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COMPARISON OF FACIAL PHOTOGRAPHS VIA MORPHOLOGICAL ASSESSMENT FOR FORENSIC SCIENCE PURPOSES

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COMPARISON OF FACIAL PHOTOGRAPHS VIA MORPHOLOGICAL ASSESSMENT FOR FORENSIC SCIENCE PURPOSES

BY

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ABSTRACT

COMPARISON OF FACIAL PHOTOGRAPHS VIA MORPHOLOGICAL ASSESSMENT FOR FORENSIC SCIENCE PURPOSES

BY

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A facial feature classification protocol was established for comparing facial photographs to surveillance video stills. Twelve examiners used the protocol, designated the morphological assessment sheet, to narrow a population of eight photographs to determine the value of the protocol as an exclusionary tool. The examiners also filled out a morphological assessment sheet for one specific photograph to evaluate examiner agreement in feature descriptions. The results of the examination indicate that morphological assessment can be a valuable method for narrowing populations of photographs. This benefits the law enforcement community by providing a time saving, systematic approach to photograph comparison.

DEDICATION

I would like to dedicate this to my parents, Theodore and Sheryl, and to my siblings, Amy and James. for their constant support and motivation.

I would also like to dedicate this to my Elaine Chilimigras and Marti Johnson, without whom my time at Michigan State would not have been the same.

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Introduction

As technology advances, surveillance video cameras become more prevalent in commercial establishments. The increase in the presence of surveillance cameras lends itself to an increase in the documentation of crime (Vanezis et al, 1996). With the rise in video evidence, there exists a need within the law enforcement community for methods of comparison of video still frames with photographs of suspects.

Comparison of video footage still frames to facial photographs would appear to be inherently simple; however, it is regarded as one of the most complex modes of forensic analysis (Iscan, 1993). There are several factors which may hamper such identifications. The significant factor is the quality of photograph obtained from the original video footage, which is typically grainy and of low quality. These blurry, indistinct images can lead to difficulty in determining feature boundaries. Moreover, the person captured on video may be sufficiently obscured (e.g., by a hat or shadow) to further complicate the comparison process. Additionally, there may be alterations in the appearance of the person in question. These changes may arise from time lapse, whether by conscious design (e.g., altering hairstyle or plastic surgery) or by the physiological process of aging. Differences in facial expression can result in dramatically different photographs of the same person.

There are three primary modes of analysis currently employed in the comparison of photographs: anthropometry, photo-photo video superimposition, and morphological assessment. These methods employ anthropological techniques developed for both antemortem and postmortem identification of individuals, as well as for medical purposes, particularly reconstructive surgery.

While very similar to visual identification of an actual face, photographic comparison is unique in that the photograph of unknown origin is being compared to a photograph of a person of known origin, rather than to an actual individual or to human remains. This poses a unique set of difficulties because the orientation of both items of comparison is static and cannot be manipulated. Therefore, particularly in video superimposition and anthropometric analysis, it is vital that both photographs be in the same orientation.

In order to ensure themself that a photograph is in identical, or nearly identical, orientation to the video still frame to which it is being compared, the analyst must often collect and assess a large volume of photographs of the suspect. In addition, the analyst must be able to draw inferences from the results of the anthropometric or superimposition analysis in order to assess the significance of minute differences in orientation. Therefore, while both of these tools are effective methods, the amount of time and level of skill required pose a considerable limit on their

practicality, principally in instances involving large numbers of suspects. The third mode of analysis, morphological assessment, qualitatively compares the features of one individual to another, based on the premise that the sum of feature descriptions of an individual is unique to that person. There are several advantages to morphological assessment: the effect of differing orientation or facial expression is diminished, as morphological assessment is based on inherent assessment abilities. With the use of a systematic protocol, morphological assessment has the potential to be a time saving, straightforward, and effective analytical tool for exclusionary purposes.

The objective of this project was to develop a standard protocol (morphological assessment sheet) for comparing photographs as a law enforcement tool, and determine if it is an effective instrument for narrowing a population of suspects. The protocol was developed using anthropological data but designed for use by law enforcement personnel; for that reason, developmental objectives included attempting to minimize the use of esoteric terms when possible, and creating a supplemental instructional guide. Specific goals in developing the protocol were to create a logical approach for describing the face and to minimize the amount of subjectivity in the descriptive terms.

The method for testing the morphological assessment sheet was to select eight photographs of Caucasian males age

18-25 (designated the `suspects'), and choose one photograph as the `target'. A morphological assessment sheet was filled out describing the characteristics of the target. Copies of the filled out sheet were distributed to a panel of twelve examiners, who were chosen to determine which photograph the sheet was describing. The result of this examination was that the suspect pool was narrowed in all cases to no more than three photographs. In most cases, the pool was narrowed to one or two photos.

These preliminary findings indicate that morphological assessment may be an effective tool for excluding individuals from a population of suspect photographs.

It is important to note that this is not an identification technique, as there are numerous factors which may potentially lead to a false positive result. The effect of false positives in forensic science is critical, as decisions of freedom are made based on the analyst's findings. Therefore, when suspects are not excluded as a result of morphological assessment, corroborative analysis is imperative. But as an exclusionary technique, morphological assessment will greatly benefit the law enforcement population by serving as a straightforward method for eliminating suspects, and thus decreasing analysis time.

Literature Review

The three modes on analysis, anthropometry, video superimposition, and morphological assessment have been developed over many years for various applications.

Anthropometry, the quantitative evaluation of the human body, involves measurement of the size, weight, and proportions of human features (Farkas et al, 1994). Anthropometry was first introduced as a technique for personal identification by Alphonse Bertillon, in 1883. The Bertillon system of identification was based on two premises; that skeletal dimensions of humans remained fixed from the age of twenty until death, and that skeletal size was unique to each individual (Saferstein, 1998). Anthropometry was considered to be the most accurate identification technique until it was superseded by fingerprints in the early twentieth century. Current anthropometric research has primarily been conducted by the medical community in the field of reconstructive surgery (Farkas et al, 1994); however, the technique has been employed for forensic science purposes (facial reconstruction and photograph comparisons) as well.

In anthropometric comparison, proportionate measurements of selected features are compared between the known and unknown subjects. A match may be assumed if several measurements are the same. The limitations which are encountered in the controlled setting of the medical

community (difficulty in locating features and their boundaries (Farkas et al, 1994)) are exacerbated by the poor quality of surveillance video. In their review of this technique, Iscan et al (1993) cite the lack of research specific to forensic science as its chief limitation. It is vital that the examiner be well-versed and experienced in this method.

Superimposition techniques were first employed to authenticate skulls of historical figures. Initially, comparisons were made with portraits, busts, and death masks (Austin-Smith and Maples, 1994). The invention of photography improved the technique of superimposition, as antemortem photographs eliminated artistic interpretation and provided a more accurate depiction of the decedent. The first documented use of photographic superimposition for forensic science purposes was the Ruxton murder case, in 1935, in which photographs of two women were enlarged to life size and compared with skull tracings (Stewart, 1979).

