

**Review****POSITIVE IDENTIFICATION OF HUMAN REMAINS BY SKULL-PHOTO COMPARISON IN URUGUAY: A REVIEW****Horacio E. Solla***Judicial Morgue of Montevideo City, Montevideo, Uruguay***RESUMEN**

El artículo presenta una revisión a través de un estudio cuantitativo de los casos antropológico-forenses ocurridos en Uruguay desde 1950 a 2013 inclusive. Los casos antropológico-forenses han crecido rápidamente en Uruguay, desde un caso registrado en 1950 hasta 91 casos en 2013. Antes de 1992 cuando se realizaba un hallazgo de restos humanos eran examinados por el médico forense que no contaba con experiencia en éste tipo de casos ni en las técnicas antropológicas forenses. Por lo tanto, en la mayoría de los casos los restos humanos no eran identificados. Como necesidad para resolver ese problema en 1992 se creó el Laboratorio de Antropología Forense en la Morgue Judicial de Montevideo. El artículo estudia un total de 1391 casos antropológico-forenses analizados en la Morgue Judicial desde 1950 hasta 2013 inclusive. El estudio se divide en dos partes: la primera representa 225 casos ocurridos desde 1950 hasta 1991 y la segunda parte representa 1166 casos ocurridos desde 1992 hasta 2013. En cada caso los restos fueron analizados para determinar posible causa de la muerte, sexo, estatura y edad al momento de la muerte. También se analizaron los casos en que se llegó a obtener una identificación positiva. El propósito de este artículo es describir el rol de la antropología Forense en el sistema judicial uruguayo y cómo las técnicas de comparaciones cráneo-fotográficas han sido utilizadas con gran éxito para identificar restos humanos en Uruguay.

**Palabras clave:** Restos humanos, antropología forense, identificación por comparación cráneo-foto, Morgue Judicial, Montevideo.

**ABSTRACT**

The article presents a review by a quantitative analysis of the forensic anthropology cases that occurred in

Uruguay from 1950 to 2013. Forensic anthropology cases have rapidly increased in Uruguay over the years, from only one case in 1950 to 91 cases in 2013. Before 1992, when human remains were found, they were analyzed by the local medical examiner with lacked experience in these types of cases and in anthropological techniques. Therefore, in the majority of cases, human remains were not identified. By the need to solve these cases in 1992, the Forensic Anthropology Laboratory at the Morgue Judicial of Montevideo was created. This article studied a total of 1391 forensic anthropology cases that were undertaken at the Judicial Morgue of Montevideo between 1950 and 2013. The study is divided into two parts: the first part represents 225 cases occurring from 1950 to 1991, and the second one represents 1166 cases occurring from 1992 to 2013. In each case the remains were analyzed to determine the deceased person sex, stature and age at the time of death. Whether a positive identification was made as a result of forensic anthropology investigation was also analyzed. The purpose of this paper is to describe the place of forensic anthropology in the Uruguayan medico-legal system and to show how skull-photograph comparison techniques were successfully used to identify human remains in Uruguay.

**Keywords:** Human remains, forensic anthropology, identification by skull-photo comparison, Morgue Judicial, Montevideo.

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**Received:** 12 October, 2014. **Revised:** 27 October, 2014.  
**Accepted:** 25 November, 2014.

## INTRODUCTION

The study of the facial surface has always been of high interest to forensic anthropologists when identifying human skulls (Iskan and Helmer 1993). Digital superimposition of a photograph over the skull is a common method of identification used by forensic anthropologists around the world (Grüner, 1993).

The technique of digital skull-photo superimposition has been used to assist in the identification of numerous victims and is accepted in courts in a number of countries. It was used by first in the United Kingdom in the famous Ruxton case by Glaister and Brash (1937). Basauri (1967a, 1967b) used this method to identify an unknown body of a woman found burned in a corn field in Perú; Eckert and Texeira (1985), Curran (1986) and Helmer (1987) used this technique to identify the skeletal remains of the nazi war criminal Joseph Mengele in Brazil; Soto et al (1989) identified several skeletal remains of young girls murdered by the serial killer Daniel Camargo Barbosa in Ecuador; Ubelaker (1996) used this technique to identify the remains of Dr. Weiss and Solla et al (2001, 2005, 2010, 2013) used this technique to identify Berrios, Gomensoro, Chaves, Miranda and a young girl skeletal remains between much more cases in Uruguay.

