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## THE SOLUTION OF CRIMES THROUGH SKETCHES: A STUDY USING FACIAL MORPHOLOGY

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**Abstract:** The Sketch Portrait is a thorough assessment carried out by a specialized technician and has been a valuable tool in elucidating crimes involving an eyewitness to the fact. This work aims to clarify how inferences are made in the creation of the respective facial representation and demonstrate that the Sketch Portrait guides the investigation. Some cases of Sketches that were made by the Civil Police of the State of Goiás over a period of 9 years, between 2011 and 2020, were evaluated, the result of which in the investigations was positive, leading to the arrest of the suspects. Photos of the suspects and their respective Sketches were compared through the analysis of facial morphology using the TOF-JB protocol and the results showed that despite presenting a variable average in the percentage of similarity, the Sketch Portrait can still contribute to the police investigation, reducing the universe of suspects.

**Keywords:** Sketch. Facial Comparison. Human Facial Representation.

## INTRODUCTION

Human Facial Representation (RFH) is the science that encompasses several methods for human identification using images, and among them the Sketch, Facial Reconstruction, Aging Projection and Prosopographic Examination stand out. One of the methods of Human Facial Representation widely used in the police field is the Sketch Portrait which, through artistic, technical and scientific work, allows the creation of a portrait of a person's physiognomy and some striking features of the face described, through their general physical aspects (age, skin color, weight, height, physique, etc.), specific (beard, mustache, goatee, etc.) and their distinctive characters (tattoos, skin marks, burns, etc.).

The Sketch Portrait had its origins at the end of the 19th century and remains in use to this

day, consisting of an important police support tool in elucidating crimes (MIRANDA et al, 2017; COSTA; SILVA; MANSO, 2019a). It is important to emphasize that the Sketch Portrait is not the photograph of the suspect, but rather the image produced through the report of a victim or witness to a crime who observed the criminal act, being created by the Police Typist/Papiloscopist. It is a complex work, which demands time and expertise, which varies between three and four hours and depends, above all, on the emotional state of the victim or witness (MIRANDA et al, 2017; INÁCIO, 2010).

The portrait is a valuable tool for public security in general, as it assists in various police investigations, allowing you to have an image of the suspect, which increases the probability of elucidating crimes. Executed properly, through interview techniques that allow obtaining information that allows the creation of a reliable image of reality and the use of software that helps in the construction of the same, it is within the reach of society and security forces, an instrument that can benefit everyone (INÁCIO, 2010).

Even though it is a procedure that often finds it difficult for victims to adhere to, since there is a possibility that they will feel embarrassed and exposed when reporting what happened, the Sketch Portrait is extremely important in helping to elucidation of crimes, as the victim is especially the one who can provide the most reliable details of the aggressor's physiognomy (REIS, 2019). In this sense, although there are other techniques or tools relevant to an investigation, the report and construction of the Sketch Portrait can help identify the aggressor with great precision, as it is possible that some detail or a very peculiar characteristic of the aggressor will emerge (scar or birthmark, for example), which can provide some direction or greater clarity for the line of investigation.

In this work, the importance of the Sketch Portrait in the police context is demonstrated, given its effectiveness and proven usefulness (OLIVEIRA et al., 2014; COSTA; SILVA; MANSO, 2019a, REIS, 2019; COSTA; SILVA, 2019), seeking to explain how this tool can be applied to solving crimes, as well as showing the relevance of encouraging victims to do so. Specifically, the objectives are: to research Sketch Portraits already used in successful police investigations and demonstrate the reason and way of using the Sketch Portrait technique to help clarify investigations. To this end, 10 sketches were randomly selected that led to the arrest of the perpetrators of the crimes and the methodologies used and the characteristics that the victims most observed and described at the time of their creation were analyzed, in addition to the study on the morphology of the face, to enable the realization comparisons between photographs and the created sketches.

Finally, the final objective of this work is to contribute to the greater dissemination of the Sketch Portrait technique in police investigations and present initial data to enable the creation of protocols for their preparation.

