FACIAL RECONSTRUCTION: A REVIEW AND COMMENT*

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Introduction

The techniques of facial reconstruction from skulls have fascinated scientists, artists and the public for many years. The method has been applied to a wide range of research topics, from reconstructions of unknown persons from history and prehistory to the identification of suspects and victims in court cases possibly having serious consequences. By recapitulating in brief the core of its historical development, one is able to evaluate the accuracy of facial reconstructions.

Review

The methodological basis for the technique and the main set of data for reconstructions were laid down in Germany at the end of the 19th century. His in 1895 (facial reconstruction of J.S. Bach) and Kollmann and Büchly in 1898 (facial reconstructions of prehistoric skulls) published their tables of soft tissue average thickness at 15-23 standardized anatomical landmarks on the skull (His 1895, sample size N=28; Kollmann/Büchly 1898, N=25). Both researchers used Caucasoid ("White") cadaver data. A Western (Western Europe and North America) and an Eastern (Eastern Europe) methodological school developed from these two publications.

In the West records from other population groups, e.g. from Japanese (Suzuki 1948, N=16) and American Black cadavera (Rhine/Campbell 1980, N=59), were added and combined to a widely used set of tables. More recently, non-metrical somatotype-oriented soft tissue thickness guidelines from the living became available (Helmer/Leopold, 1984). In the East it was Gerassimov (1968) who developed a more craftsmanlike style from 1920 on. Lately this Eastern school included ultrasonic measurements from the living in their standards (Lebedinskaya *et alii*
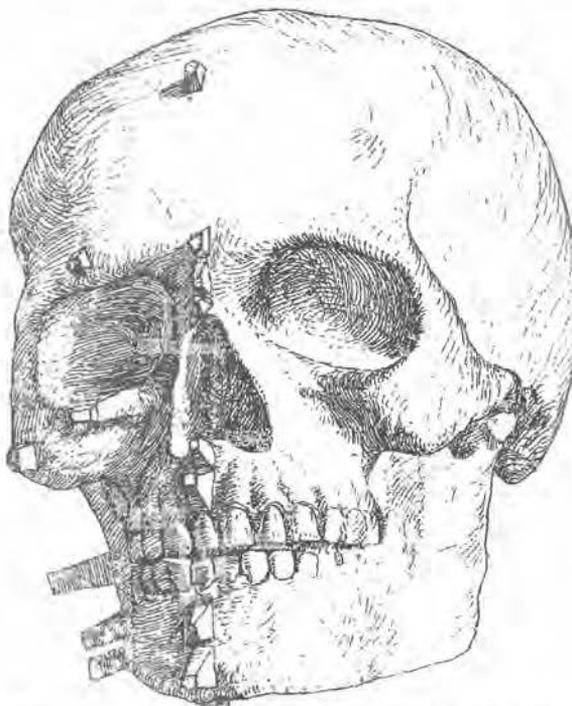
Fig. 1. Skull with blocks representing the
average tissue thickness at anatomi-
cal landmarks on the skull of a
Neolithic female from Auvernier.
(From Kollmann/Büchly 1898).

1993, N=1695!). In general, separate tables are given for males, females
and various population groups (Whites, Blacks, Buryats, etc.).
Sometimes they offer data related to age, nutritional status and somato-
type (body).
With the help of all of this information facial reconstructions are pro-
duced as artist (profile-)drawings and/or sculptures (Figs. 1, 2, and 3).
In the latter case blocks of clay or plasticine representing the average
tissue thickness are attached at anatomical landmarks on a cast of the
original skull (Fig. 2). Then the blocks are interconnected by a lattice-
work of clay strips and the leftover places filled in. The latter process
can be done by taking into consideration the inequalities of the bone
surface (Gerassimov 1968) and the muscles of the face, of which the
dimensions are said not to be critical (Prag/Neave 1997). It is the over-
all soft tissue thickness at a landmark, which is decisive. Finally,
according to a set of "rules of thumb", all remaining facial structures
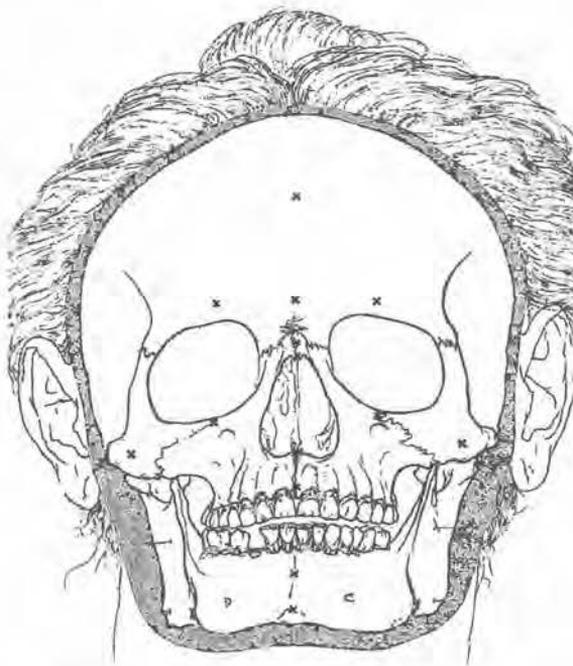
Fig. 2. Artist drawing by Büchly. Frontal
view on the reconstructed head of the
skull shown in Figure 1. Anatomical
landmarks are indicated with crosses.
(From Kollmann/Büchly 1898).