The use of video equipment has improved the superimposition process, both in accuracy and simplicity. In photo-photo video superimposition, two photographs are taken in the same orientation and each is placed beneath a video camera. Images of each photograph are sent to an electronic mixer and displayed on a monitor. The images can then be superimposed over each other by fading or wiping to determine if the features of one photo are similar to the other. Symmetry of features, particularly features of

unique shape may be indicative of positive identification (i.e., the subject in the first photo is the same subject in the second) (Iscan, 1993).

Advances in technology are allowing for improvement in the accuracy of anthropometry and superimposition. The use of computers in taking measurements is affording greater accuracy to the technique. One limitation noted in anthropometry, that the photographs must be taken in standard size, is addressed by using proportionate rather than absolute measurements (Vanezis and Brierley, 1996).

There is a large body of research devoted to superimposition techniques (Austin-Smith and Maples, 1994; Chai et al, 1989; Loh and Chao, 1989; McKenna et al. 1984, Yoshino and Seta, 1989). The research devoted to these techniques is considerably applicable to facial photograph comparisons, as it addresses such issues as determination of focal lens length, angulation (McKenna 1984; Sekharan,1973), and facial landmarks (Chai et al, 1989).

Photographic superimposition has been regarded as the least accurate of the three methods of photograph comparison discussed by Iscan et al (1993). The authors cite difficulty in obtaining photographs in identical angulation as the primary limitation of the method, and caution against relying on symmetry of one or two features despite a lack of alignment of other features. Moreover, the analyst must avoid the tendency of mentally blending the images and inferring a match where one may not exist (Venezis and

Brierley, 1996). Like anthropometry, this technique requires a high skill level, and is time comsuming.

Morphological assessment, the technique of qualitatively noting similarities and differences between two objects of comparison, has a long history in forensic science, and is used in comparative examinations of a wide array of evidence, including fingerprints and trace evidence. The application of this type of analysis to facial features has been developed recently, based on anthropological techniques.

J. Lawrence Angel introduced a list of feature classifications (unpublished), which was later modified by Iscan (1993), as a collection of the entire range of morphological classifications. The intent of Iscan's work was to "make individual variation and population differences emerge from a seemingly unremarkable visage" and to aid the forensic anthropologist in effectively comparing two photographs.

Venezis et al (1996) compiled a subset of these features to evaluate the possibility of establishing a practical classification of the face specifically designed for forensic purposes. This subset selected features based on the following criteria: ease of discrimination, agreement among assessors, feature permanence, non-reliance on anthropometry, and that the feature be part of normal morphological anatomical variation (i.e., not injury induced, etc.).

This classification was assessed by seven examiners, using agreement of five or more and low feature occurrence as an indication that the feature classification was successful for discrimination. The results of this study, which displayed a high level of agreement, indicated success of the method.

These developments suggest the future potential of anthropometry or video superimposition for identifying purposes. The intent of this project is not to suggest that morphological assessment is superior to alternative techniques; analysis protocol should be determined based on the nature of the photographs. Nonetheless, advances in anthropometry or video superimposition will not eliminate the time requirement for selecting suitable photographs for comparison and for analysis. Based on the time requirement, application of these techniques to cases with large populations of suspects is highly impractical. Morphological assessment is currently the most ideal analytical mode for narrowing populations of suspects.

The results of the Venezis et al study indicate that there is reliability in the use of feature descriptions for exclusionary analysis. The next logical approach is to determine whether an examiner who is presented with surveillance video evidence can effectively use a morphological assessment protocol to eliminate suspects from a population. This project addresses that question by asking a panel of examiners to use the protocol developed

specifically for the project to attempt to eliminate photographs from a pool of suspects which do not match the morphological description.

As this method is designed for law enforcement purposes, modifications must be made for use by personnel with limited anthropological expertise. The morphological assessment sheets proposed here subdivide features into frontal or profile views, define or eliminate the use of esoteric terms, provide an instructional guide with schematic drawings for clarity, and reduce the number of descriptive terms for features to the minimum necessary. Moreover, the sheets address specifically the problem of comparing photographs to surveillance video still frames, and exclude those that would not be apparent on video (e.g., texture and color of hair), as well as features that would not resolve clearly enough for evaluation (e.g., parts of the eye). The morphological assessment protocol proposed here includes a section for providing additional information, such as scars, tattoos, etc. Whereas the method of Vanezis and Brierley disregards "features regarded as acquired anomalies resulting in many cases as a result of injury", this method takes into account the insight from skeletal analysis that the most reliable sources in individuality are those features which show diversity from pathological development, trauma, and surgical alteration.

However, if the morphological classification is modified, it becomes necessary to reevaluate the subjectivity of the feature descriptions.

This project addresses this issue in the second part of the analysis, by having the panel of examiners each fill out one assessment sheet for a designated photograph. The sheets will be tabulated to determine the level of agreement among the examiners for each feature.

Materials and Methods

The initial part of the experiment was to develop morphological assessment sheets for frontal and profile view analysis(Figures 1 and 2), modified from the work of Vanezis et al (1996), and Iscan et al (1993). Modifications include subdividing the facial characteristics into two sheets: one for frontal view analysis, and one for profile. Another limitation that was addressed was the static nature of Vanezis' list, by adding a section (`other') and a facial outline for noting the presence and location of anomalous features. Characteristics were eliminated that were not likely to resolve in surveillance video. Additionally, an instructional appendix was added for each view (Figures 3 and 4), with guidelines for each feature class and a glossary. The sheets contain features addressing the facial shape, hairline, brow ridges, eyebrows, nose, mouth, and chin.

Twenty professional quality photographs of Caucasian males age 18-25 were obtained, and from these, eight were selected based on similarity of appearance as the `suspects'. From the suspects population, one photograph was randomly selected and designated the `target' photograph. A morphological assessment sheet was filled out, describing the target photograph. The photographs were then compiled into a 'lineup' to be used in analysis.

I. A panel of twelve college age, non-expert, Caucasian examiners were each provided with a copy of the filled out morphological assessment sheet, and shown the pool of eight `suspects', including the target. The panel was asked to eliminate suspects, based on the feature descriptions on the morphological assessment sheet. The goal of the examination was to try to locate the target by process of elimination.

II. The panel of twelve examiners were provided with a blank morphological assessment sheet, and were asked to fill it out for one specific photograph (the photograph designated '#1' in the pool of suspects). The purpose of this was to assess the consistency of descriptions among the examiners.