## **SKETCH**

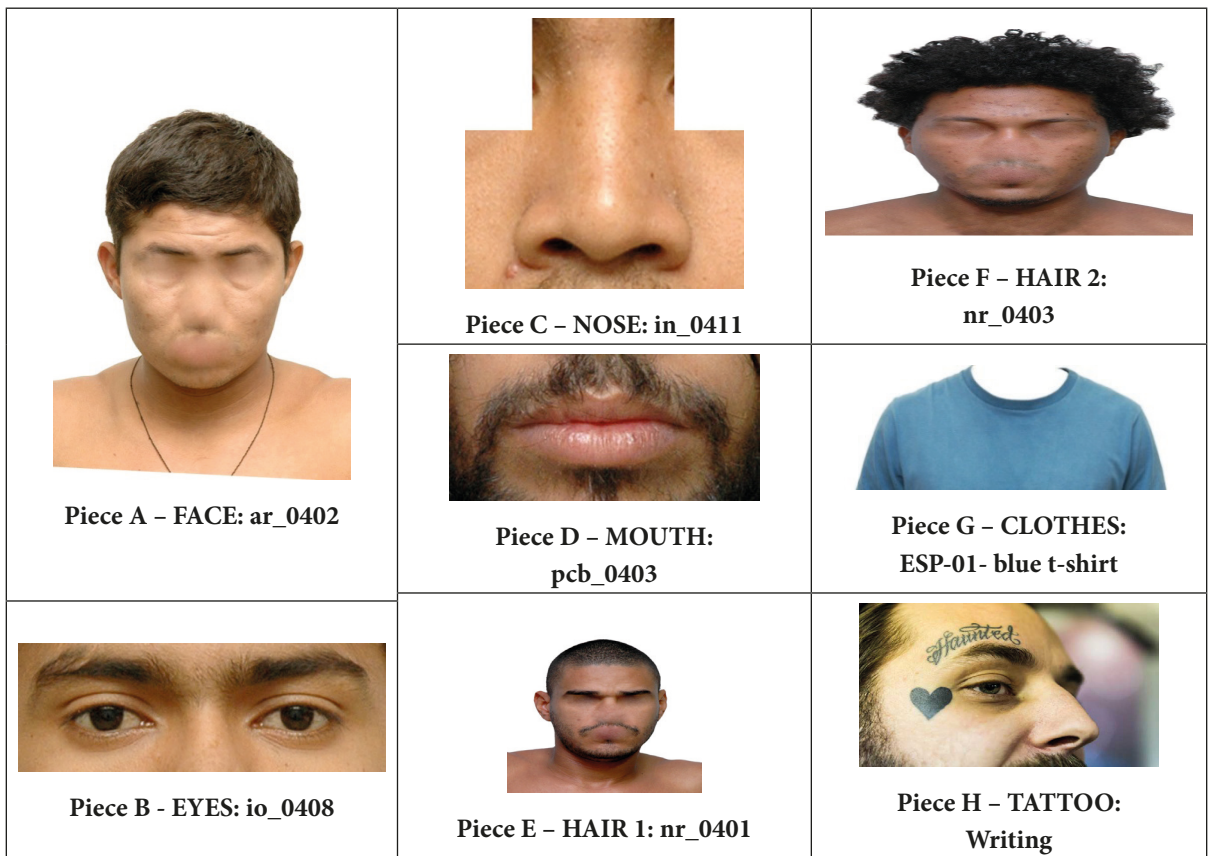
The Sketch, an area of human facial representation, is an old technique, widely disseminated and which allows assistance in the elucidation of various crimes. It has evolved over the years due to the emergence of new design methodologies and technological advances that have allowed the development of specific tools for their creation and improvement (LIMA, 2007).

In past decades, the Sketch Portrait was carried out empirically by draftsmen who, with their skills, tried to portray what witnesses or victims conveyed. However, with technological developments, these methods have become obsolete. Currently, with the help

of technology, there are several programs that help in creating a Sketch Portrait (MIRANDA et al., 2017). The software used has a database that helps to compose a face with parts of the faces of several different people. Thus, according to the victim's report, the pieces chosen by the victim/witness are put together and a characteristic face is formed with that of the suspect.

