and nasal sill are described as medium (Gill 1986:149). Ubelaker (1989:119) mentions that the Mongoloid nasal aperture tends to have a pointed lower margin, and Bass (1995:92) notes that Mongoloid skulls exhibit a nasal overgrowth. "The nasal bones project forward beyond their junction with the frontal portion of the maxilla" (Bass 1995:92).

Gill (1986:151) describes the Mongoloid mastoid process as wide and vertical, and mentions that there is some similarity between the shape of Mongoloid and Caucasoid mastoid processes.

Mandible

According to Krogman and Iscan (1986:279), racial differentiation in the mandible is insignificant, and the

mandible cannot be racially categorised with any amount of accuracy. Although they have differing views, Krogman and Iscan (1986) refer to Shultz, who believes that there are morphological variations between the mandibles of Caucasoids and Negroids.

Shultz argues that a Negroid mandible has a "...lower, wider, and more vertical ramus; greater corpal and dental arch length, i.e., a long U-shaped dental arch; relatively smaller breadth dimensions; a less dominant chin, i.e., mental tubercles more medial in position and smaller" (Shultz in Krogman & Iscan 1986:280). In contrast, a Caucasoid mandible "...has larger breadth measures; a higher, narrower ramus; a greater gonial angle; ramal surfaces more parallel to the median sagittal plane; (and) a more protrusive chin with mental tubercles more lateral in position" (Krogman & Iscan 1986:279).

Gill (1986:149) also notes racial variations in the mandible, and describes a Negroid mandible as gracile, with an oblique gonial angle. It has a reduced chin projection, a median chin form and "...an undulating mandibular border, (and) a narrow posterior aspect to the horizontal mandibular ramus" (Gill 1986:149-150). A Caucasoid mandible exhibits a medium degree of robusticity, with prominent chin projection and a bilateral chin form. A Mongoloid mandible is robust, similar to a Negroid mandible, with moderate chin projection and a median chin form (Gill 1986:149).

Ubelaker (1989:119) has made the observation that the anterior alveolus in a Negroid mandible is quite projecting in comparison with Caucasoid and Mongoloid mandibles. This is due to the pronounced prognathism, or alveolar projection seen in Negroid skulls.

Teeth

Caucasoid

According to Ubelaker (1989:120), evidence suggests that "...maxillary lateral incisors of diminished size and variable form are more common among whites, such as peg-shaped forms and miniature versions of normal teeth". Also common in Caucasoid dentition are overbites, with the maxillary teeth protruding over the mandibular teeth (Ubelaker 1989:1989:120).

Carabelli's Cusp is an extra cusp on the mesio-lingual side of the maxillary molars. This feature is most commonly found in Caucasoid teeth, occurring with a frequency of 35-50%, and is less frequently found among Negroid and Mongoloid dentition. Other features of the Caucasoid dentition are buccolingual flattening of the mandibular second premolars and a long, narrow, parabolic arch with a high-vaulted palate (Eckert 1997:309-310).

Gill (1986:149-150) describes the Caucasoid parabolic palate as triangular, and states that the reduced alveolar prognathism seen in Caucasoid skulls is due to consistent dental crowding.

Krogman and Iscan (1986:369) describe Caucasoid dental roots as shorter, straighter, and less splayed than Negroid or Mongoloid dental roots, and mention that enamel extensions are more common in Caucasoid teeth.

Negroid

According to Eckert (1997:310), Negroid dentition is characterized by 2-3 lingual cusps on the mandibular first molar, wide, hyperbolic arches with a narrow palatal vault, both maxillary and mandibular alveolar prognathism, and a *Tuberculum Intermedium*. A

Tuberculum Intermedium is an extra lingual cusp "...between the disto-lingual and mesio-lingual on (the) mandibular first molar" (Eckert 1997:310).

El-Najjar and McWilliams (1978:75) mention that crenulations tend to appear on the occlusal surface of Negroid molars, but this has not been proven to be conclusive. El-Najjar and McWilliams (1978:74) also describe the Negroid palate as rectangular in shape, or pointed and narrow. Krogman and Iscan (1986:369) state that the first permanent mandibular molar in the Negroid dentition often displays the "Y5" cusp pattern.

De Melo E Freitas and Salzano (1975:147) conducted a study on the eruption of permanent teeth in Brazilian whites and blacks, and concluded that in general, there were no vast differences in the eruption rate between black and white children. The only variation found was that at age six, black children had more of their permanent teeth than white children, and this occurred with a probability of five percent (De Melo E Freitas & Salzano 1975:147).