The scientific principles of this method are very well described in the specialized literature (Dorion, 1983; Robert, 1983; Helmer et al, 1989; Cai and Lan, 1989, 1993; Seta and Yoshino, 1993; Maples and Browning, 1994)

The use of computers with this technique has added a number of advantages to the process (Pesce Delfino et al, 1986, 1993; Nickerson et al, 1991; Bajinoczky and Kiralyfalvi, 1995; Smeets and De Valck, 1996; Ubelaker, 1992; Ubelaker and O'Donnell, 1997; Yoshino et al, 1997; Iskan and Loots, 2000; Jayaprakash et al, 2001; Humpire and Soto, 2013).

In the last twenty years, forensic anthropology has been an active part of the coroner system in Uruguay (Solla, 1994, 2002). Medico-legal studies are assigned to the Forensic Medicine Department by the Forensic Institute at Montevideo City. Autopsies and other types of forensic studies, such as toxicological and anthropological, are carried out at the Judicial Morgue of Montevideo City (Solla, 2008).

The number of forensic anthropological cases has increased considerably since the inclusion in 1992 of a forensic anthropologist to the medico-legal team. This eventually led to a higher rate of positive identification of skeletal remains (Iskan and Solla, 2000).

Since its establishment in 1992, the Laboratory of Forensic Anthropology has been assisted by the coroner and legal authorities in several criminal cases in which the study and identification of human skeletal remains was needed (Solla, 2002); they include skeletonized, decomposed and burned human remains. Generally, forensic anthropology cases were submitted to forensic anthropologists by coroners and legal authorities. When a positive identification is made on the basis of a forensic anthropologist studies, the coroner signs the death certificate based on the official report filed by the forensic anthropologist. Therefore, the forensic anthropologist is an official consultant of the Forensic Medicine Department at Montevideo City (Solla, 1991).

It is very important to remark that before 1992 all skeletal remains found were buried like no name people and no one was identified by the medical examiner. Since the creation of the Forensic Anthropology Laboratory at the Judicial Morgue of Montevideo City in 1992 almost 190 people had been identified by skull-photo comparison using digital superimposition techniques. These positive identifications were later corroborated by dental or DNA studies.

The purpose of the present paper is to describe the place of forensic anthropology in the Uruguayan medico-legal system and to show how skull-photograph comparison techniques were successfully used to identify human remains in Uruguay.

## MATERIALS AND METHODS

Two periods were analyzed: the first one before the establishment of the Forensic Anthropology Laboratory at the Judicial Morgue of Montevideo City, this is since 1950 to 1991; and the second one from 1992 to 2013.

A total of 225 forensic anthropology cases were found in the Montevideo Judicial Morgue's files for the first period of analysis, this was from 1950 to 1991. A total of 1166 forensic anthropology cases were analyzed during the second period, this was from 1992 to 2013. The human remains came from all the country, including Montevideo City. All cases were examined to estimate age at death, determine sex, geographic location of the recovery site and stage of decomposition (i.e. decomposed, skeletonized and burned), as well as, whether or not a positive identification was made. Most of the human remains were found in woods, fields, parks, along rivers and lakes by the police or civilians. There were others recovered from burned cars, septic tanks,

highways, construction sites and abandoned houses.

Positive identifications were made from the Forensic Anthropology Laboratory at the Judicial Morgue of Montevideo City using skull-photo comparison techniques.

According to skull-photo superimposition techniques two photographs showing frontal and lateral view are required to an accurate identification. Photographs were placed under the video-camera and illuminated by white fluorescent lamps. The image was adjusted on computer monitor and it was digitized by the video mixer unit and stored in the computer as a JPG file using a capture card device. Then, using the computer and Adobe Photoshop software several key anatomical landmarks on the face were traced (Comas, 1976), as well as the eight examining lines by Cai and Lan (1989). Taking account these anatomical landmarks and the eight examining lines several comparison were made. Then, close the Adobe Photoshop software and returned to capture application. The photograph was still from computer monitor using digital mixer unit and the skull was placed under the video-camera and illuminated by fluorescent lamps. The skull was manipulated by a servo motor until the position approximated that of the individual in the photograph. After the skull has been correctly oriented using the video camera zoom, the size of the skull image was adjusted so that it was as close as possible to that of the individual of the photograph. After comparing anatomical landmarks in the skull with their counterparts of the photograph, the image of the skull was digitalized using the digital video mixer unit and then stored as JPG file in the computer using the capture device software. Then, both images stored in the computer (skull and photo) were superimposed using the Adobe Photoshop software for a more detailed comparison. The entire process may be recorded by the computer DVD unit and good quality photographs could be made by the computer printer to attach to a forensic report.