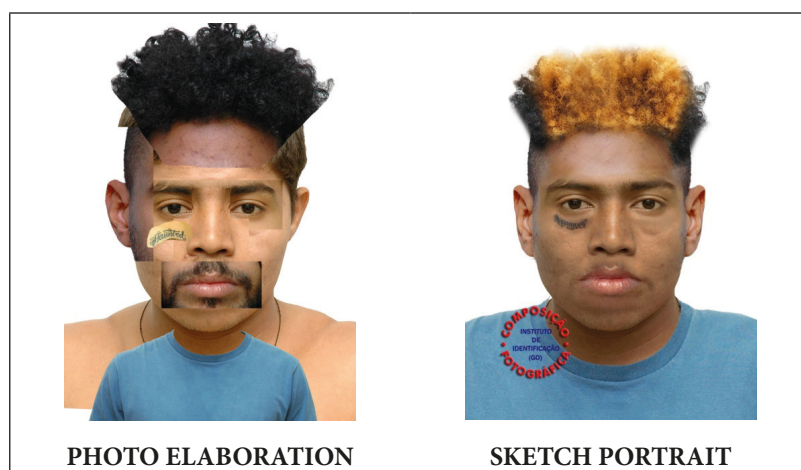
The National Institute of Identification of the Federal Police developed software called HORUS, which allows the creation of photographic quality sketches. It features images of Brazilian men and women, divided into five racial types (MIRANDA et. al, 2017). However, currently, Identification Institutes use this and other software and databases to create sketches (Figure 1). For Azevedo and Faria (2014), the dynamics of the evolution of Human Facial Representation, and specifically of the Sketch Portrait over the years, created a methodology that allowed crucial assistance to bodies linked to the Public Security Secretariats.

In addition to using software, the Sketch Portrait is constructed using interview techniques with the victim and/or witnesses, in which data is provided so that the human identification expert can prepare it. It is important to highlight that the Sketch Portrait is part of a scientific process, as satisfactory results are achieved when it follows its own methodology (MIRANDA et al., 2017). After an interview, image editing and electronic publishing programs are used that work on the physiognomic characteristics of different ethnicities (Figure 2). And then, artistic incursions are made with the aim of providing finishing and maximum approximation of the image to the individual described by the informant (INÁCIO, 2010, MIRANDA et. al, 2017). The person involved must describe the details observed in the author as accurately as possible, because the more information and



**Figure 1:** List of pieces included in the image bank of the Identification Management of the Civil Police of Goiás used to prepare the Sketch.

Source: Identification Management Sketch Portrait Archive. Almeida, 2021.



**Figure 2.** Exhibition of the assembly of the pieces used to create the image and, on the right, the final image of the Sketch.

Source: Identification Management Sketch Portrait Archive. Almeida, 2021.

data are provided, the more similar to reality the Sketch Portrait becomes (MIRANDA et. al, 2017).

## INVESTIGATIVE INTERVIEW APPLIED TO SKETCH

Creating a Sketch Portrait requires being able to extract information in a way that does not compromise memory. Paulo et al. (2014) discusses traditional interviews, in which only questions and answers are used, demonstrating that the use of this technique is quite controversial, as it can generate intimidation or reluctance in the person interviewed/victim, resulting in difficulties in recovering memories, which can cause loss of details.

A work published by Reis (2019) aimed to present discussions and reflections on the Sketch Portrait technique prepared based on testimonies from victims and/or witnesses related to crimes considered serious, such as homicide, robbery and rape. An analysis was made of the technique used to prepare the Sketch Portrait in Brazil, in order to try to understand whether the method adopted is a reliable means of arriving at criminal authorship during the course of a criminal investigation. It was found that the Sketch Portrait is a viable technique that helps the work of the Civil Police, however, it needs improvements with current psychology techniques and the use of cognitive interviews.