Mongoloid

One major feature of Mongoloid dentition is an edge-to-edge bite that occurs when the mandible and maxilla are occluded. The incisor teeth will occlude edge-to-edge without showing the overbite that is commonly found in Caucasoid dentition. Occlusal wear on the incisors will usually indicate a Mongoloid skull (Bass 1995:92).

According to Ubelaker (1989:120), Mongoloid teeth are the largest in size in comparison with those of Negroids and Caucasoids. Other Mongoloid dentition features include extra distal roots on the mandibular first molars, an elliptical maxillary arch with a flat palatal vault, a vertical, wide ascending ramus, enamel pearls (lumps of enamel on the root trunks of molars), and a *dens evaginatus* - an extra tubercle on the occlusal surface of mandibular premolars (Eckert 1997:309). *Protostylids*, which are accessory cusps/tubercles that occur in the mesio-buccal surface of mandibular molars, occur with the highest frequency in the Mongoloid dentition (Ubelaker 1989:120).

The one dental trait that can be said to be diagnostic of Mongoloid dentition is *shovel-shaped incisors*. Shovel-shaped incisors have "...prominent marginal ridges on the lingual surface, giving them a "shovel-shaped" appearance" (Ubelaker 1989:120). This occurs with a high frequency in Mongoloid populations. According to Eckert (1997:308), shovel-shaped incisors occur in 85-99% of Mongoloid dentitions. Shovel-shaped incisors can occur in Negroid and Caucasoid dentitions, but the trait is rarely found in these populations (El-Najjar & McWilliams 1978:75).

Krogman and Iscan (1986:368-369) state that Mongoloid incisors have shorter roots, that Mongoloid molar roots are more frequently fused, shorter, and less splayed, and that tooth crowns are more bulbous and taper down to the neck.

METHODS FOR RACIAL IDENTIFICATION IN THE SKULL AND TEETH

Anthroposcopic Methods

Racial differentiation can be determined through the use of anthroposcopic, or non-metric methods. Many physical characteristics found on the skull can be analyzed non-metrically in order to assess the race of an individual. When trying to identify the race of an individual, most anthroposcopic methods tend to focus on the craniofacial region of the skull. The best traits for determining race tend to be those found in and around the nose, mouth and cheeks (Gill 1986:156).

Krogman and Iscan (1986:270-274) describe an anthroposcopic method used by Todd and Tracy in 1930 to determine racial affinity from Negroid and

Caucasoid skulls. Todd and Tracy focused on five descriptive traits: supraorbital ridges, upper orbital margins, glabella, the frontonasal suture and the interorbital distance. Under each of these five descriptive traits, Todd and Tracy looked for two contrasting variations which they believed to be racially connected. The supraorbital ridges were either mesa-like or undulating; the upper orbital margins were either sharp or blunt; glabella was either rounded or depressed; the frontonasal suture was either plain or beetling; and the interorbital distance was either narrow or wide. Two types of skulls were found, a U-type and an M-type, both distributed throughout the two races. Table 2. shows the distribution of both types of skulls found in the two races studied by Todd and Tracy.

<i>Modal Characters</i>	<i>Supraorb. Ridges</i>		<i>Upper orb. Margins</i>		<i>Glabella</i>		<i>Fronto-Nas. Junction</i>		<i>Interorb. Distance</i>	
	U	M	S	B	R	D	P	B	W	N
<i>White M-Type</i>		+	+	+	+	+		+		+
<i>American Black M-Type</i>		+	+	+		+		+		+
<i>East African M-Type</i>		+	+	+	+	+	+	+	+	
<i>West African M-Type</i>		+	+		+		+	+	+	
<i>White U-Type</i>	+		+		+		+	+		+
<i>American Black U-Type</i>	+		+		+		+		+	
<i>East African U-Type</i>	+		+		+		+		+	
<i>West African U-Type</i>	+		+		+		+		+	

Table 2. Distribution of race related morphological traits in blacks and whites.
(adapted from Krogman and Iscan, 1986. Table 7.3)

Gill (1986:154-155) refers to a 1984 study conducted by Martindale, who looked at the zygomatic sutures in order to determine race from a skull. Martindale distinguished between the zygomatic sutures of Caucasoids, which he observed to curve backwards, and of Mongoloids, which were more angled.

Birkby and Napoli (1990) studied the oval window position in the middle ear, and its usefulness in distinguishing between Caucasoid, Mongoloid and Caucasoid/Mongoloid admixed individuals. The authors concluded that the visibility of the oval window within the middle ear is a racially indicative trait - the oval window of Mongoloid skulls is generally obscured from view, but this is not the case in Caucasoid and Caucasoid/Mongoloid admixed individuals (Birkby & Napoli 1990:31).