such as eyes, nose, ears, mouth and hair are "attached". For this some
workers have separate guidelines for males, females, Whites, Blacks,
etc. The origin and basis of these "rules of thumb" is non-metrical per-
sonal experience, sometimes mixed with experience from photo- or
video superimposition (Maat 1989; Fedosyutkin/Nainys, 1993; Helmer
et alii 1993) or from traditional artistic canons of proportion (George
1993). Every worker has his own (Krogman et alii 1948; Gerassimov
1968; Krogman/Iscan 1986; Helmer et al. 1993; Fedosyutkin/Nainys
1993; George 1993; Prag/Neave 1984, 1997). The number of published
rules varies from 5 to 45.
The claimed success rates resulting in a positive identification with
respect to forensic cases vary in the literature from 26% (Snow et alii
1982, N=2; the design of their test already produced a chance of 14%!)
to nearly 100% (Gerassimov 1968, N=140; all were court ordered cases
having consequences!). Most authors claim a 50-60% success rate.
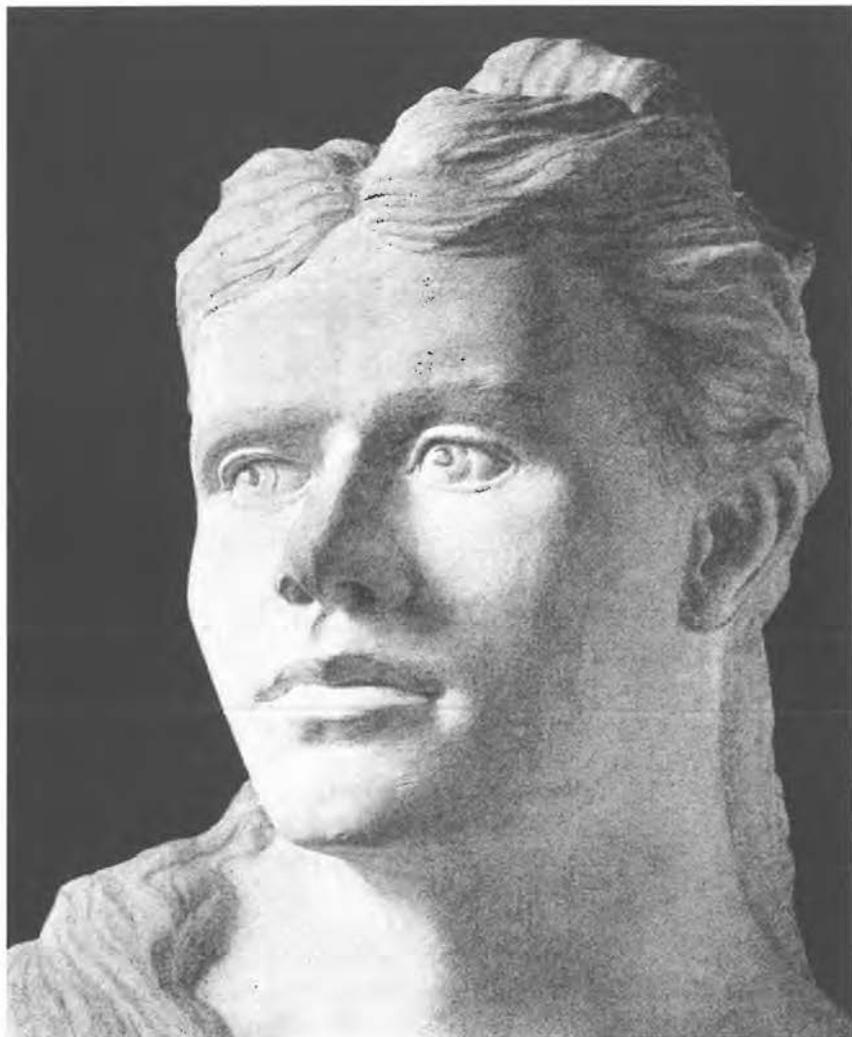
Fig. 3. Sculpture by Büchly of the reconstructed head of the skull
shown in Figs. 1 and 2. (From Kollmann/Büchly 1898).