At this point, it is important to define a forensic interview and highlight the superiority of the cognitive interview over the traditional one. The forensic interview aims to obtain a report on a past experience, lived or witnessed, of a specific person and is focused on the facts of that experience, such as: the perpetrators, the time elapsed or space in which it happened. It is an integral part of a criminal investigation and judicial decision process (PEIXOTO et. al, 2014).

It is imperative to state that this interview should not be confused with other types, such as the clinical interview, conducted within the scope of a psychological assessment process or a psychotherapeutic intervention, as its objective is not centered on resolving a person's behavioral and/or emotional problems. individual (PEIXOTO et. al, 2014). The objective of the forensic interview is to obtain a detailed description of an experience lived by the victim/witness.

The police officer conducting an interview usually uses traditional means. In the traditional police interview, questions are asked directly: "who? what? when? where? why? It is like? ". Using this type of technique, the person interviewed may feel intimidated or even be reluctant, which would lead to difficulties in recovering memories and, as a result, important details for the investigation could be lost (PAULO et al., 2014; COSTA; SILVA, 2019). On the other hand, the cognitive interview, whose research has been developed since the 1980s, has already been widely used in investigations. The cognitive interview approach, the currently recommended method, is based on the principles of the functioning of the mind, memory and cognition/perception. Social dynamics and how people communicate are taken into consideration. (COSTA; SILVA, 2019).

Professionals from different parts of the world have developed their own methodologies for conducting investigative interviews, based on their experiences and scientific knowledge (STEIN et. al, 2009). In addition to the cognitive interview, there is the PEACE model, which was developed in the United Kingdom and which shows the different stages that make up the investigative interview. The acronym PEACE is a mnemonic for five main interview stages: *Planning and preparation; Engage and explain; Account; Closure and Evaluation* (STEIN et. al, 2009).

In its manual, at each PEACE stage, it addresses various principles and techniques derived from cognitive interviewing, developing material that represents the combination of what is most valuable and strong in the main models of investigative interviewing today. An important piece of information is that, to obtain a report rich in details, the victim must be asked to report everything they can remember. This is called free reporting. Briefly, Stein et. al (2009) state that the information provided in the free report tends to be the most accurate, that to increase the amount of information reported, the interviewee must concentrate on the free report, that any type of interruption during the free report impairs access information stored in the victim's memory. Therefore, the interviewer must listen carefully to what the interviewee reports, allow pauses (seconds of silence to consider that the interviewee has concluded his narrative), eliminate any stimuli that in any way distract the interviewee and note points that need to be further investigated later.

In general, Stein et. al (2009) developed content that can be directed to investigative interviews, especially when reporting scientific advances in the Psychology of Testimony, showing that in several countries' changes have already been implemented that modified the conduct of investigative interviews in order to maximize the quality of testimonies and minimize interviewer interference and the occurrence of false memories. False memories are memories of situations that, in reality, did not happen, and which can raise questions about the validity and veracity of reports from victims and witnesses, when inappropriate interview techniques are used. In this context of investigative interviews, reproducing methodologies that allow the victim to access the greatest amount of information and details to assist in the creation of the Sketch Portrait

is extremely important (COSTA; SILVA; MANSO,2019b).

After analyzing more than 40 interviews of Sketch Portraits made by the Sketch Portrait Section of the Identification Management of the Civil Police of the State of Goiás with positive results carried out between 2006 and 2019 (Figure 3), which used techniques compatible with that of investigative interview, it was found that the quantity and quality of information obtained was much greater in relation to that obtained from the traditional interview (COSTA; SILVA; MANSO, 2019b). Furthermore, studies have shown that cognitive interviews generate 30 to 70% more information than traditional police interviews (STEIN et al., 2009). It was also observed that even though the victim had only a partial image of the perpetrator of the crime, after the techniques used compatible with the cognitive interview, it was possible to extract details from the aggressor's face, allowing the creation of a Sketch Portrait with characteristics similar to those of the suspect. (COSTA; SILVA; MANSO, 2019b). It has been shown that the cognitive interview is more efficient, as it maximizes the quantity and quality of information obtained.



**Figure 3:** Image of the arrested perpetrator (left) and the Sketch Portrait (right) created by the Identification Management of the Civil Police of Goiás. The Sketch Portrait was crucial in the arrest of this individual.