Brooks *et al.* (1990:45) conducted an anthroposcopic analysis of alveolar prognathism and its usefulness in determining race from a skull, and concluded that "...there are racially distinct differentiations in the morphological appearance of maxillary alveolar prognathism".

Angel and Kelley (1990:33) state that "...midway up the posterior edge of

the ramus, the bone is turned inward in most skulls of African genetic origin", and the authors conclude that this characteristic is a valid trait when attempting to determine race from a mandible (Angel & Kelley 1990:38).

ANTHROPOMETRIC METHODS

Anthropometric methods of determining racial affinity in the skull have been conducted through the use of discriminant function statistics. One of the first methods using discriminant function statistics to determine race was carried out by Giles and Elliot in 1962.

Giles and Elliot (1962:147-157) studied American Caucasoid and Negroid skulls from the Hamann-Todd and Terry Collections and American Indian skulls from the Indian Knoll Collections, the Gulf States, and the southwestern United States. Using this method, eight cranial measurements are taken and multiplied by a determined factor. The results are then added or subtracted to produce a score that can be assessed for racial affiliation. These variables and multiplication factors are shown in table 3.

	<i>White vs.</i>		<i>White vs.</i>		<i>Male vs.</i>
	<i>Black</i>	<i>Indian</i>	<i>Black</i>	<i>Indian</i>	<i>Female</i>
<i>Basion-Prosthion</i>	3.06	0.10	1.74	3.05	-1.00
<i>Glabella-Occipital l.</i>	1.60	-0.25	1.28	-1.04	1.16
<i>Max. Cranial br.</i>	-1.90	-1.56	-1.18	-5.41	
<i>Basion-Bregma ht.</i>	-1.79	0.73	-0.14	4.29	
<i>Basion-Nasion length</i>	-4.41	-0.29	-2.34	-4.02	1.66
<i>Max. Bizygomatic br.</i>	-0.10	1.75	0.38	5.62	3.98
<i>Prosthion-Nasion ht.</i>	2.59	-0.16	-0.01	-1.00	1.54
<i>Nasal Breadth</i>	10.56	-0.88	2.45	-2.19	
<i>Sectioning Point</i>	89.27	22.28	92.20	130.10	891.12

Table 3. Variables and multiplication factors for determining race.
(adapted from Ubelaker 1989, Table 26)

The final score is then compared with the corresponding sectioning point. Scores that are greater in value than the specific point signify that the skull is not considered Caucasoid, but Negroid or Mongoloid, depending upon the specific column and sectioning point that is used (Ubelaker 1989:121).

Birkby (1966) has criticised this specific anthropometric method for determining race. According to Birkby (1966:22-26), Giles and Elliot's method classifies skulls according to three main racial categorisations, and any skull that is analyzed using this method must be placed in one of these three categories. This method does not take into account hybridity or human variation.

Birkby also criticises the American Indian population (IndianKnoll) included in the Giles and Elliot study. According to Birkby (1966:26), the Indian Knoll population is not representative of all American Indians found in the United States, which would be necessary in order to use this method to determine race on a national basis: "The determination of race by discriminant functions based only on a single American Indian sample cannot be used with any degree of confidence on any other American Indian population" (Birkby 1966:26).

In 1984, Gill developed an anthropometric method to determine race "...that results in a ninety-percent-correct classification" (Bass 1995:93). This method involves six measurements of the midfacial skeleton and the computation of three indices: the maxillofrontal index, the zygoorbital index, and the alpha index (Curran 1990:55). According to Krogman and Iscan (1986:276), this method worked adequately to distinguish Caucasoids from Negroids and Mongoloids, but it

was not useful in distinguishing between Negroids and Mongoloids. Gill (1986:153-154) states that no other methods seems to show such stable, dependable results, but adds that it does require the use of a simometer, which is an instrument that was rarely found and/or used at the time of his publication.

DiBennardo (1986) has made use of computer implementations which have simplified the use of statistical methods, such as discriminant function analysis, in determining racial affiliation from skulls.

FORDISC 2.0, by Ousley and Jantz (1996), is an interactive DOS computer program used in determining race from cranial measurements. According to Ousley and Jantz (1996), this program is able to classify unknown adult crania based on known samples with the use of up to 21 cranial measurements. The known samples are all recent populations, and therefore the program should only be used in the analysis of modern, non-archaeological individuals. The majority of the known samples used in the FORDISC 2.0 program are from the Forensic Data Bank (Jantz & Moore-Jansen 1988). All measurements and landmarks used are published in *Data Collection Procedures for Forensic Skeletal Material* (Moore-Jansen *et al.* 1994), which is included with each copy of the FORDISC 2.0 program.