## RESULTS

According to the judicial forensic anthropology files found at the Judicial Morgue of Montevideo City, there were 1391 forensic anthropology cases from 1950 to 2013; the oldest forensic anthropology file was recorded in 1950. This period was divided into two parts: the first part, which includes 225 cases, starts in 1950 and ends in 1991; the second part, which includes 1166 cases, is from 1992 to 2013 and includes all

forensic anthropology files recorded since the Forensic Anthropology Services Department was established at the Judicial Morgue of Montevideo City in January of 1992.

From the first period of analysis (1950-1991), the forensic anthropology cases increased from 1 in 1950 to 20 in 1991 (averaged 5.4 cases per year) and 85% of the cases in this period came from Montevideo Department (the most populated of the 19 Department in Uruguay, with almost 2 million people), and 15% were from the rest of the country. Eighty five per cent of the forensic anthropology cases correspond to skeletonized remains; 3% were burned; 6% were in advanced stages of decomposition; 2.2% were fresh bodies; and 3.8% were animal skeletal remains. It was possible to estimate the age at the time of death in only 39% of the cases. The sex was determined for 49% of the total sample; of these, 68% were males and 32% were females. In general, the majority of the forensic anthropology cases from this period did not have enough relevant anthropological data to be further analyzed, especially the cases from the 1950s to the 1960s. According to files found at the Morgue Judicial of Montevideo City no techniques of identification of human skeletal remains were used in this period, so no positive identifications were made.

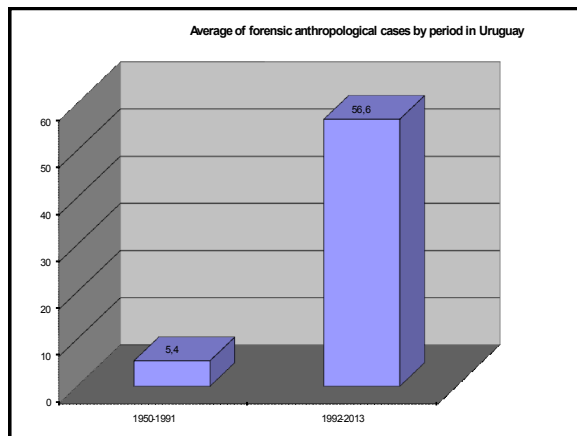
A total of 1166 forensic anthropology cases were analyzed for the second period of analysis (1992-2013). There were 14 cases from 1992 and 91 cases from 2013, with an average of 56.6 cases per year, 58.9% of cases came from the Montevideo Department and the remaining Departments represented 41.1% of the cases. In this sample of forensic anthropology cases, 66% were skeletonized remains, 17% were remains of individuals in advanced stages of decomposition, 6% were burned remains, 6% were fresh bodies, and the last 5% were animal skeletal remains. Age at the time of death could be estimated in 90% of the cases. The sex was successfully determined in 95% of the cases; males represented 71% of the remains identified and females represented 29% of the examined remains. Sex could not be determined in 5% of the cases due to poorly preserved remains or because there were insufficient remains to determine sex. Positive identifications were made in 17% of all the cases representing 188 people.