Source: Identification Management Sketch Portrait Archive. Inácio, 2012.

## FACIAL MORPHOLOGY

The importance of sketches in police investigations can be analyzed by comparing their facial morphology with photographs of the suspects. Azevedo (2017) proposes the systematization of the morphology of the elements that make up the human face in a protocol called TOF-JB (Figure 4). Morphological analysis deals with the comparison and classification of details of the face, based on its phenotypic characteristics and their visual analysis, carried out through the description of the face, highlighting details and similarities with two photographic images in general and specific physical aspects, such as shape of the face, head, ear, distance from the eyes, size of the mouth and particular characteristics, such as scars, birthmarks, among others (AZEVEDO, 2017). Using this concept, it is possible to highlight similarities between compared images.

## METHODOLOGY

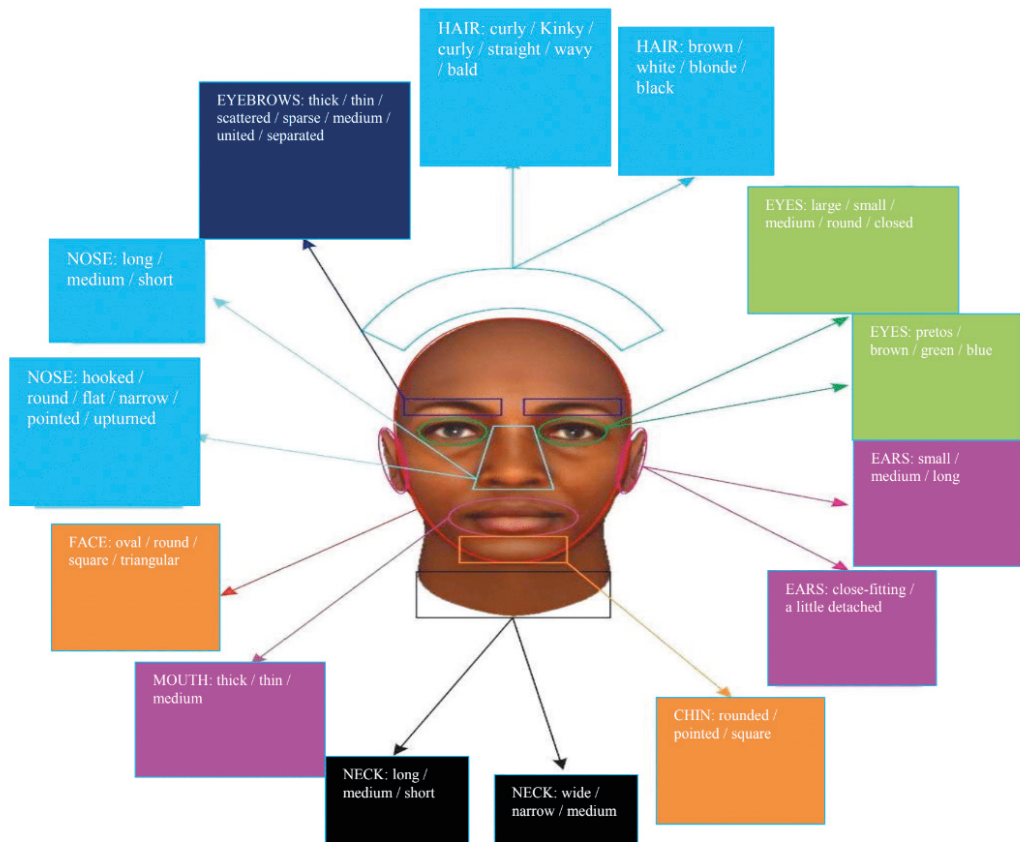
Systematized procedures were used to create the sketches in accordance with the Standard Operational Procedure of the Identification Management of the Civil Police of Goiás. The first of these was an interview, in which a methodology was followed, to ensure that technical and logical work was carried out, facilitating its development. During this stage, the declarant (victim and/or witness) provided information regarding the circumstances of the crime and the general, specific and distinctive physiognomic features of the perpetrator of the crime in question. Subsequently, images corresponding to cutouts of the faces of several people (of different ethnicities, age groups and genders), which expose different facial features, were shown to the victim. At this stage, individual pieces were used and shown that present the shape of a person's face, hair, forehead, chin, eyes, nose, mouth and other particularities, including

accessories. These sections are obtained after processing digitalized photographs and stored in the Criminal Photographic Bank of the Identification Management of the Civil Police of Goiás.