Results

Part one of the analysis was that in which the examiners were asked to eliminate suspects from a pool of eight based on the morphological assessment sheet. In the frontal view (Table 1.), all of the examiners were able to narrow the suspect pool to three suspects or less, without eliminating the target photograph. Eleven of the twelve examiners successfully narrowed the pool to one photograph (the target photo). In the profile view (Table 2.), all of the examiners were able to narrow the suspect pool to two or less. There were no false negatives (the target was not eliminated). Ten of the twelve examiners were able to narrow the population to one photograph (the target photo).

Part two tested the level of agreement among examiner responses. The criterion for high agreement was considered to be agreement of ten or more examiners. In the frontal view analysis (Table 3), a high level of agreement was achieved in nine of twenty-five categories (the category 'Other' was excluded). The categories which had high agreement were as follows: forehead height, hairline recession shape, degree of baldness, eyebrow thickness, nose bridge breadth, nose tip width, nostril visibility, upper lip thickness, and gonial eversion. In the profile view (Table 4), a high level of agreement was achieved in

twelve of twenty-five categories (category 'Other' was excluded). The categories which had a high level of agreement were as follows: hairline recession shape, degree of baldness, eyebrow thickness, septum tilt, lower lip thickness, lip eversion, mouth corner, chin projection, helix roll, presence of Darwin's point, and ear lobe.

Discussion

The primary objective of this project was to develop a systematic protocol for facial comparison, based on existing classification lists. The goal was to modify the list to be useful to law enforcement personnel, as well as anthropological experts.

The secondary objectives were to determine if the modified protocol (morphological assessment sheet) could be used to eliminate suspects from a population, and to assess the level of agreement among twelve non-expert examiners in their assessment of a photograph.

Table 5 and 6 depict the number of suspects eliminated by each examiner in part 1 of the analysis, as well as which suspects were not eliminated. From this table, one can conclude that this assessment protocol is a viable tool for eliminating suspects, and thus narrowing the suspect population for further analysis.

In part 2 of the analysis, a high level of agreement was achieved in nine of twenty-five categories in the frontal view, and twelve of twenty-five in the profile view. The category of other was eliminated from this evaluation. In the remaining categories, a lower level of agreement (nine examiners agreeing or less) was achieved.

The most dominant reason for a lower level of agreement in the other feature categories is most likely the use of non-expert examiners. Many of the terms can be taken as subjective; an expert examiner has the training and knowledge to critically regard features and assess them in a clinical manner, while a non-expert must rely in part on his own perceptions.

It is well recognized that it is easier for people to characterize features of individuals of the same race. In order to develop meaningful controls, homogeneous ethnicity was chosen for both the suspect and examiners. In real criminal justice situations, it is acknowledged that suspects, targets, and examiners will differ in ethnicity. While this poses little or no limitation for expert examiners, lay persons may not have the level of sophistication to completely overcome this.

Another limitation in this study is the level of quality of the photographs. As a preliminary study it was necessary to use professional quality photographs to determine if the analysis would be feasible, without the complication of poor quality surveillance video. It must be noted that in practice, the angulation and photo quality will not likely be as ideal as staged professional photographs, and the level of success obtained may differ.

Conclusions and Recommendations

The modification of current anthropological classifications into a comparative protocol for use by law enforcement personnel is in and of itself a major benefit to the law enforcement community. Despite the limitations (homogeneity, quality of media, small populations of suspects and examiners) of this preliminary work, the data generated from this study indicate that this protocol can be very valuable in helping non experts eliminate majority of suspects from a pool, and thus aid in identification.

Future work in this study should include expanding on the developmental objectives of this study. The morphological assessment sheets could be adapted to computer. This will allow for computer generated schematics of features in the supplemental guide. Moreover, the supplemental guide could be incorporated into the morphological assessment sheet for ease of use. Results could be tabulated from the program allowing for printout or simple electronic transfer.

The experiments should be expanded and repeated, using larger cross-sections of both examiners and suspects. Eliminating suspects from increasingly larger populations will yield a better understanding of how effective a tool

the morphological assessment sheet is for narrowing a population. In addition, this will allow for evaluation of whether high agreement is achieved consistently among certain features. Results from a larger population will allow more accurate inferences to be drawn about the effectiveness of each particular feature, which will in turn allow for refining of the classifications and sub-classifications of the features included on the morphological assessment sheet.

Further study, which has been suggested by Vanezis et al (1996) is to evaluate the concurrence of certain features. It is suggested that the knowledge of how frequently certain features exist with others would prove useful in determining the significance of findings. For example, a snub nose exists most frequently with a concave profile; therefore, would it be significant if the person in the video still frame possessed a snub nose with a convex profile? One must be cautious with this and not attempt to assign statistical probability to the features, as the morphological assessment is qualitative in nature.

Another area of interest that should be addressed is what effect non-expert examiners have on this analysis. There are several issues which should be addressed, including whether the supplemental guide and glossary are

comprehensive enough to allow the examiner complete understanding of the feature descriptions. The most straightforward approach to testing this is to have two panels of examiners use the morphological assessment sheets in an analysis, with one panel using the supplemental guide, and the other panel performing the analysis without the guide, as a control.

The second issue to be addressed with non-expert examiners is whether heterogeneity of ethnicity has any effect on the analytical outcome. This would ascertain whether a non-expert examiner possesses the level of sophistication to accurately assess individuals of races differing from his own. The method for testing this would be to have two panels of examiners(each panel of a different race), and two pools of suspects (one of each race the same as the examiners). Have both panels of examiners evaluate the suspect pools of their own race, as well as the other to determine if there is a discrepancy in the results.

After it is known whether heterogeneity between examiners and suspects has an effect on the analytical outcome, it must be evaluated as well if the morphological assessment sheets are appropriate for races other than Caucasian. This may be assessed with one panel of

examiners evaluating several pools of suspects of various races. This would most appropriately be carried out by experts who are familiar with characteristics of different ethnic groups, and could provide valuable insight on which characteristics should be eliminated, as well as characteristics which would provide a more encompassing description of a particular race.

Appendices

Appendix A

Tables

Table 1: Remaining suspects after frontal view analysis.

		Examiners											
		1	2	3	4	5	6	7	8	9	10	11	12
Suspects	1												
	2												
	3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	4												
	5												
	6						✓						
	7												
	8						✓						

Table 2: Remaining suspects after profile view analysis.

		Examiners											
		1	2	3	4	5	6	7	8	9	10	11	12
Suspects	1												
	2				✓								
	3												
	4												
	5									✓			
	6												
	7												
	8	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table 3. Subject evaluation of photograph 1a.

