



Habilitation thesis reviewer's report

Masaryk University	Faculty of Science
Faculty	Physical and Forensic Anthropology
Field of study	Dr Petra Urbanová
Applicant	Biological Anthropology Unit and Laboratory of Forensic Anthropology and Morphology
Unit	<i>New Dimension of Forensic Anthropology</i>
Habilitation thesis (title)	Prof. Sławomir Koziel
Reviewer	Department of Anthropology, Hirszfeld Institute of Immunology and Experimental Therapy, Polish Academy of Sciences
Unit	

Reviewer's report (extent of text up to the reviewer)

The evidence presented to me on which to judge the meeting of criteria and requirements applicable to habilitation theses in the field of physical and forensic anthropology consists of an assemblage of 14 scientific chapters and papers published in books or peer-reviewed scientific journals, grouped into 4 chapters. All of them are concerned with issues dealing with forensic anthropology.

Forensic anthropology, being a part of physical anthropology, has undergone significant development in recent years. This was mainly due to the enormous progress in advanced imaging and computational technologies, statistical analysis and algorithms. This progress has implied that forensic science has become more dependent on numerical and visual data processing. Definitely, as the author highlights, this has introduced new dimensions, both real as well as theoretical, into the framework of forensic anthropology. The work of Dr. Urbanová, presented to me for evaluation, is an outstanding example of implementation of new technical possibilities in forensic sciences.

Although recent simultaneous development of molecular genetics has allowed identification of individuals, the assessments of the cause of death or participation of third parties have remained the main subjects of forensic sciences.

In this context, I consider the collection of papers of Dr. Urbanová very important and an astounding example indicative of new directions of forensic anthropology, far beyond conventional methods used so far.

Since all of the presented papers were reviewed by subject specialists during peer-review process I have limited my comments to particular chapters within a broader context of physical anthropology.

The first chapter titled "Forensic Osteology" includes two book chapters and five papers. The first three studies provide a good insight into the 3-dimensional craniofacial analysis of human remains mainly in order to estimate sex and ancestral origin. Those 3D techniques are complemented by the sophisticated multivariable statistical models; all applied to various data



sets. Such an approach increases the diagnostic power and level of accuracy. However the author emphasizes that the advanced techniques should be applied with extreme caution due to the inadequate reference samples or improper exertion of a technique that can lead to the artificial results. The first set of three studies is an excellent introduction, review and guide of advance 3D techniques and hardware of data processing for all researchers practising forensic anthropology, showing the utilities but also accenting the limitations.

My only scepticism of using above mentioned techniques for sex and ancestral assessment comes from molecular biology. Actually, techniques of extraction, amplifying and analysing DNA are so advanced that they provide quick and accurate estimation of sex and ethnic affiliation, especially in a case of unidentified human remains. In this context I wonder what advantages the forensic approach provides over molecular techniques.

Next set of studies in the first chapter described morphological variation of human hyoid bone in context of identification of sex, developmental issue and established a predictive model to estimate identity-related skeletal indicator. Despite the authors use of advanced multivariable statistical methods, the accuracy of estimation sex is relatively poor indicating the need to improve methodology. Much more promising seems to be methodological approach proposed in the last study of this chapter. The paper introduced the wavelet transform, multistage mathematical tool for measuring shape variation, for objective quantification of sexual dimorphic features. The method was successfully applied to the sex determination of pilot sample of 3D analysis of supraorbital morphology. The proposed method will allow the construction of biologic profiles of unknown human remains that can be successfully used to monitor geographic variations and temporal changes in cranial features. In my opinion this paper contributes significantly to the development of advanced 3D methodology in forensic anthropology.

The second chapter consists of three papers which are concerned with research in 3D facial identification. This chapter reveals the author's valuable contribution to the subject of forensic facial identification and is an extraordinary example of cooperation with computer scientists. It shows great academia commitment of the author, her high professionalism and original, fresh approach to the issue. The papers make the potential reader familiar with the FIDENTIS 3D Database, FIDENTIS Analyst program designed for processing 3D images of human faces, and also show how to make a composite image of human faces from the real 3D facial images. In those three papers the author has shown her great knowledge, skills and high creativity in a field of 3D images processing. She also demonstrated that is able to surpass the boundaries of the field.

Third chapter consists of two papers presenting the approach composed of non-invasive or minimally invasive techniques in post-mortem examination which is referred to as the virtual, also touch-free or scalpel-free autopsy. The authors demonstrated that a single camera close range photogrammetry and stereophotogrammetry-based handheld scanners were both very beneficial for external body documentation. They provide high quality 3D surface models comparable in texture and geometry without compromising original morphology. The authors demonstrated how to make more efficient and comfortable autopsy. Also in a second paper the authors presented innovative rationalisation which brought benefits to the environment of an autopsy room.

The last (fourth) chapter provided a description of forensic examination of several case studies including the rare example of agenesis of superior cornu of thyroid cartilage. Again



the authors showed the effective and adjuvant use of 3D virtual approach. It was the first attempt to test 3D printing technology. I find that both papers are an example of introduction new techniques in the field of forensic anthropology.

In conclusion, the presented works definitely prove that the Dr. Petra Urbanová is a professional person in a field of forensic anthropology. She has presented enormous knowledge, determinism and high creativity in her work. Indeed, to the great extent she has shown a new dimension of forensic anthropology. She is a dynamic scientist, cooperating with specialists from other fields and collaborating with other forensic practitioners from foreigners institutions. It would not be exaggeration to say that Dr. Petra Urbanová has traced new directions and horizons for research in forensic anthropology.

Reviewer's questions for the habilitation thesis defence (number of questions up to the reviewer)

1. Most of the forensic studies, besides others, are aimed to determine sex and ancestral origin. Don't you think that this area of forensic research is now being appropriated by molecular analysis of DNA, which with a 100% certainty, can indicate the biological sex, and with very high probability estimate not only the ancestral origin, but also colour of hair and eyes and even some metabolic diseases if any?
2. In one of the presented studies included in the first chapter titled "Advanced methods in 3D craniofacial morphological analysis" on the Figure 4.7, which looks like presenting results of cluster analysis, the Authors presented morphological variation within the Brazilian dataset. Do this variation mirror the genetic variation/distances between defined groups? Do the Authors know paper presenting results of genetic analysis of affinity between those groups?

Conclusion

The habilitation thesis submitted by Dr Petra Urbanová entitled "*New Dimension of Forensic Anthropology*" *meets* the requirements applicable to habilitation theses in the field of the Anthropology.

In Brno on

18.4.2017