The Police Typist/Papiloscopist responsible for preparing the Sketch Portrait makes the physiognomic changes suggested by the declarant, using editing software, in order to promote the greatest possible similarity between the image being created and the perpetrator of the crime, through changing eye color, harmonizing skin tone, eyebrow thickness, among others (Figures 1 and 2). This methodology allows the construction of photographic quality sketches, as it uses a desktop publishing program and digital photograph clippings, Adobe Photoshop CS6. After the end of the assembly process and iconographic individualization of the images carried out by identification professionals, the declarant certifies the result of facial and physical similarities with the alleged suspects of the crime now being investigated.

Between 2011 and 2020, around 850 sketches were made of cases of crimes such as extortion through kidnapping, robbery, rape and robbery in the State. Of these, 10 (ten) sketches were randomly selected and were created by Police Papilloscopists and Typists of the Civil Police of the State of Goiás, most of which were of rape. The estimate of cases whose investigation results were positive is low due to the lack of response from police stations, but those selected for this research had a positive result leading to the arrest of the suspects.

The photos of the arrested suspects and their respective sketches were compared through the analysis of facial morphology using the TOF-JB protocol (AZEVEDO, 2017), carrying out a quantitative and qualitative classification and an organization in the form of dynamic tables that will be shown below. We sought



**Figure 4.** Scheme demonstrating the morphology of the elements that make up the human face in the TOF-JB protocol.

Source: AZEVEDO, 2017.

	face		hair		eyebrow		eyes			ears		nose		mouth		chin		neck		particularities		General average
case	face	color	nature	shape	type	color	size	separated	length	height	edge	width	height	width	height	width	height	width	height			
1	100%	100%	100%	0%	100%	0%	100%	0%	100%	100%	0%	0%	0%	100%	P	100%	100%	P	100%			67%
2	0%	100%	0%	0%	0%	100%	0%	0%	100%	100%	0%	0%	0%	0%	P	0%	0%	P	0%			27%
3	100%	100%	100%	100%	0%	100%	0%	0%	100%	100%	100%	100%	0%	100%	P	P	P	P				79%
4	100%	0%	0%	0%	100%	100%	0%	0%	0%	100%	0%	0%	0%	100%	P	P	P	P				38%
5	100%	100%	P	0%	0%	100%	0%	100%	100%	0%	100%	100%	100%	0%	P	0%	0%	P	0%			57%
6	100%	100%	P	100%	0%	P	100%	100%	100%	0%	P	100%	100%	100%	P	100%	100%	P	100%			83%
7	0%	100%	P	0%	0%	P	0%	0%	100%	100%	100%	0%	0%	0%	P	100%	0%	P	100%			38%
8	100%	100%	0%	0%	100%	100%	0%	0%	0%	0%	0%	100%	0%	0%	P	P	P	P				36%
9	100%	100%	P	100%	0%	0%	0%	0%	100%	0%	0%	100%	100%	0%	P	0%	0%	P	0%			43%
10	100%	100%	100%	100%	0%	100%	100%	100%	0%	0%	100%	0%	0%	0%	P	100%	100%	P	100%			60%
average	80%	90%	50%	40%	30%	75%	30%	50%	70%	50%	44%	50%	33%	40%	0%	57%						
*P	harmed																					

**Table 1:** Variables analyzed by comparing the photograph of the arrested suspect and the sketch, according to the TOF-JB protocol.

Source: Authors themselves, 2022.

P=impaired analyses



to quantify and qualify the morphological characteristics of each individual's face that are repeated and that the victim remembered most.