Howells (1989) has also used anthropometric methods, Q-Mode analysis, and analysis by population distances in order to "...search for specific distinctions between the populations of different major regions" (Howells 1989:1). Howells used fifty-seven different measurements in order to look for differences within six different populations; Europeans, Africans (sub-

Saharan), Australo-Melanesians, Far Easterners (Japanese, Chinese), Polynesians, and those from North and South America. Howells concluded that there are "...signs of evolutionary divergence in cranial shape among recent populations of different geographic areas" (Howells 1989:83). Howells (1995) recently made use of multivariate analysis in determining ethnic identification from human crania.

Benfer (1970) has used multivariate analysis on the associations among seven discontinuous cranial traits which were first presented in 1968 by Hertzog: five sites where accessory ossicles occur, the presence of parietal foramina and the form of the fronto-temporal suture. Benfer found these seven traits to occur independently from each other, and concluded that they cannot be used in order to determine racial affiliation from skulls.

CONCLUSION

All living human beings are members of a single species (*Homo sapiens*). There is a great deal of genetic diversity within all human populations, and human genetic variation should be perceived as a continuum, rather than discrete categories. But within the field of forensic osteology, determining race from a skull is useful in its ability to aid in identifying human remains. Society still perceives human genetic diversity in terms of discrete racial groups, and the forensic anthropologist must be equipped to provide results of analysis in those terms. In doing so, the forensic anthropologist must heed the warnings of Brace (1995:172), and always be aware of the biological inaccuracies

involved in the practice of assigning race to a skeleton.

Different studies in racial variation, such as morphological variation, and both anthroposcopic and anthropometric methods, make useful contributions to the practice within modern forensic anthropology of determining racial affinity from human crania. Each method focuses on observations of many different characteristics and traits occurring on the human skull. This is important because no one single trait on its own denotes "race". Only when all traits are observed together and then analysed according to a specific method, can inferences be made about the racial identification of a skull. One major problem with classifying human remains into specific races, is the fact that these racial classifications do not take into account the occurrence of hybridity. Methods used in order to classify individuals into separate racial categories do not take note of individuals who exhibit a mix of different "racial" traits. The geographic movement of peoples occurs on a very large scale, resulting in larger populations of admixed individuals. Methods used in determining race from human skulls will have to take note of this, and formulate different categories of racial affiliation when attempting to analyze race from human remains.

REFERENCES CITED

- American Association of Physical Anthropology 1996. AAPA Statement on Biological Aspects of Race. *American Journal of Physical Anthropology*. 101:569-570.

- Angel, J. Lawrence and Jennifer Olsen Kelley 1990. "Inversion of the Posterior Edge of the Jaw Ramus: New Race Trait." In *Skeletal Attribution of Race: Methods for Forensic Anthropology*. Gill, George W. and Stanley Rhine, (eds.), pp. 33-39. Maxwell Museum of Anthropology, Anthropological Papers No.4.
- Bass, William M. 1979. Developments in the Identification of Human Skeletal Material. *American Journal of Physical Anthropology*. 51:555-562.
- Bass, William M. 1995. *Human Osteology: A Laboratory and Field Manual*. Columbia: Missouri Archaeological Society, Inc.
- Benfer, Robert A. 1970. Associations Among Cranial Traits. *American Journal of Physical Anthropology*. 32:463-464.
- Birkby, Walter H. 1966. An Evaluation of Race and Sex Identification from Cranial Measurements. *American Journal of Physical Anthropology*. 24:21-28.
- Birkby, Walter H. and Michelle L. Napoli 1990. "Racial Differences in the Visibility of the Oval Window in the Middle Ear." In *Skeletal Attribution of Race: Methods for Forensic Anthropology*. Gill, George W. and Stanley Rhine, (eds.), pp. 27-32. Maxwell Museum of Anthropology, Anthropological Papers No.4.
- Boas, Franz 1940. *Race, Language and Culture*. New York: The Macmillan Company.
- Brace, C. Loring 1995. Region Does not Mean "Race" - Reality Versus Convention in Forensic Anthropology. *Journal of Forensic Sciences*. 40:171-175.
- Brooks, Sheilagh, Richard H. Brooks and Diane France 1990. "Alveolar Prognathism Contour, An Aspect of Racial Identification." In *Skeletal Attribution of Race: Methods for Forensic Anthropology*. Gill, George W. and Stanley Rhine, (eds.), pp. 41-46. Maxwell Museum of Anthropology, Anthropological Papers No.4.
- Curran, B.K. 1990. "The Application of Measures of Midfacial Projection for Racial Classification." In *Skeletal Attribution of Race: Methods for Forensic Anthropology*. Gill, George W. and Stanley Rhine, (eds.), pp. 55-57. Maxwell Museum of Anthropology, Anthropological Papers No.4.
- De Melo E Freitas, Mario J. and F.M. Salzano 1975. Eruption of Permanent Teeth in Brazilian Whites and Blacks. *American Journal of Physical Anthropology*. 42:145-150.

