H22   The Next FORDISC: FORDISC 3

Stephen D. Ousley, PhD*, Smithsonian Institution, NMNH, MRC 138, Washington, DC 20013; and Richard L. Jantz, MA, PhD, University of Tennessee, Department of Anthropology, 252 South Stadium Hall, Knoxville, TN 37996-0720

After attending this presentation, attendees will appreciate the power and utility of the next generation of FORDISC, and have a heightened awareness of modern American population variation. They will also use statistical procedures more critically.

This presentation will impact the forensic community and/or humanity by showing enhancements to the program and some lessons the authors have learned about multivariate analysis and American skeletal variation.

The goal of this presentation is to describe changes, additions, and improvements to FORDISC 2.0, the popular interactive computer program that uses Discriminant Function Analysis to classify unknown skeletal remains based on known samples using cranial or postcranial measurements. The presentation will introduce the power and utility of the next generation of FORDISC, and heighten awareness of modern American population variation. FORDISC 2.0 has been used extensively to aid in ascertaining the biolgical profile of skeletal remains. To date over 400 copies have been sold. The impetus to develop FORDISC came from increasingly frequent requests from forensic anthropologists to calculate "madetoorder" discriminant functions (DFs) using data from the Forensic

First, the reference group sample sizes have been increased, especially Data Base (FDB). The power of DFs lies in the fact that DFs maximize the differences in bone size and shape among groups. Such custom DFs are necessary when measurements required by published DFs, for example Giles and Elliot (1), are impossible to obtain. DFs are also desirable when one wishes to compare the unknown to different reference groups. FORDISC 2 allows anthropologists to construct DFs using two to eleven modern groups, some including males and females, using up to 34 craniometrics, or two to four groups using up to 39 postcranial measurements. Additionally, FORDISC 2 enabled the easy estimation of stature from long bone lengths. FORDISC 3 expands on the utility of FORDISC 2 in several areas and addresses many of the caveats of using discriminant functions (7) that have been derived from theoretical and empirical results. for Hispanics from the Southwest U.S. There are approximately twice as

many Hispanic males available for analysis, as well as a substantial Hispanic female sample. Additionally, samples of 19th century whites and black males and females have been added, making FORDISC more useful in archaeological, as well as forensic, contexts. Despite warnings, many users have been using FORDISC to analyze non-20th century remains anyway.

Second, FORDISC 3 incorporates more measurements in the reference databases, namely the full Howells [2] set of measurements. More useful measurements are now available to help discriminate among groups. Additionally, the basic FDB measurements have been expanded to include biasterion breadth, zygomaxillary breadth, and mid-orbital width. These three measurements vary among groups and the landmarks are easy to locate.

Third, FORDISC 3 will analyze and incorporate other data sets. This will allow different reference samples to be used for comparisons. Samples, for example, of Plains Indian tribes, can be analyzed against each other or against Howells or FDB groups. It will also analyze any set of variables, including cranial interlandmark distances (ILDs), which have been shown to be quite useful in discriminating among a variety of groups [3, 4, 5, 6].

Statistical enhancements are numerous. Stepwise selection (forward, backward, and exhaustive) of variables using multivariate criteria and classification accuracy is incorporated. DFs are sensitive to outliers, and a robust DF option will be available. Transformations of measurements into natural logs and shape variables can be easily selected. Logistic regression and non-parametric analyses are planned as well, including K-nearest neighbor classification and kernel DFs. Stature estimation will be possible through Model I and Model II Regression.

Enhancements to the program itself are numerous and will be ongoing. Graphic output will include kernel densities or adjustable histogram widths for 2-group analyses, and 2and 3-D scatter plots of more groups. As program changes and enhancements or database updates become available, Fordisc 3 can be updated on the user's PC through an internet connection. With feedback from users, incorporate further enhancements will be incorporated.

In short, FORDISC 3 is a quantum leap in the power and utility of FORDISC 2.0.

References:
1.   Giles E, and Elliot O. Race Identification from Cranial Measurements. *J Forensic Sci* 1962; 7:147-

157.

2. Howells WW. Cranial Variation in Man. Papers of the Peabody Museum of Archaeology and Ethnology 1973; 67. Harvard University, Cambridge, MA.

3. Mann MM, and Ousley SD. Using Nontraditional Craniometrics to address Museum, Repatriation, and other Forensic Questions. Presented at the 53rd Annual Meeting of the American Academy of Forensic Sciences, Seattle, WA, February 19-24, 2001.

4. Ousley SD. New Approaches to Human Variation and Forensic Anthropology (including Repatriation). Paper presented at the 52nd Annual Meeting of the American Academy of Forensic Sciences, Reno, NV, February 20-26, 2000.

5. Ousley SD, and Billeck WT. Assessing Tribal Identity in the Plains using Nontraditional Craniometrics (Interlandmark Distances). Poster presented at the 70th Annual Meeting of the American Association of Physical Anthropologists, Kansas City, MO, March 28-31, 2001.

6. Ousley SD, Seebauer JL, and Jones EB. Forensic Anthropology, Repatriation, and the "Mongoloid" Problem. Presented at the 55th Annual Meeting of the American Academy of Forensic Sciences, Chicago, IL, February 17-22, 2003.

7. Ousley SD, and McKeown A. A Comparison of Morphometric Data and Methods in Classification. Poster presented at the 73rd Annual meeting of the American Association of Physical Anthropologists, Phoenix, AZ, April 23-26, 2003.

Discriminant Functions, Biological Profile, Multivariate Statistics