The specific parts of the face in the photo of the perpetrator who was arrested and the portrait of him were analyzed. In this comparison, the similarity of the eyes, mouth, nose, facial style, among other characteristics, as shown in Table 1, was analyzed. The percentage value was defined as 0% for parts that were not "equal" and 100% for the parts in common between the portrait and the photo of the individual, in accordance with the facial morphology protocol. The result of the analysis culminated in the definition "positive" (100%) for those with greater similarity and "negative" (0%) for those that showed different parts. The damaged items (victim did not report, suspect was wearing a cap, or details were not seen) were not included in the sum for division and were represented by the letter P in table 1.

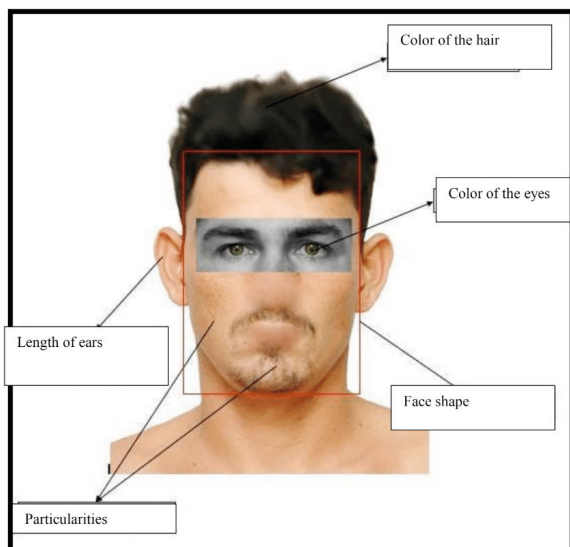
In the TOF-JB protocol table there are 16 particularities (such as Adam's apple, moles, marks, scars, warts, among others) to be analyzed, and each of these was assigned the percentage mentioned (0 or 100%) according to with the similarity between the photo of the arrested suspect and the analyzed portrait. At the end of the analysis, the results were added together and divided by 16, allowing us to obtain the total percentage of the relationship between the Sketch Portrait and the photo, as shown in Table 1. The Sketch Portraits analyzed were added together with each specific part. At the level of exemplification, the percentages of the face were added, then the nose, eyes, mouth, and so on, making it possible to define which specific part the victims remember most when creating each portrait.

## RESULTS AND DISCUSSION

Comparative analyzes between the photographs of the arrested suspects and the sketches demonstrated that there is an unstable average in the percentage of coincidences between the compared variables (Table 1). Even so, it was possible to analyze the victim's perception at the time of the crime, answering questions such as: which part of the face can victims remember best?

What is the percentage of similarity between the portrait and the photo of the arrested suspect?

It was noted that the parts of facial morphology most accurately remembered were: face shape, hair color, eye and ear color (Figure 5). The nature of the hair is a factor that is generally affected by the use of accessories (such as caps, helmets, etc.), making the information regarding this part of the body not very reliable, due to the low assertiveness as demonstrated in these results. It was not possible to analyze the neck height in the Sketch portrait, due to the fact that it is an image composed of other images (P= impaired in table 1). The size and shape of the parts of the triangle of the face (eyes, nose and mouth) is a detail that was not accurately described by the victim, with an average of less than 50%. Despite this factor, in Jataí, a city in the interior of the state of Goiás, due to the accuracy of the partial Sketch Portrait using the same variables analyzed in this work, the investigation of a robbery crime was conducted in order to identify the aggressor, who used a bullet. at the time of the crime, solving the case (COSTA; SILVA; MANSO, 2019a).



**Figure 5.** Illustrative image highlighting the parts of facial morphology most accurately remembered by the victims/witnesses interviewed to create the Portraits discussed in this work.

Source: the authors, 2022.

Among the 10 Sketch portraits analyzed, we observed that in 05 (five) of them it was possible to identify greater similarity between the morphologies analyzed, greater than 57% in all cases (Table 2) with a discontinuous range of variation (57 – 83%). The other 05 (five) showed different parts in our analysis, however with a variation in the percentage of disagreement (57 to 73%). These variations demonstrate that the degree of certainty is high using the TOF-JB protocol, both for discordant parts (up to 73% certainty) and for similar parts (up to 83% certainty).