- DiBennardo, Robert 1986. "The Use and Interpretation of Common Computer Implementations of Discriminant Function Analysis." *In Forensic Osteology: Advances in the Identification of Human Remains*. Reichs, K.J.(ed.), pp.171-195. Springfield: Charles C. Thomas.
- Dyer, K.F. 1974. *The Biology of Racial Integration*. Bristol: Sciencetechnica, Ltd.
- Eckert, William G. 1997. *Introduction to Forensic Science*. United States of America: CRC Press, Inc
- El-Najjar, Mahmoud Y. and K. Richard McWilliams 1978. *Forensic Anthropology: The Structure, Morphology and Variation of Human Bone and Dentition*. Illinois: Charles C. Thomas.
- Giles, Eugene and Orville Elliot 1962. Race Identification from Cranial Measurements. *Journal of Forensic Sciences*. 7:147-157.
- Gill, George W. 1998. "Craniofacial Criteria in the Skeletal Attribution of Race." *In Forensic Osteology: Advances in the Identification of Human Remains*. (2nd edition) Reichs, Kathleen J.(ed.), pp.293-315.
- Gill, George W. 1986. "Craniofacial Criteria in Forensic Identification." *In Forensic Osteology: Advances in the identification of Human Remains*. Reichs, K.J.(ed.). pp. 143-159. Springfield: Charles C. Thomas.
- Howells, W.W. 1989. Skull Shapes and the Map: Craniometric Analyses in the Dispersion of Modern *Homo*. *Papers of the Peabody Museum of Archaeology and Ethnology*, Vol. 79 Peabody Museum, Harvard University, Cambridge.
- Howells, W.W. 1995. Who's Who in Skulls: Ethnic Identification of Crania from Measurements. *Papers of the Peabody Museum of Archaeology and Ethnology*, Vol. 82 Peabody Museum, Harvard University, Cambridge.
- Jantz, R.L. and P.H. Moore-Jansen 1988. *A Data Base for Forensic Anthropology: Structure, Content and Analysis*. Report of Investigations No. 47, Department of Anthropology. Knoxville: The University of Tennessee.
- Kennedy, Kenneth A.R. 1995. But Professor, Why Teach Race Identification if Races Don't Exist? *Journal of Forensic Sciences*. 40:797-800.
- Krogman, Wilton Marion and Mehmet Yascar Iscan 1986. *The Human Skeleton in Forensic Medicine*. Springfield: Charles C. Thomas.
- Lahr, Marta Mirazon 1996. *The Evolution of Modern Human Diversity: A Study of Cranial Variation*. Britain: University Press, Cambridge.
- Moore-Jansen, P.H., S.D. Ousley and R.L. Jantz 1994. *Data Collection Procedures for Forensic Skeletal Material*. Third Edition. Knoxville: The University of Tennessee.

- Ousley, S.D. and R.L. Jantz 1996.
FORDISC 2.0: Personal Computer Forensic Discriminant Functions.
Knoxville: The University of Tennessee.
- Post, Richard H. 1969. Tear Duct Size Differences of Age, Sex and Race. *American Journal of Physical Anthropology*. 30:85-88.
- Sauer, Norman J. 1992. Forensic Anthropology and the Concept of Race: If Races Don't Exist, Why are Forensic Anthropologists so Good at Identifying Them? *Social Science and Medicine*. 34(2):107-111.
- Shanklin, Eugenia 2000. Representations of Race and Racism in American Anthropology. *Current Anthropology*. 41(1):99-103.
- Shipman, Pat, Alan Walker and David Bichell 1985. *The Human Skeleton*. Cambridge, Massachusetts: Harvard University Press.
- Skinner, Mark and Richard A. Lazenby 1983. *Found! Human Remains: A Field Manual for the Recovery of the Recent Human Skeleton*. British Columbia: Archaeology Press, Simon Fraser University.
- Ubelaker, Douglas H. 1989. *Human Skeletal Remains: Excavation, Analysis and Interpretation*. Washington: Taraxacum.