Feature	Responses	Feature	Responses
Form		**Shape**	
Elliptical	4	Straight	6
Round	0	Arched	5
Oval	5	Wavy	0
Pentagonal	2	Continuous	1
Square	0	**Nose**	
Trapezoid	1	**(Bridge Breadth)**	
Forehead Height		Small	0
Low	0	Moderate	12
Moderate	2	Large	0
High	10	N/A	0
N/A	0	**(Tip Width)**	
Forehead Width		Narrow	2
Narrow	1	Moderate	10
Moderate	7	Wide	0
Broad	4	N/A	0
N/A	0	**(Tip Shape)**	
Hairline		Pointed	2
(Non-receding)		Rounded	9
Round	3	Amorphous	1
Moderate	6	**Nostrils**	
Square	2	**(Visibility)**	
Widow's Peak	0	None	0
N/A	1	Slight	11
(Receding)		Visible	1
Temporal	1	**(Shape)**	
Central	1	Slit	4
Asymmetric	0	Ellipse	2
Other	0	Round	2
N/A	10	N/A	4
(Baldness)		**Alae**	
Slight	2	Compressed	3
Advanced	0	Moderate	8
Complete	0	Flaring	1
N/A	10	**Upper Lip**	
Brow Ridges		**(Thickness)**	
Absent	3	Thin	12
Visible	6	Moderate	0
Prominent	3	Thick	0
Eyebrow Thickness		N/A	0
Sparse	0		
Moderate	12		
Thick	0		

Table 3 (cont'd).

Feature	Responses
Upper Lip	
(Notch)	
Absent	8
Wavy	3
V-Shaped	0
Asymmetric	1
Philtrum	
Flat	7
Parallel	2
Divergent	1
N/A	1
Lower Lip	
(Thickness)	
Thin	3
Moderate	9
Thick	0
N/A	0
Chin	
(Shape)	
Round	5
Cleft	7
N/A	0
(Width)	
Narrow	3
Moderate	8
Wide	1
N/A	0
(Projection)	
Not apparent	4
Protruding	8

Feature	Responses
Gonial Eversion	
Not pronounced	11
Slight	1
Moderate	0
Everted	0
Very Everted	0
Ears	
(Size)	
Small	6
Moderate	6
Large	0
N/A	0
(Projection)	
Slight	2
Moderate	5
Very Everted	5
N/A	0
Other Features	
Birthmarks	0
Wrinkles	0
Scars	0
Piercings	0
Facial Hair	
Mustache	0
Beard	0
Goatee	0
Sideburns	0

Table 4. Subject evaluation of photograph 1b.

Feature	Responses	Feature	Responses
Facial Profile		**Nose**	
Jutting	4	**(Profile)**	
Forward Curve	6	Straight	5
Vertical	2	Concave	7
Concave	0	Convex	0
Low Jutting	0	**Bridge Height**	
Upper Jutting	0	Small	5
Forehead Height		Moderate	3
Low	5	High	4
Moderate	7	**Tip Shape**	
High	0	Pointed	4
N/A	0	Round	8
Hairline		**Septum Tilt**	
(Non-Receding)		Down	2
Round	0	Moderate	0
Moderate	3	Up	10
Square	6	**Nostril**	
N/A	3	**(Visibility)**	
(Receding)		None	1
Temporal	2	Slight	6
Central	0	Visible	5
Asymmetric	0	**Upper Lip**	
N/A	10	**(Thickness)**	
Baldness		Thin	6
Slight	1	Moderate	6
Advanced	0	Thick	0
Complete	0	Very Thick	0
N/A	11	N/A	0
Brow Ridges		**Lower Lip**	
Absent	4	**(Thickness)**	
Visible	8	Thin	0
Prominent	0	Moderate	12
Nasion Depression		Thick	0
Slight	7	Very Thick	0
Moderate	4	N/A	0
Deep	1	**Eversion**	
Eyebrow Thickness		None	1
Sparse	0	Slight	11
Moderate	10	Very Everted	0
Thick	2	**Mouth Corner**	
Shape		Downturn	0
Straight	4	Straight	11
Wavy	5	Upturn	0
Arched	3	N/A	1

Table 4 (cont'd.).

Feature	Responses	Feature	Responses
Prognathism		**(Darwin's Point)**	
Absent	7	Absent	12
Moderate	4	Present	0
Pronounced	1	**Lobe**	
Chin		None	0
(Shape)		Free	1
Rounded	6	Attached	11
Pointed	0	**Other Features**	
Double	6	Birthmarks	1
Projection		Moles	4
Negative	10	Wrinkles	0
Neutral	2	Scars	0
Protruding	0	Tattoos	0
Ear		Piercings	0
(Size)		**Facial Hair**	
Small	0	Mustache	0
Moderate	8	Full Beard	0
Large	4	Goatee	0
N/A	0	Sideburns	12
(Helix)		Other	0
Flat	0		
Slight Roll	0		
Very Rolled	12		
N/A	0		

Table 5: Examiner responses in frontal view analysis.

Examiner Number	# of Suspects Eliminated	# of Suspects Remaining
1	7	3
2	7	3
3	7	3
4	7	3
5	7	3
6	5	3,6,8
7	7	3
8	7	3
9	7	3
10	7	3
11	7	3
12	7	3

Table 6: Examiner responses in profile view analysis.

Examiner Number	**# of Suspects Eliminated**	**# of Suspects Remaining**
1	7	8
2	7	8
3	7	8
4	6	2,8
5	7	8
6	7	8
7	7	8
8	7	8
9	6	5,8
10	7	8
11	7	8
12	7	8

Appendix B

Figures

Morphological Examination
Frontal View

I. Form
- A. Elliptical
- B. Round
- C. Oval
- D. Pentagonal
- E. Square
- 1. Trapezoid

II. Forehead
- A. Height
  - 2. Low
  - 3. Moderate
  - 4. High
  - 5. Not applicable
- B. Width
  - 1. Narrow
  - 2. Moderate
  - 3. Broad
  - 4. Not applicable

III. Hairline
- A. Non-receding
  - 1. Round
  - 2. Moderate
  - 3. Square
  - 4. Widow's Peak
  - 5. Not applicable
- B. Receding
  - 1. Temporal
  - 2. Central
  - 3. Asymmetric
  - 4. Other (describe):
  - 5. Not applicable
- C. Receding (degree of baldness)
  - 1. Slight
  - 2. Advanced
  - 3. Complete
  - 4. Not applicable

IV. Brows
- A. Brow Ridges
  - 1. Absent
  - 2. Visible
  - 3. Prominent
- B. Eyebrows
  - 1. Thickness
    - a. sparse
    - b. moderate
    - c. thick
  - 2. Shape
    - a. straight
    - b. arched
    - c. wavy
    - d. continuous

V. Nose
- A. Bridge Breadth
  - 1. Small
  - 2. Moderate
  - 3. Large
  - 4. Not applicable
- B. Tip Width
  - 1. Narrow
  - 2. Moderate
  - 3. Wide
- C. Tip Shape
  - 1. Pointed
  - 2. Rounded
  - 3. Amorphous
- D. Nostrils
  - 1. Visibility
    - a. none
    - b. slight
    - c. visible
  - 2. Shape (if visible)
    - a. slit
    - b. ellipse
    - c. round

Figure 1. Morphological Assessment Sheet for frontal analysis.