The independent general average of agreements (53%) obtained between the photographs of the arrested suspects and the sketches made was higher than the disagreements (43%), supporting the fact that the sketches have legitimacy with the reality of the crime only with the description of the victim/witness and allows it to assist police investigations, reducing the universe of suspects.

Analysis of sketches				
Case	100%	0%		Results
2	67%	33%		Positive
3	27%	73%		Negative
4	79%	21%		Positive
5	38%	62%		Negative
6	57%	43%		Positive
7	83%	17%		Positive
8	38%	62%		Negative
9	36%	64%		Negative
10	43%	57%		Negative
11	60%	40%		Positive
average	<b>53%</b>	<b>47%</b>		

**Table 2 – Analysis of Sketches regarding positive results.** 100%: similar cases; 0%: divergent cases.

Source: Authors themselves, 2022.

There are several factors that can harm the final result of creating the Sketch Portrait, such as viewing time of the suspect, the time elapsed from the event until the Sketch Portrait was created, the victim's stress level at the time of the incident, false memories, environmental conditions (distance, luminosity, angle, etc.), objects of disguise (helmets, caps, glasses, etc.) among others (TAYLOR, 2001). The analysis of particularities using the TOF-JB facial morphology protocol also demonstrated that they are decisive factors (57%) in identifying the suspect, very important for composing the Sketch Portrait.

It is suggested that the results obtained in the particularities were not so high, probably due to the fact that in many suspects they were not visible or simply did not exist.

The preliminary findings of the analyzes carried out in this work allow us to infer that strategies for disseminating the Sketch Portrait technique are necessary both in the police sphere and in society as a whole. This implies the need for training and improvement courses for Police Typists/Papiloscopists throughout the state of Goiás, as it is necessary to increase

the number of trained professionals, with knowledge of psychology and interview techniques to improve the execution of this method. The greater the improvement in the creation of this tool, the greater the reliability in the coincidences of the variables given to the suspect, allowing further assistance in investigations. Furthermore, it will be necessary to create specific protocols with a scientific basis to guide the interviews and the creation of the Sketch portrait itself. Therefore, the relevance of this research is justified, which aims to expand the dissemination of this technique to aid identification, so that it reaches the greatest possible scope.

Despite being extremely useful in police investigations, the Sketch Portrait does not occupy a prominent place, even though there are reports of cases in which it was used and the perpetrators of the crimes were quickly found. The lack of dissemination and knowledge both within the police and in society means that this valuable tool is not explored as much. It is worth noting that due to the lack of knowledge on the scale of Human Facial Representation, not all Civil Police regions in Goiás have professionals qualified to develop sketches, which results in great losses in investigations. To try to meet this demand, the Virtual Sketch Portrait was developed by the Identification Management, which can be done remotely, through videoconferencing with the victim/witness, thus avoiding both the travel of the server and the victim/witness to carry out the interview and creation of the sketch. Despite

this, adherence is still low. It is necessary to think, therefore, about the creation of specific procedures for the dissemination of this tool in the police sphere and especially to society, so that this way we can contribute to the solution of a greater number of crimes.

## **FINAL CONSIDERATIONS**

The comparisons made between the photographs of the arrested suspects and the sketches made in each case demonstrated that it is possible to propose a protocol for using sketches in the Regional units of the Civil Police of Goiás based on investigative interviews, specific details and other observations pertinent conclusions of this work, by demonstrating the importance and impact of creating sketches in police investigations.

We also concluded that regardless of the variable average of the percentage of similarity between the Sketch Portrait and the photo of the suspect, the Sketch Portrait can contribute to police work by reducing the universe and sample space of suspects, directing the investigation, and can be used as an informative element complementary to the police investigation.

After this research, the importance of the Sketch Portrait in police investigations became evident. Additionally, continued research using other new techniques or other facial analyzes is crucial to improving this protocol.

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