## DISCUSSION

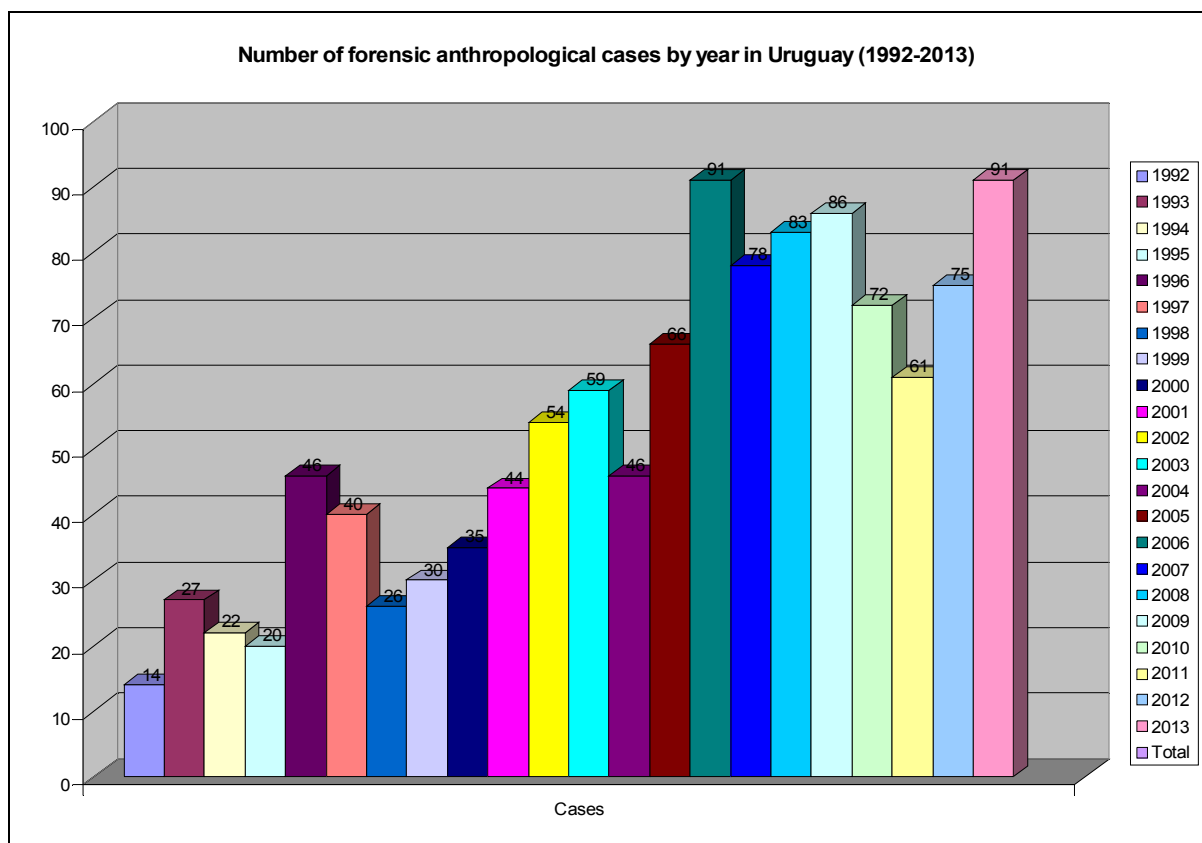
One way to judge the contribution to a field is to quantify its practical application. Before the creation of the Forensic Anthropology laboratory

at the Judicial Morgue of Montevideo City in 1992, forensic anthropological studies were not given serious consideration in Uruguay. In general, a majority of the forensic anthropology cases from this first period of analysis (1950-1991) had not enough relevant anthropological data to be further analyzed, especially the cases from the 1950s and 1960s. A total of 225 cases were found at the Morgue Judicial files for this period.

When human remains were discovered they were analyzed by the medical examiners or coroners with little training in anthropology. Most of the examinations were limited to the determination of sex and possible cause of death. These remains could not be positively identified and thus buried as unknown.