3. Alae
    a. compressed
    b. moderate
    c. flaring

VI. Mouth

A. Upper Lip
    1. Thickness
        a. thin
        b. moderate
        c. thick
        d. not applicable
    2. Notch
        a. absent
        b. wavy
        c. v-shaped
        d. asymmetric
B. Philtrum
    1. Flat (not apparent)
    2. Parallel
    3. Divergent
    4. Not applicable
C. Lower Lip
    1. Thickness
        a. thin
        b. moderate
        c. thick
        d. not applicable

VII. Chin

A. Shape
    1. Round
    2. Pointed
    3. Cleft
    4. Not applicable
B. Width
    1. Narrow
    2. Moderate
    3. Wide
    4. Not applicable
C. Projection
    1. Not apparent
    2. Protruding

VIII. Gonial Eversion

A. Degree of Eversion
    1. Not pronounced
    2. Slight
    3. Moderate
    4. Everted
    5. Very everted

IX. Ears

A. Size
    1. Small
    2. Moderate
    3. Large
    4. Not applicable
B. Projection
    1. Slight
    2. Moderate
    3. Very Everted
    4. Not applicable

X. Other Features

A. Birthmarks (describe):
B. Moles (describe):
C. Wrinkles (describe):
D. Scars (describe):
E. Tattoos (describe):
F. Piercings (describe):
G. Facial Hair
    1. Mustache
    2. Beard
    3. Goatee
    4. Sideburns
H. Other:

Figure 1 (cont'd.).

Morphological Examination
Profile View
Left Right (see Appendix A)

Case Number: _____

I. Facial Profile
- A. Jutting
- B. Forward Curving
- C. Vertical
- D. Concave
- E. Lower Jutting
- F. Upper Jutting

II. Forehead Height
- A. Low
- B. Moderate
- C. High
- D. Not applicable

III. Hairline
- A. Non-receding
  1. Round
  2. Moderate
  3. Square
  4. Not applicable
- B. Receding (Shape)
  1. Temporal
  2. Central
  3. Asymmetric (describe):
  4. Not applicable
- C. Receding (Degree of Baldness)
  1. Slight
  2. Advanced
  3. Complete
  4. Not applicable

IV. Brows
- A. Brow Ridges
  1. Absent
  2. Visible
  3. Prominent
- B. Depression at Nasion
  1. Slight
  2. Moderate
  3. Deep
- C. Eyebrows
  1. Thickness
     a. sparse
     b. moderate
     c. thick
  2. Shape
     a. straight
     b. wavy
     c. arched

V. Nose
- A. Profile
  1. Straight
  2. Concave
  3. Convex
- B. Bridge Height
  1. Small
  2. Moderate
  3. High
- C. Tip Shape
  1. Pointed
  2. Round
- D. Septum Tilt
  1. Down
  2. Moderate
  3. Up
- E. Nostril Visibility
  1. None
  2. Slight
  3. Visible

Figure 2. Morphological Assessment Sheet for profile analysis.

VI. Mouth

A. Thickness
   1. Upper Lip
      a. thin
      b. moderate
      c. very thick
      d. Not applicable
   2. Lower Lip
      a. thin
      b. moderate
      c. very thick
      d. Not applicable

B. Eversion
   1. None
   2. Slight
   3. Very Everted

C. Mouth Corner
   1. Downturn
   2. Straight
   3. Upturn
   4. Not applicable

D. Alveolar Prognathism
   1. Absent
   2. Moderate
   3. Pronounced

VII. Chin

A. Shape
   1. Rounded
   2. Pointed
   3. Double

Projection
   1. Negative
   2. Neutral
   3. Protruding

VIII. Ear

A. Size
   1. Small
   2. Moderate
   3. Large
   4. Not visible

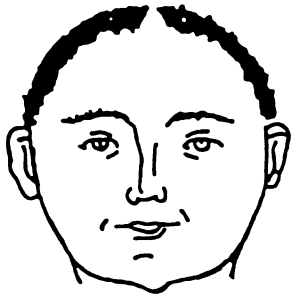
B. Helix
   1. Flat

Slight Roll

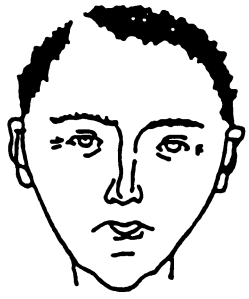
Figure 3: Instructional handbook for frontal view analysis.

I. Form - Select the facial form that most closely resembles that of the subject, based on the schematic drawings below.

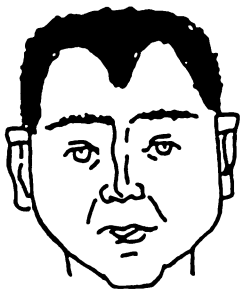
A.



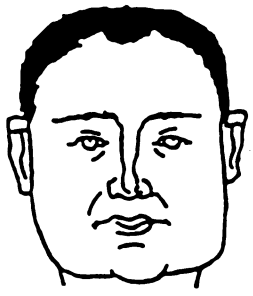
B.



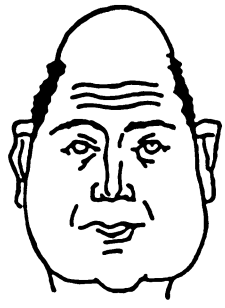
C.



D.



E.



F.

IIA. Forehead (Height) - Select the most appropriate height of the hairline. If it is obscured (by hat or hairstyle, for example), select Not Applicable.

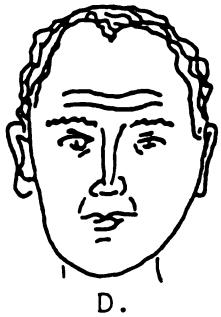
IIB. Forehead (Width) - Select the most appropriate width of the hairline. If it obscured, (by hat or hairstyle, for example), select Not Applicable.

IIIA. Hairline (Non-receding) - If the hairline of the subject is not receding, select the most closely related shape of the hairline, based on the schematic drawings below. If the hairline of the subject is receding, select Not applicable.

A.

B.

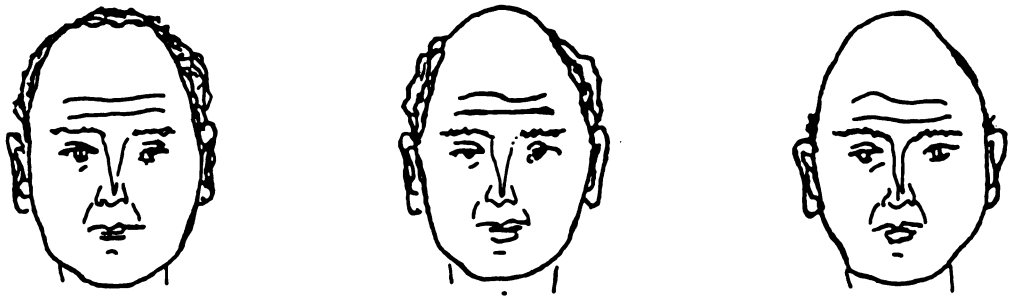
C.