Objections were heard from the moment that facial reconstruction was
used to solve forensic cases. Already in 1895, His considered it impos-
sible to predict individual features of the face. Other scientists express-
ing arguments in opposition of the use of this technique were for
instance: von Eggeling (1913), Montagu (1947), Stewart (1954), Brues
(1958), Helmer and Leopold (1984) and Caldwell (1986). Even at the
present, the forensic anthropologists Iscan and Helmer, who still prac-

tice facial reconstruction, admitted after evaluation of their products that: "the whole subtle complex of living appearance can hardly be re-created. The best one may say is that this sort of restoration is a possible added factor in individualization of skeletal remains" (Krogman/Iscan 1986). And: "Basic (but unpredictable) information about the length and colour of hair and the hairstyle is essential for every serious attempt of identification. A replica without hair has very limited resemblance to most individuals" (Helmer *et alii* 1993). But, "Attributes like hairstyle, ear shape, etc. are beyond the reach of the reconstructionist working from the bare skull alone" (George 1993). Indeed, insofar as matches have been published, they confirm these limitations.

The most thorough study to test the reliability of a series of facial reproduction techniques was done by Caldwell (1986). By photographic superimposition of 821 death masks of cadavera of the Terry Collection of known age and sex onto their related crania a comparison was made between the facial details, the published guidelines for representation of facial features, and the restoration of facial tissues. It was concluded that current instructions used to create the facial details in reproductions were not supported by the results. The features themselves varied tremendously in their relationship to the cranium.

Comment

In addition to the pending discussion in the literature we would like to mention that:

1: Tables based on soft tissue thickness taken from cadavera do not represent dimensions of the living since, due to drainage, tissue fluids from the face accumulate at the lowest point of the corpse. As a result deceased always look different, bonier.

2: Tables based on cadavera (e.g. Krogman/Iscan 1986, table 11.4) and on great numbers of ultrasonic measurements of soft tissue thickness from the living (e.g. Lebedinskaya *et alii* 1993, table 1), indicate clearly that individual variation dominates such that calculated means become meaningless:

- Variation of thickness at all anatomical landmarks, with respect to ca. 95% of the population (range: plus and minus 1.96 times the given standard deviation) is of the same magnitude as the mean of the thickness itself.

- Variation of the thickness at all anatomical landmarks, with respect to ca. 95% of the males or the females, is a manifold of the difference between the means of both sexes. Thus variation is so tremendous, that even sexual dimorphism is overruled completely by mutual differences

251

in face dimensions between males! The same holds for females.
3: Taking into account the inequalities of the bone surface (Gerassimov 1968) and the muscles of the face (Prag/Neave 1997) soft tissue application to the skull will not compensate for the highly variable subcutaneous fat distribution among individuals. The latter contributes substantially to difference in faces (identification).
4: There is no statistical correlation at all between the size of facial features (e.g. oral slit width) and the related cranial bony supports which are supposed to predict these sizes according to various "rules of thumb" (e.g. width of dental arcade at the 2nd premolars). See Lebedinskaya *et alii* (1993) table 4.
5: Since the applied "rules of thumb" for facial feature are non-metrical and based on personal experience, they are irreproducible from a scientific point of view.
6: Finally, the act of covering different skulls with the same mean thicknesses of soft tissue will make them look more alike, more average. Repeating the process would even make them indistinguishable. In fact, due to the reconstruction process, originally distinct skulls become depersonalised and equalized. Instead of being restored, they become more deprived of personal identity.

Conclusion

We feel that facial reconstructions from skulls to create images of unknown persons from history and prehistory is harmless if it is made clear to the public that the resulting products do not have the quality to identify. One should refrain from using this unscientific technique to identify suspects or victims in court cases having potentially serious consequences.

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