Graphic 1.- Average of forensic anthropological cases by period in Uruguay



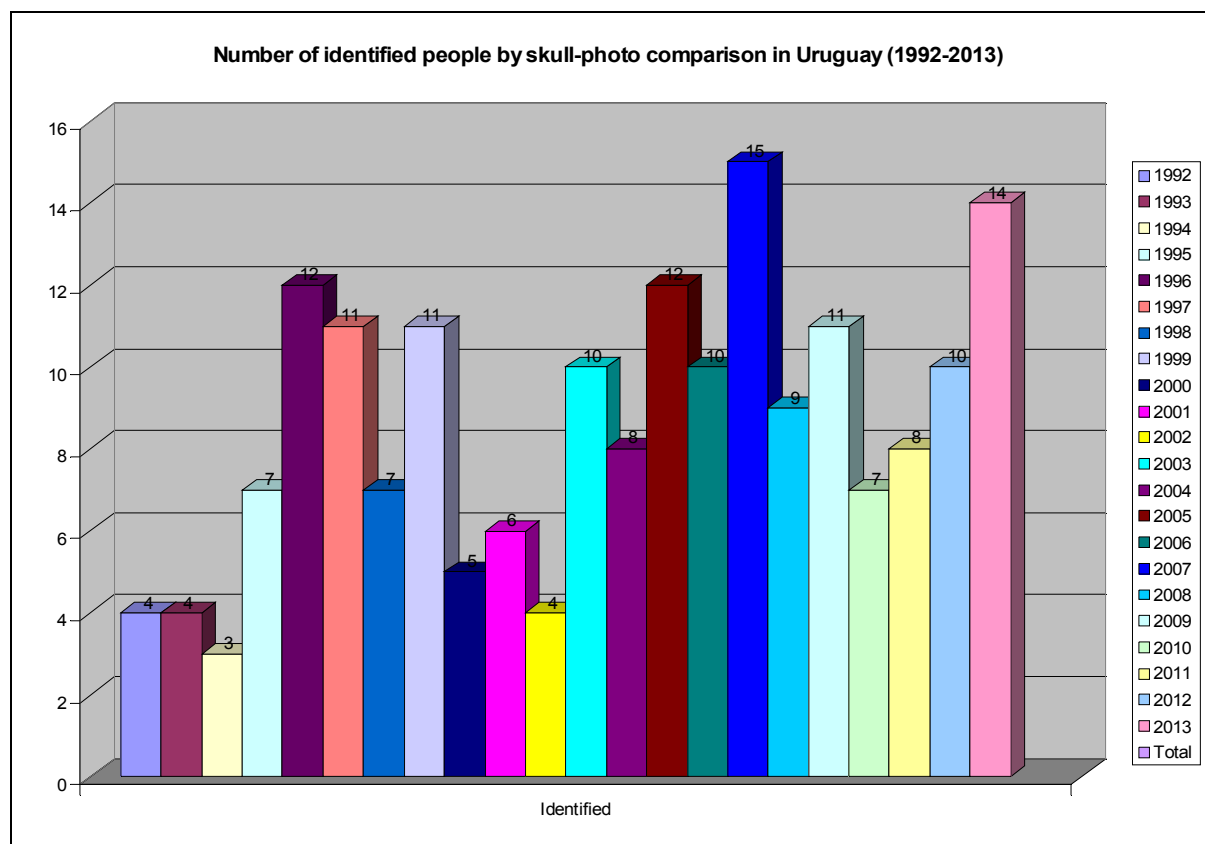
Graphic 2.- Number of forensic anthropological cases by year in Uruguay (1992-2013)

Forensic anthropology cases increased in the second period from 14 in 1992 to 91 cases in 2013, therefore the average number of cases per year increased dramatically in this period, this is since the creation of the Forensic Anthropology Laboratory at the Judicial Morgue of Montevideo City in 1992 with an average of 56.6 cases per year for this period (1992-2013) against an

average of 5.4 for the first period (1950-1991); this is an increase of almost 1050%. This difference is represented at the graphic one for both periods 1950-1991 and 1992-2013. It is comparable to those provided by others (Bass and Driscoll, 1983; Marks, 1995). This comparison of results confirms that the establishment of the Forensic Anthropology

Laboratory at the Judicial Morgue of Montevideo has vastly enhanced the scientific community's ability to identify human skeletal remains in Uruguay. Forensic anthropology has become an integral part of the official medico-legal disciplines in Uruguay. It also has been shown that participation of a trained forensic anthropologist can contribute considerably to the speedy identification of unknown cases and resolution of crimes. This paper shows how in Uruguay the forensic anthropology cases that have received expert evaluation have risen annually in the last years (Graphic 2). This increase in studied cases may be attributed to the familiarity of the service this new field can offer to law enforcement agencies and coroners; and the location of the Forensic Anthropology Laboratory at the Morgue Judicial of Montevideo gave an opportunity to medico-legal officers to have an easy access to this service. The average of 17% positive identifications of human skeletal remains have also improved considerably and comparable to other statistics in the U.S.A (Marks, 1995).

