Face Shape Variation Among Sundanese People from Western Java, Indonesia

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The face is an important visual stimulus in daily life and each face identifies a particular person. The bone structure of the skull along with various soft tissues and coloration influence perception of the face. Facial averageness, and bilateral symmetry are the two most commonly used criterion of facial attractiveness, yet, both may be perceived differently based on hormonal status of the person observed. Facial perceptions may also differ according to cultural norms. In this research, we examined variations in face-shape among Sundanese male and female adults aged 18 to 40. We applied geometric-morphometric methods to analyze the landmark-based morphological variations in the frontal and lateral views of subjects' faces. We identified five types of female frontal face views and four of male. We also identified five types each of female and male lateral face views. The trichion, gonion and gnathion were three most variable landmarks among the face views in our study, and highly determined the shape of the individuals' faces. Multiple face type variation may refer to many categories of attractive faces since there is no exactly perfect category in the assessment of facial attractiveness by the viewers. Therefore, we believe that the configuration of facial features cannot constitute the sole visual criterion of facial attractiveness.

Key words: face variation, facial attractiveness, Sundanese adults faces, geometric morphometric

INTRODUCTION

The face is an important visual stimulus in daily life (Goldstein 1983). Inter-individual variation in facial shape is one of the most noticeable phenotypes in humans, and uniquely identifies each individual (Henneberg *et al*. 2003). The bone structure of the skull, complex variations in soft tissue, and skin coloration, all influence the shape of the face and how it is perceived by others (Enlow 1966; Burke & Hughes-Lawson 1988; Jones *et al*. 2002). Moreover, morphological characteristics may be perceived differently in different cultures (Berrios 2003; Noor & Evans 2003; Geldart 2009; Fang *et al*. 2011).

Perceived attractiveness has been studied in relation to evolution, and proposed to signal mate quality with regard to producing healthy offspring. According to this theory, there is a biologically-based preference for three particular perceived facial characteristics, which humans are adapted to seek in order to find good mates. These three characteristics include facial averageness, bilateral symmetry and

sexual dimorphism (Johnston & Franklin 1993; Perrett *et al*. 1998; Scheib *et al*. 1999; Rhodes *et al*. 1999; Jones *et al*. 2001; Johnston *et al*. 2001; Rhodes 2006; Weston *et al*. 2007). Face averageness and bilateral symmetry show developmental stability and heterozygosity, and therefore signal aspects of mate quality such as health and heritable resistance to disease (Møller & Swaddle 1997; Thornhill & Møller 1997; Perrett *et al*. 1999). In addition, the morphogenetic aspect of facial sexual dimorphism is controlled by sexual hormones whose effects are activated during puberty (Guerriero 2009). High levels of sex hormones at puberty may correlate to high masculine and/or feminine traits as well as immunological competence (Thornhill & Møller 1997; Penton-Voak & Perrett 2000). On the other hand, facial attractiveness could also be understood as a secondary product of information-processing by the brain of the perceiver, with no correlation to the "good genes" signal (Enquist & Arak 1994; Johnstone 1994; Jansson *et al*. 2002).

In this research, we tried to analyze face shape variation among Sundanese female and male adults, and identify any landmark characteristics that

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may constitute facial attractiveness criteria among observers. However, this study made no attempt to assess the mate selection fitness of subjects, or relate this to perceived facial attractiveness.

MATERIALS AND METHODS

Subjects. Sundanese people are a population indigenous to the western part of Java, in Indonesia. They are the second largest ethnic group in Indonesia, besides the Javanese in central and eastern Java, with an estimated population of 36 million people as of 2010. Despite many similarities with Javanese culture, Sundanese people are predominantly Muslims and less rigid in social hierarchy. Based on the dispersal of Austronesian speakers in South East Asia (Shutler & Marck 1975; Blust 1995; Bellwood 1997), both Sundanese and Javanese were originated in Taiwan and reached Java between 1,500 and 1,000 BC. Among Sundanese population, there are some close traditional communities, termed as *kampung adat*, who still practice stronger traditional way of life compared to the outer open communities. These traditional communities still live in relatively remote villages distributed in various regencies in western Java.

In this research, we recruited subjects of fully Sundanese ancestry, sampled from various settlements in West Java Province of Indonesia (Figure 1). Subject's ethnicity was confirmed both by self identification and others' recognition. Subjects were adults of both genders, aged 18-40, drawn from communities ranging from open urban districts to close traditional villages (Table 1). The subjects were not related to each other, as was confirmed by lineage tracking going back 3 generations. Sampling areas were distributed across 14 regencies and 7

Sundanese traditional villages in the western part of Java. Informed consent was obtained from all participants and ethical clearance was obtained from the Health Research Ethics Committee at the Faculty of Medicine in Padjadjaran University-Dr Hasan Sadikin General Hospital, Bandung. Each subject's face was photographed in both frontal- and left and right-portraits. Subjects were photographed with neutral facial expressions at a horizontal lens angle of 6.96°(to minimise distortion), using a digital camera (Panasonic Lumix DMC-FZ35 from Panasonic Corp., Japan).

Facial Analysis. Facial analysis was conducted on 175 female and 150 male photographic portraits using geometric morphometric methods (Bookstein 1989). Geometric morphometrics analyzes shape differences in objects by distinguishing the cartesian location of facial landmarks, as interpolated using the thin plate spline function. Landmark digitization was conducted manually using tps*Dig* program (Rohlf 2005a). There are 36 frontal and 24 lateral standard points or landmarks as shown in Figure 2. Descriptions of each landmark are presented in Table 2. For each facial portrait, the first point was positioned on the maximum ventral curvature and continued downward from left-to-right. Digitization was repeated daily for 5 days, for a total of 5 digitizations to minimize digitizing errors. Average coordinates for each landmark were computed using the tps*Relw* program (Rohlf 2005b). These coordinates represented individual sample data. The average pixel number was calculated and classified as a composite face. The whole calculation was conducted in tps*Super* program (Rohlf 2004a).

All individual data were transformed into individual relative warp values. This calculation was conducted in tps*Relw* program (Rohlf 2005b).
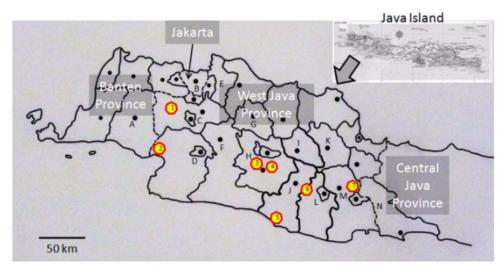

Figure 1. Sampling sites in western Java. Subjects were sampled in open urban communities (A – N) and in close traditional villages (1 – 7). Location names and sample size for each location are presented in Table 1.