D.

IIIB. Hairline (Receding) - If the hairline of the subject is receding, select the pattern in which it is receding. **Temporal** - at the temples, **Central** - by the center of the forehead, **Asymmetric** - no discernable pattern. If not receding, or if obscured, select **Not applicable.**

IIIC. Hairline (Degree of Baldness) - If the hairline of the subject is receding, select the degree to which it has receded based on the schematic drawings below. If the hairline is not receding, select **Not applicable.**

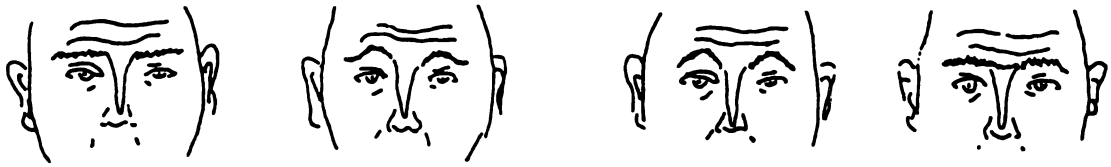


A. B. C.

IVA. Brow Ridges - The brow ridges are the bony protrusions just above the eyes, at brow level. If they are not apparent, select **Absent.** If they are noticeable but not prominent, select **Visible.** If they are very prominent, select **Protruding.**

IVB1. Eyebrows (Thickness) - Evaluate the thickness of the eyebrows.

IVB2. Eyebrows (Shape) - Based on the schematic drawings below, evaluate the shape of the eyebrows.



A. B. C. D.

VA. Nose (Bridge Breadth) - The bridge is the bony area of the nose slightly below eye level. Select the appropriate width. If the bridge is obscured so that you are unable to assess its breadth (for example, by eyewear), select **Not applicable.**

VB. Nose (Tip Width) - The tip is the lowermost central area of the nose (excluding the alae). Select the most appropriate width (do not consider the flare of the alad - see Appendix, VD3 for definition of the alae).

VC. Nose (Tip Shape) - Select the most appropriate shape of the nose tip.

VD1. Nostrils (Visibility) - Evaluate the degree of visibility of the nostrils. If they are not apparent, or only very slightly apparent, select **None.** If they are moderately apparent, select **Moderate.** If they are fully visible, select **Visible.**

VD2. Nostrils (Shape) - If the nostrils are visible enough to make a determination, select the shape nearest to that of the subject.

VD3. Alae - The alae of the nose are the fleshy areas lateral to the nose tip that house the nostrils. Select from the schematic drawings below the degree to which the alae of the subject are flaring (extending outward).

A. B. C.

VIA1. Upper Lip (Thickness) - select the degree of thickness of the upper lip. If the lip is obscured (from facial hair, for example), select **Not applicable.**

VIA2. Upper Lip (Notch) - The notch of the upper lip is the central area, directly below the nose. Select the most appropriate shape of the notch from the schematic drawings below. If the upper lip appears to not have a notch, or it is obscured, select **Absent.** The schematic drawing for asymmetric (example D) is one example only. If the notch is apparent, but does not fall into any of the other categories, select **Asymmetric.**

A. B. C. D.

VIB1. Lower Lip (Thickness) - Select the degree of thickness of the lower lip. If the lower lip is obscured, select **Not apparent.**

VIC. Philtrum - The philtrum is the area on the central line of the face from the base of the nose to the top of the upper lip, often characterized by a central groove. If the area is not obscured, and there is no visible groove, select **Flat.** If the area is obscured, so that a determination is not possible, select **Not applicable.**

A. B. C.

VIIA. Chin (Shape) - Select the shape of the chin. If the shape is obscured (by facial hair, for example), select **Not applicable**.

VIIB. Chin (Width) - Select the appropriate width of the chin. If the width is obscured so that a determination may not be made, select **Not applicable**.

VIIC. Projection - Projection is the degree to which the chin protrudes, or appears to be jutting forward. If the chin is not notably projected forward, or if it is obscured, **select Not apparent**. If it appears to project forward, select **Protruding**.

VIIIA Gonial Eversion - Gonial eversion is the outward flaring of the most lateral part of the mandible (lower jaw). Based on the schematic drawings below, select the most appropriate level of eversion. If the lower jaw is obscured so that this determination is not possible, select **Not applicable**.

A.

B.

C.

IXA. Ears - Evaluate the size of the ears. If they are obscured so that a determination is not possible, select Not applicable.

IXB. Ears (Projection) - Evaluate the degree to which the ears are projecting from the side of the face.

XA-G. Other features - Use the topics in A through G as a guide to describe other distinguishing features on the face.

Location - Define the location of the feature using the regions depicted in Figure 1 as a frame of reference (e.g., mole in upper left corner of L2a). For describing relations of points on the face, use the glossary of terms for reference (e.g., the mole is lateral to the nose, and inferior to the eye).

Size - Describe the size of features only if it is relevant and adds to the description of the feature. Use subjective terms only when necessary (e.g., large mole in upper left corner of L2a, and small mole in center of R4). Use measurements only when necessary, and in proportion to another feature on the face (e.g., the distance between the inner corners of the eyes is .4 the distance between the outer corners).

XH. Other - Use this section to list any distinctive features on the face that are not previously in the examination. Note the location of the feature, and any objective description that will aid in identification.