In the majority of cases the human remains were found by police or civilians in forests, fields, parks, lakes or rivers. Some were found in burned cars, on highways or in abandoned houses. All of the forensic anthropology cases were analyzed to determine the number of persons, age at time of death, sex, location where the remains were found, stage of decomposition of the remains (fresh, advanced decomposed, burned, or skeletonized) and whether a positive identification was made. Skull-photo digital superposition was used for identification purposes with available equipment at the Forensic Anthropology laboratory of the Morgue Judicial of Montevideo City. Together with other methods like DNA or dental studies, the comparisons by digital superposition assisted by computers were the most useful method used in identifying human remains in Uruguay from the second course of time analyzed (1992-2013) where a total of 188 cases were solved and identified using skull-photo comparisons by digital superposition assisted by computers (Graphic 3).



Graphic 3.- Number of identified people by skull-photo comparison in Uruguay (1992-2013)

However, the rate of identification in Uruguay depends on a number of problems. First, law enforcement agencies may not be knowledgeable about which data are relevant to obtain a positive identification from skeletal remains.

Second, positive identification may be very difficult when no missing people are reported to the police. Therefore, a positive identification could not be established when there are no comparative records. Third, dental records are particularly difficult to obtain in Uruguay as well as many other countries in Latin America because dental health is poor and minimally maintained for the majority of the people because of its high cost.

Today, forensic anthropology has been integrated into forensic teams in the majority of countries in the world, and the specialty is working its way into medico-legal systems around the world as well (Iskan, 1995). Scientific literature has described numerous times in which forensic anthropology has solved crimes or identified skeletal remains (Iskan and Solla, 2000). Clearly, it is important to have a well-trained forensic anthropologist available when human skeletal remains are found and a positive identification should be made. The number of forensic anthropology cases in Uruguay has increased over the last twenty years since 14 in 1992 to 91 by 2013 and, hopefully, in future cases there should be an even higher percentage of positive identifications.

All forensic anthropological investigation started with the initial observation about sex, age, race and stature, time since death and cause of death (Krogman and Iskan, 1986). A high degree of positive identifications were made using modern skull-photo comparison techniques assisted by computer. It demonstrated effective consistency between skulls and facial photographs submitted for comparisons. Success in identification depended, upon the quality of the submitted photograph, on the correct orientation and articulation of the skull and mandible. Although the remains were identified by digital skull-photo superimposition other type of evidence was incorporated like dental or DNA studies; those were later found to be in agreement with the identification based on skull-photo comparison.

Forensic anthropology contributions to the Uruguayan medico-legal system have increased considerably in the last twenty years and the number of cases in which positive identifications have been reached is similar to those of the United States (Bass and Driscoll, 1983; Marks, 1995). It should be remarked that according to actual tendencies, forensic anthropology cases are increasing in Uruguay. Reasons that explain this increase in Uruguay are the following:

- The creation of the Forensic Anthropology Laboratory at the Judicial Morgue of Montevideo City in 1992, which made it easier for medical examiners and coroners to contact the resident forensic anthropologist when needed.
- The creation of a full time Resident Forensic Anthropologist position at the Forensic Anthropology Laboratory in 1992.
- The ability to have a trained forensic anthropologist working in a forensic team with medical examiners, coroners, dentists and radiologists.
- A better knowledge of the scope of this modern branch of forensic science by the medico-legal system.
- The high percentage of positive identifications carried out by the Forensic Anthropology Laboratory from 1992-2013.

In conclusion, this study shows how positive identifications could be successfully made using a traditional osteologic analysis and skull-photo comparison by digital superimposition assisted by computers.

#### **Conflict of Interests**

None declared

#### **Funding**

None declared

#### **Ethical Approval**

None declared

#### **Informed consent**

None declared

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## ACKNOWLEDGMENTS

I must thanks so much to my lovely wife for her patience and a very especially acknowledgment to my mentor and friend Prof. Dr. Mehmet Yasar Iscan.

In Memoriam: This article is dedicated to the memory of Prof. Renzo Pi Hugarte.