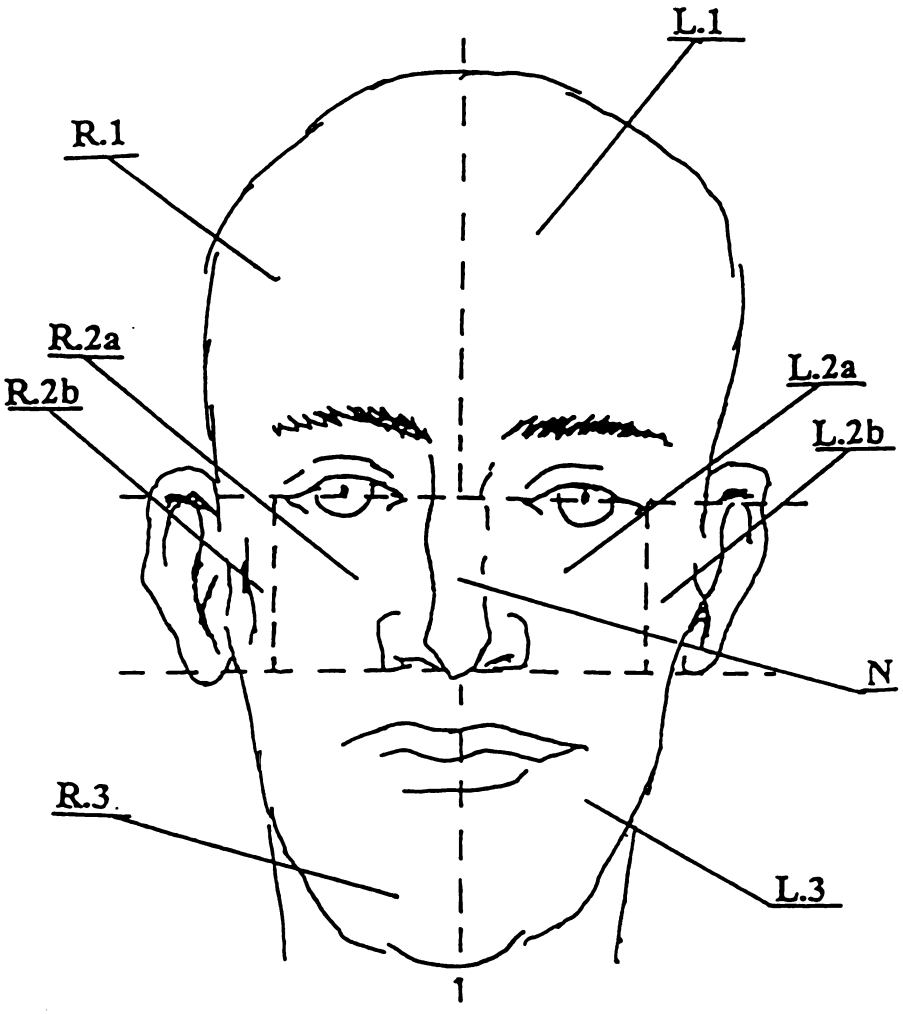


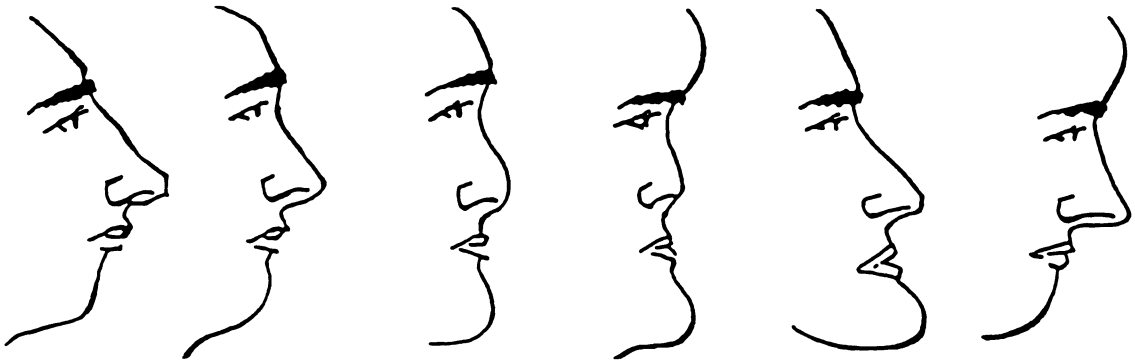
Figure 4. Instructional handbook for profile view analysis.

View. Select the profile view as it appears in the photo.

Right

Left

IA. Profile - Select the profile that most closely resembles that of the subject, based on the schematic drawings below.



A. B. C. D. E. F.

IIA. Forehead Height - Select the most appropriate height of the hairline. If it is obscured (by hat or hairstyle, for example), select **Not applicable**.

IIIA. Hairline (Non-receding) - If the hairline of the subject is not receding, select the most closely related shape of the hairline, based on the schematic drawings below. If the hairline of the subject is receding, select **Not applicable**.

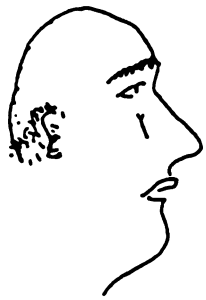
A. B. C.

IIIB. Hairline (Receding) - If the hairline of the subject is receding, select the pattern in which it is receding. **Temporal** - at the temples, **Central** - by the center of the forehead, **Asymmetric** - no discernable pattern. If not receding or if obscured, select **Not applicable**.

IIIC. Hairline (Degree of Baldness) - If the hairline of the subject is receding, select the degree to which it has receded based on the schematic drawings below. If the hairline is not receding, select Not applicable.

A.

B.



C.

IVA. Brow Ridges - The brow ridges are the bony protrusions just above the eyes, at brow level. If they are not apparent, select **Absent**. If they are noticeable but not prominent, select **Visible**. If they are very prominent, select **Protruding**.

IVB. Depression at Nasion - The nasion is the point located on the median of the face, at approximately eye level. Below are two profiles superimposed upon each other. The dashed line profile has a deeper depression at nasion, in relation to the solid line profile. Evaluate the profile of the subject, and determine the degree of depression.

IVB. Eyebrows (Thickness) - Evaluate the thickness of the eyebrows.

IVB2. Eyebrows (Shape) - Based on the schematic drawings below, evaluate the shape of the eyebrows.

A. B. C.

VA. Nose (Profile) - Based on the drawings below, select the profile

A. B. C.

VB. Nose (Bridge Height) - The bridge of the nose is the bony area located just below eye level. Select the most appropriate height of the bridge.

VC. Nose (Tip Shape) - Select the most appropriate shape of the nose tip.

VD. Septum Tilt - The actual septum of the nose is the fleshy membrane between the nostrils. Select the most appropriate direction of tilt (i.e., an 'upturned nose', or 'downturned nose').

VE. Nostrils (Visibility) - Evaluate the degree to which there is visibility of the nostrils. If they are not apparent, or only very slightly apparent, select **None**. If they are moderately apparent, select **Moderate**. If they are fully visible, select **Visible**.

VIA1. Thickness (Upper Lip) - Select the degree of thickness of the upper lip. If the lip is obscured (from facial hair, for example), select **Not applicable**.

VIA2. Thickness (Lower Lip) - Select the degree of thickness of the lower lip. If the lower lip is obscured, select **Not applicable**.

VIB. Eversion - Eversion (as it pertains to the lips), is flaring outward, or protruding. Evaluate the degree to which the lips of the subject evert.

VIC. Mouth Corner - Evaluate the angle of the mouth corner, if the subject is in a closed mouth pose. If the subject's mouth is open, or the expression of the subject's face hampers this evaluation, select **Not applicable**.

VID. Alveolar Prognathism - Alveolar prognathism is projection of the upper jaw (overbite). Evaluate the degree of alveolar prognathism of the subject.

VIIA. Chin Shape - Evaluate the shape of the chin.

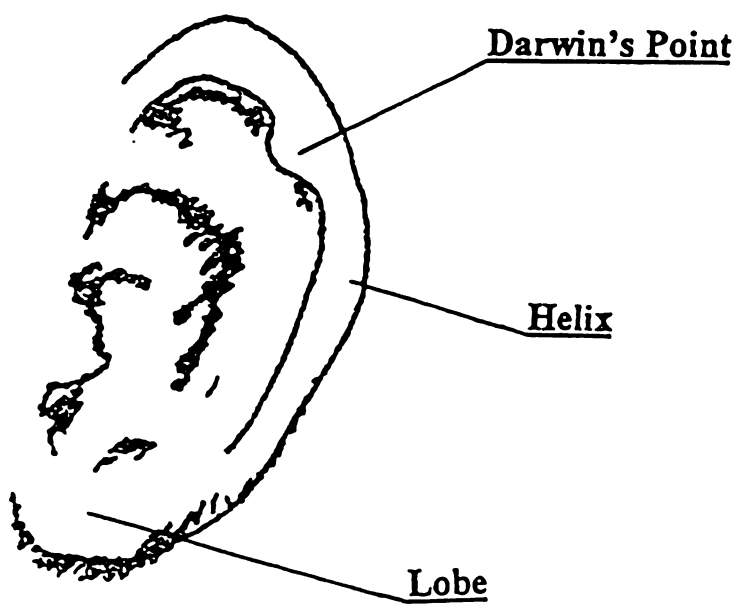
VIIB. Chin Projection - Evaluate the degree to which the chin is projecting, or jutting forward. If it appears to have an average level of projection, select **Neutral**. If less, then **Negative**. If the subject's chin appears to project more than averate, select **Protruding**.

VIIIA Ear (Size) - Select the size of the ear. If it is obscured so that a judgement of the size cannot be made, select **Not visible**.

VIIIB Ear (Helix) - The helix of the ear is the outside edge of the upper part of the ear, sometimes slightly rolled. Evaluate, and select the most appropriate description of the helix.

VIIIC Ear (Darwin's Point) - Darwin's Point is a 'bump' on the inside edge of the helix. Refer to the figure below to find the location wher ethe point may be found. If the ear is obscured to that the point would not be visible, select **Not applicable**.

VIIID Ear (Lobe) - Note the status of the ear lobe. If it is obscured so that a judgement is not feasible, select **Not applicable**.

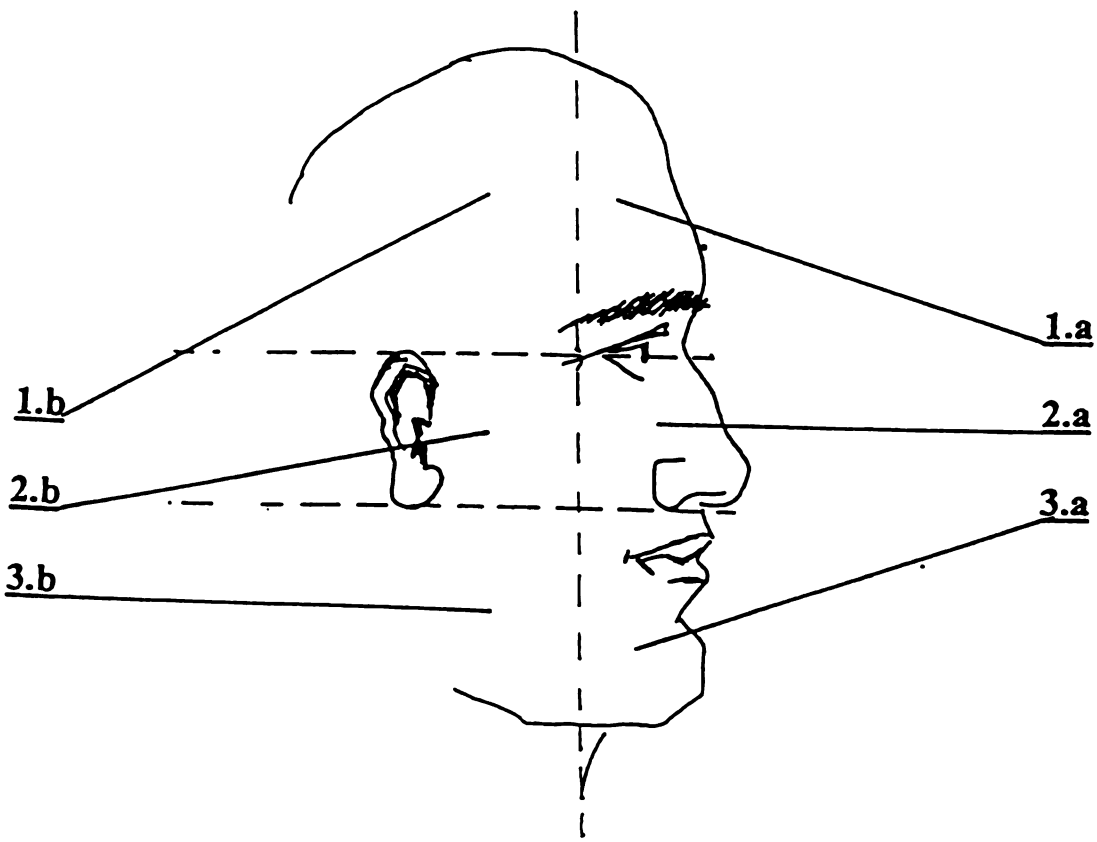


XA-G. Other Features - Use the topics in A through G as a guide to describe other distinguishing features on the face.

Location - Define the location of the feature using the regions depicted in Figure 1 as a frame of reference (e.g., mole in upper left corner of L2a). For describing relations of points on the face, use the glossary of terms for reference (e.g., the mole is lateral to the nose, and inferior to the eye).

Size - Describe the size of features only if it is relevant and adds to the description of the feature. Use subjective terms only when necessary (e.g., large mole in upper left corner of L2a, and small mole in center of R4). Use measurements only when necessary, and in proportion to another feature on the face (e.g., the distance between the inner corners of the eyes is .4 the distance between the outer corners).

XH. Other - Use this section to list any distinctive features on the face that are not previously in the examination. Note the location of the feature, and any objective description that will aid in identification.



Relations

Inferior - located below another stucture.

Lateral - further away from the central line.

Medial - closer to the center line.

Median - on the center line.

Superior - located above another structure.

Glossary of Terms

Alae (as pertains to the nose) - Fleshy areas lateral to the tip of the nose which house the nostrils.

Divergent - moving apart from a common point.

Flare - to expand or open outward.

Gonial eversion - the flaring of the mot lateral point on the lower jaw (approximately below the earlobe.

Notch (as pertains to the mouth) - point on the upper lip, often characterized by a depression of wavy, or V, shape.

Parallel - two lines at equal distance from one another at every point.

Pentagonal - shaped like a pentagon (having five angles).

Philtrum (as pertains to the mouth) - area on the median of the face, from the base of the nose to the top of the upper lip, often characterized by a central groove.

Projection - something that thrusts outward: protuberance.

Temporal - Of, or relating to, the temples of the skull.

Trapezoid - A four-sided structure with two parallel sides.

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